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CIRCULATION STATEMENT

During 1909 *we printed and circulated* 534,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

Our circulation for May, 1910, *was* 39,500 *copies.*

June 4	13,500
June 11	9,500
June 18	9,500

None sent free regularly, no back numbers. Figures are live, net circulation.

Contents

The Zinc Ore Market at Joplin

According to the statistics that we published in the JOURNAL of April 16, the receipts of zinc ore from Missouri and Kansas, as reported by the smelters amounted to 304,581 tons in 1909. This total comprises the output of the Joplin district proper, but excludes that of Oklahoma.

Out of the total shipments from Missouri and Kansas, 285,680 tons were received by 11 smelters. Ten of these smelters bought in excess of 10,000 tons each; six in excess of 25,000 tons. Five smelters, who make sulphuric acid as a byproduct, bought an aggregate of 122,410 tons. Certain others among these smelters make a specialty of producing a grade of spelter somewhat superior to what goes nowadays as ordinary prime western, and for that purpose buy selected ores. It is impossible to state the amount of such purchases, but we are safe in saying that the purchases of ore from which sulphuric acid is to be recovered, or special brands of spelter are to be made, in 1909 accounted for fully 50 per cent. of the total output of Missouri and Kansas.

In the remainder of the output is included the production of calamine and of blende that is below standard grade and sells ordinarily at a considerable discount. The Joplin blende is not, nowadays, by any means so uniform in quality as it used to be. A good deal more "sludge" is produced now than formerly, and also a good deal of "sheet ground" containing pyrites is worked, producing a concentrate that is higher in iron than the pristine ore of the district.

The competition for ore in the Joplin district has driven a number of smelters out of that market, there being several who did not purchase a pound of ore at Joplin in 1909. They have been unable to stay in that market in competition with those smelters who can bid relatively high for ore because they are going to make acid from it, or realize some other special advantage. This condition, which has been manifest for a long time in the narrowing margin between ore and spelter, signifies that in reality the producers of the ore realize its sulphur value.

We can indicate only approximately what the sulphur value of such ore is. Pyrites fines, containing about 45 per cent. sulphur, are worth in the Eastern market about 10c. per unit of 20 lb. Joplin blende of the best grade contains about 30 per cent. sulphur, the value of which is relatively less than in pyrites, partly because of the lower grade of the ore and partly because blende is less easily burned than pyrites. If a price were made per unit of sulphur in blende, it might be expected to be in the neighborhood of 7½c., corresponding to about $2.25 per ton of ore of the best grade. Consequently, if the smelters who formerly were able to purchase ore on a $14 margin are now able to do so only upon a $12 margin, they are in effect paying for about all the sulphur value of the ore, the market being established by those smelters who produce acid. This condition will, of course, tend to increase the number of smelters making that byproduct.

The Copper Statistics for May

The unfavorable character of the copper statistics for May is not to be denied. A substantial decrease in the European visible supply was more than offset by an unexpectedly large increase in the American accumulation. During the first five months of 1910, the world's visible supply has increased from 385,970,911 lb. to 399,568,373 lb. This assumes that the copper afloat from America, which ranges ordinarily from 10 to 25 million pounds, was the same in amount on June 1 as on Jan. 1. Although this copper is visible, it is not included in the statistics.

Insofar as the reported visible supply is concerned, the statistics indicate that during the last five months the consumption of Europe and America has been a little less than the supply. However, there is no doubt that the invisible supply has diminished in this country and perhaps also in Europe, and that actual consumption has consequently been in excess of the production. This idea, together with the probability that during the remainder of this year there will be no great increase in production, has been the basis for such optimism respecting the situation in copper as could be expressed. If, however, a reaction in commercial conditions in this country is going to retard our consumption of copper, the outlook is ominous and the market cannot be expected to hold its own under a maintenance of the large production. Safety will lie only in a curtailment of production.

Curtailment is indeed what ought to have been inaugurated six months ago and what ought to be started now; not concerted curtailment that might be illegal, but individual curtailment based upon the recognition that more copper is being produced than is immediately required, and that it is a poor policy to sacrifice resources for a lower price than they ought to fetch. This is an argument that should appeal especially to those producers whose cost is so high that no real profit is realized at present prices.

We are inclined to think that some producers will be more disposed to consider this matter, now that there are lean times in the stock market. There was until recently an object in making a large production by mines whereof it was desired to distribute the stock. There might be no profit in producing copper, but the sale of stock yielded a good profit to some persons interested. There is no longer any market to speak of in Wall Street and State Street, and consequently we shall hear less of the wonderful profits that some mines are earning or are going to earn. We are getting to the point where promoters are thinking that they may have to work their mines for what they are worth. This may even have a healthful reflex action upon the market for the metal.

The Proportioning of Dust Settling Flues

The proportioning of flues for the deposition of dust from metallurgical furnaces used to be chiefly a matter of rule of thumb. Indeed, it was often far worse than that, the whole design showing an ignorance of the principles involved. Thus we frequently saw long, narrow flues with many changes of direction, or larger flues with baffle walls to give the gaseous current a zigzag direction, through which the gas had to sweep with whirlwind velocity, a condition that is naturally opposed to the deposition of its solid matter.

The proper condition is, of course, a large flue in which the velocity will be checked sufficiently for the solids to fall by gravity, just as when a muddy stream discharges into one side of a lake and a limpid stream flows out from another side. However, there are other conditions to be observed in the designing of dust chambers, such as the matter of superficial exposure that affects the cooling of the gas, and structural features that affect the sucking in of external air.

In present practice these principles are much better considered than formerly, and in most modern works the chimneys and flues are proportioned with respect to the velocity of the gas that is to pass through them. The importance of this is well illustrated by some results at the Tyee smeltery, Ladysmith, B. C., recently communicated by Thomas Kiddie in the Transactions of the American Institute of Mining Engineers. The dimensions of the dust chamber were 155x10x8 ft. In a period of two years, with a velocity of 20 ft. per second, the recovery of flue dust was 2 per cent. of the ore smelted. In another period of two years, with a velocity of about 7 ft. per second, the recovery was 3.1 per cent. The flue dust was worth $14.92 per ton.

In another plant having a dust chamber 300x16x10 ft., three years of operation at velocity of 21 ft. per second gave 2.9 per cent. of flue dust. One year at 7.5 ft. per second gave 4.4 per cent. In this case the flue dust was worth $30.20 per ton.

The application of such figures to a smeltery treating 350,000 tons of ore per annum—a 1000-ton plant, which is nothing out of the ordinary in these days—is illuminating. Even a velocity of 7 ft. per second is higher than the precept of the best practice, which indicate about 4 ft. per second as the proper rate for the most efficient deposition of dust.

The Directorship of the Bureau of Mines

The delay in nominating a director for the recently created bureau of mines is due to the contest among several candidates for this position. In this contest political considerations have unfortunately entered.

The leading officials of the Geological Survey have been playing an active part with respect to the nomination of the head of the new bureau and have engaged in measures in connection therewith that are hardly proper from a scientific organization. In this the Geological Survey is not only defying the expression of many of the best opinions in the mining profession, but also is committing a mistake that will do a great deal to alienate many mining men who have always been warm friends of the Survey.

Without reference to any special candidate we say emphatically to the President and to Secretary Ballinger that the mining industry demands that in making the appointment to this position all political considerations be dismissed. The new bureau should enter upon its duties uncontaminated by any poison of politics and if the leading officials of the Geological Survey have been animated by political considerations they should be promptly reprimanded. If the administration and the bureaucracy has any doubt about the temper of the mining industry in this matter they will soon learn.

Edward C. Hegeler

Edward C. Hegeler, one of the founders of the Matthiessen & Hegeler Zinc Company, of Lasalle, Ill., died at Lasalle, June 4. He was one of the founders of the zinc-smelting business of the United States and was prominently identified with this industry throughout his life.

Mr. Hegeler came to the United States in company with F. W. Matthiessen, in 1857, immediately after their graduation from the *Bergakademie* at Freiberg, Saxony. The Lehigh Zinc Company, of South Bethlehem, Penn., had been for several years attempting to smelt the zinc ore of its mine at Friedensville, Penn., without success. The ore was of troublesome character, and it was not then known in America how to smelt such ore.

Matthiessen and Hegeler obtained permission from the company to experiment on their own account at the abandoned plant. They did it on a small scale, using one muffle placed in a kiln altered for the purpose. They demonstrated that anthracite, as well as New Jersey clay could be used, and made some spelter in this experimental way, but failed to come to an agreement with the owners of the property for building works, largely on account of the financial crisis prevailing at that time.

The two young men had become satisfied as to their ability to smelt zinc ore in a commercial way and foresaw the great future of this industry in the United States. Looking around for an opportunity, they turned their attention to the West, where they studied the zinc deposits of Wisconsin, and later, in 1858, they began the erection of the present works at Lasalle. They proceeded with scientific deliberation. Lasalle was selected as the point where the Illinois coalfield approached nearest to the Wisconsin zinc mines, which at that time were the only supply of zinc ore, the Joplin mines being still unknown. In fact, Matthiessen and Hegeler established their works directly over a coal mine, from the shaft of which the coal was delivered to the furnaces without intermediate handling. The works at Lasalle went into operation in 1860, and have continued without interruption to the present time. For many years they were the largest single producer of spelter in the United States.

The history of these works has been a record of uninterrupted success, and it has been without question the greatest commercial and technical triumph that the zinc-smelting business of this country has witnessed. The wisdom of the original selection of location, so deliberately made, has been proved by the development of a great smelting industry in the same region by other concerns.

From the beginning, attention was directed toward improvement of the art of zinc smelting, and this was a work in which Mr. Hegeler gloried and excelled. In the early days of zinc smelting in the United States there were comparatively few trained metallurgical engineers, and most of the smelters were content to follow blindly the lead of those who had gone before. Consequently, there was little or no progress among the rank and file. Mr. Hegeler was practically the only one of the early zinc metallurgists who displayed noteworthy originality. Some of his innovations were of questionable value, but many were of great importance and obtained common adoption, and in the history of zinc smelting in the United States the name of Hegeler certainly stands with that of Wetherill as the two men who have made the greatest contributions to the metallurgical art.

Mr. Hegeler naturally first took up the subject of the distillation furnace and early directed his attention to gas firing. He showed that this practically eliminated the restrictions as to hight of a distillation furnace; but since it would have been inconvenient to build and operate a furnace so high as his system of firing permitted, he built a very long furnace and turned the gas in at one end, which came to substantially the same thing as if he had built a furnace of equal hight and turned the gas in at the bottom. This was accomplished by introducing the quantity of gas required to heat the whole furnace and burning it gradually by the introduction of air at intervals.

Hegeler's first large furnace, which was erected in 1872, had a high-arched combustion chamber, 40 ft. long, containing 408 retorts (204 per side), arranged in five rows. In connection with this furnace there were many peculiarities, which were abandoned in later constructions, but the general principle has remained unchanged and the length of the furnace was increased finally to 1008 retorts, but that was found to be too long for satisfactory working and the number was reduced to 864. As to whether these excessively long furnaces are good or bad practice is a question. Their use has been confined to Lasalle and to works in the natural-gas fields of Kansas and Oklahoma. However, the long Hegeler furnace certainly had the important result of leading to the introduction of labor-saving devices for charging and discharging the retorts, which subsequently became a distinctive feature in American zinc-smelting practice in general. The method of preparing the charge by means of a mechanical mixer and bringing it to the furnace in a large car, moving on a track in front of the furnace, from which it could be shoveled directly into the retorts; the tapping of the spelter from the condensers into a kettle carried by a truck, with a shield to protect the men from the heat of the furnace; and the drawing of the residues from the retorts with the aid of a car, having a protecting shield and rollers to support the heavy rabbles which are put into the retorts; these were all in regular use at Lasalle previous to 1882. Also in use at that time were the auger machine for making retorts and a plunger machine for making condensers.

Probably the most important invention of Mr. Hegeler was his muffle roasting furnace in 1881. With its aid the manufacture of sulphuric acid as a byproduct of blende roasting was begun in the same year. Mechanical roasting furnaces had previously been used in Europe, but had not found much favor, and to this day are regarded somewhat askance, even for simple roasting, not to speak of roasting for sulphuric-acid manufacture. Yet the Hegeler furnace has been in regular and successful use since 1881. After the expiration of the patents upon it, other zinc smelters engaging in sulphuric-acid manufacture in this country adopted it, and among them it is the only furnace employed for this purpose at the present time.

Mr. Hegeler was also the first to inaugurate the rolling of sheet zinc in the United States. A complete list of Mr. Hegeler's inventions would be long. His was perhaps the most original mind that has concerned itself with the art of zinc smelting during the century of its history. During his 50 years of life and practice at Lasalle he resided close to his works. The beauty of his great mansion, with its adjacent gardens, in close proximity to the great metallurgical establishment is an object lesson in taking care of metallurgical smoke, which ordinarily desolates the surrounding country. Mr. Hegeler brought up his sons in his business, with which they continued to be connected until a few years ago, when they started out for themselves. Although in the later years of his life Mr. Hegeler withdrew from the direct management of his business, with its commercial cares, he maintained a live interest and supervision over the strictly metallurgical work.

Rumor of Reorganization of Butte & Superior Company

It is generally believed that a reorganization of the Butte & Superior company is under way. The plan is to issue $1,000,000 of 6-per cent. convertible bonds, cut the present capital stock in half and increase the par value of the shares from $5 to $10. This will provide sufficient money to erect a mill and leave a balance of $300,000 for working capital. The Butte & Superior company is a zinc operation, controlled largely in Duluth, where the stock has been selling around $3 per share.

Renewed Activity in San Juan Region of Colorado

DENVER CORRESPONDENCE

The high mines of that rugged region in southwestern Colorado, known as the San Juan, have fairly entered upon their work of marketing the ore developed during the winter, and a great many that have been idle for some time have been reopened.

In the Telluride district 100 cars of ore were shipped in May, as against 82 in May, 1909, the Liberty Bell, Smuggler and the Tomboy, in Savage basin, being the chief producers. The Marshall basin dumps, treated at the Pandora mill, and the '76 mine, are adding their quota, and the Favorite group at Ophir, under the management of Felix Leavick, is credited with new and important discoveries of free gold.

In the Ouray district, the mines below town are active. The Wedge is shipping steadily and will increase the output of silver-lead ore to four carloads per week. The Bright Diamond has rehabilitated the American mill, and a new aërial tram will convey the ore to it from the mine. The Calliope old workings have been broken into by the tunnel, and a force is clearing them out, prior to exploitation.

In the Sneffels district, above Ouray, the Revenue and the Camp Bird are working about 250 men each, and the Thistledown, where the concentration mill has just been started, has about 40 men at work. This is a silver-lead producer, and under the management of M. L. Thistle.

The Red Mountain district, between Ouray and Silverton, will soon be shipping, as the road to Ouray is being shoveled out, and the railway from Silverton to Ironton will be running again shortly. The Silver Link mine, located on the road to Poughkeepsie gulch, belonging to Standard Oil people, and idle for many years, is being reopened under the management of Fred Seaburg.

All the Ouray section seems greatly encouraged by the offers of the new Kuenzel smeltery at Buena Vista to buy the ore, the smelting charge being $4, and the freight $5 per ton, with immediate settlements on control assays of every lot shipped to this point.

In the Animas Forks district, above Silverton, the Otto Mears railroad is open, and shipments from the Frank Hough and other mines on Engineer mountain to the Durango smeltery have commenced.

The Bagley tunnel, which cut a number of big low-grade veins last summer, and was closed down during the winter, is being reopened in charge of Charles Gagner.

Goldfield Consolidated

The preliminary report of the operations of the Goldfield Consolidated Mines Company for May shows an increased tonnage over that for April, amounting to 37.5 per cent. The total value of the output is, however, less by $113,144.

MAY PRODUCTION.

	Wet Tons.	Dry Tons.	Assay, Oz.	Value.
Combination	4,945	4,656	1.18	$114,742
Mohawk	6,848	6,549	1.32	180,472
Red Top	4,583	4,409	1.31	121,136
Clermont	4,392	4,204	2.63	605,306
Shipping ore from Clermont	727	691	25.88	.....
Total	21,495	20,509	2.41	$1,021,656

RESULTS OF MILLING OPERATIONS

There were 19,818 dry tons milled during the month. The average value of the ore treated was $32.89 per ton; total value, $651,868. The loss in tailings was $31,260 and the value realized, $620,628, which indicates a 95.2-per cent. extraction. In April an extraction of 95.57 per cent. was made.

MAY EXPENSES.

		Amount.	Per Ton.
Bullion tax and marketing bullion		$22,000	
Administration, etc		21,000	
Total general		$43,000	$2.10
Mining		81,000	3.95
Transportation		3,000	0.15
Milling and cyaniding	$51,000		
Marketing concentrate residues	$16,000		
		$67,000	$3.27
Construction		40,000	1.95
Cost of marketing high-grade ore		33,000	1.61
Net cost		$267,000	$13.03
Loss in tailings		31,260	1.52
Total costs and losses		$298,260	$14.55

The average value per ton of ore mined in May was $49.81. A profit of $35.26 per ton, or a total of $723,396 was realized.

DEVELOPMENTS

The total advance in May was 2661 ft., equal to 1 ft. for 7½ tons ore mined. This work was all done in new ground, extending the partially explored areas. New ore was taken from main levels as follows: Combination, 180-ft. level, 422 tons assaying 1.54 oz.; Mohawk, 350-ft. level, 358 tons assaying 0.76 oz.; 450-ft. level, 76 tons assaying 1.21 oz.; 600-ft. level, 219 tons assaying 0.44 oz.; Clermont, 600-ft. level, 546 tons assaying 1.26 oz.; 650-ft. level, 243 tons assaying 5.97 oz.; 750-ft. level, 102 tons assaying 0.99 oz.; 900-ft. level, 306 tons assaying 1.21 oz.; total, 2272 tons assaying 1.63 oz. The tonnage of new ore found gained on the amount mined, but the grade of it does not equal the high average of the ore extracted during the last three months.

NEW ORESHOOT IN THE MOHAWK

The most interesting discovery was on the 450-ft. level of the Mohawk, where an orebody was encountered between the Mohawk and the Red Top shafts. This is apparently an entirely new oreshoot not previously opened on any level. It lies in the middle of a section of ground about 500 ft. long, between the above mentioned shafts. For some reason this tract has remained unexplored even at the surface. Explorations are now being directed into it at several different points.

The mine is reported in good condition at all points. The mill reconstruction is now proceeding rapidly. Practically all material required is on the ground and the essential parts should all be completed by July 1. It is expected that a somewhat increased tonnage will be treated during June.

Construction in other directions is also proceeding as fast as circumstances will permit. A complete fire-protection system has been planned, and material ordered. The storage-battery plant is in process of construction. Transformer stations and other points vital to the operations are being made as nearly fireproof as possible. This involves some minor buildings of steel and concrete.

May Oil Dividends

The accompanying table gives the amount of dividends paid by a number of California oil companies during May, 1910, together with their total dividends to date, as reported by the California Stock and Oil Exchange, San Francisco.

Name of Company.	May, 1910, Dividend.	Total Paid to Date.
Amalgamated Oil	$50,000	1,500,000
American Petroleum, pf	25,000	1,310,166
Caribou	20,175	740,883
Claremont	10,000	345,000
Columbia	9,992	294,782
Del Rey	3,927	11,783
Empire	2,000	2,000
Euclid	3,500	131,000
Home	2,000	478,000
Illinois crude	2,000	92,000
Imperial	500,000	2,500,000
Kern River	2,000	104,000
Linda Vista	3,859	76,770
Mascot	5,000	20,000
Mexican Petroleum	85,617	3,648,577
Monte Cristo	50,000	490,000
Palmer	18,020	286,401
Paraffine	3,000	21,000
Piedmont	3,890	26,877
Pinal	15,000	917,086
Premier	10,000	20,000
Producers	80,000	80,000
Record	7,500	70,000
Rice Ranch	3,000	105,000
Royalty	300	16,067
S. F. & McKittrick	15,000	370,000
Sauer Dough	4,988	527,279
Section 25	10,000	30,000
Sesnon	8,000	118,000
Traders	15,000	209,147
Union	124,813	6,617,881
United	40,375	2,259,711
Wabash	3,000	126,000
Total for May, 1910	$1,136,956	

The Uraniumite Company of America has been incorporated at Buffalo, N. Y., with a capital stock of $400,000. It is the intention to produce uranium and its alloys.

The Freiberg School of Mines

SPECIAL CORRESPONDENCE

Upon the occasion of placing the estimates for the maintenance of the mining college at Freiberg before the second chamber of the Saxon diet, the government authorities made the following statements:

The mining college has had a steady gain in students during the last 10 years, averaging 454 for the year, 191 of whom were Germans and 263 foreigners. Of the 191 Germans there were only 73, or 16 per cent. from Saxony, the State which supports the college. The regulations for the admission of aliens to the college[1] have been rendered more severe, in order to bring the standard of previous education more in accord with that required of natives. Recently a bright young man, who had been actively engaged at a mill in the Transvaal, was sent from there by a benefactor to attend the lectures at the Freiberg college. After a six-months' trial he came to the conclusion that owing to his insufficient previous education he was unable to follow the lectures, although he spoke the German language fluently. It is hardly necessary to say that he returned to his native land without having accomplished anything. Undoubtedly there have been many cases of this kind among aliens.

COLLEGE FEES

Stands in the laboratories and drafting rooms are reserved for Germans only during the first fortnight of the annual term. After that foreigners are accommodated. The registry fee for Germans is 12 marks, and for foreigners 24 marks. Foreigners have to pay an extra tax of 200 marks annually besides the tuition fees fixed for all students. The graduating fees amount to 100 marks for Germans, and 200 marks for foreigners. The fees for acquiring an academic degree are 240 marks for Germans, 480 marks for foreigners.

ATTITUDE OF SAXON GOVERNMENT

The Saxon government recognizes the desirability to find larger and better lighted quarters for the valuable collections of the college, but, in order to erect new buildings an appropriation of several hundred thousand marks would have to be made, which the Government does not feel at liberty to recommend at the present time. It wants to be sure that the attendance of the college will remain the same after the Freiberg mines have been closed for good, and that the reduction works will be able to secure sufficient smelting material without the ores of the Freiberg mines. Nor has the question of the maintenance of a mine for teaching purposes been definitely settled. Such a one would need two shafts to insure safety and sufficient ore to employ 50 men steadily besides the supervising officials. It is estimated that this scheme would cause a permanent expense of from 80,000 to 100,000 marks per annum and an amount of at least 50,000 marks, at once, to equip the mine with the proper machinery and buildings for teaching purposes.

[1]There is a *Bergakademie*, or mining college at Freiberg, which ranks with a university, and a *Bergschule*, a school of a lower order, for the education of foremen, surveyor's handy man, laboratory attendants and the like.

The American Iron and Steel Institute

The first regular meeting of the American Iron and Steel Institute, organized in 1908, was held at the Waldorf-Astoria, New York, May 27. Judge E. H. Gary called the meeting to order with the announcement that various obstacles had prevented an earlier meeting to perfect the details of the organization, and that in the meantime a committee had been appointed to nominate directors to fill vacancies.

Some discussion then took place as to the best plans to be pursued to promote the future prosperity of the organization, during which it developed that the officers had some partly perfected plans of a most ambitious character for the future. It is hoped that in the near future permanent quarters may be secured and a secretary chosen who will be able to give his entire time to the work of the organization.

Some of those present urged that it be the policy of the association to give a large measure of attention to the technical and practical phases of the industry, while others felt that the gathering of statistics and measures to promote the commercial prosperity of all concerned should not be overlooked.

It was finally decided by a unanimous vote to hold the first annual meeting in the fall, probably in the month of October, at which time there will probably be a two-days' session, with reading of papers and discussions on popular subjects bearing upon some features of the business.

The subjects discussed at the dinner were international competition and some phases of the labor question; the latter with especial reference to the new plan of the Steel Corporation to avoid Sunday work, or at least to restrict employees to a six-day week.

The officers elected were: President, E. H. Gary; first vice-president, Powell Stackhouse; second vice-president, Willis L. King; third vice-president, Charles M. Schwab; treasurer, Edward Bailey; secretary, W. J. Filbert. The following directors were also reëlected: Edward Bailey, E. A. S. Clarke, Willis L. King, Samuel Mather, John A. Topping, T. J. Drummond, W. J. Filbert, J. C. Maben, W. A. Rogers and J. F. Welborn.

Publication of Invention before Patenting

BY J. F. BRANDENBURG*

I have frequently been asked the question, if an inventor publishes an account of his invention, in a technical journal or elsewhere, what effect does such a publication have upon an application for patent on the invention filed by him subsequently? Under the statute, such a publication which is not more than two years prior to the date of the application for patent is no bar to the granting of a patent. In other words, an inventor may wait as long as two years after publishing his invention before applying for his patent. It may even be a distinct advantage to have published a full and clear description of the invention previous to applying for a patent thereon. In event of an interference, that is, a proceeding in the Patent Office to determine which of two rival claimants is entitled to the patent, the proof of publication may be of value in establishing priority of invention. But for this purpose, the publication must have been full and clear; so that if an inventor desires to secure this advantage by publication, he should make the description and illustration complete enough so that the invention could be performed by others skilled in the art.

On the other hand, if the invention has not been reduced to practice, i.e., successfully performed or embodied in an operative machine, it would be a mistake for an inventor to feel that by publication he had fully established his right to a patent, so that he could allow the invention to rest entirely idle for two years, or even for a shorter period, before filing his application. The question of diligence is often a controlling one in the Patent Office in interference proceedings and in the courts in patent suits; and it is best to complete an invention by reducing it to practice or by filing an application for patent as soon as possible after conception. In other words, an inventor loses no rights, up to the expiration of two years, by the publication of his invention, and may even gain an advantage as just explained; but publication will not atone for slothfulness.

*Expert in patent causes, 2 Rector street, New York.

H. A. Buehler, State geologist of Missouri, reports that the shipments of tailings from the Joplin district for the year 1909 amounted to 937,937 tons. These are used largely for railroad ballast and concrete.

DETAILS of PRACTICAL MINING

Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

Collapsible Gate for Cages *

The object of the gate shown in Fig. 1 is to allow the gate to collapse into a minimum space, in the case of complicated headgears. The gate should be so constructed that in case the cage is signaled away without its being closed, it will do no damage during its journey in the shaft.

The gate is constructed of flat iron bars, built up in such a manner as to allow of both a horizontal and a vertical motion. The vertical bars *A B C*, are made 1¼ in. wide by ⅜ in. thick, and are riveted 9 in. apart to the horizontal

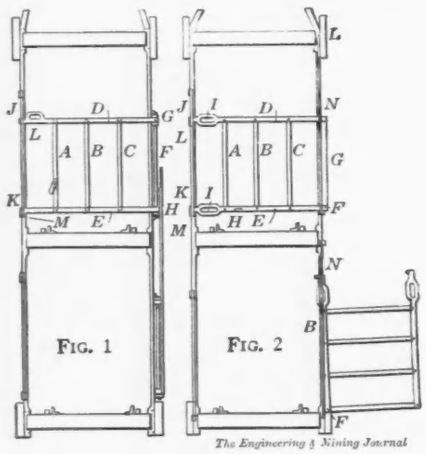


Fig. 1 Fig. 2

Collapsible and Rigid Gate for Shaft Use

bars *D* and *E*, which are 1¾ in. wide by 7/16 in. thick. Loose rivets ⅝ in. in diameter, are used so the gate will collapse into the desired form. The horizontal bars are 24 in. apart, the lower bar being 6 in. from the bottom of the cage-deck. The whole gate swings horizontally upon a rod *F* which is ¾ in. in diameter and to which the horizontal bars are attached by loose rivets *G H*, ¾ in. in diameter, thus allowing of the vertical movement. The top horizontal bar has a hand hole 1½x4 in. to allow of the lifting of the gate. When the gate is closed, the ends of the horizontal bars rest in slots *J* and *K*, being kept in position by catches *L* and *M*.

When opening the gate, it is lifted clear of the catches, and is moved first in a horizontal and then in a vertical direction, in which latter position it is retained by a shackle until the cage is ready for moving away, when the gate is closed. The gate is easily manipulated. If anyone wishes to get out at any station in the shaft, it is only necessary to lift the gate vertically to the cage-hoops and to walk out.

Rigid Gate

This gate, Fig. 2, is a somewhat similar type to the collapsible gate, and is recommended when space is not a serious consideration. It must, however, be closed before any movement of the cage takes place. In this gate the vertical bars *A B C* are riveted with fixed joints to the horizontal bars *D* and *E*, and the whole gate swings vertically on only one pivot or axis *F* which is ¾ in. in diameter. On the hinged end of the gate there is attached an additional vertical bar *G*, 1¼x⅜ in., for the purpose of stiffening the structure. There is, moreover, an additional hand-hole *I* provided in the lower horizontal bar, to which is also attached a stop-piece *H*, 2½x½x½ in., which prevents the gate, when opened, from going too far through the slot *N*. It is simple in construction and is not likely to get out of order.

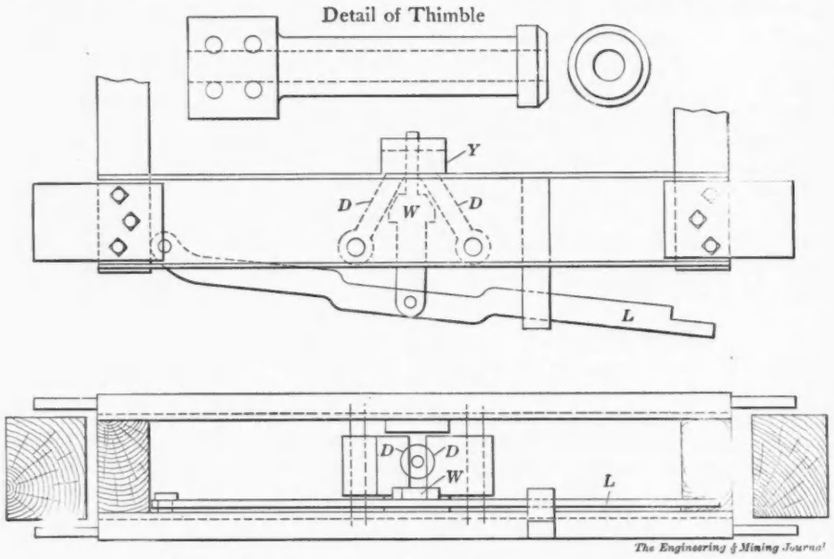
*C. A. Crofton, *Trans.* North of England Institute of Mining and Mechanical Engineers.

Launders in Concentrating Mills

The ordinary launder in concentrating mills is a wooden trough, lined with sheet steel. When the steel lining wears through, which quickly happens, the trough becomes leaky and a general nuisance until it be relined. Sometimes it is useful to substitute for the ordinary launder a 3-in. or 4-in. wrought-iron pipe. When a hole wears in this, the pipe may be turned 90 deg., or as much as necessary, and this may be continued until the pipe is so far gone that it has to be relegated to the scrap heap.

Safety Crosshead for Bucket Shaft

A crosshead is in use at the Colby mine at Bessemer, Mich., which holds the bucket whenever the crosshead is stopped either accidentally or intentionally. C. E. Holley describes the device as follows: At a suitable distance above the bucket, the thimble shown in the accompanying sketch is attached to the cable by U-bolts. The crosshead is made up of channels bolted to vertical timbers. Across the bottom channels is a yoke *Y* through which the cable passes, and this yoke rests on the top of the thimble, thus supporting the crosshead.



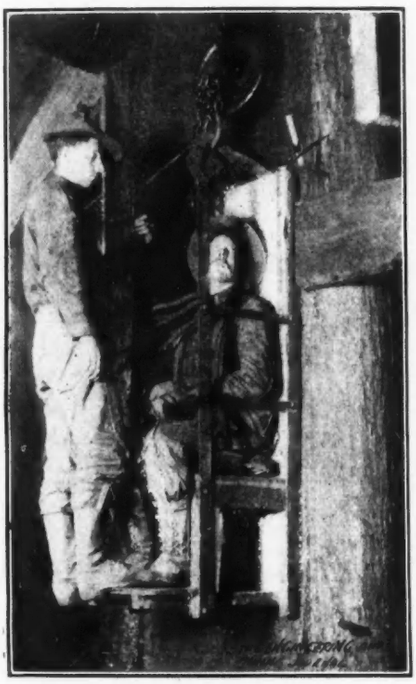
Safety Crosshead for Hoisting with Buckets

Operation of Crosshead

The dogs *D* close in below the collar of the thimble preventing the bucket leaving the crosshead in case the crosshead should stick in the shaft while being lowered. When the crosshead strikes the stop at the bottom of the guides, the lever *L* is raised, raising the wedge *W*. This wedge forces the dogs apart and permits the thimble to pass down between them, lowering the bucket without the crosshead. The wedge is guided by an extension, which slides in a hole in the yoke.

Apparatus for Conveying Wounded Men from Stopes

Most well managed mines pay particular attention to the physical welfare of their employees. They find it profitable to do so. Yet, even though all possible pains are taken to prevent injury, when the inevitable accident does happen and a man is seriously wounded, the facilities for getting him quickly and comfortably to where medical attention can be rendered are usually lacking. This is especially true when accidents occur in stopes, for, with no special arrangement for his removal at hand, the wounded man must often be carried down ladderways or lowered through a timber chute in improvised slings.



INJURED MAN IN SPECIAL CHAIR FOR CONVEYING FROM STOPES

At the Morning mine of the Federal Mining and Smelting Company, near Mullan, Ida., although every provision is made against accidents, specially constructed chairs for conveying wounded men from stopes are always kept in the levels above which ore is being mined. The design of these chairs is shown in the accompanying photograph of a man strapped in and ready to be lowered. The frame of iron strips gives the necessary stiffness and strength to the apparatus, and the side framing and high back protect the wounded man while he is being lowered.

A man strapped tightly into such a chair rides comfortably to the level, where, if desirable, the chair can be disconnected from the hoisting rope and used to convey the man where medical treatment is available. If similar contrivances were put in all of our mines many a poor fellow would be saved much real torture.

Bell Signals in Lake Superior District

BY W. L. FLEMING

The code of bell signals given below is that adopted by the Cleveland-Cliffs Iron Company for all its mines in the Lake Superior district. The code was described by O. D. McClure before the Lake Superior Mining Institute in order to call attention to the desirability of a uniform code for the district.

BELL SIGNALS AT CLEVELAND-CLIFFS.

1 bell, stop.
2 bells, lower.
3 bells, hoist.
4 bells, lower men.

Engineer must slow up at levels when lowering men.

4 slow bells, lower men slowly.
5 bells, hoist men.
5 slow bells, hoist men slowly.
6 bells, blasting signal.

Engineer must answer by raising rope two feet, then lower back two feet. Engineer will then stand at hoist under strict attention to hoist until given 3 bells.

7 bells, turn on or off steam.
8 bells, turn on or off air.
9 bells, danger signal.

Then ring number of level where danger exists. No person, except the cage tender, shall ring any bell, except in case of danger or when the main shaft is being sunk.

After danger signal is given engineer will obey hoisting and lowering signals with extreme caution until notified that danger no longer exists.

15 bells, or notification by messenger, releases danger signal and informs engineer that hoisting conditions are normal.

Fire: 10 bells, then give level signal, then give 10 bells again.

LEVEL SIGNALS.

2—1	bells,	1st level.	4—1	bells,	11th level.
2—2	"	2nd "	4—2	"	12th "
2—3	"	3rd "	4—3	"	13th "
2—4	"	4th "	4—4	"	14th "
2—5	"	5th "	4—5	"	15th "
3—1	"	6th "	5—1	"	16th "
3—2	"	7th "	5—2	"	17th "
3—3	"	8th "	5—3	"	18th "
3—4	"	9th "	5—4	"	19th "
3—5	"	10th "	5—5	"	20th "

Rule 1. In giving signals, make strokes on bell at regular intervals. The bar (——) must take the same time as for one stroke of the bell, and no more.

Rule 2. No person must get off or on the bucket or cage while the same is in motion. When men are to be hoisted or lowered, give signal for men.

Rule 3. After signal "Ready to shoot in shaft," engineer must give signal when he is ready to hoist. Miners then "spit fuse" get into the bucket and signal to hoist.

Rule 4. All timber, tools, etc., "longer than the depth of the bucket" to be hoisted or lowered, must be securely lashed at the upper end to the cable.

Rule 5. The captain will see that one printed sheet of these signals and rules for each level and one for the engine room is attached to a board not less than 12 in. wide and 36 in. long, and securely fastened where signals can be read at the places above stated.

Rule 6. The above signals and rules must be obeyed. Any violation will be sufficient grounds for discharging the party or parties so doing.

COMPARISON WITH WESTERN PRACTICE

The most noticeable difference in this code, as compared with the Western practice, is the one-bell signal. In the West one bell is the signal to hoist or stop, while universal practice in the Superior district is to use the one-bell signal to stop only. It can hardly be an advantage to replace the long-used 3-1 signal for hoisting men by the use of five bells alone. In using the 3-1 signal, the three bells are rung before the men get on the cage, thus giving the engineer warning to stand by his hoist. This is a safeguard well worth observing, especially when using a comparatively light engine and a bucket.

The blasting signal, six bells, must be followed by three bells as the hoisting signal. Quite often the bell cord is heavy and the bells must necessarily be rung slowly. The time required to pull a heavy bell cord three times might preferably be spent by the men at some locality other than on top of a dozen or two sputtering fuses. Further, the great majority of signals given in an ordinary shift are merely the hoisting signal. The replacement of the simple one-bell signal by three, seems just that much added work on the part of the cage tender, with no corresponding advantage gained.

Of course it is probable that the Cleveland-Cliffs mines are all equipped with electric signaling devices, and the addition of extra bells in the signal code would not matter greatly to the cage or skip tenders, but an ideal signal code should be adaptable to all possible contingencies and represent the maximum efficiency under different conditions. The departures from Western practice noted above do not seem to represent an improvement when using electric signals, and certainly are not as desirable when using a heavy bell cord; further, the signals for hoisting men and for blasting are inferior in any case.

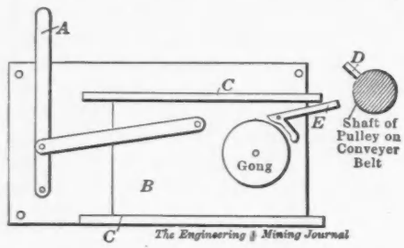
Determination of Mill Tonnage

In the new West mill of the Bunker Hill & Sullivan company, at Kellogg, Idaho, a rather clever device is used to check the daily mill tonnage. The apparatus is a timer giving the travel of the conveyer belt from the crusher house to the mill. From the weight of the sample cut in a certain time the corresponding mill tonnage per 24 hours can be determined.

The timing arrangement is shown in the accompanying drawing. On the shaft of the drive pulley of the conveyer belt is a lug *D*. When the plate *B*, on which is mounted a gong, is shoved forward by the lever *A*, the lug on the shaft strikes lever *E*, ringing the gong at every revo-

lution of the conveyer-belt pulley. The plate *B* slides in grooves *C* and *C'*.

The number of strokes of the gong, while the sample is being cut, is noted, after which the sample is weighed and the corresponding mill tonnage per 24 hours figured. A table giving tons per day corresponding to pounds per revolution of the pulley has been worked out for sample weights of from 11 to 40 lb.;



TIMING DEVICE IN BUNKER HILL & SULLIVAN MILL

it reads to the nearest ¼ lb. The rate of travel of the conveyer belt is constant so that the various tonnages per 24 hours were calculated from the weight of ore carried on any certain length of belt. This is determined by the discharge per revolution of the pulley.

Volatilization of Lead and Silver in Cupellation

BY DONALD M. LIDDELL*

The following is a record of experiments to determine lead-cupellation losses by volatilization in the ordinary bone-ash cupel, and also the cupellation losses of silver. Fine silver and test lead almost free from bismuth were taken for these experiments, so that any effect of various impurities on the volatilization losses is eliminated.

Weight Lead Taken, Grams.	Weight Silver Taken, Mg.	Weight Silver Recovered, Mg.	Per Cent. Ag Recovered.	Cupel Weighed		Addition to Cupel, Grams.	Loss of Litharge, Grams.	Per Cent. Loss.	Remarks.
				Before, Grams.	After, Grams.				
20	109.64	108.02	98.52	34.36	55.54	21.18	0.37		Copious feathers.
20	102.14	100.40	98.30	34.53	55.78	21.25	0.30		Copious feathers.
20	109.76	107.98	98.38	35.16	56.36	21.20	0.35	1.81	Well feathered.
20	100.26	97.80	97.55	34.20	55.17	20.97	0.58		Trace of feathers.
20	103.72	101.52	97.88	35.62	56.82	21.20	0.35		Trace of feathers.
15	101.80	100.56	98.78	35.38	51.34	15.96	0.20		Frozen and reopened.
15	100.88	97.00	96.15	35.00	50.95	15.95	0.21		Frozen and reopened.
15	105.16	103.32	98.25	34.78	50.69	15.91	0.25	1.46	Copious feathers.
15	103.52	101.12	97.68	34.80	50.68	15.88	0.28		No feathers.
15	106.18	103.76	97.72	34.72	50.64	15.92	0.24		No feathers.
10	107.08	105.58	98.60	12.80	23.49	10.69	0.08		Frozen and reopened.
10	102.20	101.00	98.83	11.89	22.59	10.70	0.07	1.14	Frozen and reopened.
10	103.30	101.44	98.20	11.50	22.17	10.67	0.10		Slight feathers.
10	101.70	99.44	97.78	11.03	21.56	10.53	0.24		No feathers.
5	102.94	101.74	98.83	12.23	17.57	5.34	0.05		Copious feathers.
5	104.40	103.24	98.89	12.16	17.51	5.35	0.04		Copious feathers.
5	106.40	104.72	98.42	12.52	17.84	5.32	0.07	1.48	Trace of feathers.
5	101.56	98.96	97.44	12.82	18.09	5.27	0.12		No feathers.
5	105.74	103.04	97.45	12.07	17.32	5.27	0.12		No feathers.

The method adopted was to bake cupels sufficiently long to insure freedom from organic matter and moisture; weigh the cupel; and cupel known amounts of lead, noting the gain in weight of the cupel. The difference between this weight and the calculated weight, of the original charge in terms of PbO, assuming that the lead is all oxidized to PbO, is the loss of litharge by volatilization.

The objections to the method are: (1) If any lead is oxidized to Pb_3O_4, the loss by volatilization is greater than it appears to be; (2) the cupels may lose weight in handling, which would make the apparent loss greater, although precautions in manipulaion can almost overcome this. The records by individual cupels is shown in the accompanying table, with those cupels which are noted as "frozen and reopened," there was an effort made to run especially cold throughout the cupellation. It is interesting to note how the volatilization losses of lead respond to this, while with the silver the results corroborate the general experience, that a silver assay frozen and then reopened may be correct or may be decidedly low. Omitting the frozen beads it is interesting to note how the loss of silver swings with the feathering of the cupel, being a good proof of the narrow temperature limits within which two commercial assayers must work in order to keep within the ordinary splitting limits.

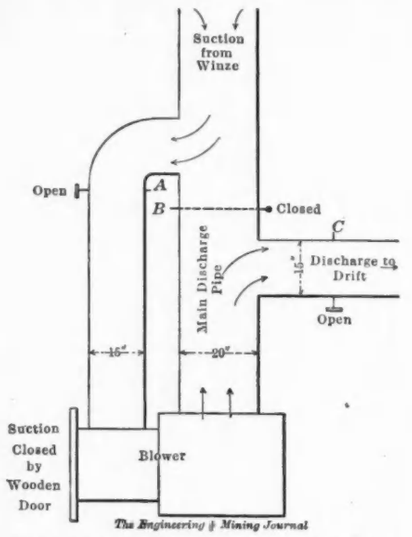
As of further interest it may be noted the furnace in which the above experiments were run had a forced draft which carried off the lead fumes. When the pipe which carried off the fumes was cleaned after several months' running, the condensed lead oxide was found to carry 23.8 oz. Ag per ton. At this rate the litharge carried off in the above experiments, viz. 4.02 grams, would have contained 3.271 mg. of silver or about 0.16 per cent. of the silver cupelled. This, however, is only two-sevenths the amount of volatilization loss as given by direct assay of the cupel bottoms and determination of the fineness of the beads recovered. However, it is possible that with greater refinements, this method might give valuable determinations of silver losses.

*Grasselli, Indiana.

Piping Arrangement for Fan Blower

The accompanying sketch shows a simple piping arrangement for reversing the air current from a fan blower. The scheme is employed on the 2000-ft. level of the Union mine, at Virginia City, Nev., where a Sturtevant, multivane blower is used to supply air to a winze from which levels are being opened. The main discharge of this blower is 20 in. in diameter and the fan is run at 1120 r.p.m., being belt connected to a 20-h.p. motor. The power consumption is about 16 horsepower.

Ordinarily the fan is used merely to blow fresh air down the winze through the 20-in. main-discharge pipe. After blasting, it is, however, necessary to draw the foul air and gas from the winze. The 20-in. pipe then acts as a suction pipe, the air current being drawn (into the blower) through the parallel length of 15-in. pipe and discharged through the 20-in. pipe and connecting 15-in. pipe. A wooden door or gate is used to close the suction end of the blower and the gates *A*, *B* and *C* in the pipes control the air current. The sketch shows the blower drawing air from the winze and discharging it into the drift. After clearing out the winze the door is removed from the suction of the fan, valves *A* and *C* closed, *B* opened, and fresh air is blown into the winze. This is a much more simple arrangement than is usually seen and requires a minimum amount of pipe: The wooden gate to close the suction end of the fan can be quickly constructed of a few nails and some plank.



PIPE ARRANGEMENT ON FAN BLOWER USED ON COMSTOCK

It is much quicker and more economical to draw out bad air than to force it out by blowing in fresh air. In the winze mentioned, no time has to be lost between shifts even though the temperature of

the air would quickly rise to above 120 deg. F. if artifical ventilation were not resorted to. By this arrangement it is possible to deliver the gases directly to an upcast air current instead of allowing them to mingle with the air currents about the winze station.

Construction and Operation of Hand Jigs

In many outlying districts where water is scarce and the scale of operations at small mines does not permit of a large expenditure for plant, it is often possible to produce small quantities of ore which would yield a shipping product, if suitable appliances could be installed with a moderate outlay. For this purpose a jig operated by hand has proved its usefulness, especially in the treatment of lead, zinc and copper ores.

With sulphide ores, good results can be obtained, provided the ore is fine enough and several sizes carefully screened for treatment. At the Messina copper mine, in the northern Transvaal, a number of hand jigs were installed under the direction of J. M. Calderwood, and he has described[1] their construction and operation.

Ease of Operation

As will be seen from the accompanying sketch, the ore box, having a screen bottom, is moved up and down in the water tank by means of the lever, which is given a quick down stroke with somewhat slower recovery, and just sufficient play or loose motion to give the required movement. The work is soon learned and carried out in an expert manner by boys. The box is filled by shovel, and a few minutes' jigging is sufficient to allow the heavier mineral to settle on the screen and the gangue or tailings to collect on top.

The top layer of tailings is first removed by means of a tin scraper, and then the concentrates. The concentrates are not removed each time the tailings are scraped off, but allowed to accumulate until in the judgment of the operator there is a sufficient accumulation of clean product, which is then dried and bagged for shipment.

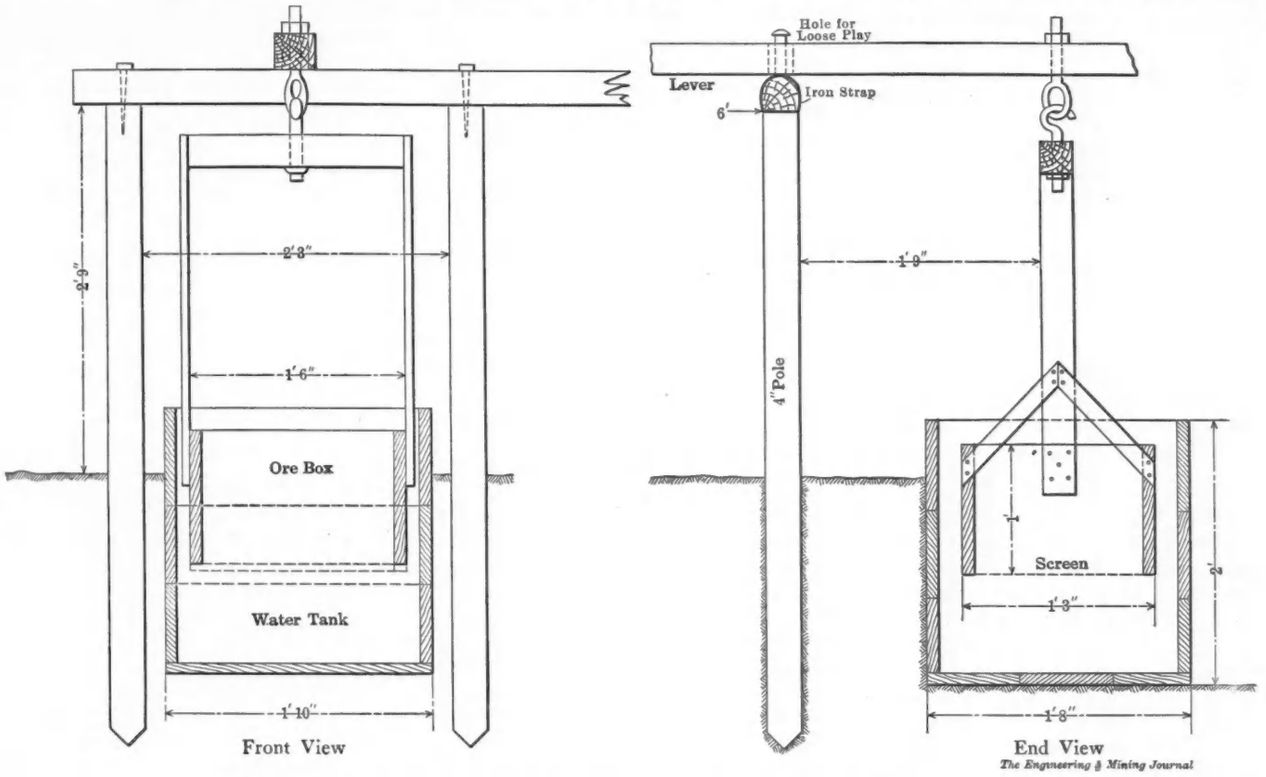
Little Water Required

The tank or hutch is kept full of water, and the fine material and slimes settle in the bottom and are emptied as often as necessary by removing the screen. The quantity of water required is small, and is chiefly to make up for the loss by splashing and for refilling the tanks. The fines mentioned can be retreated in another jig having a smaller mesh screen if of sufficient value.

The mesh of the jig screen depends upon the size of the screened material treated and the proportion of fines desired. For coarse ore, ½-in. iron-wire screening is used, and for finer material ¼- to 1/16-in. screening, although for close work even finer screening may be used. The capacity of the hand jig, of course, depends upon the class of material treated and the grade of the ore as regards its mineral contents. From half a ton to one ton of material per day can be handled by each jig, according to the grade treated and the experience of the operator.

Satisfactory Results

The results obtained compare favorably with the work done by mechanical jigs, as regards the value of the concentrates and tailings produced. The initial outlay is small and the cost of operating a battery of hand jigs is merely a question of labor, repairs to screens, etc. The operation of these jigs may appear to be tedious, and certainly is when compared with the work done by the large mechanically operated jigs, whereby clean concentrates are automatically turned out and the tailings pass off without handling, but the importance and usefulness of the hand jig has been recognized and employed on many occasions where conditions have been feasible for their adoption.



Constructional Details of Jig Used at Messina Mine in Northern Transvaal

[1] *South African Min. Journ.*, March 12, 1910.

There is much activity in the magnesite mines of Livermore, Alameda county, Cal. Kilns are being built to calcine the magnesite prior to shipment. It has been found too costly to haul the 35 miles to railroad by team and the operators will again use a traction engine. The engine takes 3½ days for the round trip, hauling three wagons besides the oil-fuel wagon.

The True Story of the Camp Bird Discovery

DENVER CORRESPONDENCE

In 1875 William Weston was sent to London as European agent of the Kansas Pacific Railway. The following year, he received a letter from a friend, Captain Higgin, formerly of the British army, then staying in Del Norte, Colo., with Robert Andrews, assayer, and formerly melter at the Denver mint. Captain Higgin informed Weston that some extraordinarily rich ore was coming there to be assayed from the Wheel of Fortune mine, in the Sneffels district, and advised him to enter the Royal School of Mines and learn the assaying of the ores of gold, silver and lead, and then come out to San Juan. This Weston at once did; and resigning his railway appointment he worked for six months in the metallurgical laboratory and attended the lectures by Doctor Percy, then head of that school.

In October, 1877, Weston arrived at Del Norte, having wagoned his outfit over from La Veta, which was then the end of the railroad; from there he packed his outfit on burros over Cunningham gulch to Silverton, and thence up Mineral creek, and over the divide by Commodore gulch into Imogene basin, in the Sneffels district.

CLAIMS STAKED

Here he made the acquaintance of George Barber, an Englishman, and a good miner. The two formed a partnership, built a log cabin, got up some supplies from Silverton, and then staked seven claims; the Gertrude, Una, Crusader, Conqueror, Monument, Emily and Norma. They worked these single-handed for four years. The Gertrude and Una being at the head of the gulch, and at an elevation of 11,500 ft. were almost inaccessible, and on these they did only assessment work. Weston assayed his own ores, as he had brought an outfit with him, and obtained gold returns of from $12 to $20 per ton from Gertrude and Una outcrop ore, but at that time the smelteries would not pay for less than an ounce per ton of gold, and it cost $35 per ton to pack the ore to the Greene smeltery at Silverton, and $45 per ton for treatment, so it would not pay to extract ore running less than $100 per ton.

UNA CHANGES HANDS

Weston & Barber conveyed the Una to H. W. Reed and his brother Caleb, they agreeing to drive a crosscut tunnel to intersect the Gertrude and Una vein 150 ft. below its outcrop. This they did, but cut the vein in a "pinch" showing no pay ore. The Gertrude and Una were described in special correspondence of the JOURNAL under the head of "San Juan Mines" in the issue of July 24, 1880, and incidentally prophesied to be the "coming bonanza."

In 1881 W. C. Coman, a mining engineer, of Quincy Ill., visited the basin to examine the Hidden Treasure for Orrin Skinner, a lawyer of that city. He saw the Weston & Barber group, and subsequently they sold it to Skinner for $50,000, receiving $20,000 each in cash, and paying Jim McCoy, of Quincy, who introduced the business, $10,000 as commission.

Orrin Skinner incorporated the Allied Mines Company, the chief stockholders of which being Mr. Blair, Mr. Browning, formerly Secretary of the Interior under President Lincoln, Thomas Ewing, Mr. Sanders, of Haverhill, Mass., and other prominent men in the East. Coman was made manager of the mill and metallurgical department, and Weston, mine manager.

FIRST COMPANY WRECKED

Skinner ordered a large mill, which was entirely unwarranted by the mine development, started in on a stock-jobbing scheme, and soon wrecked the concern, Weston resigning when money was not forthcoming in advance to pay his men. The last work done on the Gertrude was a contract let to drive 50 ft. on the vein. It was late in the autumn and when slides began to run the contractor got scared and quit the work after he had completed only 38 ft. He brought no ore down to the superintendent for assay, nor could the latter get up to the mine; subsequently it was found that the last 10 ft. of rock passed through contained gold, but back of that there was no ore.

About 14 years after this Thomas F. Walsh was running a pyritic smeltery at Silverton, and meantime the Allied Mines properties had been sold for taxes and practically abandoned. In those days no concentration was being done, and consequently silica predominated in the dumps of low-grade ore which would not pay to ship. The veins of the San Juan region are all silicious. Walsh was looking for these low-grade dumps carrying sufficient gold and silver to pay their freight to Silverton as he needed the silica for fluxing the basic ores of the Red Mountain district which he was then treating.

CAMP BIRD ORGANIZED

A. W. Richardson, the first prospector in Imogene basin, still owned and was working some claims there, and he was asked by Walsh to sample the dumps of the Allied mines, Walsh being then in Ouray. Richardson sampled the Gertrude dump, sent the samples down to Walsh, who had Harry Strout assay them. These disclosed some rich gold ore, and a search showed that there was gold in the face of the Gertrude drift. This happened in September, 1896.

Walsh then set quietly to work, and bought up practically the whole basin; the Allied Mines claims, including the Gertrude, on tax titles, and the Una on a bond from H. W. Reed for $10,000. He called the whole group the Camp Bird mines. Eventually Walsh sold out to an English company, and the $3,000,000 which has been paid in dividends was taken out of the Gertrude and Una claims, and not out of any claim called the Camp Bird, which was a claim east of the Gertrude located by A. W. Richardson after the ore had been found in the Gertrude. Walsh was a large owner of stock in the English company, so shared in the above dividends, besides receiving $5,250,000 for the mine; he also took out a large sum from the mine prior to selling.

The above is the true story of the discovery and development of this great gold mine, unvarnished by the various romantic yarns which have been attached to it by sensational newspaper writers, and it resolves itself into the following facts: Weston and Barber located the claims, A. W. Richardson discovered the rich ore, and Thomas F. Walsh, by good management, aided by the mine's extraordinary richness, developed it into one of the world's great gold producers.

Work of the Canadian Department of Mines

The work of the Mines Branch of the Canadian Department of Mines for this season has been arranged as follows:

Extensive work is to be done investigating the peat bogs along the Canadian Pacific railroad and tests of this fuel will be made at the Ottawa fuel testing plant. The iron-ore deposits of New Brunswick and Nova Scotia are to be investigated by Einar Lindeman. An experimental ore-dressing plant for the concentration of iron ores is to be installed at the Ottawa testing plant by G. C. Mackenzie.

The copper resources of Canada will be studied by Dr. A. W. G. Wilson. The season's work on copper will be mostly in Ontario and some of the eastern provinces.

The commercial processes for utilizing the sulphur of pyrite are being investigated with the object of preparing a special bulletin. The molybdenum deposits of Canada will be investigated by Dr. T. L. Walker. A special report on the building and ornamental stones of Ontario is in preparation. A second edition of the monograph on mica will be issued during the year. The manufacture and use of explosives will be investigated by J. G. S. Hudson.

Officers of the division of mineral resources and statistics will visit mining districts in various parts of the Dominion for the purpose of collecting statistics of mineral production. The plant at

the School of Mines, Kingston, has been placed at the service of the Mines Branch for conducting certain metallurgical experiments, especially in connection with Canadian zinc ores.

New Keystone Copper Company

The first annual report of Consulting Engineer J. Parke Channing to the directors of the New Keystone Copper Company was made this week. The company is capitalized at $3,000,000, comprising 600,000 shares with a par value of $5 each, of which 358,174 have been issued. The financial report from the beginning of operations to June 14, 1910, shows receipts of new capital amounting to $352,166. There has been expended on the mine $149,245, leaving a balance of $202,921. Mr. Channing's report is given, practically in full, below:

The property of the New Keystone Copper Company consists of about 243 acres of land in Gila county, Ariz., about seven miles west of Globe, in the Miami district. Before the property was acquired by this company the major portion of it was operated by the Keystone Copper Company, which exploited some veins in granite porphyry in the southern end of the property, and large shipments of high-grade carbonate and silicate ores were made.

The developments at the Miami called attention to the possibilities of disseminated ore in the northern portion of the property, where much Pinal schist outcropped, and with that view operations have been continued in that portion of the property for the last year.

Of the total 243 acres surface indications show that probably about 60 acres are underlain with Pinal schist, though in a great many cases the Pinal schist is overlain by a relatively thin sheet of granite porphyry varying from 25 to 200 ft. in thickness, and it is in this district that explorations have been carried on.

Development Work

The work up to the first of June consisted of 30 drill holes, a main shaft 330 ft. deep, from which drifting on the 150-ft. and 250-ft. levels has been conducted to a total length of about 7200 ft. In addition to this, 1200 ft. of raises and winzes have been put through, making a total of approximately 8730 ft. of underground work.

Based upon the results of the underground work there has been developed on 11 acres of ground 2,000,000 tons of ore. The assay of 591 samples from this area gave an average of 2.36 per cent. copper. In addition to this 11 acres there are eight acres prospected by drill holes which would indicate an additional area of probably the same tonnage and value per acre as that already opened up.

The development of the property will be continued by the use of two drills, which will be followed up by underground work, and while it is impossible to predict the future, there seems to be strong probabilities of materially increasing the tonnage already developed and indicated.

The exact relation of the granite porphyry to the ore has not yet been thoroughly worked out and it is not yet known whether or not concentrating ore may be found in the southern part of the property, or in those places more deeply covered by the granite porphyry.

The property is on the mineral belt, the sequence of the properties from the east being Miami, Inspiration, Keystone and Live Oak. The southern portion of the property is well adapted for the driving of tunnels for the extraction of the ore. While the orebody is thin the ground is extremely dry, and mining can be carried on at a low figure by the use of an adit tunnel.

No steps have been taken toward the consideration of a concentrator for the property, it being considered more desirable to thoroughly determine the tonnage of the ground before giving that matter serious consideration.

Utilization of Peat in Canada

The fuel tesing plant in Ottawa is to be operated this season under the direction of B. F. Haanel, by the Canadian Department of Mines, for the purpose of experimentation and demonstration. A second producer, suitable for lignite and bituminous coal, is to be installed at the plant.

The Government peat bog at Alfred is to be operated for a period of about three months to demonstrate the latest process of manufacturing air-dried peat. Several thousand tons will be produced during the present season. Part of the peat fuel produced will be shipped to Ottawa for use in the peat-gas producer plant now installed, and part will be sold for domestic use. The operation of the plant at the bog, which is open to public inspection, is under the direction of A. Anrep. The bog can be reached from Caledonia Springs, or from Alfred, on the Canadian Pacific railroad.

The investigation of peat bogs in Canada, to ascertain their extent and to determine the quality and quantity of peat available, will be continued by A. Anrep after the operating plant at Alfred is closed down for the season.

Steel Making in Great Britain

The British Iron Trade Association reports the production of steel in Great Britain in 1909, as shown in the accompanying table.

The total bessemer or converter steel in 1908 was 1,478,539; open-hearth, 3,817,103 tons. The increase in bessemer in 1909 was 254,681 tons, and in open-hearth ingots 331,305 tons; a total gain of 585,986 tons, or 11.1 per cent. The production of bessemer-steel rails, ties and fishplates amounted to 821,079 tons, which was 105,672 tons more than in 1908 and about equal to the 1907 production. While the production of open-hearth rails increased greatly, there was a falling off in blooms and billets. Imports of blooms and billets were largely increased.

STEEL PRODUCTION IN GREAT BRITAIN.

	Acid		Basic		Total	
	Tons.	Per Ct.	Tons.	Per Ct.	Tons.	Per Ct.
Converter	1,111,042	18.9	622,178	10.6	1,733,220	29.5
Open-hearth	2,763,158	47.0	1,385,250	23.5	4,148,408	70.5
Total	3,874,200	65.9	2,007,428	34.1	5,881,628	100.0
Total, 1908	3,485,306	65.8	1,810,336	34.2	5,295,642	100.0

The steel production of the United Kingdom for 10 years has been, in long tons:

	Bessemer.	Open-Hearth.	Total.
1900	1,745,004	3,156,050	4,901,054
1901	1,606,653	3,297,791	4,904,444
1902	1,825,779	3,083,288	4,909,067
1903	1,910,018	3,124,083	5,034,101
1904	1,781,533	3,245,346	5,026,879
1905	2,009,712	3,879,748	5,889,460
1906	1,907,338	4,554,936	6,462,274
1907	1,859,259	4,663,489	6,522,748
1908	1,478,539	3,817,103	5,295,642
1909	1,733,220	4,148,408	5,881,628

The production of 1909 has been exceeded three times—in 1905, in 1906 and in 1907. It was less than in 1907, the year of maximum production, by 641,120 tons, or 9.8 per cent. The proportions have not varied greatly, that of converter steel decreasing from 35.6 per cent. in 1900 to 29.5 in 1909; while that of open-hearth increased from 64.4 to 70.5 per cent. of the total.

Mining Water

There seems to be a continued demand for water from the Old Dominion mine, Globe, Ariz., in addition to furnishing 1,000,000 gal. per day to the Miami company at 5c. per 1000 gal. when that plant starts, the Old Dominion is negotiating a contract with the city of Globe for between 400,000 and 500,000 gal. daily at a cost of 10c. per 1000 gal. for city purposes. It is not improbable that the Old Dominion will soon come to a position where its pumping costs will not be very heavy, as a result of its income from the sale of water, and this will be a considerable factor in reducing operating costs.

A Silver Bearing Diorite in Southern Arizona

Silver Considered an Original Constituent of the Rock, and Is Inclosed in Secondary Magnetite. Ferro-Magnesian Minerals Much Altered

BY JOSIAH BOND*

The discovery of silver in altered diorite is interesting as describing a new occurrence of silver. Several years ago I determined the presence of copper in small quantities in the First Mountain trap of New Jersey, where it was probably a primary mineral, and following Vogt's suggestion, showed that this was probably the source of the copper deposits underlying that rock mass. In view of the exploitation of what are called mineralized porphyries for copper in these days, this occurrence is suggestive of the possibility of low-grade silver deposits of the same general character. The determination of the rock is by Frederick W. Apgar, of Jamaica, N. Y., and is as follows:

General Characteristics

"In hand specimens the rock presents a granular, mottled appearance, of rather fine grain, greenish gray in color on fresh fracture, weathering to a brownish color on exposed surfaces; the alteration due to weathering extends only slightly beneath the surface.

"A close megascopical examination shows that the prevailing color is due to irregular grains of a green mineral inclosing, in many cases, minute specks of magnetite. In the lighter colored areas the striations of a plagioclase feldspar can be detected with orthoclase and occasionally minute grains resembling quartz in fracture. Cleavage plates of biotite appear sparingly. The finely granitoid texture, with plagioclase as the chief feldspar and moderate quantity of dark ferromagnesian mineral, would lead to the opinion that the rock was either a diorite or possibly a gabbro.

"Under the microscope, however, in thin section, an examination shows the mineralogical characteristics of a diorite, but the presence of pyroxene places the specimen close to the gabbro group, probably as more definitely describing it, the name augite-diorite may be applied. Many interesting metamorphic changes can be traced through various sections, including the presence of minute well defined crystals of native silver disseminated through the rock mass, which is an unusual occurrence in igneous rocks.

"A summary of the minerals composing this diorite follows, tabulated in the probable order of their crystallization from the molten magma: Apatite, zircon and titanite (rare), some magnetite and the silver; part of the magnetite is secondary as will be shown later; then in the order of development, augite, hornblende and biotite and finally plagioclase; and as a binder, filling the interstices, orthoclase and a small amount of quartz.

The Feldspars

"The most abundant constituent of the rock is plagioclase, which occurs in characteristic elongated hypidiomorphic forms varying in length from about 0.2 to 1.7 mm. Twinning, according to the albite law, is universally common. In some cases polysynthetic twinning after both the albite and pericline laws was observed. The majority of the crystals appear to be andesine as indicated by the extinction angles in sections normal to the albite twinning plane (maximum angle slightly over 20), but the composition varies; in a few crystals optical tests seemed to indicate a composition closely approaching labradorite.

"Inclusions of small idiomorphic apatite crystals are comparatively rare, but extremely minute, glassy inclusions are frequently observed. The evidence of alteration in the plagioclase feldspars is not marked, but a slight cloudiness partially due to kaolinization, and partly to the glassy inclusions above mentioned, is visible along crystal boundaries and cleavage cracks.

"Orthoclase, one of the last minerals to form, appears in grains and as a cementing material filling the interstices between the other minerals, it is comparatively fresh in appearance. Quartz, although of infrequent occurrence in the rock, was observed in one section as small, irregular grains, evidently formed at about the same time as the orthoclase.

The Amphiboles

"Compact green hornblende in irregular grains, possibly original, is found sparingly. The amphibole has the peculiar uralitic structure consisting of approximately parallel, fibrous or columnar aggregates, light green with slight pleochroism, and occasionally in aggregates of a radiating fibrous habit. In all cases chlorite and epidote occur in conjunction with the uralitic bornblende and in many instances the remnants of what appears to be a fibrous augite.

"The epidote, distinctly a secondary formation, occurs in pale yellow fibrous aggregates bordering the augite as well as surrounding and penetrating the secondary hornblende.

The Pyroxenes

"Augite in well defined, colorless crystals, evidently original, is found sparingly, nearly always bearing evidence of alteration. The earliest trace is a slight, cloudy greenish or brownish tint. In an advanced stage of alteration, minute greenish fibrous masses and plates spread through the crystal from the edges and give the appearance of a confused aggregate; finally, uralitic hornblende results with only a trace of the original augite remaining.

"All stages in the alteration of augite can be observed in the sections and render it probable that all the uralitic hornblende resulted from the metamorphism of augite. Possibly the compact green hornblende may be still a step in advance in the alteration, being formed from the fiberous hornblende, but the conditions seem to favor more strongly the theory that this is a primary mineral.

Other Minerals

"Cleavage plates and crystals of biotite, usually much corroded and surrounded by aggregates of fibrous hornblende and magnetite, were observed scattered sparingly through the sections, also minute grains and plates of hematite, the latter probably derived from augite.

"Magnetite is present in the rock as an abundant constituent, and bears evidence of having separated early in the solidification of the magma. In other cases it occurs in inclusions and as aggregates and grains surrounding the hornblende, biotite and silver and is certainly a product of later metamorphic change. It is difficult and often impossible to distinguish in all cases with certainty between the primary and the secondary formation.

"Native silver hypidiomorphic crystals varying from 0.05 to 0.2 mm. in size, included in all cases in magnetite, are of constant occurrence through the rock; their sharp crystal faces and angles lead to the supposition that they are an original constituent; a few partially corroded forms and irregular grains are seen.

"In the rock under consideration it thus seems probable that upon consolidation the predominant ferromagnesian mineral was augite, with possibly some amphibole, then later, by partial metamorphism through hydrochemical processes, a change took place and the gradual formation of fibrous uraltic hornblende, replacing the augite with the de-

*Patagonia, Arizona.

velopment of epidote and magnetite, altered the mineralogical character.

"It would appear also, from the conditions observed in the slides, that at an early period in this action a partial corrosion or solution of the silver crystals took place, and later by the deposition of secondary magnetite and its segregation around the metallic silver, further change was prevented, preserving the silver as observed, while the alteration of the ferro-magnesian minerals proceeded."

Geology of the Silver Bearing District

The rock above determined lies on the south slope of the Santa Rita mountains in Arizona. The geological sequence has not been determined by competent authority, but it is quite clear that the mass of the rock lies on the slope of an earlier mass of typical syenite, which carries a large variety of accessory ingredients. This syenite seems to be the earliest rock now exposed in this vicinity, and is, as it now seems, the core of the district. On the other side of the mountain are exposed a variety of breccias, which are of later origin. The augite-diorite here described is itself flanked by effusive andesites and dacites and probably these are subsequent to the diorite, though this has not yet been completely demonstrated.

Syenite Contains No Veins

The syenite, so far as now known, presents no veins, but all the other rocks are cut by veins from 3 to 10 ft. wide, all of which, so far as tested, carry silver in or near the outcrop. There has been no work done in depth on any of these veins, but several 100-ft. shafts near by show silver in the bottom, generally associated with lead or copper, or both.

The rock herewith determined is from a point within a few feet of the original surface. As the silver is probably an original constituent of the rock, but is partially corroded, it follows that some part of the silver must have been carried away in solution to be deposited where conditions were favorable to precipitation. The eroded rock must have been enormous in quantity, so that the amount of silver taken into solution has been large, as the carefully sampled rock near the surface still carries 7.5 oz. of silver.

The economic point to be determined is whether the deeper rock may have preserved its full original silver content and be amenable to exploitation. It is such problems that occasionally face the prospector. I may add that since this discovery of silver, some other rocks in the district are found to carry similar disseminated silver, as well as copper; but to what extent has not been fully demonstrated as yet.

Tunnel of the Utah Metal Mining Company

Salt Lake Correspondence

The Utah Metal Mining Company, which is driving the 11,000-ft. drain and operating tunnel between the Tooele side of the Oquirrh range and Carr Fork, Bingham district, Utah, has completed all of its preliminary work and is advancing the face of the tunnel 80 to 90 ft. per week. The tunnel has been straightened and enlarged to 8x10 ft. and is in a distance of 3000 ft. A double track, 24-in. gage, with 35-lb. rail, will be laid its entire length. At present a single track and switches are used. The grade is 0.4 per cent. Waste and supplies are hauled by a Baldwin-Westinghouse locomotive in trains of four cars. The cars are side dump and have a capacity of two tons each. An exhaust fan with a capacity of 5300 cu.ft. per min. has been installed.

Power Plant

Power is produced from the company's own water supply. A pipe-line has been laid from springs in Pine flat and Hansen Springs cañon, both branches of Middle cañon, in which the plant is situated, and gives a head of 750 ft. at the powerhouse. A 125-h.p. Pelton wheel is direct connected to a Westinghouse 55-kw. direct-current generator, and furnishes electricity for the traction circuit. The fan at the entrance of the tunnel is driven by a 15-h.p. motor connected to this line. The water from the tunnel amounts to about 500 gal. per min. This has a head of 160 ft. at the power house, and drives a 20-h.p. Pelton wheel, which operates a separate dynamo for the lighting circuit. An Ingersoll-Rand two-stage compressor with a capacity of 600 cu.ft. of free air per min. is belt-driven by a 60-h.p. Pelton wheel.

Tunnel May Be Used to Transport Ore to International Smeltery

The company has two additional power sites, lower down in Middle cañon. By piping the water two miles from the present power plant, a head of 900 ft. can be secured. Below this is another power site, and if it should be required, more than 1000 h.p. can be developed. The company also has a second tunnel site 700 ft. vertically below the tunnel now being driven.

The tunnel started in limestone and has cut interbedded limestone and quartzite with a flat dip. During the last week, mineralized limestone was cut for 70 ft. Two Ingersoll-Rand 3¼-in. drills are used abreast, and three shifts are worked, drilling and blasting each shift.

When the tunnel is completed it is expected that the company will transport some Bingham ores to the International smeltery. To do this, it will be necessary to build an electric road from the tunnel to the smeltery, six miles. This will have a down grade of about 3 per cent.

Leasers are working on the Bingham side and shipping both silver-lead and copper ore. Some of the old upper workings where this ore is being mined are 2000 ft. higher than the new tunnel. The company has built a living house accommodating 40 men, with a library, bath rooms, etc. At present, 50 men are employed.

Recent Tariff Decisions

Two decisions of some importance have been filed by the Board of General Appraisers on duties levied by the new tariff on articles in which the metal industries are interested:

The board has sustained protests filed by the Goldschmidt Thermit Company, Moses Norris and others, regarding the classification under the tariff of metallic chromium, manganese, tungsten, etc. General Appraiser Fischer, who writes the decision, says that these substances differ from the ferroalloys passed upon in an earlier decision of the board in that they have a much smaller percentage of iron in their composition, although in other respects they are identical in character and are used similarly in the manufacture of special steel or alloy steels. The metals in question are combinations of chromium and the other substances mentioned above. The decision says: "We hold the merchandise specified in schedule *A* dutiable properly as claimed at the rate of $4 per ton under paragraph 122 of the tariff act of 1897, by similitude to ferromanganese."

Bort

In sustaining a contention raised by the General Electric Company, the board holds that, under the provisions of the tariff of 1909, so called bort, a species of commercial diamond, entitled to free entry. General Appraiser Sharretts, who writes the decision for the board, refers to the fact that a similar issue arose under the Dingley act. He points out that when the earlier decision regarding diamonds for industrial purposes was handed down by the board, the courts upheld the decision for free entry. The board is convinced that the diamonds in question are not intended by Congress to be dutiable at 10 per cent., as alleged by the Government. The decision says that if Congress had intended that diamonds for industrial purposes were to be regarded in the same category with stones for jewelry and decorative purposes, they would have been provided for specifically in the new law with a corresponding duty. As the new law stands, the board believes that diamonds intended for tools and similar uses are free of duty. The protest is sustained accordingly.

Leinweber Method of Extracting Oil from Wells

Endless Cable Carrying Absorbent Material Is Main Feature. Used Successfully at a Depth of 3838 ft. Delivers 7 oz. Oil per Foot of Cable

BY FREDERICK A. TALBOT*

A new method for extracting oil from boreholes was described in the JOURNAL, May 15, 1909. It is the invention of Bruno Leinweber, an Austrian engineer. The principal feature of this system is the employment of an endless cable, which is faced on one side with carpet shag or pile, so as to absorb the oil as the band trails through the contents of the pit, and which is subsequently passed between mangling rollers to drive out the oil with which it has become saturated. The result of the preliminary tests on the Kryg oilfields were considered so satisfactory that arrangements were completed for the thorough test-

FRONT VIEW OF LEINWEBER MACHINE IN OPERATION

ing of the system under normal conditions on the Galician oilfields. Georg Mészáros, the director of the Galician-Carpathian Petroleum Company, has been interested in the experiments, and when the Maryampolski tests were completed he installed the apparatus at Boryslaw, so that comparative results might be obtained with the ordinary methods of raising the oil. These trials have been in progress for a year and have substantiated the claims of the inventor.

IMPROVEMENTS IN THE PROCESS

The inventor has simplified the machine. Instead of having a nest of guide rollers and a pair of pressing rolls, he now employs only two wheels. The upper or driving disk is of large diameter, and the lower disk is about a third of the diameter of the upper. The two wheels are so mounted as to bring their rims together and almost secure a friction drive. The upcoming band passes over the lower disk and under the larger wheel being mangled in the process, so that the oil is driven out, and then round the periphery of the upper wheel from which it drops into the borehole again. This arrangement makes the machine far more compact, and facilitates transport. The complete apparatus can be fitted up in a workshop, transported intact to the borehole and set up, so that the only labor involved is the lowering of the band and the setting of the belt drive from the engine.

EXPERIMENTAL PLANS

An experimental plant was erected so that the laborers would become familiar with the operation of the machine. This installation, known as Plant No. 2, was erected over a borehole 607 ft. in depth, with tubes 5.118 in. in diameter. The band employed was an old steel-wire rope that had been used before in deep borehole investigations. It was considerably worn at places, but it served to familiarize the men with the working of the machine. The cable is 1.968 in. wide, the shag facing being 1.77 in. in width.

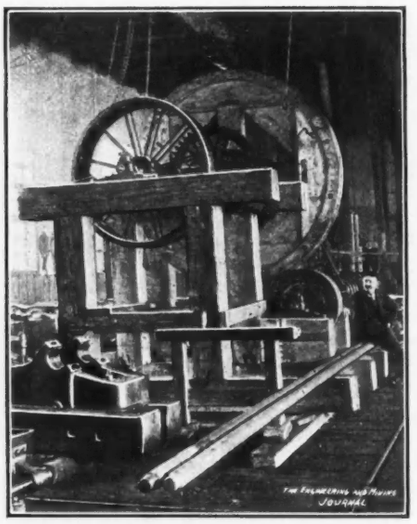
In the course of these experiments it was found that the band offered certain obstruction to the passage of the free gas issuing from the borehole. Pockets of gas formed in the tube, and when they were released suddenly, a violent shock was produced. Efforts were at once made to remedy this defect, and the inventor has now patented a special device whereby this trouble is satisfactorily overcome. The downward and upward traveling sections of the band now offer no impediment to the upward flow of the escaping gases.

The mounting and dismounting of the band at the pit is carried out quickly. It can be lowered to the full depth of 607 ft. in eight minutes, and hauled to the surface in 12 min. Severing or splicing the band to take off, or mount on the machine occupies one-half hour. As the power required to drive the cable is only that to lift the weight of the oil carried in the upcoming section (the two halves of the band counterbalance one another) and the slight friction losses, a high efficiency is secured.

PLANT INSTALLED AT A DEEP WELL

When the men had become familiar with the working of the machine, a plant was erected over pit No. 25. This borehole is 3838 ft. deep, and in order to secure the most successful results, the inventor devised a special type of steel-wire rope, the feature of which is great strength combined with flexibility. It is built up of a series of steel wires of 0.098 in. in diameter; the width of the cable being 2.2 in. It is covered with shag 1.77 in. wide, and the rope has a tensile strain of 12,540 pounds.

The borehole in which this cable is used was badly constructed, the tubes being of varying diameters and badly



SIDE VIEW OF MACHINE IN SHOP

screwed together at various points. Consequently, in order to avoid the cable scraping the sides of the tubes, the width of the band had to be kept within certain limits. This drawback notwithstanding, the band has been found to possess an absorbing and hauling capacity from a depth of 3838 ft. of 9.16 oz. of crude oil per foot of cable. The oil clings so tightly to the shag that the net yield at the rollers is about 7 oz. per foot of band. It will thus be seen that a certain proportion of oil present in the band travels up and down as a "dead load." The speed of the cable is 2½ ft. per second.

SPLICING THE CABLE

Special devices have also lately been adopted for splicing the sections of the steel rope so as to secure a flush and exceedingly strong joint. In

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fact, on several occasions this joint has proved to be far stronger than the main body of the cable. When hemp rope is used, the joints are merely sewn together by an ordinary cobbler's machine.

When this apparatus was first set up at Pit No. 25, the lowering and withdrawing of the cable was a somewhat protracted operation. Special tools had to be employed for hauling out the cable and the task lasted about six hours. Recently, however, the inventor has devised a simpler improved system, whereby the rope is hauled up by the winding engine and can be raised from a depth of 3838 ft. in about an hour. The machine framing for this pit was also made massive and heavy, so as to secure strength, but now the inventor has devised what he describes as "quick mounting machines." These are much more compact, lighter, easier to handle and transport from place to place. With the new machine, about two hours will suffice for mounting the band, and it can be lowered to 3838 ft. in 23½ minutes.

Leinweber and Plunger Systems Compared

A striking instance of the possibilities of the process was afforded in connection with Pit No. 25. The plunger system previously used raised 44,000 lb. of oil per day. When the Leinweber band was first installed, it was only operated to a depth of 3615 ft. The first runs proved the plant to be working so satisfactorily that the band was withdrawn and lengthened so as to reach the full depth of 3838 ft. After two days adjusting, it was set to work, and the yield of oil per day was increased by 50 per cent. as compared with the former system, the aggregate yield being 66,000 lb. Even this is not the maximum yield that has been obtained per day by this process, for the cable now in use in Pit. No. 2 was previously used in a borehole 2624 ft. deep and brought to the surface over 110,000 lb. of crude oil daily.

Should the band from any cause suddenly snap when running at full speed, the drive is automatically cut off and the machine at once brought to a stop. The upper end of the band is made fast and the cable wound up until the other end is regained, when the ends are respliced and the band relowered. For lowering purposes the band is coiled on a drum in the roof of the building and its descent is controlled by one man who has two large wooden levers. One actuates the mechanism for guiding the band down the borehole, while the other controls the brake mechanism.

Owing to the complete success of the system further extensions are in progress in the Galician oilfields. The inventor is at present building two new machines for more exacting work. In one the endless cable will be 8530 ft. in length and will be used in a borehole 4265 ft. deep.

Mining Notes from Norway

Special Correspondence

The Norwegian State silver-leaching works produced in the fiscal year of 1908-9 about 8300 kg. of silver, a gain of 1300 kg. over the previous year; but owing to the drop in the price of silver, the works were operated at a loss.

Nickel

The nickel mines at Evje, in Saetersta, in 1909 produced 6600 metric tons of nickel ore. The smelting of this yielded 168 metric tons of copper-nickel matte, which contained 70 metric tons of nickel. The matte was exported. Recently it has been decided to erect an electric plant for the production of nickel from this product.

Copper

The copper works at Sulitjelma employed last year, 1600 men and produced 110,000 metric tons of pyrite for export, 16,000 metric tons of smelting ore and 8000 metric tons of Elmore concentrate, which yielded 950 metric tons of copper. The Elmore concentration plant has been running since April, 1909, and gives satisfaction. The company's production for 1910 is estimated at 122,000 metric tons of pyrite for export and 25,000 metric tons of smelting ore and Elmore concentrates. The future of this company is considered promising. The ore in sight amounts to about 1,800,000 metric tons.

The famous copper operations at Röros employed daily 600 to 700 men and produced 10,000 metric tons of pyrite for export and about 17,000 metric tons of smelting ore, with a yield of 700 metric tons of copper.

The value of the total Norwegian copper and pyrite production was about $2,000,000, a small increase over 1908. The price of copper during 1909 averaged about £60 a ton, but the price of sulphuric acid was very low, about 3½c. per unit, and this caused the accumulation of a large stock of pyrite at the end of the year.

Zinc

A wet zinc concentration plant near Gru, in Hadeland, was started in November, 1909, and at the end of the year had treated 12,700 metric tons of zinc ore.

The Bergwerks A. G. Norge reported for the year 1909 an output of 5400 tons. Several important discoveries of zinc ore in the eastern part of Norway were reported during the year.

Iron Ore

From the iron districts in the northern part of Norway it is reported that the concentration plant at Sudvaranger expects to start operation in July. Its yearly capacity will be 600,000 metric tons of concentrates and briquets. Also, the plant at Salagen (Amt Tromoso), it is reported, will start operations in a short time and will produce 5000 metric tons of ore or briquets monthly. The works at Dunderlandstale were shut down during the whole year. It is said that operations will be started after a reconstruction of the concentration mill.

Important iron-ore deposits were discovered north of the Trondhjemsfjord in the county north of Breitestade and to the west in the direction of Aafjorden. The ore contains 55 per cent. iron and the orebody is estimated to contain about 7,500,000 metric tons of ore. The production of several smaller mines which were in operation during 1909 amounted to 40,000 metric tons of ore.

The works at Nas, near Tredestrand, commenced the production of crucible steel during the year with a force of 100 men. An electric steel furnace, of Alb. Hiorth patent, was built at Josingfjorden, in the county of Soggendal, and has produced several tons of steel. Also, at Odda, in Hardange, the erection of an iron and steel plant is planned.

Gold Mining in the Priamur District, Siberia

A correspondent of the *Mining Journal* says it is the opinion of geologists that the Priamur gold area in Siberia is practically untouched as to rock gold, and that only the richest sands have been worked at all, whereas reef gold is abundant in all the mining districts of the province. Expressing regret at the hitherto incomplete geological investigation of the Priamur, he continues: "Nevertheless, the gold industry there is gradually growing, as can be seen from the accompanying table furnished by the Irkutsk Mining Department.

MINING IN THE PRIAMUR DISTRICT, SIBERIA.

	1905. oz.	1906. oz.	1907. oz.	1908. oz.
Gold product	241,032	254,134	288,031	251,569
Mines work'd	251	287	278	297
Mines unw'd	617	643	617	790
New claims	300	360	566	457

The correspondent states, in conclusion, that mining technique in the Priamur is low and there is rarely any disposition shown to resort to modern methods; consequently, quiet prevails for the moment. Horsepower has lived its time; but steam and electricity are far from being generally employed. A recent effort to introduce excavators resulted in failure. More hope is now expressed in dredges; though where they are used not much skill in their use is shown, sometimes none at all. The consequence is that the mines are gradually getting into the hands of foreigners.

Report of the International Smelting and Refining Company

The first annual report of the International Smelting and Refining Company, covering the year ended Dec. 31, 1909, has just been published. This company, incorporated under the laws of the State of New Jersey, Dec. 21, 1908, has an authorized capital stock of $50,000,000, of which $10,000,000 is issued. The par value of the shares is $100. The officers of the company are: John D. Ryan, president; Dennis Sheedy, vice-president, and J. W. Allen, secretary and treasurer. The directors are: Charles F. Brooker, Charles N. King, Thomas Morrison, Charles H. Sabin, Chester A. Congdon, Edmund C. Converse, Adolph Lewisohn, William D. Thornton, Urban H. Broughton, Thomas F. Cole, John D. Ryan and Dennis Sheedy.

Statement of Financial Position

The combined balance sheet, as of Dec. 31, 1909, and the income account of the International Smelting and Refining Company and subsidiary companies, is given in the accompanying tabulation.

COMBINED BALANCE SHEET, DEC. 31, 1909.

Assets.

Fixed:		
Real estate, plants, buildings, railways, machinery, etc....		$7,816,902
Office furniture and fixtures...		800
Deferred:		
Supplies on hand.....		266,149
Metals on hand.....		72,650
Insurance unexpired.....		4,930
Current:		
Accounts receivable.....		1,615,944
Advance payments on purchases		31,869
Cash in banks and on hand...		1,989,207
		$11,798,455

Liabilities.

Fixed:		
Capital stock—Issue of 100,000 shares par value $100 each..		$10,000,000
Current:		
Accounts payable.....		630,309
Payroll labor.....		28,824
Reserves:		
Reserve for depreciation.....		203,609
Surplus:		
Net income for year ending Dec. 31, 1909 .....$1,235,712		
Deduct dividends paid $300,000		935,712
		$11,798,455

INCOME ACCOUNT, DEC. 31, 1909.

Income.

Tolls on copper and net profits on metals	$2,442,901
Interest and discount.....	67,516
Miscellaneous revenues.....	76,124
	$2,586,542

Expenditures.

Manufacturing and operating costs	$1,079,012
General expenses.....	46,004
Depreciation	225,812
	$1,350,830
Net income for year, carried to balance sheet annexed.....	$1,235,712

Early Organization

The board of directors of the company first met and elected officers on March 31, 1909, and immediately thereafter the company took over by assignment, at actual cost, a contract previously entered into by William D. Thornton with the Utah Consolidated Mining Company, providing for the treatment of the ore from the mines of that company for a period of 10 years, beginning Nov. 11, 1908. As a part of the contract, the company acquired a site near Pine cañon, Utah, upon which Mr. Thornton had already begun the erection of a smeltery.

The company also purchased from the United Metals Selling Company all the capital stock of the Raritan Copper Works, the Raritan Terminal and Transportation Company, and the New Jersey Storage and Warehouse Company. The Raritan copper-refining plant at Perth Amboy, N. J., was taken over as of Jan. 1, 1909.

Tooele Valley Railway

To serve the new smeltery the Tooele Valley Railway Company was organized under the laws of Utah. A well ballasted road has been built for a distance of seven miles from a point on the main line of the San Pedro, Los Angeles & Salt Lake Railroad near Tooele to the smelting plant. The expenditures for the year upon the Tooele plant and railroad, and upon land for the smeltery site, amounted to $1,579,628.

Data on the Tooele Smeltery

The report includes a description of the smeltery by E. P. Mathewson, who has been in full charge of the construction of the smelting works, railroad, etc. Mr. Mathewson's report contains some later information than was given in the Journal article of April 23, 1910. The capacity of the sampling mill is stated as 4500 tons per day, and the capacity of the sampling ore bins as 6000 tons; that of the blast-furnace storage bin, 3000 tons and of the roaster storage bin, 5000 tons. The 32 McDougal roasters are quoted as each having a capacity of 40 tons of dry ore per 24 hours. The smoke from the roasting department will pass directly into a large dust chamber so arranged that a system of wire filters, such as is in use at the Great Falls plant of the Anaconda Copper Mining Company, may be introduced at the expense of merely hanging the wires.

The five reverberatory furnaces are of the Anaconda type, the hearths being 19 x102 ft., and the capacity of each is estimated at 275 tons of calcined material daily. Adjoining the reverberatory building is the converter building, which is a fireproof steel structure with a clay floor. There are five converter stands, manufactured by the Power and Mining Machinery Company, all electrically operated. Matte from the reverberatories will be tapped directly into the converters, and the slag from the converters will be taken in large ladles by cross cranes to the reverberatory furnaces and poured in hot, thus making a minimum amount of cold slag to be handled. Copper from the converters will be transferred in ladles to the molds in the casting shed adjoining, and at first poured from the crane into the molds and then loaded on cars on a track adjacent for shipment.

Will Begin Smelting in August

Ore will be received from the Utah Consolidated mine over the cableway, having a capacity of 100 tons per hour, which is expected to be finished and in operation by July 1, 1910. It is planned to store 15,000 tons of ore during July, so that active smelting operations can be commenced Aug. 1. Mr. Mathewson states that the construction of the plant has gone on without much trouble, excepting that a delay of about four months was occasioned by the non arrival of the structural steel, due to a fire on the manufacturer's premises in Milwaukee.

International Nickel Company

The annual report of the International Nickel Company for the year ended March 31, 1910, shows a net profit of $2,067,528, after deducting expenses, depreciations, exhaustion of minerals, bond-sinking funds and all other charges. During the year $238,841 were expended for new equipment and additional property. The amount set apart for depreciation of plant was $305,025; exhaustion of minerals $123,581; and sinking funds $184,000. Four quarterly dividends of 1½ per cent. were paid on the preferred stock amounting to $534,745. Dividends of 5½ per cent., amounting to $487,978, were paid on the common stock.

The demand for the company's product was much larger than during the previous year and indicates a broadening of the normal market. During the year the United States battleships "Florida" and "North Dakota," as well as several government vessels, were equipped with propellers of Monel metal and the two Argentine Republic battleships now being constructed are to be similarly equipped.

After making the usual provision for depreciation of plant and mineral exhaustions, which in the opinion of the board was deemed sufficient, the net accumulated earnings applicable to dividend on common stock were $1,499,227, or equal to 16.9 per cent. on the outstanding stock.

Copperas Production in the United States

According to statistics collected for "The Mineral Industry," the production of copperas in the United States, in 1909, amounted to 42,225 short tons, valued at $464,475, as compared with an output of 35,334 tons valued at $388,674 in 1908. Prices were practically unchanged throughout 1909. New York quotations were 55c. per 100 lb. for copperas in bulk, 65@75c. per 100 lb. in barrels and 60@70c. per 100 lb. in bags.

Mines and Mill of the Consolidated Mercur Co.

Wide Veins Worked by Caving System; Little Machine Drilling; Successful Cyanidation of Complex Refractory Ores; Dry Crushing Employed

BY ROY HUTCHINS ALLEN*

The Consolidated Mercur Gold Mines Company operates the Mercur, Golden Gate and Brickyard mines, together with a cyanide plant of 800 to 1000 tons daily capacity, at Mercur, Utah. Mercur, a town of but a few hundred inhabitants, is near the southern end of the Oquirrh mountains almost on the line between Tooele and Utah counties, 62.5 miles by rail south of Salt Lake City at the terminus of the Salt Lake & Mercur railroad.

Silver mining was started in this camp in 1868 or 1869, but the work was sporadic and on a small scale, and not until about 1890 when gold was discovered, did the camp begin to attain its present importance and rank as the most famous gold producer in the State. The ore is of low grade and not free milling, and interesting methods of mining and treatment have been developed to work it at a profit.

Geology

The geology of the Mercur district has been described in some detail by J. E. Spurr[1] and from that report, modified somewhat by the later development in the mines, the following brief account of the geology is taken.

The rocks of the district comprise an exposed thickness of about 12,000 ft. of sedimentary beds of Carboniferous age, chiefly limestones, which have been folded into a simple anticline with its axis in a northwesterly direction. The mines of Mercur are all on the northeastern limb of this fold. The ore deposits occur near the bottom of the series in the lower portion of a bed 5000 ft. thick, known as the Great Blue limestone. This is a comparatively uniform, massive and pure limestone, of a dark, gray-blue color, which on weathering becomes light colored and often nearly white. It has been intruded by several sheets of quartz porphyry, from 4 to 40 ft. in thickness, which in general correspond with the bedding of the limestone in both strike and dip. As seen in the underground workings the limestone has a strike varying from north 23 deg. west in the Brickyard mine to about north 55 deg. west in the Mercur mine, with a dip ranging from 10 to 40 deg. toward the northeast.

The ore deposits underlie the sheets of porphyry and are made up of both altered porphyry and altered limestone. Their lines of greatest mineralization coincide closely in direction with a series of nearly vertical fissures which have a trend toward the northeast. The mineralizing agents are believed to have ascended in gaseous form through these fissures, depositing the ore minerals along the lower contact of the porphyry and impregnating both it and the limestone, forming a total thickness of workable ore varying from 4 to 70 ft. As a rule only a few feet of the porphyry is mineralized, the greater portion of the ore being in the limestone.

The original ore minerals included pyrite, realgar, cinnabar and gold which occurred both associated with the pyrite and probably as a telluride. The greater portion of the ore which lies within the porphyry remains unchanged, while that in the limestone immediately below is almost completely oxidized. The pyrite is in small grains; a few are visible, but most of the grains are microscopic. None of the gold is visible even under a good pocket lens. Realgar and cinnabar are present in but small amount and they are of interest chiefly in the consideration of the genesis of the ores.

The unaltered porphyry is fine-grained, compact and nearly white in color, showing a few inconspicuous phenocrysts of quartz, feldspar and biotite. This unaltered rock, however, is not seen near the ore deposits. There it is almost black, quite soft, and contains small crystals of gypsum, while upon exposure to the air it crumbles and has the semblance of a dried mud. The mineralized limestone is hard and cherty, but the evidence points to the fact that the silicification antedated the deposition of the ore minerals.

The Brickyard Mine

The Birckyard mine lies at the northerly end of the Consolidated Mercur property and adjoins the Geyser claim, which has been abandoned. It is entered by several winzes and by an incline which follows the Brickyard vein. This vein has a strike of north 23 deg. west and a dip toward the northeast varying from 20 to 40 deg. It follows the under side of a sheet of porphyry and is of the character already described. The vein varies from 8 to 40 ft. in thickness, the latter figure including also the "lower vein," which in places is worked with the Brickyard vein. Of this thickness from 2 to 4 ft. is the mineralized porphyry, which is quite as high in gold content as is the limestone, but the porphyry ore is apt to be "basic" (containing sulphides) and refractory, and has to be roasted before the gold can be extracted by cyanide.

Drifts are run close together, rarely as much as 30 ft. apart, and the ore worked out in open stopes. Much of the ore is mined by a modification of drift stoping. The vein is so flat, averaging from 20 to 25 deg., that ore will not run in the stopes and there are therefore but few chutes in this mine, and those of the simplest construction. Practically all of the broken ore is shoveled from the stopes into the mine cars, the drifts being so near together that little wheelbarrow work is required. Pillars are left to support the roof, and these are occasionally supplemented by a few stulls. At the point where the ore is 40 ft. thick it is planned to start an underground glory hole.

The ore in this mine is drilled almost entirely with machine drills, 3⅛-in. Ingersoll and Sullivan machines being used. The ground is hard and breaks badly. In running a 5x7-ft. drift, 13 to 15 holes are required for the round and the face is "slabbed" off. A round is drilled in about 1½ shifts.

The ore is trammed by hand to an incline 1000 ft. long, where it is lowered by a double-drum hoist, working in balance, to the main haulage level, and is then taken in trains of seven cars each to the Golden Gate shaft. All tramming on this level is done by horses or mules.

The Golden Gate Mine

The ore from the various properties is all brought to the Golden Gate shaft and there hoisted to the surface. This shaft in 6x16 ft. inside the lagging, and has three compartments, each 4 ft. 8 in. by 4 ft. 6 in. wide. The wall- and end-plates are of 8x8-in. timbers, while the dividers are 6x8-in. in section. The shaft was sunk vertically but the encroachment of the waste dump from the mill, which is considerably higher, led to some modifications and peculiarities of construction. From the original collar, the shaft has been carried up through the dump at an angle of 22 deg., then from its point of emergence the skipway is continued at an angle of 45 deg., both from the plane of the shaft and from the horizontal, to the ore bins at the back of the Golden Gate mill.

The two south compartments of the shaft are used for hoisting ore and each contains a skip holding from 2½ to 3

*Mining engineer, Lunenburg, Mass.

[1]*Sixteenth Annual Report* (1894-5), U. S. Geol. Surv., Part II, pp. 349-455.

tons. These skips are handled in balance by a Webster, Camp & Lane double cylindrical-drum hoist. The drums are 6 ft. in diameter and 32 in. long, and take a 1⅛-in. hoisting rope. They are driven through bevel and spur gearing by a 150-h.p. Westinghouse type-C alternating-current motor, taking two-phase current with 7200 alternations at 200 volts. The motor has a speed of 580 r.p.m. and is run continuously, the drums of the hoist being thrown in and out by friction clutches. The speed of hoisting is between 500 and 600 ft. per minute.

The third compartment of the shaft contains a cage for handling men and supplies. This cage is operated by a single-drum hoist of the same design as the skip hoist, being driven through bevel and spur gearing and friction clutch by a Westinghouse motor, which runs continuously at 720 r.p.m. The hoist drum is 4 ft. in diameter with a 4-ft. face, and takes a ⅞-in. wire rope.

The ore from the Brickyard and Golden Gate mines is brought to the shaft in end-dumping cars of 26 cu.ft. capacity in trains of seven cars and a brake car, drawn by horses, while that from the Mercur mine is brought by electric locomotives in trains of nine cars each. The cars are dumped by hand at the shaft into ore pockets holding from 60 to 160 tons each. These are provided with what may be called the shovel type of gate—a simple slide gate of sheet iron lifted by a handle and closed with the aid of the operator's foot. In order to prevent ore from falling down the shaft a bulkhead is lowered below the skip which is being loaded, and this deflects any spilled ore into small pockets placed below the large ones, the small pockets holding about four skiploads of ore.

The shaft is timbered with regular shaft sets and lagging, except at the ore pockets, where it is cribbed. The mine is dry, a small air-driven pump, working about one hour daily, handling all of the water. With the exception of the blacksmith shops, of which there is one at each mine, the surface plant is all situated at the Golden Gate shaft. The carpenter shop contains but the ordinary tools, all of the mine timbers being framed by hand, but there is a well equipped machine shop and a small foundry in connection with the mill.

The two compressors are in the hoist room. These are Nordberg two-stage air compressors of the same size. They have cylinders 16 and 10 in. by 28-in. stroke, and are classed as 11-drill machines. One is run at 92, the other at 110 r.p.m. Each is driven by a 125-h.p. Westinghouse type C, 2-phase, 7200-alternation, 200-volt motor, one running at 600 and the other at 580 r.p.m. The normal capacity of each machine is 600 cu.ft. of free air per min. compressed to 80 lb. per sq.in. There are air receivers in the compressor room and also at the entrance to the Mercur tunnel, about ½ mile to the south.

The Mercur Mine

The Mercur mine is at the southern end of the property. It has been opened by several adits, but all of the ore is now taken out through one. This adit has a single 18-in. track, 1200 ft. of which are equipped with electric haulage, while on the remaining 1900 ft. horses are used.

The ore is trammed to the collecting station, about 1200 ft. from the portal, by men, or by horses drawing trains of seven cars each. From this point it is taken by either one of two electric locomotives which haul trains of nine cars each along a surface tramway which follows a contour of the hill, then through an adit under the mill dumps to the Golden Gate shaft, at which point the ore is hoisted to the mill bins.

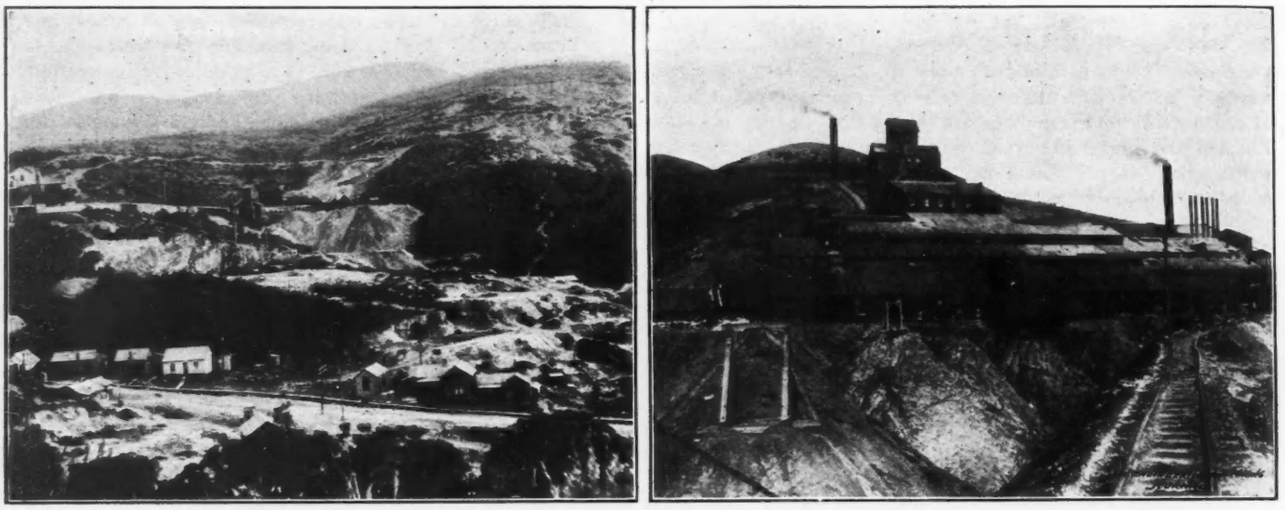
The principal vein is the Mercur, which also runs through the other mines, and which outcrops plainly on the hillsides on both sides of Lewiston cañon. It is dark gray in color and is characterized by fine networks of quartz or calcite with more or less barite running through it. The vein as worked, including the so called "lower" vein which in most places is mined with it, varies in width from 12 ft. to a maximum of 70 ft., with an average width of from 20 to 30 ft. The dip varies from 10 or 12 deg. up to 30 deg. The general relations to the porphyry are similar to those already described.

Mining Methods at the Mercur Mine

In the narrower portions of the orebody, the levels are driven about 20 ft. apart vertically, and the ore is mined in open stopes which may or may not be timbered with stulls. From the drifts inclines are put up in the vein, and the ore is broken down on both sides of them. These stopes have no fixed dimensions, the width depending upon the extent of the shoot and also upon the character of the roof. About 4 ft. of ore are left next to the hanging-wall to support the roof, and stulls are placed wherever necessary. When the stope has attained its proper size, the ore next the hanging-wall is extracted by the retreating system. The roof is then allowed to cave.

The above method is employed only where the ore has a thickness of less than 15 ft. Most of the orebodies in this mine have a thickness considerably in excess of this figure, and these are mined by a modification of the caving system as used in the soft-ore iron mines of the Lake Superior region.

From the main levels raises are put up at intervals of 25 to 50 ft., and so far as possible, are kept as near the foot-wall as is permitted by the angle of slope at which the ore will run in the chutes. In most places the dip of the orebody



Mercur Mine and Golden Gate Mine and Mill of the Consolidated Mercur, Tooele County, Utah.

is so low that a series of chutes, offset from one another, is necessary, the ore being drawn from one chute and trammed into another nearer the hanging-wall.

Where the orebody is wide, as many as three drifts approximately parallel may be run on each main level, chute-raises being carried up from each drift in order to reduce to a minimum the labor of handling the ore in the stopes. As a rule, only the foot-wall raises are used for both manway and orechute.

From the raises, sublevels are started at vertical intervals of 14 ft., the development on each sublevel consisting only of crosscuts driven to both the foot- and hanging-walls. The work of caving is commenced on the upper sublevel and continued downward in successive steps. In starting this work the ends of the crosscuts next the hanging-wall are widened out until two or more of the crosscuts are connected. A few holes are then drilled in the roof and blasted to start the caving. The broken ore is then shoveled into wheelbarrows and conveyed to the chutes. When waste appears in the broken ore the intervening pillars are successively sliced to the hight of the crosscut toward the foot-wall, meanwhile holding the roof temporarily by stulls. Practically all the work is done by hand, so heavy timbers are not needed to withstand the shocks of blasting. As the working faces of the slices recede, the roof is allowed to cave, only maintaining a safe working place for the men along the new outline of the pillar. After the second slice has been taken out, the back over the working places must be supported by tunnel sets as the pillar itself is liable to crush.

When the ore from one sublevel or block of ground has been extracted, caving is commenced on the sublevel immediately below, where the process is carried out in the same manner. It is not necessary that all of the ore be extracted from one sublevel before caving can be started on another, for caving is carried on at several levels in the mine, but not in the same block of ore.

Recovery and Costs in Caving System

Where the sublevels are 14 ft. apart the thickness of the back which remains to be caved varies from 4 to 7 ft., the lesser thickness having proved the more satisfactory. It is questioned by the mine superintendent whether better results would not be obtained if the sublevel interval were not reduced to 12 ft. By caving a small thickness of ore, a higher percentage of recovery is made, and the operation is kept under better control. It will be seen that in this mine from 50 to 70 per cent. of the ore is extracted by drift-stoping and slicing, leaving but 30 to 50 per cent. to be obtained by caving.

Where the caving is begun next to the hanging-wall it is sometimes difficult to obtain all of the ore along the foot-wall, particularly where the dip of the orebody is low. This method, however, is well adapted to the conditions prevailing in this mine, where the ore is firm and stands well without timbering but the hanging-wall is weak. In case the caving were commenced next the foot-wall the pressure upon the pillars would become almost insupportable by the time the caving had proceeded for two-thirds the width of the deposit.

The system requires little powder or timber, but as employed here requires a large amount of development work and a great deal of shovel and wheelbarrow work. The ore is rather soft and almost all of the drilling is done by hand, there being but seven machine drills in use in the three mines. Mining is done largely by contract, the price in the Mercur mine varying from 60c. to $1.40 per car of 1¼ tons delivered at the electric-haulage station, while in the Brickyard mine the costs in some instances run as high as $4 per car. On the Mercur property considerable ore was taken out on the surface through glory holes, at a cost of about 20c. per car. This ore, however, was of low grade. The limit on ore mined is placed at $3 for oxidized, and $4.65 for base (sulphide) ore, though much ore of less value is mined and milled. Six-dollar ore is considered first-class, while that running $10 per ton is high grade.

Development is done largely by contract, the price for a 5x7-ft. drift varying from $2 to $4 per ft., the average cost being $3.50. The contractors furnish all their supplies and deliver their ore or broken rock to the electric-haulage station. With hand drilling the drifts are run at a rate of up to 70 or 75 ft. per month.

Miners receive $2.75, and machine men $3 for an eight-hour shift, while contractors average about $3.50 per day. The mine is operated two eight-hour shifts every day in the week. From 270 to 290 men are employed underground during the 24 hours and the daily output ranges from 700 to 800 tons of ore. The average figure is, therefore, about 2½ tons of ore per day per man.

The Golden Gate Mill

The Golden Gate mill is situated on the hillside just above the Golden Gate shaft with which it is connected by an incline, as was stated in the description of that shaft. The mill, until recently, has had a capacity for treating 1200 tons of ore daily, but the collapse of the foundations in the north wing of the mill rendered useless eight of the large leaching vats, reducing the capacity to about 800 tons per day.

Apart from the magnitude of its operations the mill is of interest for it represents the result of many years of thought and costly experiment in the endeavor to treat the refractory ores at a profit. It was on these ores that the first large-scale tests of the cyanide process were made in this country, and in the old mill of the company the idea of the vacuum system of slime filtration was first conceived.

In the system as finally devised, the oxidized and base ores are kept separate until the final leaching is done. The two classes of ore are dumped from the skips into separate bins with grizzly bottoms, there being 1¼-in. spaces between the bars. The oversize from each bin passes to a No. 6 Gates gyratory crusher, where it is crushed to pass a 2½-in. ring. The undersize of the grizzlies and the product of the crushers goes to storage bins having a capacity of 1000 tons.

Oxidized Ore

From the bins the oxidized ore is fed through any one of ten gates to a belt conveyer which discharges to a 24-in. belt running at right angles to the first, and on which the ore is carried to the screening and fine-crushing plant. The ore is dropped on a stationary inclined screen having ⅝-in. square holes, the oversize passing into a 15x36-in. Gates roll set with approximately a ⅝-in. space. The product of the rolls passes over a screen similar to the first and with the same size of openings.

The undersize from both screens is raised by a bucket elevator to the fine-ore bin, while the oversize after passing through a 15x26-in. Gates roll is elevated to a trommel having a ½-in. screen, the undersize from which drops into the fine-ore bin while the oversize goes to the coarse-ore bin. The coarse ore falls through pipes to the charging bins, from which it is taken in one-ton cars to form the beds in the leaching vats.

The fine ore is conveyed on belts to a trough in which it is sluiced with cyanide solution into the first Consolidated Mercur mixer-classifier. This machine is a combination of log washer and classifier. The box, which is 20 ft. long, is inclined at an angle of 12½ deg., and the revolving blades of the mixer propel the coarse sand up this slope while the rush of water through the machine carries off the fine sand and slime. The coarse sand goes to a second mixer-classifier, where the slime and fine sand is further removed. The dewatered coarse sand is conveyed to the charging bins and thence to 12 of the leaching tanks, together with the roasted base ore and coarse oxidized ore.

The slime and fine sand from each mixer-classifier flow into a cone classifier which has no rising current. The overflow from the two cones passes to a third cone while the spigot product of each is further sized in a Dorr classifier. These Dorr classifiers are similar in appearance to the paddle conveyers used in many smelting works for conveying hot roasted ore from the roasting furnaces. They con-

sist of a series of back-and-forward moving blades or hoes, suspended from a common rod and operated by a bell crank lever. These hoes convey the fine sand up an inclined trough through which water is running, delivering the clean sand at the upper end, while the slime, practically free from sand, passes out with the overflow.

The sand from the classifiers is sluiced to four leaching vats where it is treated by itself, while the slime from both the cone and Dorr classifiers flows to three settling tanks, 30 ft. in diameter and with slightly conical bottoms, equipped with Dorr continuous slime thickeners. These slime thickeners consist of four slowly rotating arms making six revolutions per hour, to which are attached plows which move the accumulating slime toward the discharge opening at the center of the tank. The treatment of the slime is complete in these settling tanks and the pulp passes directly to the filters. These filters are of the stationary vacuum type, designed by the Consolidated Mercur company, but similar to the Butters filter.

There are 104 filter leaves, each 7 ft. square, placed in hopper-bottom tanks in groups of 16 or 20 each. With a vacuum of about 20 in. of mercury it takes 50 min. to form a cake 5/8 to 3/4 in. thick, and another 50 min. to wash it. The filters are washed in the same tank and the washed cake later discharged by forcing water into the interior of the filter leaves. It requires about 10 min. to change from pulp to wash water and about the same length of time to change back again, so the average length of the complete cycle is two hours. The washing is done with weak cyanide solution.

The greater part of the solutions from the filters, as well as the clear overflow from the Dorr slime thickeners, is returned to the upper floor of the mill and is used for sluicing the ore into the mixers, and also as the weak solution in the sand leaching vats.

Base Ore

The method of preparing the base ore for treatment with the cyanide solution is quite different from that outlined above, for although the oxidized ore will give fairly good extraction even when broken as coarse as 1 in. in diameter, the base ore must be finely crushed and roasted. After passing through the No. 6 Gates gyratory crusher and into the storage bin, the ore is discharged through four gates on an 18-in. belt conveyer which delivers it to a stationary inclined screen having openings 1/8 in. square. The oversize passes through a 15x36-in. Gates roll set with a 1-in. space, the product falling on a second screen having the same size opening as the first.

The oversize of this screen passes through a second set of 15x36-in. Gates rolls set 1/4 in. apart, the product falling on a third inclined screen which also has openings 1/8 in. square. From this screen the oversize is crushed in a third pair of 15x36-in. Gates rolls set 1/16 in. apart, and is raised by a bucket elevator to two trommels, one of which has a screen with 1/8-in. openings, while the second trommel, which was provided to prevent overcrowding of the first, has a screen with openings 1/8x1/2 in., it being considered that the two trommels give the same size of product. The undersize of the trommels falls into a storage bin, while the oversize, after passing through a set of 15x26-in. Gates rolls, joins the product of the third set of rolls and is returned to the trommel. The undersize from all of the stationary inclined screens is raised by a bucket elevator to the top of the building and discharged into storage bins.

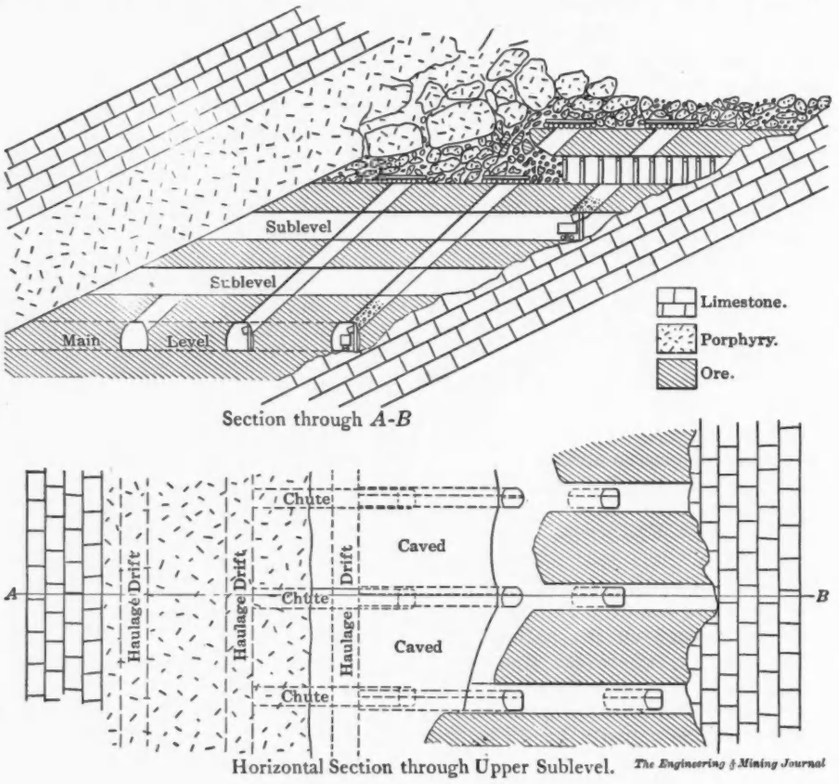
From these base-ore bins the ore falls through chutes, or is taken by belt conveyers to the roasting furnaces. There are five straight-line furnaces, one Holthoff-Wethey, one Brown and three Jackling. Each has a capacity of 70 to 72 tons of ore daily and consumes about seven tons of coal per day. It takes about six hours for the ore to pass through the furnace, at the end of which time the roasted material goes by conveyers and chutes into the charging bins.

Sand Treatment

There are at present 18 rectangular vats, each 25 ft. wide, 50 ft. long and 4 ft. 10 in. deep, with a capacity for 225 tons of sand. Of these tanks four are used exclusively for the leaching of the fine sand from the Dorr classifiers, 12 are used for the coarse oxidized and roasted base ore, while two tanks are held in reserve. The four tanks for the fine oxidized sand are filled by sluicing, while the other 12 are filled by hand, the ore being trammed in V-shaped, side-dumping cars of about one ton capacity, which are dumped from four trestles running above the tanks.

In charging the tanks a layer of the coarse oxidized ore—that which passes a 1-in. and is caught on a 1/2-in. screen—is formed to a thickness of about one foot. Sixty-four cars of ore are taken to form this layer, which is then leveled off with a shovel. On top of this the tank is filled with a mixture of the coarse oxidized sand from the Consolidated Mercur mixer-classifiers. and the roasted basic ores.

When the tank is full the strong cyanide solution (2 lb. per ton) is run in from the bottom and allowed to rise slowly through the ore. This requires about eight hours. The solution is allowed to stand for four hours, when leaching is commenced. Leaching with strong solution is carried on continuously for 24 hours, then with the weak solution for 48 hours. The weak solution is merely the strong solution which has been used once and which has gone through the precipitating tanks and filter presses. It contains about 1 1/4 lb. cyanide per ton. The washing requires about 12 hours, the wash water joining the weak solution.



MINING WIDE VEINS AT MERCUR, UTAH

The total time of treatment is thus four days. The treatment of the fine oxidized sand is completed in three days.

The tanks each have eight bottom doors, 18 in. in diameter, through which the sand is shoveled into gable-bottom, side-dumping cars of about two tons capacity, and hauled to the dump by horses.

The gold-bearing solutions go to three precipitating tanks, each of which holds 30 tons. Five pounds of zinc dust are added to each tank and the only agitation received is that resulting from the flow of the solution into the tank during the process of filling. The precipitation of the gold is incomplete in these tanks, the greater part taking place within the filter presses. There are ten Johnson filter presses, each with 36 leaves 24-in. square. Only four presses are required at the beginning of the month, when the leaves are clean, but as the precipitate accumulates more are pressed into service until at the end of the month all are in use. The clean-up is usually made at the end of the month and averages over $60,000 at a time.

The precipitate, with the zinc residues, is treated by the ordinary sulphuric-acid method; the residues from this treatment being roasted and then melted down to bullion. An unusual thing is occasionally noted in the treatment of the precipitate. The ore contains some cinnabar and this is reduced to metallic mercury during the course of the ore through the mill, or forms an amalgam during the precipitation in the filter presses. This amalgam is but little affected by the acid treatment, and during the subsequent roasting the mercury which is driven off and collects in the cooler part of the furnace is found to carry a high percentage of gold. In the ordinary distillation of amalgam the loss of gold is usually small, and the explanation for the losses in this case must be sought in the influence of the zinc in the amalgam.

All Crushing Done Dry

In this mill dry crushing is practised exclusively. This is necessary in the case of the basic ores in order to avoid drying the crushed material before it can be charged into the roasting furnaces; but with the oxidized ores it was found that wet crushing produced a large amount of slime. By crushing dry the amount of slime formed was reduced to about 15 per cent. The amount of slime present in the roasted ore does not seriously affect the leaching qualities, and it was found unprofitable to remove it.

The slime from the base ore is difficult to treat and the extraction is lower than that given by the coarser roasted material, while the latter yields less than the oxidized ore. It is found that the tailing from the coarsest sand (½ to 1 in. in diameter) of the oxidized ore assays no higher than does that from the finer sand, though the percentage extraction is slightly lower on account of the original gold content being less. The slime tailing assays from 15c. to 20c. per ton less than does the sand tailing.

During the fiscal year ended June 30, 1909, the average assay of all tailing was 88c. per ton, while the heads assayed $3.58 per ton, showing an extraction of 75.4 per cent. The consumption of cyanide was 0.66 lb.; lime, 5.4 lb.; caustic soda, 0.05 lb.; and zinc, 0.45 lb. per ton of ore treated. The cost of mining 282,269 tons of ore is given as $1.53 per ton; and of milling, $1.09 per ton, of which $0.3973 was for roasting and $0.3737 for leaching. The cost of roasting was $1.05 per ton of ore roasted. Classifying and slime treatment cost 50c. per ton of slime.

The lack of water is keenly felt in the milling operations and nowhere is a drop wasted. The slime carries away about 45 per cent. of water, but the sand from the leaching vats contains only about 16 per cent. moisture. There is almost no rainfall in the district and the tailing has accumulated in a series of immense dumps radiating from the mill. These dumps now contain about 3,000,000 tons of material which will average nearly $1 per ton in gold, and are fast encroaching upon the little town of Mercur. The mine has contributed much to the arvancement and development of metallurgical processes, and in these dumps lies a field for processes yet to be developed.

The Delaware & Hudson Company

This company owns a large estate in the anthracite region of Pennsylvania; it owns and leases a system of railroads running from the anthracite country to the Hudson river and northward into northern New York, Vermont and Canada. The company mines its own coal directly and not through the medium of a controlled company, though it has lately organized a selling company, as explained below. The report is for the calendar year.

The coal-department report gives the shipments for the year from the company's lands as follows:

	1908.	1909.	Changes.
Coal mined	6,526,871	6,199,042	D. 327,829
Coal bought	287 329	39,611	D. 247,718
Total	6,814,200	6,238,653	D. 575,547

The decrease in coal bought is due to the fact that since the organization of the selling company purchases from lessees and others are made by that company. The total fuel tonnage carried by the company's road in 1909 was 7,002,877 tons anthracite, 1,863,136 bituminous and 151,569 coke. In addition the company carried 795,005 tons ore and 759,050 tons of stone, sand, etc., making a total of 11,171,637 tons mineral freight, or 62.7 per cent. of the total freight carried. The railroad earnings from coal were $8,311,479, or 42.6 per cent. of the total receipts.

The income statement of the coal department is as follows:

	1908		1909	
	Amount.	Per Ton.	Amount.	Per Ton.
Receipts	$23,847,116	$3.50	$16,340,290	$2.62
Expenses	22,993,999	3.37	16,133,836	2.59
Net earnings.	$ 853,117	$0.13	$ 206,454	$0.03

Expenses include taxes, which were $301,421 in 1909. The decrease in gross earnings last year was $7,506,826, or 31.1 per cent.; in net earnings, $646,653, or 75.8 per cent. The coal-department relief fund showed receipts of $10,984 from employees and $6988 from the company, a total of $17,972. Accident and death benefits paid were $13,393; the balance of the fund carried over was $7,361, which included $2782 brought forward from preceding year.

The comparison between the two years is not an even one, as in 1908 the coal was sold at various points on the company's lines and at tidewater, while the expenses included transportation and selling, while for a large part of 1909 the coal was taken by the selling company at the mines, that company assuming the transportation and other charges. The comparison, however, serves to bring out the contrast in results between the two methods of handling.

The report says: "The collieries and washeries of the company were idle a portion of the year on account of the general depression in the coal business; they produced 6,199,042 tons of anthracite coal out of a total of 61,969,885 tons produced in the region. The coal-department expenses include construction and betterments amounting to $726,313. Taxes for the year 1909 increased $9119. On June 1, 1909, a contract was made with the Hudson Coal Company by which that company purchases outright, at the pit mouth, all the coal produced from the mines belonging to the Delaware & Hudson Company. . . .

"The litigation referred to in the last annual report in reference to the so called commodity clause added to the Interstate Commerce act in 1906, was terminated during the year by the decision of the United States Supreme Court to the effect that the said commodity clause did not prevent carrier corporations from transporting, in interstate commerce, coal which they had originally mined, but which they had sold before such transportation, nor prevent a carrier corporation from transporting in interstate commerce coal belonging to a coal company some or all the shares of the capital stock of which were owned by such carrier. Since this company now sells in the State of Pennsylvania all the anthracite coal produced from its mines it can, therefore, lawfully transport such coal on its railroads."

The Wolski Hydraulic Rock Drill

Utilization of Water Hammer Effect Produced When a Moving Column of Water Is Suddenly Stopped; Drill Strikes 20 to 30 Blows per Second

BY F. A. TALBOT*

Some interesting and striking demonstrations have recently been carried out in England with a new hydraulic rock-boring drill, which is the invention of Waclaw Wolski, an Austrian engineer connected with the petroleum industry of Galicia. It depends for its action upon the water-hammer effect produced when the motion of a column of water is suddenly arrested. Water under pressure is led through a horizontal striking tube to the apparatus, and flows to waste past a flap valve until the pressure above the valve attains a certain value. The valve then closes and the sudden stoppage of the column of water in the striking tube produces a pressure in the interior of the apparatus many times greater than the pressure requisite to actuate the apparatus. For instance, when the working pressure is 450 lb. the pressure induced by the sudden stoppage is about 3000 lb. per sq.in. This pressure acting on the boring bar forces it forward and a heavy blow is dealt.

The boring bar is rifled, but the rifling is so arranged that it is thrown out of gear on the forward stroke while it is engaged on the recoil. The drill thus strikes a direct blow with a rotary return. The recoil is brought about by means of rubber springs. When the boring bar is forced forward, the pressure in the interior of the apparatus is diminished owing to the greater space thereby created. The valve then opens and a certain quantity of water flows out. By this time the rubber springs have brought the bar back, the pressure again rises, the valve closes, and another blow is struck.

Hydraulic Transmission of Power

Hydraulic transmission of power has many advantages in mining work. In the first place, water is nearly always available and a natural head of water is frequently possible. In the second place, such a system is absolutely safe. There are certain serious disadvantages which have hitherto militated against the adoption of hydraulic power. There is difficulty in constructing a powerful hydraulic motor owing to the nature of the force-transmitting medium, which is heavy and almost incompressible. Every stoppage, and every change in direction of the motion of the water, is unavoidably accompanied by a more or less heavy shock of the water in the pipes and the motor; and this phenomenon, increasing in force with the rapidity of the motion, limits the working speed. As it is absolutely impossible to overcome this difficulty of hydraulic shock, the inventor has ingeniously turned this factor to profitable account.

Referring to the accompanying diagrams it will be seen that the apparatus consists of a cylinder in which is a piston free to move; at the rear end of the cylinder is a flap valve kept open by a spring. The interior of the cylinder is in communication with a striking tube *S T* (Fig. 2); at the end *S* is an air vessel. When the valve *V* is opened water flows through the apparatus past the valve *D* into the waste pipe *E*. The rush of water past the valve causes the pressure on the under side to be less than the pressure on the upper side, where the velocity is less.

When the velocity attains a certain value the difference of pressure is sufficient to close the valve, and the column of water in the striking tube is stopped suddenly. The kinetic energy of the water in the tube is communicated to the piston *C* which is impelled forward with high velocity, and the drill delivers a heavy blow upon the stone or rock.

The pressure in the interior of the cylinder is diminished by the moving out of the piston, and at the same time the water, having been compressed slightly by the shock, acts like a spring and surges back into an air vessel. The extent of this surging is, of course, very small, owing to the insignificant compressibility of water, but the combined effect of these two causes is to secure the sufficient fall of the pressure in the cylinder to enable the valve to open. Water then flows through the open valve. The piston is meanwhile being brought back to its original position by means of springs, but before it reaches the extent of its backward travel, and while it still retains an appreciable velocity, the valve *D* closes and the direction of motion is reversed by the hydraulic shock. The same cycle of operations is then repeated.

It will be observed in the diagram that the boring bar is rifled. The female part of the rifling arrangement is provided with a spring device, whereby the rifling is only engaged on the return stroke. The drill thus strikes a direct blow with a rotary return. The boring bar passes through a guide, packed with leather packing, which can be easily replaced when worn. The whole drill can be dismantled in about five minutes.

The actual magnitude of the blow delivered is primarily dependent upon: (1) the weight of the striking column; (2) the velocity of the water when the valve closes; and (3) the weight of the chisel and boring bar. Since the kinetic energy of the striking column is $\frac{W V^2}{2 g}$ where W is the weight of the column in pounds, V the velocity at the instant the valve closes, in feet per second, g is acceleration due to gravity; it follows that the magnitude of the blow will be proportional to the weight of the striking column and to the square of the velocity of the column. The weight of the chisel and boring bar affects the problem in so far that a certain relation between the weight of the striking column and that of the chisel and boring bar is necessary in order to insure the most efficient transmission of the energy of the striking column to the chisel and boring bar. As a matter of fact, the best effect is obtained when the mass of the striking column is equal to the combined mass of the chisel and boring bar.

The velocity of the column is fixed

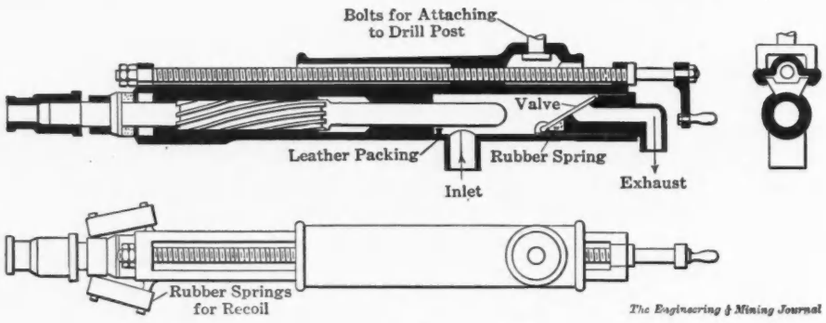


FIG. 1. WOLSKI PATENT HYDRAULIC ROCK DRILL

*15 Wilbury Crescent, Hove, England.

by the velocity at the valve required to produce the necessary difference of pressure to close the valve, i. e., it is fixed by the stiffness of the spring controlling the valve. The rapidity of the blows is limited by the fact that after each blow the striking column is brought to rest, and it must be accelerated to the requisite velocity before the valve will close. The rapidity of working depends, therefore, upon the pressure in the supply mains.

It must be borne in mind, however, that the actual magnitude of the blow is unaffected by the varying pressure in the mains, and depends only on the weight of the striking column and the strength of the spring controlling the valve. Machines of the type described strike from 20 to 30 blows per second. This is a great advantage as compared with percussion machines of existing types, which

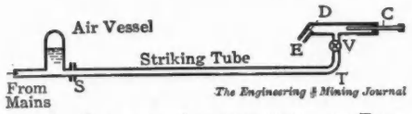


FIG. 2. GENERAL ARRANGEMENT OF TUBE

have a maximum speed of only from 3 to 5 blows per second.

RESULTS OF TESTS AT LONDON

The demonstrations in London were carried out by Arthur Rowse, at the Millbank pumping station of the London Hydraulic Power Company. The pressure used was 450 lb. per square inch. This, with the particular type of drill used, gave a pressure in the interior of the apparatus of 3000 lb. per sq.in. The tests were carried out on a block of hard Portland stone. The diameter of the drill used was 2.375 in., and the average progress made in the stone was 10½ in. per minute, representing the removal of 46 cu.in. of stone per minute. The drill stood the work so well that after holes aggregating about 25 ft. in depth had been drilled, it was not necessary to do anything to the edge. A stream of water plays on the chisel the whole time and serves the threefold purpose of keeping the chisel cool, of rinsing the borehole, and of allaying the dust. There is absolutely no free dust with this apparatus, as was convincingly demonstrated.

Experimental results with hard rocks such as granite, gneiss, etc., are not at present available, though further demonstrative tests are to be carried out. Such trials have been made in Galicia with the implement and have proved highly satisfactory. The actual quantitative results, however, have not yet come to hand.

The machines can be made to work at any pressure from 75 lb. per sq.in. upward. For the softer rocks such as coal, the lower pressures may be advantageously used, but for the harder rocks, where a larger striking tube and heavier drill bits are used, the higher pressures are recommended, the increase of effect therewith being marked.

If the striking tube is arranged to be straight and nearly parallel with the direction of motion of the chisel, there is little shock on the machine, as the force of the shock is transmitted directly to the chisel; the machine merely serves as a casing and guide for both masses. There is, however, no absolute necessity for the striking tube to be straight if the conditions are not amenable thereto.

It is important to realize the fundamental differences between the hydraulic shock in the case of this machine and the shock in the case of machines where it must be avoided, e. g., in impulse water wheels. There we have an open jet of water, dispersing itself by the impact, scattering itself in all directions and wasting its energy. In this case there is a column of water locked in tightly, which, just as any other elastic body, does not lose any of its energy by collision. The consumption of water for all purposes in a machine of this type is from 3 to 4 cu.ft. per min. The drill is bolted to a post or bar, which may be either held between roof and floor in the ordinary way, or supported on a carriage, or, for small power drills working soft rock, it may be supported on a tripod.

The weight of the apparatus above described and as used in the London demonstrations is about 100 lb., and its length about 4 ft. The former is the weight of the machine itself, exclusive of the bar, striking tube and air vessel. It can be easily manipulated by two men,

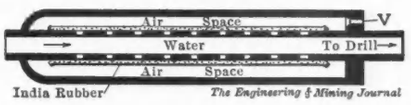


FIG. 3. WOLSKI DRILL. DETAIL OF AIR VESSEL

or, if the emergency arrives, one attendant suffices as the Millbank trials demonstrated.

The air vessel used is not the type shown in the general diagram annexed, but is of the ingenious type illustrated in Fig. 3. The wall of the inner tube is perforated with a large number of small holes like a sieve. Over this is stretched a rubber hose tied up at both ends. The whole is covered by a steel tube closed hermetically at both ends, and the space between this tube and the inner one is filled with air, forced in through the valve *V* by means of a pump. During the boring operation, the hydraulic pressure and the air pressure act against one another, and the rubber, alternately expanding and contracting, forms the elastic separation between the air space and the water space.

Mr. Rowse estimates that the drill will cost much less to construct than existing types of rock drills, and that the speed of working is far in advance of anything at present used in mining practice, while the maintenance costs are extremely small. Should anything go wrong with the apparatus while working, it stops automatically, and it behaves well in broken ground. The efficiency is high, being about 25 per cent. as compared with the 10 to 15 per cent. efficiency of compressed-air drills.

The Bullfrog District, Nevada

A report on the geology and ore deposits of the Bullfrog mining district, Nye county, Nevada, has been published[1] by the U. S. Geological Survey.

Long before valuable ores were discovered at Tonopah and Goldfield the springs in Oasis valley, just north of the site of Beatty, attracted a few wanderers, who established rude ranches along Amargosa river, a feeble rill that furnishes the only drinkable water within a radius of 40 miles.

The discoveries at Tonopah and Goldfield stimulated prospecting throughout southern Nevada, and in 1904 the Bullfrog claim was located. The name is said to have been suggested by the green color of the ore; certainly no one has found in that scorchingly arid region anything resembling a bullfrog.

At first, only the richest ore could be handled but in 1907 three lines of railroad reached the district, and the value of its mineral output was $207,538, principally in gold and silver.

The deposits of the Bullfrog district, unlike those at Goldfield, are not likely to yield quick and large profits with a moderate outlay of capital, though small masses of superficial ore may for some time reward a few fortunate lessees. The ores generally are of low grade and the question whether the deeper sulphide ores can be profitably mined is still unanswered,

Magnesite Production

According to statistics collected for "The Mineral Industry," the total production of magnesite in the United States in 1909 was 9535 tons, valued at $62,391. In 1908 the output was 8967 tons, valued at $52,342. The only commercial deposits of magnesite in the United States are in California, and the high cost of transportation to the Atlantic seaboard prevents competition with the mineral imported there from Austria and Greece. The crude mineral is worth from $3 to $3.50 per ton at the mines, and from $12 to $20 per ton when calcined. The average price in 1909 of crude Grecian magnesite in New York was $9 per ton, and of powdered calcined $32.75 per ton.

[1] *Bull.* 407, by F. L. Ransome, W. H. Emmons, G. H. Garrey; U. S. Geol. Surv., Washington, D. C.

Empire-Enterprise Zinc Mines, Wisconsin

Ore Occurs in "Flats and Pitches" in Galena Limestone. Contains Marcasite and Requires Roasting and Electric Separation. Haulage by Mules

BY HAROLD C. GEORGE*

The largest body of zinc ore ever worked in Wisconsin is, perhaps,, the Empire-Enterprise orebody at Platteville. At present this orebody is worked a total length of 2900 ft. and an average width of 70 ft. Since these two mines started operations, the Enterprise in 1899, and the Empire in 1903, to Dec. 1, 1909, $1,375,287 have been received from the sale of ore.

Geology

The ore occurs in "flats and pitches" in the lower part of the Galena limestone, which in this district is from 100 to 180 ft. thick, overlying the Trenton limestone and separated from it by a thin bed of clay shale, locally called "clay bed." These flats and pitches are arch shaped. Fig. 3 shows the "flats and pitches" as they are found in the Empire-Enterprise mines, the crevices forming the flats and pitches being larger to one side of the top of the arch than to the other and thus making the main orebody on one limb of the arch. Fig. 4 shows an ideal cross section of the Chamberlain orebody.

It is generally believed that the crevices which afforded channels for the ore-bearing solutions were formed by the lateral pressure produced by the shrinkage of the earth's crust. These crevices were enlarged by circulating water dissolving the limestone walls, and by subsidence of the strata within the arch, produced by compression of the underlying "oil rock" (the oldest member of the Galena limestone). The oil rock is a light, carbonaceous shale, from one to eight feet thick at various places, but usually from four to eight feet thick under the ore deposits and thinning to the sides, so that subsidence must have been greatest where this member of the Galena limestone is the thickest. It is also believed that the impervious clay bed caused the ore-bearing solutions to travel laterally above its horizon, and the gaseous hydrocarbons escaping from the oil rock aided in the precipitation of the ore in the existing crevices, which forms flats and pitches.

The interior part of the arch *M* in Fig. 3, being free from the pressure of the overlying strata, in subsiding formed openings along the bedding planes and also along lines of fracture perpendicular to the bedding planes, which readily formed water channels and thus were filled with thin sheets of ore. This part of the orebody is generally spoken of as the "core."

Fig. 1. Enterprise Mill, Platteville, Wis.

Fig. 2. Empire Mill and Power House

Beginning at the western end of the Enterprise mine, the course of the orebody is south 85 deg. east for about 1000 ft., then it turns to the left and continues north 30 deg. west about 400 ft., where it turns to the right, crosses the Empire property line and has a course of north 60 deg. east to the eastern end of the present workings.

History

The Enterprise mine, since the time of discovery in 1899, has been owned and operated by the Platteville Lead and Zinc Company, a company capitalized at $20,000. From the time that mining operations began in 1899 to the first of Dec., 1909, this company sold $577,900 worth of ore, yielding $179,500 in profits.

The Empire Mining Company was organized in the autumn of 1901, but the mine was not discovered until 1903. This company was capitalized at $30,000. From the opening of the mine until June, 1908, when the mine was sold to the Wisconsin Zinc Company, the Empire Mining Company sold $599,587 worth of ore at a profit of $262,900. Since that time to Dec., 1909, under the management of the Wisconsin Zinc Company, the mine has produced $197,800 worth of ore.

Mining Previous to 1908

I will first describe the method of working these mines previous to June, 1908. The upper flats were first worked because this part of the orebody contained less marcasite than the pitches and lower flats, and thus produced concentrates which brought a good market price without roasting and electric separation. Later, when the best ore of the upper flats was worked out, the lower flats and pitches were worked, and finally the entire face was carried forward at the same time. After the upper flats were exhausted, roasting and magnetic separation were added to the milling process, and a high-grade roasted ore was produced. The parts worked at different times in both mines are shown in cross section in Fig. 3.

The parts worked up to this time contained only the main flats and pitches. A face was carried no higher than necessary to get the main orebody, so that in most places the roof was not more than five or 10 ft. from the floor. Small air drills were used, and 6-ft. holes were usually drilled. In the handling of the mill ore, the method used at the Enterprise mine was different from that used at the Empire mine. In the former the large rocks were sorted from the ore by hand and corded in front of the working face, with only a narrow space left for a tramway. At the Empire mine, all broken rock was hoisted and sorted on the grizzly at the surface.

Shovelers, drillmen, helpers and much of the surface labor were paid by the day. The ore was shoveled into "tubs" of 500- to 1000-lb. capacity, and trammed to the

*Director, Wisconsin State Mining Trade School, Platteville, Wis.

shaft by hand. In the Empire mine the ore was trammed from the face to the shaft on one level, while in the Enterprise mine the ore was worked on several levels; the ore in the upper levels being wheeled in wheelbarrows or trammed to the edge of the stopes, dumped to the lowest level, reshoveled into tubs and trammed to the shaft.

Recent Work

When the Wisconsin Zinc Company purchased the Empire mine, there was no opening from the Empire workings to the Enterprise workings. But the Enterprise mine had previously been worked on the upper flat to the Empire property line. The Wisconsin Zinc Company began operations at the Empire mine in June, 1908. Mules were introduced in underground haulage from the working faces to the foot of the shaft and the shoveling was placed on a contract basis. Operations were continued on this basis until in 1909, when the western property line was reached, the ore pitched downward and the mine was shut down for surface-equipment repairs, in order to properly handle the low-grade ore which previous prospecting work had shown existed at the foot-wall. Recent developments on this orebody illustrates the tendency toward better methods and mining equipment in Wisconsin zinc mines.

Equipment of Empire Shafts

The Empire shaft No. 1 is used only for pumping purposes, through the drainage tunnel which connects the main workings with the foot of this shaft. The pumping equipment at this shaft consists of two 9-in. crosshead lift pumps, belt driven by a 60-kw. motor. Running these pumps about half of the time is sufficient to keep the workings free from water. Shaft No. 2 has always been used as the hoisting shaft. The new surface equipment at this shaft consists of a large wooden headframe, shaft house, 200-ton hopper, with a 55-h.p. motor-driven hoist for hoisting the ore from the mine, and a 15-h.p. motor-driven hoist for operating the car on the ore tramway from shaft to mill. At present, ore is being hoisted from this shaft at the rate of four hundred and fifty 1000-lb. buckets in a nine-hour shift. The landing is 200 ft. above the foot of the shaft and the time required for the round trip when hoisting ore without delays, is 45 seconds.

During 1908 and 1909, prospecting with the churn drill showed that the orebody continued to the east at a lower level. To handle this ore, shaft No. 3 was completed in the latter part of 1909. This shaft is equipped with a wooden headframe and shaft house, a 40-h.p. electric-driven hoist and one 8-in. electric pump.

Mine Labor

The mine is worked by two nine-hour shifts. The day shift consists of one foreman, five machine men, five helpers, one "brunoman" or boulder breaker, eight shovelers and one station tender. The night shift consists of one foreman, nine shovelers, one "brunoman," and one station tender. Sufficient rock and ore are broken by drilling on the day shift only. Mining is being done in the foot-wall, near the shaft, and each shoveler trams his own tubs. He is paid 6c. for each 1000-lb. tub of ore delivered at the foot of the shaft. The method of breaking the ground consists of side shooting. A round of holes generally consists of one lifter, one breast hole and one upper, each about 10 ft. deep. Fifty pounds of 40-per cent. dynamite break on an average, 70 tons of ore. In the near future, 1500-lb. tubs will be used, instead of 1000-lb. tubs.

Empire Mill and Power Equipment

The Empire mill and power plant are housed in the same building, Fig. 2. The mill is of 150 tons capacity in 10 hours. It has two seven-celled jigs. It is run two 10-hour shifts in 24 hours. An average of 21 tons of concentrates is produced in 24 hours. Two revolving, cylindrical roasters of the Brückner type, one provided with a Cleveland-Knowles, and the other with a Ding electric separator, produce a high-grade roasted product from the mill concentrates.

The Empire power plant consists of two 150-h.p. boilers, one 100-h.p. boiler, two steam engines, one a 250-h.p. Corliss used for running the mill, and a 100-kw. electric generator; the other an 80-h.p. engine used for driving a 40-kw. generator when the larger generator is shut down and the mill is not running. A cross-compound steam-driven compressor, Ingersoll-Rand type B-10, furnishes compressed air for mining purposes. In addition to furnishing the power for the mill and roasters, this power plant furnishes all of the electrical power for the hoists at shafts No. 2 and and 3, and for the pumps at shafts No. 1 and 3.

The Enterprise Mine

Mining operations at the Enterprise mine are conducted under difficulties. The former method of working has left the workings full of waste rock, which in many places covers the best ore to a depth of six to 10 ft. As mining proceeds the waste is being moved to worked out parts of the mine. About 150 tons of rock and ore are being handled daily and about half of this amount is hoisted to the surface. Mining is being done only during one nine-hour shift per day. The underground force consists of three drillmen, three helpers and four shovelers. Stopes eight feet high are being worked and the rock is broken mostly with down holes, using 30-per cent dynamite. Rock drills (2¾ in.) are used with cross bits. The rock is hard to drill, but breaks easily.

Surface Equipment at Enterprise Mine

The Enterprise surface equipment comprises two power plants, two hoisting plants, a mill and roasting plant shown in Fig. 1. The mine power plant consists of one 100-h.p. boiler, a Gardner steam-driven compressor, one 30-h.p. steam engine used in connection

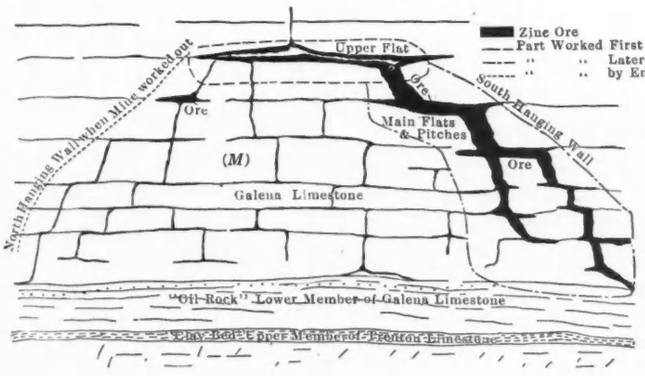


Fig. 3. Ideal Cross-section of the Empire-Enterprise Orebody

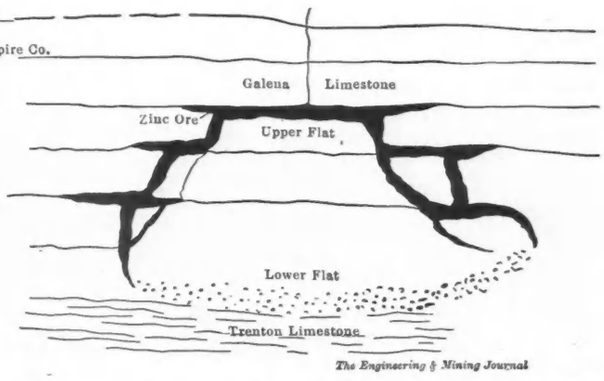


Fig. 4. Ideal Cross-section of "Flats and Pitches" in Chamberlin Deposit

with a 30-kw. generator, for supplying electric power to the roaster and separator. Shaft No. 1 is used for entrance to the mine and for pumping purposes. A 22-h.p. gasolene engine operates a 16-in. Cornish pump and a belt-driven hoist at this shaft. Running the pump about half of the time is sufficient to keep the workings free from water. Shaft No. 2 is used for ore hoisting. The surface equipment at this shaft consists of a wooden headframe, a 75-ton hopper and a 14-h.p. steam-driven hoist.

The power plant in connection with the mill consists of two 100-h.p. boilers and a 60-h.p. steam engine. The mill is equipped with one eight-celled jig, using the Baldwin tap. The mill is run one nine-hour shift per day, producing from 75 tons of ore an average of 10 tons of 40-per cent. concentrates. A 60-per cent. roasted ore is produced from the mill concentrates. The roaster and electric separator running fourteen 24-hour shifts treat all of the concentrates produced in a month.

The mill is near the Chicago, Milwaukee & St. Paul track. All ore mined up to the present time has been hauled by wagon from the hopper at the shaft to the hopper at the mill. The present labor force consists of about 25 men per shift.

Both of these mines have a great advantage over most mines in the district in that they are near the railroad and have facilities for receiving coal and shipping ore. Many of the other mines have to haul coal and concentrates from one to five miles by wagon. Several years ago these mines were generally supposed to have been worked out, but recent developments still promise a number of years of production.

Mining in New Caledonia

T. Maning, British acting-consul at Noumea, New Caledonia, reports that the stocks of nickel ore within the colony on Dec. 31, 1909, were not less than 122,000 tons; only 79,995 tons were shipped during the year, but the production may be estimated at not less than 120,000 tons. A number of contracts have been made during the last year for forward delivery, and all nickel ore produced has become the property of the smelters. Several large contractors are not inclined to contract for too long a period, feeling confident that lower prices will prevail in the near future.

The result of the first reduction of nickel ore by the electrolytic process at Tau is anxiously awaited. By this process, it is claimed, nickel can be produced at a cost which will enable the selling price to be reduced from £190@ 200 to £100 per ton.

The chrome industry is confined for the present to one mine, and the export for 1909 was only 32,136 tons—14,344 tons less than in 1908. The price of this mineral has reached a low figure—about £1 2s. per ton for 50 per cent. ore in bulk at mines, or £1 14s. 6d. for 50 per cent. ore in sacks f.o.b. Noumea. The stock of chrome existing in the colony on Dec. 31, 1909, was about 21,000 tons.

There is no demand whatever for cobalt, and producers have now closed down the mines. The stocks in the colony are probably 400 to 500 tons.

Origin of Diamonds in German South West Africa*

By R. G. Pearson

Of the several theories put forward to account for the presence of alluvial diamonds on the Damaraland field, that of Doctor Merensky and Mr. Troye seems to me the only one which is tenable. Their theory is that a pipe or fissure exists under the sea somewhere in the neighborhood of Pomona, and that the sea current deposited the diamonds and wash along the valley bottoms when the coast belt was submerged. As the sea receded, the incessant southwest winds (it is the windiest country on earth) distributed the diamonds, at the same time concentrating the wash in the valleys by blowing away all the lighter sand into the dunes lying a few miles inland.

In support of this theory, the following facts are of interest: That the coast belt was undoubtedly submerged during a recent geological period; that the largest diamonds all occur in the neighborhood of Arch Rock and Pomona, and that the size of the stones grades off to north and south of this point in the most regular manner possible. Taking these facts in conjunction, it is reasonable to suppose that the original source is a pipe or fissure situated near Pomona, probably under the sea.

Orange River Origin

Other theories are that the Orange river is primarily responsible for bringing the stones down with it and that the sea washed them up on the coast. Why, then, the increasing size of stones from the river mouth northward as far as Pomona, after which they decrease, and why the marked difference in characteristics, such as hardness and quality between the German stones and river stones? It must also be noted that the German stones show no signs of travel, being almost nonwater worn. These various arguments all militate against the stones having come from inland.

Product of Country Rock

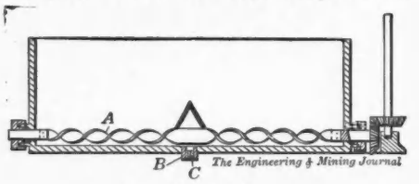
Again, it is suggested that the stones are the weathering product of the country rock, the heavy wash having remained in the valleys and the lighter sand having blown away. The country, to within 10 miles of Pomona, is entirely crystalline schists, granite and feldspar, and is from there southward, covering the richest ground, and that containing the largest stones, almost entirely limestone, onyx and quartzite. From which do the diamonds originate? If from the granite all the valleys should be diamondiferous, whereas only one long valley, or rather a continuous chain of valleys from south to north, contains diamonds in any quantity.

Of the above three theories, only the first seems to me feasible, but I consider that there is also a bare possibility of the Orange river having formerly had its outlet in the neighborhood of Pomona, which would account for the grading off to north and south of that point, the greater deposit to the north on account of the southwest current and wind. I do not think, however, that the existing evidence is sufficient to support this theory and the occurrence of diamonds on Possession island, together with the unique characteristics of the German stones, decidedly opposes the theory.

*Abstract of an article in *South African Min. Journ.*, March 5, 1910.

Pulp Extractor

A device for conveying pulp or other material under water or other fluid with little agitation, and especially adapted for use in connection with ore concentrators, classifiers and settling tanks is shown in the accompanying illustration. The rotary feed screw *A* is placed in the bottom of a V-shaped settler and conveys the pulp to the discharge outlet in the



Janney Pulp Extractor

center. Outlets may be placed at one end or both ends of the tank. When the outlet is in the center the screw is right handed from one end of the tank to a flat portion over the outlet, and left handed to the other end.

To control the density or thickness of the pulp discharged from the spout *B*, the spout is made comparatively large in diameter to receive several reducing tubes *C*. These tubes may have openings of different sizes, so when a tube with a small opening is used the discharged pulp will be thicker than if a larger one had been used. The extractor was patented (U. S. Pat. 955,077, April 12, 1910) by W. H. Janney, Bingham Cañon, Utah.

A recent ruling made by the register of the Visalia land office holds that a placer location on which gypsum in commercial quantities has been found and developed, is legitimate even if the claim was primarily taken up as an oil speculation.

NEW PUBLICATIONS

ECONOMIC GEOLOGY OF THE FELDSPAR DEPOSITS OF THE UNITED STATES, by Edson S. Bastin. U. S. Geological Survey. Bull. 420. Government Printing Office.

THE ANALYSIS OF SILICATE AND CARBONATE ROCKS, by W. F. Hillebrand. U. S. Geological Survey, Bull. 422. A Revision of Bull. 305, 1910. Government Printing Office.

REPORT OF THE DEPARTMENT OF MINES FOR THE YEAR ENDED SEPTEMBER 30, 1909: PROVINCE OF NOVA SCOTIA, by Christopher P. Chisholm, Commissioner of Public Works and Mines.

GEOLOGY AND ORE DEPOSITS OF THE BULLFROG DISTRICT, NEVADA, by F. L. Ransome, W. H. Emmons and G. H. Garrey. U. S. Geological Survey, Bull. 407. Government Printing Office.

A DESCRIPTIVE SKETCH OF THE GEOLOGY AND ECONOMIC MINERALS OF CANADA, by G. A. Young, with Introduction, by R. W. Brock. Canada Department of Mines, Geological Survey Branch.

REPORT ON THE INVESTIGATION OF AN ELECTRIC SHAFT FURNACE, DOMNARFVET, SWEDEN, ETC.. (Second Edition), by Eugene Haanel. Canada Department of Mines, Mines Branch, Ottawa.

ANALYSES OF ROCKS AND MINERALS FROM THE LABORATORY OF THE UNITED STATES GEOLOGICAL SURVEY, 1880 to 1908. Tabulated by F. W. Clarke. U. S. Geological Survey, Bul. 419. Government Printing Office.

PRELIMINARY REPORT ON THE MCKITTRICK-SUNSET OIL REGION, KERN AND SAN LUIS OBISPO COUNTIES, CALIFORNIA, by Ralph Arnold and Harry K. Johnson. U. S. Geological Survey, Bul. 406. Government Printing Office.

THE MANGANESE-ORE DEPOSITS OF INDIA, by L. L. Fermor. Part I: Introduction and Mineralogy. Part II: Geology (Mode of Occurrence and Origin). Part III: Economics and Mining. Part IV: Description of Deposits. Memoirs of the Geological Survey of India, Volume XXXVII, 1909. Parts I, II and III, 3 Rs. each Part IV, 5 Rs. Geological Survey of India.

COMMERCIAL PEAT: ITS USES AND POSSIBILITIES, by Frederick T. Gissing. J. B. Lippincott Company.

The subject is handled in a clear, concise manner. The book contains 59 illustrations showing a number of peat plants and the various kinds of machinery used. The various processes described cover practically all the modern methods employed in the production, manufacture and utilization of peat.

FUEL AND REVERBERATORY MATERIALS. Revised Edition, by A. Humboldt Sexton. $2.50. D. Van Nostrand Company.

The general arrangement of the book is similar to the first edition, but the many recent changes and developments in connection with coke ovens, gas producer, and pyrometry practice have been recorded and additions have therefore been made in the chapters dealing with these subjects. The book is well illustrated and shows careful preparation throughout.

HANDBOOK OF BRITISH GUIANA. Compiled by George D. Bayley. Published by the Permanent Exhibitions Committee, Georgetown, Demerara, British Guiana.

An elaborate volume of 608 pages, with many illustrations, giving full information about the geology, natural resources, population and industries of the colony. There is also much interesting matter of a historical nature. The section relating to mining is both descriptive and historical, giving also some account of the production and present conditions of the gold and diamond mines.

THE COAL TRADE, 1910: A COMPENDIUM OF VALUABLE INFORMATION RELATIVE TO COAL PRODUCTION, PRICES, TRANSPORTATION, ETC. By Frederick E. Saward. $1.50. Published by the author.

The book is an interesting compilation of valuable facts relating to the coal trade. The information is presented in a manner that makes good reading for mine operators as well as those interested solely in the trade end of the industry. Much technical information is also included so that the volume is in reality a condensed review of the year's happenings in coal mining.

ELEVENTH ANNUAL REPORT OF THE MINING INDUSTRY OF IDAHO FOR THE YEAR 1909. F. Cushing Moore, State Inspector of Mines.

Mr. Moore has issued promptly a careful review of the varied and growing mining resources of Idaho in the form of the eleventh annual report. It is sufficiently complete for its purpose and apparently shows that the State Inspector is in thorough touch with the mining development of the State. The statistics are complete and in detail, and the descriptions of the districts and of the individual properties are sufficiently full for the purposes of the work.

JOINT REPORT ON THE BITUMINOUS, OR OIL SHALES OF NEW BRUNSWICK AND NOVA SCOTIA; ALSO ON THE OIL INDUSTRY OF SCOTLAND, by R. W. Ells, L.L.D., pp. 131, 9½x6½ in. Paper; illustrated. Canadian Department of Mines. Government Printing Bureau, Ottawa.

The success which has attended the manufacture of oil from shales in Scotland has resulted in an investigation as to the possibility of rendering the shale deposits of Albert and Westmoreland counties, N. B., commercially valuable. "The Economic Possibilities of American Oil Shales" was discussed in the JOURNAL, July 24 and 31, 1909, by Charles Baskerville. In this article Dr. Baskerville covered much of the ground that this report embraces.

MINERAL PRODUCTION OF VIRGINIA DURING THE CALENDAR YEAR 1908. By Thomas L. Watson. Virginia Geological Survey, Bull. No. 1-A. University of Virginia.

This annual report by Thomas Leonard Watson, director of the Virginia Survey, and professor of economic geology in the University of Virginia, treats statistically of the mineral production of Virginia for 1908. The varied and not unimportant mineral resources of Virginia are well described. The chapters on the pyrite and copper formations are complete and include the geological features carefully presented. There is also a general article on the Appalachian geology, and considerable definite information about some of the special mineral development of the State.

THE MINING INDUSTRY IN NORTH CAROLINA DURING 1907 WITH SPECIAL REPORT ON THE MINERAL WATERS. BY Joseph Hyde Pratt. Economic Paper No. 15, North Carolina Geological and Economic Survey.

This report, covering the year 1907, recently issued, is of interest as a historical record, but much of its intended usefulness is impaired by the delay in issuing, particularly in regard to the statistical matters; the description of mines and districts have to be read largely from the retrospective point of view, inasmuch as the developments since the date of the report may have modified or radically changed the status of the property. Much of the report is devoted to the mineral waters of the State, which apparently constitute an important resource and one that is going to be more utilized in the future, as it becomes better understood through the studies of the survey. Apparently the State has a great number of medicinal springs, a tangible asset in view of the situation of the State. The Gold Hill copper district is fully described by F. B. Laney, and a chapter in the report is devoted to the past resources, written by Charles A. Davis. This study seems to indicate that the State may have a large latent resource in the extensive peat deposits, which are becoming more and more available with the development of transportation and the increased local demand for peat products. The report describes the varied and interesting mineral resources of this Appalachian state, and gives one a hope that the future reports may be issued more timely, so that they may be read in the present tense.

An Analysis of the Coal Dust Problem

Showing the Quantity of Dust Necessary in a Mine to Produce an Explosion, and Suggestions That Will Afford Greater Safety Underground

BY AUDLEY H. STOW*

If a small particle of coal is to be classed as dust, it is essential that the relation of its weight to its size and shape shall be such that it will not readily settle from a body of air in motion, the limit in size being the maximum that will not readily settle as long as the velocity under consideration is maintained. The size, rather than the weight, is the more convenient unit of measure, and is equally definite, owing to the practically constant relation, particularly for any given class of coal, between the cubic contents and weight. That the limit in size of the dust should vary with the velocity of the air is plausible; consequently, there is no reason why we may not to advantage determine, or arbitrarily agree upon, a standard maximum-size limit to serve as the nominal dividing line between fine coal and dust.

Effect of High Velocities

Extremely high velocities of air are occasionally, under exceptional local conditions, encountered in actual mining; during the progress of an explosion, sizes of coal that no one would in any sense consider dust may be temporarily in suspension. In adopting a standard maximum size, we should disregard not merely the high velocities realized during an explosion, but also such exceptionally high velocities as in mining operations are realized only at rare intervals.

The maximum size corresponding to a common maximum velocity of the ventilating currents does not as yet appear to have been satisfactorily determined, although the data in this connection rather indicate the 200-mesh screen as the limit in size. The aperture of this screen, as proposed by the council of the Institution of Mining and Metallurgy, London, in 1907, should be 0.0002083 ft.; the radius of the sphere that would exactly fit this aperture is 0.0001042 ft. If we allow 0.0000042 ft. for the clearance required in order that our maximum sphere may without clogging pass through the aperture under consideration, we thus have 0.0001 ft. as the radius of the maximum sphere that will readily pass through a 200-mesh screen.

Illustration of the Size of a Molecule

The mechanical difficulties involved in the construction of screens finer than 200 mesh are rather serious; yet it is evident the sizes of dust smaller than the aperture of this screen are numerous. The limit of mechanical division being the single molecule of coal, Sir W. Thompson's illustration[1] of the size of molecules of the more common liquids and solids becomes of interest in this connection:

"If a drop of rain, or a glass sphere the size of a pea, be magnified to the size of the earth, the molecules being magnified in the same proportion, the structure of the mass would then be coarser than a heap of fine shot, but probably not so coarse as that of a heap of cricket balls."

In using this illustration in the consideration of our maximum sphere, approximate quantities near enough for our purpose will be substituted as follows: If we magnify a sphere of coal one-hundredth of a foot in diameter until this dimension becomes 40,000,000 ft., the molecules of coal will then be one-tenth of a foot in diameter, that is, if they are magnified 4,000,000,000 times, their diameter will still be only one-tenth of a foot. In order that their diameter may be a foot, they must be magnified 40,000,000,000 times, equivalent to this number of molecules, in a single row, per linear foot. A single row, the length of the diameter of our maximum sphere that will readily pass through the 200-mesh screen, will thus contain 8,000,000 molecules; if the molecule be taken as the unit of measure, our maximum sphere will then contain 4.1888 $(4,000,000)^3$, or nearly $(6,450,000)^3$ molecules. Certainly, if Sir W. Thompson's illustration is only approximately correct, there must still be an almost, if not quite, inconceivable number of sizes smaller than our maximum sphere, and much more than amply sufficient to provide for a considerable difference in size for every appreciable diminution in velocity of the air currents encountered in mining.

Ascertaining Coal Dust Sizes

That any form of screen is totally inadequate to separate the finer grades of dust is evident, yet this operation, with modern scientific methods, should not be at all impossible. For example, if the number of corpuscles in a drop of human blood may within a reasonable degree of accuracy be determined, the relation of sizes of dust to the velocities with which they settle in water should be ascertained without serious difficulty.

Between the grade known as buckwheat coal, for instance, and the standard maximum sizes of dust, as heretofore outlined, there are certain intermediate sizes, which, in instances of unusual velocity, may readily be retained in suspension. These sizes, varying from two ten-thousandths to four thousandths of a foot in diameter, may appropriately be designated as coal "sands."

Dust Necessary to Produce Maximum Explosive Effect

In explosions, and in the presence of a large excess of dust, it is probable, as indicated in instances by extensive deposits of coke, that the fixed carbon does not take an equally active part with the volatile matter. Under these conditions it is not altogether incorrect, in estimating the minimum amount necessary to produce a maximum explosive effect, to disregard the fixed carbon, basing our calculations on the volatile matter alone. However, a minimum figured on this basis is only such in the absence of sufficient air to complete the reaction that would otherwise take place. Consequently, the estimation of the fixed carbon as an active agent, equally with the volatile matter, according to the well known formulas, is clearly essential to the correct determination of the minimum quantity of dust; and is therefore so included, unless otherwise stated. The substantial difference in the amount of these two minimums, however, is of less interest in view of the large quantities with which comparison is to be made.

The minimum weight of coal, for instance, required for the complete exhaustion of all the oxygen in a given volume of air will vary with the composition of the coal as well as with the temperature and hygrometric state of the air; yet the variations due to these two causes, in comparison with the difference between the two minimums just referred to, are so slight that they may be disregarded.

It is sufficient, for all practical purposes, to select some type of coal of average composition as the basis of our calculation. Any one of the several methods available for then determining the minimum, that may be most convenient, is altogether sufficient. The minimum quantity, within a reasonable degree of accuracy, having been determined, we are then enabled to readily estimate the relation, with respect to dust, of certain points bearing on this somewhat objectionable form of coal, particularly in underground workings.

The weight of 100 cu.in. of dry air, at 16 deg. C., practically equivalent to

*Consulting mining engineer, Maybeury, W. Va.

[1]"Ganot's Physics," p. 2.

61 deg. F., is 31 grains, or 0.076526 lb. per cu.ft. of air; the specific gravity of marsh gas being 0.559 and the maximum explosive mixture 1 to 9.57 (volume),[2] the quantity of marsh gas required per cu.ft. of air will be

$$\frac{0.0765 \times 0.559}{9.57} = 0.004468 \text{ lb.}$$

If we consider that the coal contains 20 per cent. volatile matter (which is an average composition), we have, disregarding the volume of air displaced by the dust, $0.004468 \times 5 = 0.02234$ lb. of coal per cu.ft., or 0.6031 lb. per cu.yd. of air.

There is, with 6-ft. coal, per running foot of an entry 12 ft. in width, the track filling and gob being disregarded, 72 cu. ft. of air space to 12 sq.ft. of either roof, floor, or ribs, equivalent to $0.02234 \times 6 = 0.134$ lb. of coal dust per sq.ft., or 1.206 lb. per sq.yd. of floor; for instance, with absolutely no dust on either ribs or roof and with neither dust, gas nor smoke in the air.

Fixed Carbon Included

The exact chemical structure of coals not having as yet been determined, it will be assumed that the type of coal selected as the basis of calculation has such a composition that when subjected to destructive distillation, it will yield 56 atoms of fixed carbon, and 11 molecules of methane, practically 20 per cent. volatile matter and 36 per cent. fixed carbon. If we allow 3.64 per cent. for ash, moisture, etc., the volume of air required for the complete combustion of this coal is given near enough by the equation:

$$\underbrace{\begin{matrix}56\,(C) + \\ 11(CH_4) \\ + \text{Ash}\end{matrix}}_{\text{Coal}} + \underbrace{\begin{matrix}156\,(O) + \\ 624\,(N)\end{matrix}}_{\text{Air}} = \begin{matrix}67\,CO_2 + \\ 22\,H_2O \\ + \text{Ash}\end{matrix} + 624\,N$$

(848 + Ash) + (11,232) = Sum of Atomic Weights.

The sum of the atomic weights of the coal and air being 848 and 11.232 respectively, for one part of coal by weight, free of ash, 13.2453 parts by weight of air will be required. Adding, however, to the sum of the atomic weights of the coal a correction for the ash, we have 880 and 11.232 respectively, corresponding to 1 part by weight of coal, including ash, to 12.7636 parts by weight of air, the weight of a cubic foot of the latter being 0.0764 lb., there will only be required for the complete combustion of 1 cu.ft. of air, $0.0764 \div 12.7636$, or 0.005985 lb. of coal dust.

The minimum weight of dust may also be calculated from the amount of marsh gas that will consume the same amount of oxygen as the variety of coal just considered, and as shown by the following equation:

$$\text{Methane } 39\,(CH_4) + \underbrace{\begin{matrix}156\,(O) + \\ 624\,(N)\end{matrix}}_{\text{Air}} = 39\,CO_2 + 78\,H_2O + 624\,N$$

624 + 11,232 = Sum of Atomic Weights.

[2] J. T. Beard's "Mine Gases and Explosions."

For 1 lb. of marsh gas the equivalent weight of coal is given by the proportion.

$$624 : 880 :: 1 : X \quad \therefore X = 1.41 \text{ lb. of coal.}$$

If 0.004468 lb. of marsh gas per cu. ft. of air represents the maximum explosive mixture, and if 1.41 lb. of coal will replace 1 lb. of marsh gas, then the minimum weight of coal dust per cu.ft. of air will be given by the proportion

$$1 : 1.41 :: 0.004468 : X \quad \therefore X = 0.00607 \text{ lb. of coal.}$$

If 0.006 lb. of dust be taken as the quantity per cu.ft., there will be required per cu.yd. of air, 0.162 lb., thus only slightly more than one-fourth than in the previous section.

With a 6-ft. coal, as in the previous example, 0.006 lb. per cu.ft. of air corresponds to 0.036 lb. per sq.ft., or 0.324 lb. per sq.yd. of floor, ribs or roof, as may be under consideration, 1 lb. of coal dust thus sufficing for the complete exhaustion of all air over 27.78 sq.ft., or 3.09 sq.yd. of floor space.

The minuteness of these quantities is perhaps more evident if, instead of being expressed as weights, they are given as the thickness of a uniform layer of coal, a foot square for instance, in the consideration of either the minimum amount of dust per cu.ft. of air, or per sq.ft. of floor space. The weight of a cubic foot of water at 60 deg. F. being 62.367 lb. and the average specific gravity of bituminous coal, 1.31, the weight of a cubic foot of the latter will be 81.7008 lb. Dividing the minimum weight of dust per cu.ft. of air, 0.006, by the latter figure, gives the 0.00007344th part of a foot as the thickness of the layer of coal 1 ft. square. Then $0.00007344 \times 6 = 0.00044064$, the minimum thickness of a uniform layer of coal that represents the complete exhaustion of all the air in a mine in which the thickness of the coal is 6 ft. An average thickness of dust may then be expressed in minimums, instead of in fractions of a foot.

The thickness of bond writing paper, 500 sheets of which constitute but 1½ in., equivalent to 4000 to the foot, is but 0.00025; twice this amount in coal, in the shape of dust equally distributed on the floor, for instance, and exclusive of other forms of carbon or carbon compounds, represents more than the minimum amount, 0.005 being a not uncommon thickness of the dust and soot on the ribs on many haulageways, and on the roof on steam-locomotive hauls.

Relative Volumes

Dividing 81.7008 by 0.006 gives 13,617, the number of cubic feet of air required for the complete combustion of 1 cu.ft. of coal, which on this basis, with 6-ft. coal, will consume all the air over 2270 sq.ft. of floor space, or over 6810 sq.ft. of workings, if one-third of the coal is removed on the first mining. One ton of dust, therefore, will consume all the air over 61,290 sq.ft., or 1.4 acres net open work, or over 4.2 acres of workings.

The cubical contents of a particle of dust, spherical in form, are, if r be the radius, equal to $4/3\ r^3$; if R denote the radius of the outer surface of the surrounding hollow spherical shell of air containing 13,617 times the volume of coal in our particle of dust, we thus have

$$\tfrac{4}{3}\pi R^3 = 13{,}618 \times \tfrac{4}{3}\pi r^3 \quad \therefore R = 23.88\, r.$$

That is, whatever the size of the particle of dust, the radius of the outer surface of the surrounding hollow spherical shell of air will, for the ratio of volumes under consideration, be 23.88 times that of the particle of dust.

A molecule of coal of the composition C_7H_4, for instance, requires for its complete combustion an amount of air near enough represented by the symbols 16 (O) 64 (N), a total of only 80 atoms, or 40 molecules of two atoms each. If air be liquefied by sufficient pressure and reduction in temperature, it appears a somewhat plausible view that the molecules of oxygen and nitrogen will then perhaps be somewhat the same distance apart as the molecules of coal.

A pressure of some 320 atmospheres is, however, required to liquefy oxygen, the inference being, at ordinary temperatures and pressure, that the molecules of oxygen and nitrogen constituting air are in a state of intense vibration, the number of impacts per second, for instance, being probably far past comprehension. Increasing the complexity of the molecule of coal probably also increases its cubical contents, as well as that of the surrounding spherical shell. The increase in complexity should not, however, increase the volume of air required for the combustion of a given volume of coal, provided the proportion of carbon and hydrogen remain the same. That the number of such more complex molecules, for a given volume, is correspondingly reduced, would appear to be indicated by the slight range in specific gravity of bituminous coals.

If the radius of the standard maximum particle of dust, heretofore assumed spherical in form, be taken as unity, then the edge of the cube containing the same volume of coal will be 1.612; if E denote the edge of the surrounding hollow cube of air containing 13,617 times the volume of coal, we thus have

$$E = \sqrt[3]{(1.612)^3 + (1.612)^3 \times 13{,}617} = 38.495,$$

the unit of measure being the radius of the standard maximum particle of dust, the suggested value of which, as expressed in feet, is 0.0001; on this basis, E, as also expressed in feet, will be equal to 0.00385, which is thus, for the

relative volumes under discussion, the distance between centers of contiguous cubes and equivalent to 259.74 per linear foot, or slightly less than 22 per inch, for the size of dust, spherical in form, that will readily pass through a screen of 200 apertures per linear inch. A correspondingly smaller number, for larger sizes, is sufficient to produce maximum explosive effect. Clouds of dust in the mines, as revealed by the miners' acetylene lamp with semi-circular shield, certainly appear, in instances and under suitable conditions, extremely dangerous.

If one volume of coal requires for its complete combustion 13,617 volumes of air, while one volume of marsh gas requires but 9.57 volumes of air, then one volume of coal may be said to be equivalent to 1423 volumes of marsh gas, thus illustrating in another way the relatively large amounts of dust seen at times in suspension, if expressed in equivalent volumes of this much dreaded gas.

Dust Resulting from Machine Mining

It will be assumed that pick, puncher and chain-machine mining, under the same conditions, result in substantially the same amount of fine coal or cuttings, the larger portion if not all of which, in the presence of a blown-out shot for instance, are capable of sustaining an explosion, although only in part, in the absence of violent disturbance, classed as a true dust. The chain machine, owing to the uniform cut or kerf made, serves as a convenient basis of estimate of the amount of "coal sand" and dust resulting from the mining operation.

A 4-in. cut is equivalent to 27.234 lb. of coal per sq.ft.; the minimum amount per unit of area for a given thickness of coal, as 6 ft. for instance, being the same whatever the width of the place or working; dividing the weight of the coal in the cut by the minimum amount per sq.ft. of floor will give 756 times the minimum as the amount of the cuttings. With a 6-in. cut, which is of advantage in that less powder is required to turn out the coal, we get 1135 times the minimum necessary to produce maximum explosive effect.

The cuttings in a chain-machine mine hardly represent the entire dust contents; 100 times the minimum appears a moderate estimate for the considerable amount of fine coal resulting from the action of the roof on the pillars, which is distributed by the mine cars along the haulageways.

On the basis that 800 times the minimum is the average amount of cuttings, if seven-eighths are loaded at the working faces and five-eighths reach the outside, we thus have the remaining two-eighths, or 200 times the minimum, probably the finer grades, distributed along the haulageways, making, in all, with the pillar dust, 400 times the minimum not hauled outside.

Changes in Amount and Distribution

A considerable proportion of the cuttings remaining at the working faces soon becomes covered with gob; of the 300 times the minimum that distributes along the haulageways, perhaps one-half, the coarser grades of dust and coal sand, remains *in situ* and in time becomes hard and compact or possibly thoroughly soaked with water, and changes in chemical composition so as to be less dangerous, if not entirely harmless. Of the remaining 150 minimums, perhaps 25 are retained within the mine due to adhesion, the same amount carried outside and 100 either carried outside or distributed throughout the working districts by the ventilating currents.

A Practical Example

If the rooms in a given mining district are twice the width of the haulageway to the district, and are driven on 60-ft. centers, 480 ft. in length, with 240 ft. of crosscuts, room width, per room, the total area of the rooms or crosscuts will be 24 times that of the entry. If the haulageway under consideration, off which these 480-ft. rooms are turned, is throughout its entire length ankle deep in dust and thus equivalent to about one-half a 5-in. chain-machine cut, or 500 times the minimum for the entry, then this amount of haulage dust alone, with no other dust in the rooms and with neither dust gas nor smoke in the air, will represent some 20 times the minimum amount for the entire district; nor will a great deal of dust in the rooms be required to bring the average contents up to 100 times the minimum.

Dust ankle deep along the haulageways has been in general, as far as noticed, only local, occurring more particularly on steep mule or fast motor hauls, the average being perhaps as stated, about 150 times the minimum.

Comparison of Pressure and Exhaust Ventilation

The total amount of dust in a given period of time that, for instance, will be carried out of the mine with pressure ventilation, or retained within with exhaust ventilation, will depend not only upon the average dust contents per cu.ft. of air (which may conveniently be expressed in fractions of a minimum), but also upon the number of cubic feet passing through the mine in the period of time under consideration. Owing in part to the minimum amount, expressed as an absolute quantity, being relatively small, while on the other hand the total amount of air for a considerable period reaches quite large figures, it is not surprising that a small fraction of a minimum, per cu.ft. of air, will in time result in a considerable accumulation of dust, whether expressed in minimums or as an absolute quantity; this will perhaps be more clearly illustrated by an example:

The amount of air required for a given area of mine workings depends, in the absence of gas, to some extent upon the proportion of idle unproductive territory, but to a greater extent upon the system of ventilation, and more particularly upon what may be considered a proper allowance of air. I will assume that 200,000 cu.ft. of air per minute is a suitable allowance for a block of workings 5000x5000 ft., or a total area, including pillars, of 25,000,000 sq.ft., in fairly active operation; let us further assume (as convenient figures for the purpose) that the net area of the open work is 10,000,000 sq.ft., leaving as the standing pillars 15,000,000 square feet.

A 10-hour shift being equivalent to 600 minutes per day will thus give per shift 120,000,000 cu.ft., or 12 cu.ft. of air per sq.ft. of net open work, or with 6-ft. coal, just twice the entire contents of the mine; if we assume, with exhaust ventilation, that none of the dust in suspension subject to the action of gravity is carried out, and that this portion of the dust contents of the air is only one-hundredth part of the minimum per cu.ft., there will thus be deposited in the open work each day, one-fiftieth part of the minimum, or in a year of 300 working days six times the minimum. A volume of air, in the latter period of time and exclusive of the interval between actual working shifts, is equivalent to 600 times the total contents having been passed through the mine.

With the pillar work following upon the advance work as rapidly as well planned barriers will admit, the average length of life of the different workings (although only too often much greater) may be reduced to about four years, on which basis, at the rate of six minimums per year, we get 24 minimums as the dust contents at any given date due to the action of the ventilating currents. With the average age of the workings as eight years, a not uncommon figure, we get 48 times the minimum as the average dust contents, while 16 years, for instance, will give 96 times the minimum, one-fiftieth part of the minimum per cu.ft. of air in place of one-hundredth part, doubling these already large figures.

If one-hundredth part of the minimum amount per cu.ft. of air will, with exhaust ventilation, in 4 years give 24 times the minimum for the entire mine, one twenty-four hundredth part of the minimum per cu.ft. of air will, in the same length of time, bring a mine from which all dust has been removed up to its explosive capacity.

The one-hundredth part of the minimum per cu.ft. of air is a rather small quantity that, by an analysis of a small volume of the return, would require fairly careful work to determine with certainty. The probable small quantities involved would rather suggest set-

tling from a continuous current in a bag or dust house through which, with pressure ventilation, known volumes of the return may be readily deflected, thus giving averages extending over a considerable period of time. With exhaust ventilation a number of experimental stations, well distributed over the workings perhaps, are required.

In this connection, 0.42 grain per cu.ft. of air for 120,000,000 cu.ft. per day, equivalent to 7200 lb., or 3.2 atoms of fine dust, does not seem at all an unreasonable figure for a mine that should have an output of 1000 tons per shift.

Reserve Coal Should Be in Solid Blocks

The figures given are incidentally suggestive of a reduction to the least minimum possible of all open work, all reserve coal being, as near as may be practicable, in large solid blocks and not as standing pillars. Large sections of idle workings that must be ventilated are almost ideal dust collectors, and nearly, if not quite, equal to well designed dust flumes--with exhaust ventilation.

The more nearly all entries are driven blank, and all reserve coal is in solid blocks, the more nearly the room-and-pillar system, on the score of dust, may be said to approximate longwall work.

The figures given are again incidentally suggestive of the question, whether in instances and with exhaust ventilation the amount of dust carried into the mines from closely adjacent tipples may not be an equally interesting calculation.

Explosive Capacity of a Mine

The minimum amount of dust, 0.036 lb. per sq.ft. of floor space, may be said to represent the explosive capacity of a mine. In the example in the previous section, 10,000,000 × 0.036 = 360,000 lb., or 160.7 tons of dust, equivalent to 300 lb. per day for four years of 300 working days each, representing the explosive capacity of the mine under consideration; in that, if equally distributed and in suspension, this amount will suffice for the complete exhaustion of the total amount of oxygen in the workings at any given moment.

Table of Calculated Quantities

The calculations previously given, and intended more particularly to illustrate the relatively small amounts of dust required to produce maximum explosive effect, are for convenience of reference here summarized; the thickness of the seam of coal mined is assumed to be 6 ft., and the conditions, etc., are as stated in the sections referred to:

FIXED CARBON DISREGARDED.

Minimum Amount of Dust.

Per cu.ft. of air in suspension	0.02234 lb.
Per cu.yd. of air in suspension	0.603 lb.
Per sq.ft. of floor, of roof or of ribs	0.134 lb.
Per sq.yd. of floor, of roof, or of ribs	1.206 lb.

FIXED CARBON INCLUDED.

Minimum Amount of Dust.

Per cu.ft. of air in suspension	0.006 lb.
Per cu.yd. of air in suspension	0.162 lb.
Per sq.ft. of floor, of roof, or of ribs	0.036 lb.
Per sq.yd. of floor, of roof, or of ribs	0.324 lb.
Per cu.m. of air in suspension	96.114 grams.

One pound of coal dust is the minimum for—
- 13,617 cu.ft. of air.
- 504 cu.yd. of air.
- 2,269 sq.ft. of floor, of roof, or of ribs.
- 252 sq.yd. of floor, of roof or of ribs.

Minimum as a Uniform Layer.

	Thickness, Cu.Ft.
Per cu.ft. of air	0.00007344
Per sq.ft. of floor, of roof, or of ribs	0.00044064

Relative Volumes.

1 cu.ft. of methane is the minimum for 9.57 cu.ft. of air.

1 cu.ft. of coal is the minimum for 13,617 cu.ft. of air.

Coal requires 1,423 more volumes of air than methane.

1 cu.ft. of coal in the form of dust is the minimum for:
- 2,270 sq.ft. of net open work, clear of pillars.
- 6,810 sq.ft. of mine workings, including pillars.

One ton of coal is the minimum for:
- 61,290 sq.ft. or 1.4 acres net open work.
- 183,870 sq.ft. or 4.2 acres mine workings.

Amount of Cuttings (Chain Machine).

4-in. cut equals	765 minimums
6-in. cut equals	1,135 minimums
Minimum per Cu.Ft. of Air.	Explosive Capacities
1/200 in four years, equals	1
1/2 in four years, equals	100

Lower Explosive Limit of Dust.

Per cu.ft. of air	0.0044 lb.
Per cu.m. of air	70.775 grams.

1 cu.ft. of coal in the form of dust is the lower explosive limit for:
- 18,568 cu.ft. of air.
- 3,094 sq.ft. of net open work.
- 9,282 sq.ft. of mine workings.

Résumé

It is only evident from the foregoing figures that neither loading out nor improvements in systems of ventilation, nor attention to mine cars, nor devices for cleaning ribs and roof can, at least with present methods, even approximate the degree of freedom from dust that is essential in order that an explosion cannot possibly occur. We should not, however, lose sight of the fact that the smaller the total quantity of dust in a given mine, although far in excess of the minimum amount, the less are the chances of either the necessary quantity being in suspension at possible points of ignition or of a local explosion becoming general. Simple and relatively inexpensive methods for reducing the amount of dust certainly deserve thorough and conscientious trial, in so far as may be at all practicable with the means at our disposal.

We should more particularly not lose sight of the fact that to result in an explosion the dust must be in suspension in air; as long as it remains on roof, ribs or floor, it is harmless. The statement is not infrequently made, in good faith, that there is no dust in a mine, or in a certain section of a mine, as the case may be; nor is the statement necessarily incorrect, in the sense intended, even though the quantity be considerable, as long as all of it remains so thoroughly moistened with water that it cannot be detached from its resting places, as by a closely adjacent blown-out shot. If, however, but one small section of a mine is allowed to become dry, an explosion therein may readily generate sufficient heat to dry out the entire mine as the explosion extends from section to section. Local application of water, in dry mines, can be but little more effective, for instance, than loading out local accumulations of dust, and the same would appear to apply to the use of calcium chloride. Thorough saturation of the entire intake appears the only method by which every particle of dust, in every section of a given mine, can be reached with certainty; while at points at which large volumes of dust are rapidly brought into suspension as by the mining operations, ample volumes of air, free from all forms of dust, appear perhaps equally desirable.

Coal Mining Industry in Indiana

Special Correspondence

The conditions of the mining industry in Indiana, on the whole, are said to be on a better basis and look more encouraging than at any previous corresponding period for a decade. The record for May is believed to be the dawn of a new era in coal mining in Indiana. There are several causes that have contributed to the present prosperity and point to a more propitious future in this State. The contending interests that occasioned a 30-day suspension during April settled their differences more easily and satisfactorily than was expected. The operators and miners have come to realize that arbitration along equitable and practicable lines is far more conducive to the economic advantages and prosperity of employer and employee than by resorting to strikes and lockouts.

The demand for Indiana coal has been unprecedented and in consequence every mine in the State is being operated on full time. Old and new markets are placing orders far ahead of the output of the mines. Never before were there so many coal buyers sent into the Indiana field, and in consequence mine-run coal is readily selling at $1.45 to $2 at the mines. The suspension of mining in Illinois contributed not a little to the extraordinary activity at the Indiana mines. Markets supplied by Illinois mines rushed their agents into Indiana and the operators say the prospect for a steady and full summer's output at high-notch prices was never better. Another cause for rejoicing is the fact that the railroad companies are doing exceedingly well in moving the big daily output. In some instances the railroads have doubled their crews in order to prevent the blockading of coal trains. In this connection it is observed that the railroads are taking care to store coal in order to avoid higher prices, which are almost certain to prevail later on during the year. Of the 60,000 locomotives in this country, Indiana

coal is said to feed an unusually large number of them at the present time.

Condition of Mines

The physical condition of the mines in Indiana is good. Chief mine inspector Epperson says there are a few mines in need of repairs, but generally the mines are in excellent condition for speedy and safe operation. During the period of suspension, the operators in control of the larger mines were busy in making them ready for successful operation. In some instances electric lights and haulage were installed and some mines equipped with telephones.

There are perhaps a few hundred more miners employed in the Indiana mines than at any time last year. Operators say more miners could be worked, but experienced men are not obtainable. During the suspension, a large number of the foreign miners left for the old country. Their places, for the most part, have been filled by American miners.

Thousands of acres of coal land are being bought or leased for development. Prospective drilling is being pursued in a number of fields. The Miami Coal Company and the Crown Hill Coal Company have each just completed new shafts in the Clinton field and the Jackson Hill Coal and Coke Company is sinking a new shaft in West Terre Haute district.

Oil Mining

The production of oil in the eastern or Montpelier field and the southwestern or Oakland City field continues to attract investors. New wells are being completed almost daily and the territory is being extended. Thousands of acres of land are under lease and apparently there is but little wildcat operation going on. Indiana is very much richer by reason of her oilfields.

Rock and Cement

According to present indications, the production of cement in Indiana will be a third larger this year than last. The cement mills in southern Indiana are working at full capacity and the new plants in northern Indiana are getting fairly well started.

Rock quarrying as a business is growing extensively in this State. Indiana stone for building purposes is in popular demand. It is also gaining a wide reputation for sculpture work and figures—only recently, Indiana stone was shipped to Paris for sculpture work.

The present era of macadam-road building in Indiana has created a good business for those operating crushing plants. There are more men and more capital employed in quarrying and crushing rock in Indiana at present than ever before in the history of the State.

Steps have been taken through congressional appropriation to establish rescue stations—one at Evansville and one at Terre Haute.

In conclusion, it is safe to say that mining conditions at present in Indiana are most satisfactory and that the future is more optimistic than for a number of years.

The Sizing of Anthracite

The yearly report of Heber S. Thompson, engineer, of the Girard Estate, is always of interest, owing to the careful analysis of the production from the different collieries owned by the estate. Owing to the fact that these collieries are leased to several different companies and operated under varying conditions, they present a fair average of practice and results, although their aggregate production is only about 3 per cent. of the total output of anthracite. The Girard Estate had last year 13 leases in effect—12 collieries and one washery—these leases being held by six different companies. Three of the collieries were operated by the Philadelphia & Reading, five by the Lehigh Valley, one by the Susquehanna Coal Company, a Pennsylvania Railroad subsidiary, the rest by independent companies, one colliery being leased by the Thomas Coal Company and two by the W. R. McTurk Coal Company, while the washery was leased by the Oxford Coal Company.

The total anthracite produced from the several collieries and washeries was, in long tons, for two years:

Shipments:	1908 Tons.	1908 PerCt.	1909 Tons.	1909 PerCt.
Fresh mined	1,713,256	78.6	1,610,656	81.4
Washery	247,635	11.4	147,730	7.5
Total shipments	1,960,891	90.0	1,758,386	88.9
Used at mines	217,332	10.0	218,915	11.1
Total	2,178,223	100.0	1,977,301	100.0

The large decrease in washery coal was due in part to a lighter demand for the small sizes; but the production from washeries is generally decreasing as the old culm banks upon which they operate are gradually worked out. Under present systems of operating, the small sizes are saved at the breakers and do not go into the culm piles as formerly. The division of anthracite into sizes is established by custom as follows: Lump, or coal screened but not broken; broken, which now includes the size formerly known as steamboat, which has gradually been disused in the trade; egg; stove and chestnut. These five sizes are known as large coal. The small or steam sizes are pea, buckwheat, rice or buckwheat No. 2 and barley. The residue, after barles is screened out, is culm, which is not marketable, though some is burned at the collieries.

The division of coal mined from the Girard collieries, according to sizes made during 1909, was as follows:

	Sent to Market—Fresh Mined.	Sent to Market—Washery.	Consumed at Collieries.
Lump	4,176	.....	.....
Broken	226,989	.....	.....
Egg	200,245	.....	.....
Stove	261,353	825	.....
Chestnut	315,314	9,773	.....
Total large	1,008,077	10,598	5,863
Pea	212,542	16,713	.....
Buckwheat	266,582	46,039	34
Rice	95,944	43,172	67,326
Barley	27,511	26,208	142,348
Culm	.....	.....	3,344
Total small	602,579	137,132	213,052
Total	1,610,656	147,730	218,915

The growth in the saving of small coal is shown by the following historical table, which covers a period of 48 years, showing the percentage of different sizes shipped at five-year intervals:

	Stove and Over.	Chestnut.	Pea.	Buckwheat.	Rice and Barley.
1863	90.00	10.00	.....	.....	.....
1868	87.87	11.20	0.93	.....	.....
1873	82.83	12.16	5.01	.....	.....
1878	77.22	12.52	10.19	0.07	.....
1883	71.81	12.17	11.91	4.11	.....
1888	69.91	11.79	12.63	5.67	.....
1893	59.91	16.80	10.32	12.97	.....
1898	45.12	22.90	12.58	18.03	1.37
1903	33.00	17.48	13.87	21.61	14.04
1908	38.37	17.66	12.44	17.25	13.91
1909	39.45	18.48	13.04	17.79	11.24

Up to about 1875, chestnut was regarded as a small size, and brought a lower price than the others, but the introduction of improved grates and other appliances brought it into large demand for household fuel. Pea coal was first reported in 1867; buckwheat in 1878; rice and barley in 1895. The saving of these sizes was accompanied by the development of a number of appliances for burning them, such as the Wootten locomotive boiler, and was followed by the establishment of washeries for working over the culm banks, which had accumulated at the mines. They now constitute an important part of the trade. These sizes are used for the making of steam, and in the Eastern cities also find extensive consumption in the large buildings heated from central plants.

The Cost of Labor in Wales

The average figures for a number of Welsh collieries, showing the proportion between the different elements of cost in the production of a ton of coal at the pit mouth, are given as follows: Labor, 81.72 per cent.; stores and materials, 11.87 per cent.; royalties, 4.38 per cent.; rents, rates, etc., 1.84 per cent.; and incidentals, 0.19 per cent. Examining similar figures for previous years, it is shown that the cost of labor has been increasing for some time. It is evident, therefore, that mine labor should be employed as economically as possible, and furthermore that in addition to the items of first cost and cost of maintenance of mining machinery, the superintendent who is building a plant should carefully consider how each piece of machinery is going to affect the cost of labor.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

John D. Moodie has returned to Los Angeles, Cal.

E. D. Bronson, of Pachuca, Mexico, is visiting the United States.

H. W. Turner, of San Francisco, has gone to Alaska. He expects to return in July.

J. R. Masson, a metallurgist from Melbourne, Australia, has been visiting Leadville, Colorado.

Gerald F. G. Sherman, superintendent of the Copper Queen mines, has been visiting New York.

Henry H. Love of Boston is in Humboldt county, Nevada, in connection with mining negotiations.

Arthur Lakes, of Denver, Colo., is making geological examinations in Arizona and California.

J. N. Hauser has succeeded W. S. Mann as superintendent of the Calumet & Sonora Mining Company.

Arthur Lakes Jr., of Denver, Colo., is making mining and metallurgical examinations in Summit county, Colorado.

Dr. L. D. Ricketts has gone to Butte, Mont., and will spend more than a month examining processes in that section.

J. B. Risque, general manager of the Utah Consolidated, has resigned and will leave the company on Aug. 31 next.

W. S. Lecky, of Montreal, has been elected an associate member of the British Institute of Mining and Metallurgy.

Alexander P. Rogers has returned to New York from Colombia, where he spent two months on professional business.

A. J. Eveland, of the General Development Company, has returned to New York from a field trip of several months duration.

Prof. Joseph W. Richards, of Lehigh University, sailed on June 11 to attend the International Metallurgical Congress at Düsseldorf.

Edwin Hull, State geologist of Wyoming, has been spending several weeks in the Province of Quebec, inspecting the asbestos fields.

Hallett R. Robbins will not this year direct exploration work for the Colonial Gold Mining Company, being fully occupied at Boise, Idaho.

Lewis T. Wright, general manager of the Mountain Copper Company, passed through New York this week, on his way from London to San Francisco.

Melbert B. Cary has been chosen president of the Pacific Mining and Smelting Company. He has been connected with the company for several years.

The new hospital at Munising, Mich., was opened June 5. It has been built and equipped at the expense of William G. Mather, president of the Cleveland-Cliffs Iron Company.

John H. MacMillan, late mine manager for the Royal Collieries, Ltd., Lethbridge, Alberta, has been given charge of a new coal mine near Midway, in the Boundary district of British Columbia.

Robert H. Large has been appointed general coal freight agent of the Pennsylvania Railroad, succeeding J. G. Searles, who has been assigned to other duties on account of ill health.

W. Murdoch Wiley, of New York, accompanied by R. B. Lamb, has left for Montana to examine the Ohio-Keating mine. They will also make mine investigations in Idaho and California.

Lawrence Adams, late vice-president and general manager of the Guanajuato Amalgamated, is leaving New York for Montana and California in connection with mining properties that he is interested in.

George B. Clark and W. L. Stone, forming the firm of Clark & Stone, have bought the assay office and laboratory formerly conducted by George B. Eberenz at Pueblo, Colo., and will conduct the business hereafter.

T. W. Starkey, an English mining engineer well known in Mexico, was shot by a Mexican, formerly in his employ, while on his way from Cucupe to Cerro Prieto, Sonora. He was severely wounded, but has a chance of recovery.

Enoch Henderson, formerly superintendent of the Yuma Copper Company, Salome, Ariz., has been appointed superintendent of the Franklin mine in the Lake Superior district under General Manager R. M. Edwards.

Frederick Cutlar Poisson, who has been in the Inca district in Chile for several years, has been visiting in New York and vicinity for several weeks and will sail about June 24 for England. His address will be Bartholonew House, E. C., London.

Howland Bancroft, of the United States Geological Survey, is going to Washington, where he will spend a couple of months finishing a reconnaissance of the ore deposits in the northeastern part of the State, commenced last summer.

Charles T. Mitchell, construction engineer for the Granby company, during the time important additions were made to that company's smelting plant, has taken a similar position with the Canadian Copper Company, at Copper Cliff, Ontario.

Albert L. Waters, who has been directing successful tests on the Colorado Iron Works Company's new oil-burning blast furnace, left Denver on June 1 for Arizona and Sonora, on professional business. He will pass July at his home in Los Angeles.

Paul S. Couldrey, formerly manager for Le Roi, No. 2, Ltd., Rossland, and for the last year superintendent of the British Columbia Copper Company's Mother Lode mine, Boundary district, is leaving for Peru to take charge of the Cerro de Pasco Mining Company's mines under General Manager A. B. W. Hodges.

William C. Potter, of the American colony in Mexico, who for several years has been chairman of the executive board of the American Smelting and Refining Company in Aguascalientes, was recently appointed to the same office on the New York board. Mr. Wagner, of the Chihuahua smeltery, and Kuno Doerr, vice-president of the Aguascalientes smeltery, will become the leading members of the Aguascalientes board.

OBITUARY

Dorrance S. Goddard died in Worcester, Mass., June 3, aged 80 years. He entered in early life into the manufacture of wire with his father, who founded the business which afterward grew into the great shops of the Washburn & Moen Company.

SOCIETIES and TECHNICAL SCHOOLS

National Institute of Mine Inspectors—The annual convention is in session this week—June 13-18—in Chicago.

American Institute of Chemical Engineers—The second semi-annual meeting, June 22 to 24, will be held at Hotel Clifton, Niagara Falls, Canada. The following papers are promised: Address of President McKenna: "The Study of Materials as an Element in a Course of Chemical Engineering." Report of the committee on chemical engineering education, F. W. Frerichs. "A New Product for Use in the Arts," F. G. Wiechmann. "Changes in Industrial Chemistry Caused by Electricity," Edward R. Taylor. "Notes on the Corrosion of Iron and Steel and its Prevention," G. W. Thompson. "Vacuum Distilling Apparatus," Philip B. Sadtler. "Chemical Industries of Canada," J. A. DeCew. "The Manufacture and Industrial Applications of Ozone," Oscar Linder. "Problems in Chemical Industry," J. T. Baker. "Arrangement of Filter Presses for Bleaching Oils with Fullers Earth," David Wesson. "Commercial Manipulation of Refractory Elements for Incandescent Lamp Purposes," Ralph E. Myers. "Underground Waters for Manufacturing Purposes," W. M. Booth. "Loss in Coal due to Storage," A. Bement. "Nitric and Mixed Acids," Schuyler Frazier. "Plant Design," W. M. Grosvenor." A number of visits to industrial plants will be made.

EDITORIAL CORRESPONDENCE

Reports From Our Own Representatives on Important Events From Many Important Mining Centers of the World

San Francisco

June 9—The oil industry of the State still continues to grow in importance. English investors have made their appearance in several fields and many large sales have lately been made. Storage and marketing the oil are the two problems. The production of the wells of the state is about 220,000 bbl. daily, and the consumption is 30,000 to 40,000 bbl. less. Besides the tanks and reservoirs in the fields, large reservoirs will be made near the seashore. There is some talk of trying to introduce California oil on the Atlantic coast in opposition to coal. There is already a pipe line across the Panama isthmus, and there are oil-tank steamers on both oceans.

The oil men of the State have not been well organized, but they are making preparations to stand off pernicious legislation, like the Pickett bill. An attempt will be made to get the oil men together. The big Lakeview gusher in Kern county, after 85 days steady flow, is still yielding at the rate of 47,000 bbl. daily. Between 3,500,000 and 4,000,000 bbl. have already flowed from the well. Storage is the pressing problem. The oil stream is carried in ditches to reservoirs near by and more or less has been piped away. More reservoirs are being added.

The California State Mining Bureau has, in the matter of collecting gold and silver statistics in this State, started an opposition to the U. S. Census and the U. S. Geological Survey, having issued special blanks to gold, silver and platinum producers, asking amount of output, etc., in 1909. The Geological Survey is not this year sending out any blanks to miners, this work being in the hands of census agents. When the census agents get the mining blanks filled in, however, they are turned over to the Survey, which will compile the figures and prepare the mine reports.

The recent strike of rich ore in the Pacific mine near Placerville, Eldorado county, is considered of great interest in that section. The mine is an old one. The 500-ft. shaft has been only lately unwatered and retimbered. Drifting was commenced at the 500 level and run south 240 ft., running parallel with the old Pacific vein. The north end of the oreshoot has finally been encountered. In the crosscut east from the old Pacific workings another good vein has been found. The Pacific is being operated by a British company and is on the Mother lode.

Another attempt is to be made this summer to revive the Meadow Lake district in Nevada county. These mines were discovered in the early 60's and quite a town was built. No satisfactory way was found to work the "refractory" ores nor has one been found since. The snow fall is very heavy in that section and only during the summer months can work be prosecuted. John Clark and others will undertake operations.

Denver

June 13—More than usual interest now centers in the Raven Park oilfield, near Rangely, and only six or seven miles south of the projected line of the Moffat road. A great deal of preliminary drilling has been done in the Raven Park anticline, beginning as far back as 1901. In 1907 several new wells were drilled and some of the old ones pumped out, under the management of J. H. Hunt, of Hayward, Cal. Oil was found in nearly all the wells at from 400 to 700 ft. below the surface, and in all of them rose to about the same level, approximately 360 ft. below the surface. The area in which oil has been found is three miles by one and a half miles. It is a light, thin oil, and it is stated has been burned in lamps like refined oil. The principal workers in the field at present are Raven Park Oil Company, George Hildebrand, manager, 26 Jacobson building, Denver; Meeker Oil Company, of Meeker, Colo., Mr. Pratt, manager; and the Emerald Oil Company, T. J. O'Donnell, of Vernal, Utah, manager. An engineer for London people is on his way to examine this oilfield, and it only awaits the construction of the Moffat road to that point to be extensively developed. In the great fruit section of the Grand River valley, about 70 miles due south, oil is in demand for smudge-pot purposes, and it is now reported that a company has been organized at Fruita, Colo., to build a pipe line at a cost of about $200,000, to convey the oil from the Raven Park oilfield to this fruit country.

With reference to the strike in the Vindicator, at Cripple Creek, mentioned in the JOURNAL of June 3, the reports of the value of ore since then are rather more credible, and it is now stated that the orebody has widened to 16 ft. and has several seams of calaverite through it. It is now affirmed that the entire orebody without sorting would yield gold to the value of $100 per ton, and that is certainly big enough. The output of the mine last month was 2800 tons, a large proportion of which was smelting ore.

Butte

June 11—It has been announced that the Chicago, Milwaukee & Puget Sound Railway will build from Melstone in Fergus county, on its main line, through Great Falls, to Missoula, at which point it will again connect with its main line. The distance is approximately 400 miles and the road will tap some productive mining districts. It is probable that large shops will be built in Great Falls.

On May 31, the Anaconda company assumed the operation of the Clark properties and all ore from them will hereafter be shipped to the Washoe plant at Anaconda. The Butte Reduction Works, owned by Senator Clark and treating ore from his mines, has ore for three weeks and then the smelting part will be shut down. The concentrator which the company has leased to Clark will be used by him for the concentration of zinc ores from the Elm Orlu and Poser mines which he still retains. Recently the Original shaft has been the only one of the Clark shafts in operation, the Stewart ores being mined through it also, but the Anaconda company will put the Stewart shaft in commission and through it work the Little Mina and the Stewart. When the new Gagnon vertical shaft is completed, connections will be made with the Original workings and it is probable that the ores from both properties will be hoisted through the Gagnon shaft while the Original shaft will be abandoned. With the closing of the smelting department of the Butte Reduction Works, it is probable that the custom ore which it has handled will be sent to the East Butte company's Pittsmont smeltery. Proceedings have been begun by the Butte, Anaconda & Pacific Railway, for the acquisition of a right-of-way from the Parrot to the West Stewart. This will enable the hauling of ore from the latter mine to the Washoe smeltery.

Salt Lake City

June 13—Interest is being taken in Utah oilfields in Grand and San Juan counties in the southeastern part of the State. Two drilling rigs are being shipped into the Grand River field near Moab, and drilling will be started during the summer. The oil and gas territory extends from Moab ferry to Richardson about 30 miles up the river. Part of this land has been staked and surveyed. A number of leases on prospective oil land have been secured from the farmers in Grand Valley. The lessees claim no right

to any artesian or other water discovered except what may be necessary for operating purposes. Until oil or gas is discovered the land owners are to receive 10c. per acre each year, also 10 per cent. of all oil discovered, and $50 per year for any gas wells. The oilfields southeast of Emery in Emery county are also attracting attention. At present it is necessary to haul machinery from Price over 100 miles from the railroad to reach the oilfield, although Green River on the railroad is about half that distance. Coal for power purposes can be obtained within 15 miles of the oilfield along the road near Emery.

Oil men from Pennsylvania and California have been examining the San Juan field and also other fields in Wayne, Garfield, and Uinta counties.

The traffic bureau of the Salt Lake Commercial club has issued a circular, calling for a general meeting for the purpose of considering and adopting a definite plan of action in regard to the railway rates on coal in Utah. The circular states that the rates are unjust, excessive and oppressive, and should be reduced to a reasonable basis for the proper progress of local industry.

After reconstructing 90 miles of railroad along the washout, the Salt Lake & Los Angeles railroad has resumed operations. Surveys for another route have been made, on which a new road will be built for many miles, and the present line will then be abandoned. Resumption of the road will be a great benefit to many mines. The service has been suspended for nearly six months.

Goldfield

June 13—The Goldfield Consolidated is arranging for the installation of a system of fire-fighting and fire-prevention facilities not only at the mill but in the mines. Besides a large supply of piping, hose, reels, ladders and chemical tanks, a number of air helmets have been added to the equipment. In case of fire underground large chemical tanks conveniently mounted on mine car trucks will be lowered and taken directly to the scene of the blaze by men wearing helmets. Bulkheads and air-tight doors are being built at various strategic points throughout the workings. At the mill a triplex pump has been installed which will give a suitable pressure always available.

Every mining company, domestic and foreign, selling mining stock in Nevada, must file during June with the attorney general and county recorder the semi-annual statement showing in detail all expenditures, all kinds of stock issued and sold, a list of all its claims, holdings and improvements, and in addition thereto must deposit in the post office, addressed to each stockholder of record a copy of said report. Failure to comply with this makes the company liable to a forfeiture of $1000 to the State, and cost of suit.

Birmingham

June 11—There is much discussion in reference to better mining laws and a better regulation of the mines. Chief State Mine Inspector James Hillhouse has made public a letter received from the Governor, in which statement is made that efforts will be made to carry out recommendations as to improvements offered by the State inspectors. The mine inspector followed this with an interview that when mines are found to be in a dangerous condition, steps will be taken by law to stop all operations until a correction has been made. Many improvements are now being put in by mining companies to minimize as much as possible the dangers in coal mines. Sprays to hold down dust, firing machines, coal-cutting machines and general orders against the use of dynamite in the mines are some of the steps being taken.

Indianapolis

June 13—In the case of Yemm against the Vandalia Coal Company, on appeal, the Indiana Supreme Court has affirmed the decision of the Putnam County Court, holding: (1) A violation of the section of the law of 1908, requiring a mining company to sprinkle the roadways and entries of a mine to prevent dust, whereby a miner is injured, entitles the miner to recover for the damages. (2) The statute is made for the protection of the lives and health of the miners. (3) The knowledge by the miner of the dry condition of the roadway did not prevent his recovery for the injury.

Cobalt

June 13—In spite of the assurances of the Government that the much needed road in South Lorraine would be built, nothing has as yet been done. The present road is so bad that after a heavy rain an empty wagon can hardly be drawn over it. As a consequence, machinery for the mines is still lying at the wharf.

Porcupine is also heavily handicapped for lack of roads, although one is shortly to be started from Matheson. Several of the mines are running short of supplies. A large amount of development is going on. There are 20 companies operating.

Toronto

June 10—The Canadian Department of Mines has commissioned Joseph G. Hudson, mining engineer, of Ottawa, to visit all plant where explosives are manufactured or stored, and ascertain what precautions are taken to insure safety in their handling. His report will be used in connection with the legislation to be introduced next session. The Department has also engaged Capt. A. H. P. Desborough, a British expert from Woolwich arsenal, for two months to advise the Government in preparing these regulations and in establishing a Government explosives testing station.

The mining law of Quebec province has been amended in some important particulars. The title to building materials, stone, clays, peat, ochre and sand hitherto retained by the Crown is granted to the surface owner. The money for mining licenses amounting to $1 per acre, when purchase is made, will in future go toward the purchase money. The time allowed between the staking of a claim and the taking out of a mining license, or an application to purchase, is extended from four to six months. The penalty for tampering with the stakes of mining claims is increased to $200 fine, or six months imprisonment. The Government has been given authority to reduce the price of the iron-bearing sand of the Lower St. Lawrence to $4 per acre, the rate of $10 per acre under the general law being regarded as prohibitive. The law passed in 1900 exempting mines and mining plants for municipal taxation for ten years expires in July. The amendment exempts mines and underground plants from municipal taxation, but the surface plants, mills and buildings are made taxable.

A prospecting license has been issued by the Mines Department to Martin McDonald and George C. Cook, covering an area of 30 miles square along the Port-au-Pique and Bass rivers, near Castlereagh. They intend to prospect for copper ore, small quantities of which have been found on the area.

The amalgamated company has issued a circular to shareholders of the Dominion Iron and Steel Company and Dominion Coal Company, saying: "The proposed issue of stock of this corporation in exchange for the common stock of the coal company and steel company has now been arranged. The new stock has been listed on the Toronto, Montreal and Boston stock exchanges; transfer agents and registrars have been appointed at these places and a large number of shares have already been exchanged. Shareholders who intend to accept the proposed exchange are requested to deposit their stock. Certificates for shares to be exchanged may be sent to the corporation's transfer agent, the National Trust Company, Ltd., Toronto, or they may be sent to the Royal Trust Company, Montreal, the National Trust Company, Ltd., Montreal, or the American Trust Company, Boston."

The shareholders will vote on changing the name of the corporation to "Canadian Steel Corporation, Ltd.," at the special meeting called for June 17, at Montreal.

THE MINING NEWS

Reports of New Enterprises, New Machinery, Installations, Development Work and Property Transfers The Current History of Mining

Alaska

Contracts will be let soon by the Alaska Northern Railroad for 170 miles of railroad from its present interior terminal into the Matanuska coalfields and to the Susitna river, in the direction of the Haiditarod.

Chicago Exploitation Company—This company has purchased the placer claims of the Unuk River company, and a large amount will be spent for drill work.

Gogitem—This company has been incorporated, capital $500,000, to exploit option on Willow and Flat creeks in the Haiditarod.

Pioneer—This company has secured control of the Miocene Ditch Company, at Nome, and all of this water will be used on the company's mines. Jafet Lindegerg is manager.

Perseverance—The Juneau court has decided in the suit involving interests in the mine between Pearce and Sutherland in favor of the plaintiff, Pearce, and awarded a decree of $25,000. The company is planning a stamp mill and improvements.

California-Nevada Copper Company—An executive committee has been elected as follows: F. L. Underwood, M. W. O'Boyle and C. H. Briggs. The committee and some of the directors and larger stockholders accompanied by Prof. L. D. Huntoon, will leave for the Ebner mines, Juneau, soon. The 200-stamp mill will be erected under the supervision of Angus Mackay. The company also has a copper property in Madera county, California.

Alabama

Providence Oil and Gas Company—This new company, Dr. G. B. Crowe, president, is asking the City Council of Birmingham for a franchise to lay pipes into the city for the purpose of furnishing natural gas from the recently discovered field in Fayette county. Parties interested in the field have applied to the United States Geological Survey, requesting that an examination be made of the new field.

Arizona

Gila County

Venture Exploration Company—This company, headed by W. A. Eaton, of Duluth, Minn., is closing a deal by which it will acquire control of the Gibson property of 15 claims, 18 miles west of Globe. The purchase price for 70 per cent. of the stock is $400,000, distributed over four years. The company is planning extensive development of the claims as a low-grade operation.

Live Oak—Hole No. 6, 200 ft. south and 400 ft. west of the shaft, has passed through 55 ft. of ore averaging 2½ per cent. copper and is still in the orebody. Disseminated chalcocite in schist was first encountered at 250 ft. M. E. McCarthy is manager.

Miami—The company will establish its own medical and surgical department at the mine, beginning July 1. Dr. John Bacon, of Tombstone, Ariz., will be resident physician. For the present, one of the larger dwellings will be equipped as a temporary hospital, but plans for a large, new infirmerly are now being prepared. Drifting to block out the ore on the outer edge of the mineralized-schist area above the 420-ft. level is showing a greater extent of the orebody than was anticipated. On the 570-ft. level, a drift has been started from shaft No. 4 to the orebody 700 ft. away.

Graham County

Shannon—For a number of years the "ore tunnel" level marked what was believed to be the bottom of orebody, but recently a winze from this level encountered rich ore. Since that time three or four winzes have been sunk, and from 35 to 50 ft. below the "ore tunnel" level drifts have been run in ore averaging from 6 to 10 per cent. copper. The east and west winzes are 1500 ft. apart.

Mohave County

Carter—A mill is to be installed on the mine, adjoining the Tom Reed. Development is being continued in the 250-ft. drift.

California

Amador County

South Eureka—The mill is nearing completion at this mine, Sutter Creek.

Lincoln Consolidated—The company will reopen the Lincoln mine, Sutter Creek.

Amador Limerock Company—This company has been organized to purchase the limestone deposits near Mt. Echo, between Sutter Creek and Ione. The limestone is to be utilized in making lime, cement and in sugar refining. W. F. Detert is a director.

Butte County

Hecker & Andrews—A strike has been made in this mine adjoining the Phœnix, at Hurleton.

Eldorado County

Pacific—This company near Placerville, A. Baring Gould, manager, has encountered on the 500 level 7 ft. of high-grade quartz.

Humboldt County

Lower Klamath—This dredging company owns about 20 river-bed claims 20 miles from the mouth of the Klamath river. John A. Chestnut has gone with a crew to begin prospecting. It is the intention to put dredges at work this season.

Inyo County

The southern part of this county expects a revival of interest in mining through the reopening of the Four Metals mine and smeltery. President Short and Manager Skinner have been in Keeler and it is understood that funds have been raised for reopening.

Defiance—A company will operate this mine at Darwin and build a smeltery to Keeler or Olancha.

Chloride Cliff—At this mine a mill is being installed. The Big Bell and Keane-Wonder, near by, were working good forces. These mines are on the edge of Death Valley. The Nevada-California Power Company will connect from Rhyolite.

Shang Group—John Freise has bonded this mine near Queen.

Mariposa County

Crown Lead—This company, of Coulterville, S. E. Lewis superintendent, is working a large force near Nameless dam. A tramway is being built from the Adelaide mine to the mill on the Merced river.

Mono County

Standard Consolidated—Pres. Albert Fries has issued a circular to the stockholders stating that it appears that the expensive development work has been productive of good results. Notwithstanding the limited quantity as well as grade of ore encountered, the management has bettered the plant and made other improvements. The company is working the ponds and also pushing work toward the new claims recently purchased. Final figures for May will show a profit and indications appear favorable for June.

Native Son—The last payment on the mine at Blue Tent has been made, and work will be resumed under the management of J. H. Bishop, of Nevada City.

Oustomah—The owners have brought suit against E. A. and J. O. Hayes, of San Jose, for $18,000, alleging that this is due for royalties.

Republic—An important discovery has been made in this mine at Graniteville, operated by William McLean & Company.

Ethel—This mine at Washington is being reopened by Frank McPherson.

SHASTA COUNTY

Delamar—Following an order of the Government that some smoke-consuming device must be installed at the smeltery at Bully Hill, it is expected that the plant will temporarily close and the ore from the mine be sent to Kennett and Coram.

Balaklala—The diamond-drill explorations in this mine at Coram, are showing up bodies of ore of better grade than that previously found.

SIERRA COUNTY

Tippecanoe—Work in the lower tunnel on this quartz claim in Slate Castle ravine shows the same rich character of rock that was encountered in the upper level. The tunnel is being run by Messrs. Camp and Ish, who have a bond on the Jumper and Tippecanoe claims.

Taft-Sherman—Rich quartz and arsenical sulphide ore was found on this property in Jim Crow cañon.

Cove Ledge—The drift to the north on this property in Coyote ravine proves that the payshoot of rich rock is wide.

Young America—This producer, which has been idle for some years, will be reopened by Plumas county people.

Black Warrior—The same character of arsenical sulphides as those in the Standard mine in Sailor ravine have been encountered on this property. Development is being rushed by the bonders, Richardson & Davis.

La Caradad—After a year's continued activity, all work has been discontinued on this group, Moctezuma district.

Sierra Buttes—A 200-ft. tunnel is being run to ascertain the extent of the rich strike recently made in this mine at Sierra City.

SISKIYOU COUNTY

Highland—A compressor and drills are being installed and the mine will resume.

Black Bear—This mine, owned by John Daggett, will be operated again. New machinery will be installed.

TEHAMA COUNTY

Sacramento Improvement Company—This company, Frank March superintendent, is preparing to mine the bed of the Sacramento river at Jelly Ferry about 12 miles from Red Bluff.

TUOLUMNE COUNTY

Fleming—The Yorktown Mining Company has been organized at Eureka, Cal., to work this mine on the east belt of the Mother Lode.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Central—The tunnel at Idaho Springs is in 8536 ft. Work is being carried on the laterals on the Lake vein.

Raymond—This tunnel, on the Baltic vein at Georgetown, has cut a vein with zinc ore.

McKinley—This company, on Lincoln mountain, at Georgetown, has let a contract for continuing the adit.

Conqueror—The company on Covode mountain, at Empire, is carrying on much development. The 50-ton mill is running.

Kelly—This tunnel will be continued into Kelly mountain, at Georgetown, for several thousand feet. An examination has just been made.

Vidler—It is again reported that this bore will be completed, affording a short route to the Montezuma district in Summit county.

Gunnell—Frank A. Schermer, of Boston, vice-president of the Newhouse Tunnel Company, has acquired the mine, which will be developed at 1800 ft. below the surface by the Newhouse tunnel.

Santiago—This mine, operated through the Wilcox tunnel, is the scene of a strike of 3 ft. of ore averaging about $50 per ton in gold and silver. C. J. Morley is the leaser.

Old Town—In driving the 4th level east, lessees have made a strike of 30 in. of ore, and a crosscut from the same point to the Wautauga vein opened from 12 to 14 in. of high-grade gold-silver-copper ore. Both these orebodies, hitherto unknown to exist, will now be worked.

LAKE COUNTY—LEADVILLE

Cache Creek Placer—After 11 days' operations on this property, a cleanup of $5000 in gold is reported. This placer has a record of 50 years' production.

Danville—Supplies have been taken up to this mine, and 26 men are at work. The first shipment of one carload of ore was made May 24.

SAN JUAN DISTRICT

Favorite—A strike is reported from Ophir on this group in which large nuggets predominate. The group is owned by Felix Leavitt, of Denver.

Intersection—This mine, Maggie gulch, has been unwatered and the ore is being tested again.

Golden Egg—On this group, George Fisher has opened up 2-oz. gold ore.

Bullion Bar—This mine is starting with a small force.

Gold Prince—This mine at Animas Forks is producing concentrates running 2 oz. in gold.

Kittemac—This mine in Minnie gulch continues to mill and ship sulphide ore from the Clarke vein.

Tomboy—Returns for May are: mill ran 29 days; crushed 10,500 tons; yielding bullion, $40,000; concentrates shipped, $31,500; total, $71,500; expenses, $45,000; profit, $26,500.

TELLER COUNTY—CRIPPLE CREEK

Gold Sovereign—The Clements company, leasing on the Gold Sovereign, pro-

Doctor-Jack Pot—Felix Walter, leasing through the Ingham incline, is said to have 1½ ft. of $40 ore. The Lucky Corner, C. Esshorn, lessee, is also shipping 3-oz. gold ore, and is working through the Ophelia tunnel.

Rigi—The lessees on this group, Battle mountain, are shipping again, and have sent out 30 tons estimated to carry 2 oz. gold per ton.

Victor—The Roscoe Leasing Company shipped 250 tons of $25 ore in May.

Mary McKinney—Lessee Keener is shipping surface ore of $30 per ton value.

Cresson—A large hoisting and compressor plant is being installed to replace that burned April 11, and the mine is expected to be in full operation again by July 15.

El Paso-Gold King—Fifteen sets of lessees are at work, and two veins are showing ore from 2 to 3 ft. wide, which is being shipped direct to the smelteries.

Idaho

COEUR D'ALENE DISTRICT

The Enaville smeltery, the first built in the Cœur d'Alene district, will blow in soon. The first car of ore to be treated is one from the King & Queen mine of Carter, Mont. Maurice Blanchard, of Portland, is in charge. A feature is the burning of soft coal instead of coke.

Success—Charles Clark, of Montana, has inspected this zinc mine and is negotiating on behalf of Senator W. A. Clark for the property. The Success is producing and has been shipping for several years.

Murray Development Company—The holdings of this company, which were supposed to have been worked out 20 years ago, have been leased by William Whistler, who has discovered a copper vein on the property.

Indiana

GREENE COUNTY

The coal mines in the Jasonville field are unusually active. About 2000 miners are employed and $110,000 was paid to them June 11. The work on two new shafts west of Jasonville is progressing.

VIGO COUNTY

The Western Coal Company, of Terre Haute, has dissolved.

W. D. Horn, president of District 11 of the United Mine Workers, and a large number of miners and operators, have

notified the Government their unanimous preference for location of the Indiana mine rescue station at Terre Haute, which is declared to be near the center of the Indiana coalfields.

Kansas

The production for Kansas for May was 4,436,640 lb. of blende, 133,490 lb. of calamine and 320,190 lb. of lead concentrates, total value of $98,344.

Peacock Valley—This company has purchased the Boughton lease at Galena and is developing with drill.

Kiawa and Cimmaron—These companies at Galena have drained the Luscombe and Sapp 40's that have had so many shallow mines on them and have opened the ground to miners. The companies will drill and mine the lower levels.

Maryland

Maryland Coal and Iron Company—This new company has acquired the property of Avery & Morgan, near Frostburg, and proposes to install equipment and increase the capacity to 1000 tons of coal per day. It will install 150-h.p. boiler, 100-kw. generator, mine hauling motor of 42-in. gage, mining machines, rock drills, etc. H. B. Avery, Troy, Penn., is president.

Michigan

Copper

Michigan—The company continues exploratory work on the amygdaloid formation at the Bee tract. Two drills are on the property, one on the trend of the three Adventure lodes and the other in proximity to the Eastern sandstone.

Isle Royale—This company has stopped all surface trenching in search for the Baltic lode. In the first trench an encouraging showing was made but after it was opened to 6 ft. it did not warrant development. A second trench was started at 500 ft. south without results. Drifting and crosscutting at "A" shaft to open the Baltic lode continues.

South Lake—No. 3 drill has been started at 1400 ft. from No. 2 hole. Drill operations have failed to reveal anything important.

Ahmeek—One head in the new mill is now doing regular service and will be soon followed by the second. The new Nos. 3 and 4 shafts are down about 900 ft., and drills will be started to ascertain the distance to the lode on the present pitch of the shafts, it being estimated at about 1250 ft. These shafts are going down at an angle of 80 deg. and when the lode is reached they will changed to conform to the formation.

Calumet & Hecla—The company has started diamond drilling in rear of its abandoned No. 20 shaft which was put down on the Kearsarge lode to test the formations between that lode and the Eastern sandstone. Work has also been started on a large addition to its machine shop.

Laurium—This company has located the site for another shaft 2600 ft. north of its present No. 2 shaft.

Wyandot—The company has started drilling 1200 ft. northeast of its exploratory shaft to determine at depth the lode that this shaft was put down on. The shaft was sunk several years ago on a very promising surface outcropping to 700 ft. but the rich copper ground continued to only a shallow depth.

Algomah—This company was recently incorporated under Michigan laws with a capital of 100,000 shares at $25 par; 60,000 shares were given in exchange for the land, and 10,000 shares underwritten at $10,000, making a working capital of $100,000 and 300,000 shares in the treasury. Among the incorporators are Steven R. Dow, John C. Watson, R. M. Edwards and John H. Rice. Active work will be undertaken as soon as the equipment can be delivered and a shaft will be started on the site of the trenching which exposed encouraging ground. Drill operation will be carried on.

Iron

The U. S. Steel Corporation has acquired an option on the lands of the Michigan Iron and Land Company comprising 400,000 acres in the Upper Peninsula extending westerly from Marquette for nearly 100 miles and containing a large area of undeveloped iron-bearing formation. The Steel Corporation has under the contract five years in which to explore the iron land. The deal was made through F. H. Begole who has had the option on the property.

Minnesota

Section 30—This mine on the Vermilion range has shipped its first train of ore.

Scranton—This mine at Hibbing has completed the concrete shaft. It is 150 ft. deep and 30 ft. in diameter with walls 6 ft. thick.

Missouri

For May the Joplin camps produced 35,569,696 lb. blende, 2,571,580 lb. calamine, and 5,820,930 lb. of lead concentrates valued at $824,828.

Granby—This company has started to unwater the Oronogo mines and will open a prospect at Smelter hill.

Hackett—This company is building a new mill in the West Joplin sheet-ground district. J. C. Marcun has the contract.

Atlas Coal Company—The new shaft sunk by this company at Rich Hill in Bates county, struck a narrow vein of good coal at 200 ft., and has now reached a vein 6 ft. thick at 270-ft. depth.

Montana

Butte District

Parrot—There seems to be doubt as to whether the minority holders of Parrot stock who protested against the sale of the property to the Anaconda Company under the merger will continue the suit.

Broadwater County

Radersburg Consolidated—B. Binnard the president, and other officers of this company controlling the Ohio-Keating and the Manhattan-California have left on a tour of inspection. The electric power line has been completed to Radersburg and active operations will be resumed. It is the intention of the company to commence development on the Manhattan-California property and it is expected that the equipment will be placed during the fall.

Keating—At a meeting of stockholders in Butte, a new board was elected and the principal office of the company removed to Duluth. The following were elected: R. T. Goodall, president; A. L. Agatin, vice-president; Julius H. Barnes, secretary and treasurer; all of Duluth; Jesse B. Roote and Charles W. Newton, of Butte. Pritchett & Hamilton, consulting engineers of Denver, will supervise. The electrically operated surface plant at the Blacker shaft has been completed and sinking on the shaft, now 600 ft., will be continued to 1000 ft. Stations will be cut and crosscuts run, every 100 feet.

Cascade County

Great Falls Power Company—The company has recently been incorporated with a capitalization of $15,000,000 and will utilize the water power of the Missouri river in Montana. Among the incorporators are P. E. Bisland, G. F. Canfield and Marcus Daly, of New York, and C. F. Kelly and John G. Morony, of Butte, all being associated with the Amalgamated interests.

Granite County

Butte-Georgetown—This company has been incorporated by Frank Boucher, H. Avare, H. A. Maillet, C. E. Farnsworth, Ovila Nadean, William Page and Donet Dorais. The capitalization is $1,000,000, shares par $1. The properties are in the Georgetown district.

Hidden Lake—The 3-stamp mill was put in operation recently for experimenting, and if this method proves a success a number of other stamps will be installed. The company owns 380 acres.

Jefferson County

In the Corbin-Wickes district the recently organized London-Corbin Exploration Company has installed a hoist for 900 ft. and sinking has been resumed. The shaft will be sunk 300 ft. before any crosscutting is done. A tunnel has been driven 300 ft. on the footwall of the vein and at 260 ft. from the portal encountered

4 ft. of leached ore assaying 4 per cent. copper. At the Pennsylvania Corbin Copper Company's property a surface plant will be installed to sink 500 ft. The work will be done under the direction of H. E. Emmerson, superintendant of the Boston & Corbin company. The Corbin Copper Company concentrator has been built near the Bonanza tunnel. The company plans to begin shipping concentrates this month. At the Montana-Corbin property preparations are being made for weekly shipments.

Boston & Corbin—General manager Emerson reports that the Bertha vein has been struck in Bertha No. 2 ground on the 5th level, and has 3½ ft. of ore. This gives the Boston & Corbin a continuous oreshoot on the 5th level for 1300 feet.

Nevada

Esmeralda County

Consolidated—Ten stamps have been added to the 70 which have been dropping since the fire of April 9, and within a few weeks the remaining 20 will be in commission. The "bonus system," inaugurated by Manager Finlay in the mine is giving excellent results. Several crews of miners have been making increased wages during the month, but the company has been profiting by the extreme rapidity with which ground is being broken.

Booth—Sinking has been resumed by the Weber McLaughlin leasers to tap the ore which they have been working through a winze from the 150-ft. level.

Florence—The enlarging of the main shaft to three compartments is complete, including timbering from the 580- to the 350-ft. levels. As soon as the surface is reached sinking will be resumed, eventually to reach 1000 ft. While this work is in progress, the Little Florence workings are supplying most of the ore for the mill.

Pittsburg-Silver Peak—The report filed with bullion tax collector for first quarter of 1910 shows: 41,030 tons mined; cost of extraction, $64,883; transportation, $20,515; reduction, $102,575; gross yield, $195,237; net yield, $7,357.

Toquima—This company, headed by Boston capitalists, has closed a deal involving the placer ground owned by the Round Mountain company, and has also negotiated a 2½ years' lease on the Daisy property and accompanying water rights. Hydraulic operations will be undertaken on a large scale.

Lyon County

Malachite—The sale of this property near Mason to an eastern company is reported. Also that $10,000 monthly will be spent for development.

Nye County

West End—A new discovery is reported 500 ft. west of the shaft on the 400-ft. level in heretofore unproductive territory.

Tonopah—The most important recent developments have been in the Silver Top workings on the 440-ft. level, where it is believed the westerly continuation of the main Silver Top vein has been picked up.

Tonopah-Belmont—Foundations will soon be laid for the new electric hoist and the 40-drill compressor.

Montana-Tonopah—The semimonthly cleanup and meet of cyanide precipitates resulted in 23 bars of bullion valued at $17,200. Sixty tons of concentrates were also shipped.

Montgomery-Shoshone—Sinking has been abandoned because of excessive water. A diamond drill has been installed to prospect below the 700-ft. level.

Manhattan-Earl—The Swanson lease has 1000 tons on the dump ready for the next mill run.

White Pine County

Hübnerite Tungsten Company—This company will install a concentrator at Osceola to treat tungsten ore. E. L. Fletcher is manager.

Giroux—The company will operate the 500-ton concentrator in treating second-grade ore. Shipments of high-grade will begin this fall.

New Mexico

Sierra County

Ocean Wave—A smelting plant has been ordered. The property now has a 50-ton concentrator. J. S. Lovern is superintendent.

Oklahoma

The low prices of ore and the shortage of fuel, together with water troubles, have curtailed the output of the Oklahoma camps for May. These camps produced for the month 2,034,665 lb. of blende and 377,680 lb. of lead concentrates, total value, $46,555. The Turkey Fat, Miami-Amalgamated and the Emma Gordon have produced most of the ore from Miami camp this month.

Nowata—The Kenwood mill at Miami has been bought by this company and will be moved to Galena.

Oregon

Josephine County

In the Galice district, the Oriole, Sugar Pine, Golden Wedge, Old Channel, Galice Consolidated, the Anderson and Almeda companies are developing. At the Almeda a smeltery has been installed. The district is hampered by poor transportation conditions.

Tennessee

The Osgood Exploring Company, of Chicago, has leased zinc properties at Jefferson City and will develop.

Texas

Terlingua—The company is installing an ice plant and machinery at the quicksilver mines in Brewster county, near Marathon. H. E. Perry is president.

Washington

Ferry County

Swamp King—A recent strike of free gold was made on the 80-ft. level. A. J. McIntire is superintendent.

North Star—Preparations are being made for shipment. J. E. Pickerel, of Spokane, is manager.

Tom Thumb—Preparations are made for a mill.

Stevens County

Ark—The Rickey group has been purchased by the company. Extensive development work has been planned, including a 700-ft. tunnel. J. J. Bodell is manager.

Yakima County

Aurora—This property at the head of Cle Elum river will buy machinery to equip.

Wisconsin

C. D. Harding & Co. have leased the Preussing land east of Platteville and will begin prospecting.

Enterprise—This mine has been subleased to Joseph Piquette and is being unwatered.

Vinegar Hill—This company has acquired the St. Croix, at Linden, and is developing.

Old Homestead—This mill and roaster, at Platteville, owned by Shepherd Brothers, were burned. The plant will be rebuilt.

Klondyke—A Sutton, Steele & Steele dry-process concentrating mill is under construction at the mine on the Brunton farm 5 miles southwest of Platteville. J. M. Jenks is manager.

West Virginia

Boone County

Capitalists of Scranton, Penn., have incorporated the Lackawanna-Crescent Coal Company at Charleston with $10,000,000 stock. The company will build a railroad from the Coal River branch of the Chesapeake & Ohio to open up its 60,000 acres in Sherman district, which is known to contain coal and timber and may also have gas and oil.

W. H. Warner, of Cleveland, O., nas recently formed the Peytona Coal Company, to develop about 1000 acres near Peytona.

Kanawha County

The U. S. Steel Corporation has closed a deal for 10,000 acres of coal and timber land in this and adjoining counties. On this land there are already six small

mines with 600 tons daily output. Recent incorporations at Charleston have been the Kentland Coal and Coke Company, with $50,000; and the Augusta Coal Company, with $20,000 capital

MARION COUNTY

Consolidation Coal Company—This company has decided to expend a large sum to increase its output. It has placed an order for 14 electric locomotives to be used for inside haulage in the Fairmont mines. It has also been determined to open a new mine in the Fairmont district on a tract of 2000 acres, the operation of which will necessitate the bridging of West Fork river. The company will also expend about $250,000 in the erection of dwellings.

MINGO COUNTY

Pike Collieries Company—The plant at McCarr, on which $400,000 is said to have been spent, was recently acquired at foreclosure sale for $71,000 by Huntington creditors.

RANDOLPH COUNTY

A survey is being made for a 90-mile northern extension of the Coal & Coke railroad, from Elkins to Rowlesburg, on the Morgantown & Kingwood line.

RALEIGH COUNTY

Big Coal Company—This company has started a new shaft at Dorothy and has begun 150 new cottages and an addition to its power plant. It is hoped to complete these changes inside of three months and thereby double the present output of 2000 tons of coal daily.

Clear Fork Splint and Gas Coal Company—This company, of which T. E. B. Siler is president, is planning to develop 1300 acres of coal land in Jarrolds valley.

Utah

JUAB COUNTY

Iron Blossom—The management reports exceptionally good ore in the gold vein cut in a raise from the 400-ft level of the south shaft. Much development is being done.

East Tintic Development—Operations on company account have been suspended, though leasers are at work.

Uncle Sam Consolidated—At the meeting, June 6, the directors were reëlected. The report shows that 6841 tons of ore were shipped during the year. This sold for $116,323, or an average of $17 per ton. During the year, $50,000 was paid in dividends, and on June 6, the company had $12,048 cash, with ore in transit valued at $6000.

Crown Point—The Eureka stockholders are interested in a movement to develop. The finding of ore in the Sioux and Iron Blossom trending toward the Crown Point has revived interest, and work may be continued from the shaft owned jointly with the Colorado and Iron Blossom, 400 ft. deep. The stockholder meeting in Provo, June 6, reëlected the Knight directorate, with the exception of R. E. Allen, director, whose place is taken by John Roundy. Development will be resumed.

SUMMIT COUNTY

Scottish Chief—An assessment of 1c. per share has been levied and work will be resumed. A winze has been started from the tunnel level and sinking will be continued to reach a bed of limestone, where it is cut by mineralizing fissures.

Canada

ALBERTA

Cardiff Commercial Coal Mines—These mines, at Morinville, including 500 acres of coal-bearing lands and a plant valued at $125,000, have been sold to J. Anderson, of Winnipeg, who is understood to represent Canadian Northern interests, for $300,000. The mines will be capitalized at $750,000 and bonds floated in England.

BRITISH COLUMBIA

Many men are going to the Portland canal district, in the northern part of the province. Numerous prospectors are leaving Stewart for neighboring mountains. A sale of government town lots in Stewart on May 31 brought $440,000. The Portland Canal Company has erected an aërial tramway from mine to the 100-ton concentrating mill now being equipped. A compressor is being put in at the Red Cliff mine. Strikes of rich silver-gold ore on the Stewart company claims are reported. Mackenzie & Mann, of Toronto, are building wharves and preparing to construct a railway up Bear river, on tributaries of which are many claims. The Hidden Creek company is completing arrangements for the building of a 500-ton smeltery adjacent to its properties at Goose bay. M. K. Rodgers is president.

Ikeda—This mine on Moresby island has been sold to a Vancouver syndicate. A. G. Larson is manager.

BRITISH COLUMBIA

Second Relief—C. A. Owens, of Calgary, representing an Alberta syndicate, has taken an option on the mine on the north fork of the Salmon river, for $300,000. This option precludes an amalgamation of the Second Relief and the Big Bump. The Second Relief, owned by Wisconsin men, is one of the old mines of the Ymir district.

British Columbia Copper—Work has been resumed at the Mother Lode and Ore Denoro mines and the smeltery, labor troubles having been overcome. A new orebody has been found at the Oro Denoro. Shipment of ore from the Wellington group will be commenced shortly; about 100 tons daily will be the output.

Consolidated—At the War Eagle, Rossland, much gold-copper ore of good grade is being produced. The Idaho is also productive now. The St. Eugene is shipping 1100 to 1200 tons of lead-silver concentrate to Trail monthly. The Sullivan, East Kootenay and Richmond-Eureka, Slocan, are also shipping silver-lead ore to Trail regularly. Copper ore is being sent from the Queen Victoria, near Nelson, to Trail. All these properties and the Snowshoe, Boundary, are being operated by this company. An aërial tramway is being constructed between the No. 7 and Boundary Falls, a distance of three miles, and a compressor plant being put in for the same mine.

Granby—O. B. Smith, the company's mine superintendent, has been examining mining property at Franklin, 50 miles from Grand Forks, with a view to purchase.

Similkameen—Promising coal lands near Princeton have been acquired by Andrew Laidlaw, Spokane, Wash., and associates.

ONTARIO

The shipments from Cobalt for the week ended June 3 are: La Rose, 377,390, lb.; McKinley-Darragh, 151,140; Crown Reserve, 188,448; Nipissing, 127,586; Chambers-Ferland, 56,000; Coniagas, 63,280; Right-of-way, 82,500; Temiskaming, 60,000; Kerr Lake, 60,380; total, 1,166,724 pounds.

Silver Cliff—A new high-grade vein 3 in. wide has been discovered at the 150-ft. level.

Alliance—A 6-in. vein of calcite carrying silver has been struck. A boiler and hoist are being put in.

Clinton Mines Company—This company, owning property at Elk City, has been listed on the New York Curb. Charles Clinton is manager.

McKenzie—This Toronto company, A. J. Harrington, president, has been listed on the New York Curb.

Waldman—This Cobalt company has listed its stock on the New York Curb.

Nipissing—The vein recently struck in the Keewatin formation on the property known as R. L. 406, hitherto considered the poorest ground belonging to the company—averages 3 in. wide and is rich in silver content. The find apart from its value is considered significant as showing the possibilities of the property.

Ophir—A new vein recently discovered in trending is from 6 to 15 in. wide consisting mainly of solid smaltite carrying bloom and decomposed calcite. In the latter are found silver nuggets. The winze in the vein in the north crosscut will be put down to the 300-ft. level.

YUKON TERRITORY

The first gold from the creeks is beginning to arrive in Dawson. Quartz and Gold Run have sent in the heaviest ship-

ments. The largest dumps taken out this winter are those on lower Gold Run. which were taken out by the men working for McDonald & Ennis.

Yukon—This company has all of its hydraulic plants going full.. The main ditch, crossing the country from the Twelve-mile, is carrying 5000 in. to Lovett gulch, and 3000 up Bonanza beyond Lovett.

Mexico

CHIHUAHUA

Dolores—One man was killed and several injured in an explosion at the mine, May 26. The explosion started a fire which destroyed 100 homes.

Naica—It is believed that the deal for the sale of this property to American interests for 6,000,000 pesos has fallen through.

DURANGO

San Juan—The control of this property is reported to have been acquired by the Peñoles company.

HIDALGO

Santa Gertrudis — The cyanide plant has been put into commission and will be used until the new 700-ton mill is completed, which will be about the first of 1911.

GUANAJUATO

Nueva Luz—The company is installing new machinery including pumps to handle 400 gal. of water per min., in three stages, from 2000 ft. The pumps are in units of 100 and 300 gal respectively. The shaft is now down 1890 feet.

MEXICO

Coetzillos and El Lucera—These properties at Zacualpan have been placed under bond to E. P. Ryan, of Mexico City.

SINALOA

Panuco—The annual report shows a revenue of 884,182 pesos in 1909. The mill products provided 813,023, and high-grade ore shipped to the Selby smeltery, 54,512 pesos. The company treated 13,411 tons of ore, containing a total of 15,325 kg. of silver and 102 kg. of gold. The extraction of silver was 85.54 per cent. and gold 90.76 per cent. The treatment cost per ton of ore was only 8.31 pesos. The company has been in existence 33 years, and up to the end of 1909 the total dividend disbursement was 7,465,000 pesos. The 1909 dividends amounted to 425,000 pesos. The enterprise is controlled by Spanish capitalists of Mazatlan.

West Coast—The mines and concentrating plant of the West Coast Mining Company, of Los Angeles, have been acquired by W. C. Prichard and B. A. Wilkinson for 150,000 pesos. Cyaniding equipment will be installed. The properties are in the Cosala district.

Mazatlan Smeltery—J. S. Murray is investigating possible ore production in the Sinaloa and some Durango districts with a view to the erection of a custom smeltery at Mazatlan. A concession for a smeltery at the port was secured by A. H. McKay, of Mexico City, several years ago, and an extension was arranged early this year.

Butters-Felton—A shoot of rich ore was recently encountered in an old crosscut at these Copala mines. The big cyanide plant built by the Butters interests was shut down last year because of a scarcity of ore that could be profitably treated at the low price of silver. A small amount of development has been in progress since.

Realito—This American company, operating in Tamazula district, 7½ hours from Culiacan, is making small shipments of bullion regularly. The property is low-grade gold.

Metates—The Metates mines, two days by road and trail from Mazatlan, have been purchased by J. S. Johnston, of Los Angeles, for $125,000. The mines have been owned and worked for several years by Maximiliano Lopez Portillo, of Mazatlan. Present reduction equipment consists of a 4-stamp mill, concentrator and amalgamating plates. Ten stamps and several tables will be installed at the end of the rainy season, and cyanide equipment may be added later.

Guadalupe de los Reyes—These Sinaloa mines produced in 1909 ore to the value of 1,427,000 pesos. The expenses were high and dividends of only 290,000 pesos were paid. The company, controlled by Spanish interests of Mazatlan, has paid as high as 1,200,000 pesos in annual dividends. Timber supplies adjacent to the mines are being exhausted and the installation of charcoal-gas engines is being considered.

Minas del Tajo—These old properties, controlled by the Bradbury interests of Los Angeles, produced 1,144,000 pesos in 1909. Dividends of about 450,000 pesos were paid.

SONORA

Buena Fortuna—A strike of high-grade, shipping ore was recently made on this property, Magdalena district.

Jacolitas—A division of profits is being distributed among the shareholders of this company. It is a gold-silver proposition, in the Alamos district, managed by J. J. Smith.

Cananea Northern—This corporation has been formed to develop lead and zinc bearing ground north of Cananea.

La Jojoba—This mine, a former producer in the Magdalena district, has been secured by Arthur Hamilton, who is arranging to cyanide the tailings. Messrs. Spurr & Cox, of New York, have denounced 600 pertenencias of ground on an extension of the La Jojoba.

Pedrazzini—This company shipped 175 tons of concentrates to the El Paso last month with a net profit of $30,000.

Santo Domingo—A mill is in construction at this mine in the Alamos district.

Sonora Central—A mill will soon be built to treat the product of the San Bernardino mine. in the Alamos district.

Africa

TRANSVAAL

The Transvaal Chamber of Mines cables the total production of gold in May at 634,170 oz.; being 15,125 oz. more than in April, and 9672 oz. more than in May, 1909. It is the largest monthly return so far this year. For the five months ended May 31, the total was 3,019,430 oz. in 1909, and 3,037,324 oz.—or $62,781,487—in 1910; an increase of 17,894 oz. this year.

Europe

GREAT BRITAIN

British Iron Ore Imports—Imports of iron ore into Great Britain, four months ended April 30 were 1,850,677 long tons in 1909, and 2,441,431 in 1910; increase, 590,754 tons; of the imports this year, 1,768,909 tons came from Spain.

Germany

German Iron Consumption—The German Iron and Steel Union makes the following statement of production and consumption of iron for the two years given, in metric tons:

	1908.	1909.
Pig-iron production	11,813,511	12,917,653
Imports, pig iron	399,677	318,938
Imports, steel, etc., in terms of pig	461,263	479,523
Total supplies	12,674,451	13,716,114
Exports, pig iron	421,548	644,935
Exports, steel, etc., in terms of pig	4,948,891	5,032,653
Total exports	5,370,439	5,677,588
Approximate consumption	7,304,012	8,038,526

Steel and finished material are reduced to their approximate equivalents in pig iron. The pig-iron production was 187.57 kg. per capita in 1908, and 202.20 kg. in 1909. The approximate consumption was 115.97 kg. per capita in 1908, and 125.83 kg. in 1909. The increase in consumption in 1909 was 734,514 tons, or 10.1 per cent.

German Iron Trade—Exports and imports of iron, steel and machinery in German Empire, four months ended April 30, metric tons:

	Exports.	Imports.	Excess.
Iron and steel	1,534,991	167,397	Exp. 1,367,594
Machinery	107,361	22,422	Exp. 84,939
Total	1,642,352	189,819	Exp. 1,452,533
Total, 1909	1,322,371	147,803	Exp. 1,174,56

Imports of iron ore this year, 2,333,558 tons; exports, 972,337. Imports of manganese ore, 155,643; exports, 1213 tons.

THE MARKETS

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal Trade Review

New York, June 15—Coal trade in the East is not active. There is talk of summer dullness, but this year it seems to come earlier and be more pronounced than usual. Eastern manufacturers do not seem sure enough of the future to be ready to put in large stocks of coal, and the trade is slow in consequence.

In the West there has been no change in the situation since last week. The various districts are settling down to work with more or less jarring, with the exception of northern Illinois, the Southwest and Colorado. The Indiana mines are reaping quite a harvest in consequence of the continued suspension in Illinois.

The Lake trade is coming up slowly. Shipments are increasing, but the Northwest is backward in ordering supplies. This may result in a rush for coal later in the season.

Strike Predictions—President T. L. Lewis, of the United Mine Workers of America, states that there are now about 70 000 miners idle on account of the suspension of operation on April 1. According to Mr. Lewis, whose headquarters are in Indianapolis, the only mining districts where men are not all at work are in portions of Illinois, in Southwestern districts, and in the State of Colorado. Mr. Lewis says he expects all idle miners in the country to return to work in a short time.

Coal Traffic Notes

Coal receipts at Boston, five months ended May 31, reported by Chamber of Commerce, in long tons:

	1909.	1910.	Changes.
Anthracite	718,818	742,961	I. 24,143
Bituminous	1,261,517	1,701,692	I. 440,175
Total domestic	1,980,335	2,444,653	I. 464,318
Foreign	196,600	125,711	D. 70,889
Total	2,176,935	2,570,364	I. 393,429

The foreign coal is almost entirely from Nova Scotia mines.

Anthracite coal shipments by companies, five months ended May 31 are given below, in long tons; the totals were published last week:

	1909.	1910.	Changes.
Reading	5,396,756	5,467,602	I. 70,846
Lehigh Valley	4,397,739	4,806,847	I. 409,108
N. J. Central	3,365,138	3,551,671	I. 186,533
Lackawanna	3,942,293	4,025,290	I. 82,997
Del. & Hudson	2,870,585	2,679,500	D. 191,085
Pennsylvania	2,566,269	2,684,096	I. 117,827
Erie	3,359,109	3,068,898	D. 290,211
N. Y., Ont. & West.	1,148,983	1,132,721	D. 16,262
Total	27,046,872	27,416,625	I. 369,753

Five companies—the Philadelphia & Reading, the Lehigh Valley, the Central of New Jersey, the Delaware, Lackawanna & Western and the Pennsylvania—increased their shipments this year.

Coal passing through Sault Ste. Marie canals, season to June 1, short tons:

	1909.	1910.	Changes.
Anthracite	260,060	467,042	I. 206,982
Bituminous	836,800	1,579,224	I. 742,424
Total	1,096,860	2,046,266	I. 949,406

The large increase this year was due to the earlier opening of navigation.

Coal production of the State of Maryland in 1909 was: Shipments from Cumberland-basin mines, 3,306,888; Upper Potomac-basin, 592,208; small mines, local trade and used at mines, 626,508; total, 4,525,604 short tons.

New York

Anthracite

June 15—There is nothing new in the anthracite trade. Business runs along quietly and coal is in about the usual demand.

Schedule prices for domestic sizes are now $4.45 for broken and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor points. For steam sizes current quotations are: Pea, $3@3.25; buckwheat, $2.20@2.50; No. 2 buckwheat or rice, $1.65@2; barley, $1.35@1.50; all according to quality, f.o.b. New York harbor. The lower prices are usually for washery coals.

Bituminous

Dullness has settled over the market. Buying is limited entirely to the lower-priced coal. New England is taking little coal, partly as a result of the large sales of cheap West Virginia coals made earlier in the season; partly because business at the mills is not active, and those which use water power have an unusual supply this year, owing to the rainy season.

New York harbor is not buying the best coal. Good Miller vein steam coal has been offered at $2.50, f.o.b. harbor points, with no takers. Gas coal is in good demand, however, but at low prices.

Car supply is good, and there is little delay in transportation. Lake trade has been slow thus far this year, leaving plenty of coal and plenty of cars for the seaboard trade.

In the coastwise market vessels are scarce, the lumber trade having taken away a number with higher rates. Freights are accordingly strong. Large vessels from Philadelphia get 75c. to Boston, Salem and Portland; 65c. to Providence and the Sound.

Birmingham

June 13—Mining operations in the South are active, a strong demand for the product having been worked up. Coal prices are still low, but operators are making every effort to keep up production. There is a need for labor throughout the Southern territory. The labor troubles in the West which gave the trade in Alabama a boost are over, but some business is being transacted as a result of those troubles. Considerable development is still going on in the mining district of Alabama. The railroads are handling the output at the mines promptly.

The demand for coke is not as brisk as it has been. The production has not been disturbed of late.

Chicago

June 14—The coal market shows no signs of uneasiness or discomfort on the part of buyers for steam-making purposes over the lack of Illinois coal. Some of these consumers may have storage piles still left, but most of them are using Indiana, Hocking or smokeless coal, bought constantly in small lots, and are watching impatiently for a restoration of their accustomed supply. Indiana mines, the nearest supply outside Illinois, are sending large amounts to the Chicago market, which are promptly sold. Screenings from Indiana are eagerly sought at $2.15@2.35; run-of-mine and lump bring nearly the same prices as screenings, both being less in demand as the summer comes on—screenings being the favorite summer fuel. As has often been noted in these letters, the use of automatic stokers is increasing in Chicago and seems bound to increase constantly. This brings an increasing demand for screenings, which is likely to bring about some changes of methods at the mines. Smokeless coal has an increased sale and is not troubled with surplus on track; lump brings $3.50@3.60 and run-of-mine $3.15. Hocking also holds to the circular price, $3.15, with large sales and well regulated shipments. Coals from east of Indiana are fairly stable in price, and their use is not likely to increase greatly when Indiana coal is available at lower prices.

Cleveland

June 13—Local trade has settled down to a fair normal condition. Slack is in good supply now, owing to the freer movement of Lake coal. The shipments up the Lakes are increasing.

Quotations for Middle district coal, Cleveland delivery, are $2 for 1¼-in., $1.85 for ¾-in., $1.75 for run-of-mine and $1.60@1.65 for slack; No. 8 district, about 15c. higher; Cambridge district, $2.20 for 1¼ in., $2 for ¾-in., $1.90 for run-of-mine and $1.70@1.75 for slack. Pocahontas, $2.85 for lump and $2.45 for run-of-mine.

Indianapolis

June 13—The joint scale committee of Indiana coal operators and the United Mine Workers of District No. 11 is holding meetings and endeavoring to settle several important matters to be included in the permanent wage contract. One of the questions which is causing considerable trouble is the fining clause—a matter which has for many years been fought by the mine workers in this State, who insist on the elimination of the clause. Another clause in the contract which has halted negotiations for some time is the five-day's clause, a regulation requiring all grievances to be settled within five days by the district officers of the mine workers and the secretary of the Operators' Association after the case has been presented to them. Nothing looking toward the signing of a permanent contract has yet been accomplished but the men are all at work on full time and there is little likelihood of their being called out even if it takes all summer for the committees to come to an agreement.

Pittsburg

June 14—Conditions are unchanged in the coal trade, demand being good, mines running practically to capacity, with adequate car supply and heavy shipments to the Lakes. Prices, while occasionally shaded, are in the main held at former rates: Mine-run and nut, $1.20@1.25; ¾-in., $1.30@1.35; domestic 1½-in., $1.50; slack, 80@85c. per ton at mines.

Connellsville Coke—The market has been very quiet, with no furnace-coke contracts reported and little prompt sold. The Cambria Steel Company closed a contract last week with J. K. Dimmick & Co. for 10,000 tons of furnace coke a month for two years beginning Jan. 1 next, at a flat price, which is understood to be $1.90 at ovens. This tonnage will be in addition to the 20,000 tons monthly contracted for a few weeks ago for the same period with the Tower Hill Connellsville Coke Company.

We continue to quote standard grades of Connellsville coke: Prompt furnace, $1.65@1.70; second-half contracts, $1.70@1.80; prompt foundry, $2.15@2.25; contract foundry, $2.25@2.50 per ton.

The *Courier* reports the production in the Connellsville and lower Connellsville region in the week ending June 4 at 388,294 tons, a decrease of 8000 tons, and shipments at 3966 cars to Pittsburg, 6272 cars to points west and 1039 cars to points east, a total of 11,277 cars.

Directors of the Thompson-Connellsville Coke Company, Tower Hill Connellsville Coke Company and Isabella Connellsville Coke Company met last week and ratified the agreement made by their officers to consolidate as the Thompson-Kuhn Coke Company, as noted last week. Today the stockholders of these companies are meeting to ratify the action of the directors. Negotiations are actively on with one or two other large interests and it is hoped to take in quite a number gradually.

St. Louis

June 13—The market has continued to ease off and the price of coal has dropped about 25c. per ton during the last week. It seems to have settled down to a price of about $1.30 per ton for mine-run and $1.50 for 2-in. lump. No concessions are being made from this price for future delivery and in fact it seems that the future market is even a little stronger than the spot, which is a reversal of the conditions of last week. The strike in the Carterville and Springfield districts is being stubbornly contested and there seems to be very little chance of a settlement in the near future. The fear that these fields would sign up is really what led to the break in price, as the demand has been exceptionally good right along.

Current prices are as follows for the St. Louis market:

	Mine.	St. Louis.
Illinois, Standard:		
Mine-run	$1.30	$1.82
2-in. lump	1.50	2.02
2-in. screenings	1.40	1.92
Carterville:		
6-in. lump or egg	2.00	2.67
Mine-run	1.50	2.17
Screenings	1.50	2.17
Pocahontas and New River:		
Lump or egg	1.50	4.00
Mine-run	1.10	3.65
Pennsylvania Anthracite:		
Nut, stove or egg	.....	6.65
Grate	.....	6.40
Arkansas Anthracite:		
Egg or grate	3.35	5.35
Coke:		
Connellsville foundry	.....	5.40
Gas house	.....	4.50
Smithing	.....	4.15

The engineers in the Carterville district have decided to secede from the miners' union and form a separate brotherhood of their own. This action was attended by considerable trouble. Conditions in southern Illinois are very unsettled. The fifth and ninth districts which signed up are running full time. Owing to the fact that the other districts in the State are shut down, cars are plentiful and these mines are reaping as much of a harvest as they did during the time just preceding the strike. Screenings and nut are in good demand and are bringing a premium over mine-run. For some time after the resumption of operations in the Belleville district very little outside coal came in, as Indiana and Kentucky mines were able to obtain a better price in other markets; however, Indiana mines are now willing to make a much lower price for their coal and consequently quite a little is coming into St. Louis.

Anthracite coal continues to hold up and while the June business has not opened up to any great extent, yet everything is satisfactory.

FOREIGN·COAL·TRADE

Belgian Coal Consumption—Coal consumption in Belgium for two years past was, in metric tons:

	1908.	1909.	Changes.
Stocks, Jan. 1	454,050	917,330	I. 463,280
Production	23,557,900	23,561,125	I. 3,225
Imports	5,922,846	6,424,921	I. 502,075
Total supply	29,934,796	30,903,376	I. 968,580
Exports	6,404,347	6,919,975	I. 515,628
Stocks, Dec. 31	917,330	588,410	D. 328,920
Total	7,321,677	7,508	
Consumption	22,613,119	23,394,991	I. 781,872

The consumption at collieries is estimated at 10.1 per cent. of the coal mined.

French Coal Trade—Imports and exports of fuel in Frances, three months ended March 31, metric tons:

	Imports.	Exports.	Excess.
Coal	3,430,825	306,502	Imp.3,124,323
Coke	529,038	38,864	Imp. 490,174
Briquets	237,551	35,328	Imp. 202,223
Total	4,197,414	380,694	Imp.3,816,720
Total, 1908	4,622,889	314,686	Imp.4,308,203

The total decrease in imports in 1910, as compared with 1909, was 425,475 tons, or 9.2 per cent.; the decrease in exports was 66,008 tons, or 20.9 per cent.

Spanish Fuel Imports—Imports of coal into Spain, three months ended March 31, were 558,153 metric tons, an increase of 23,592 tons over 1909; imports of coke, 59,704 tons, a decrease of 4009 tons.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of Welsh coal as follows, on June 4: Best Welsh steam, $3.96; seconds, $3.78; thirds, $3.66; dry coals, $3.72; best Monmouthshire, $3.60; seconds, $3.48; best steam smalls, $2.10; seconds, $1.80. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, June 15—The iron and steel trades have gone backward a little, the spurt of activity manifested two or three weeks ago having passed over. A considerable business is being done, but it is a slow market on the whole.

Pig iron continues to be taken, but chiefly in lots of moderate size, showing that users are not yet ready to go too far ahead; and also that they do not believe prices are ready for the upward turn yet. In this belief they are encouraged by the action of many furnaces, which are ready to take contracts at present—in some

cases lower—prices. What iron the East is taking is chiefly foundry. The Central West is buying both foundry and basic. Southern ironmakers are looking for orders and making concessions to get them.

In finished material structural steel is the leader, mainly through the placing of many small contracts. Bars, nails and small material generally are in good demand. Beyond that business is only moderate. Some orders for cars and locomotives have made up a fair total for the railroad orders.

All this does not mean that there is not a large quantity of iron and steel being made and used. The quantity taken would have made a most active market three or four years ago. It means that the boom years of 1906-7 led many ironmasters to spread out to an unwarranted extent; the result being—as we have said before—that possible production has run ahead of the growth of consumption. The result is an excess of capacity which must remain unemployed; or can secure employment only through the inducement of low prices. This disorganizes the trade and produces an appearance of dullness much greater than is warranted by the facts. Idle mills are discouraging; but the only way is to wait until consumption catches up with production—as it surely will, if given time.

The Steel Corporation deal with the Michigan Iron and Land Company is referred to on another page. It increases the Corporation's hold on iron-ore reserves, concerning which there is a great deal to be said, for which there is no space now.

Pig Iron Production—The reports of the blast furnaces on June 1, as collected by the *Iron Age*, show on that date 279 coke and anthracite stacks in blast, having a total daily capacity of 76,850 tons of pig iron; a decrease of 1850 tons as compared with May 1. Making allowance for the charcoal furnaces the total make of pig iron in the United States in May is estimated at 2,423,500 tons; for the five months ended May 31 at 12,638,500 tons; of which 8,423,000 tons were made by the steel company furnaces.

Baltimore

June 13—Exports for the week included 1704 tons steel rails and 343,674 lb. rail fastenings to Vancouver, B. C.; 311,819 lb. pipe to Tuxpan, Mexico. Imports included 5675 tons manganese ore from Poti, Russia; 5400 tons iron ore from Cuba.

Birmingham

June 13—A better tone is noted in the Southern iron market. There have been some sales made recently, the general demand showing up better than for several weeks. No. 2 foundry has strengthened up some at $12 as the minimum. There is a strong inquiry coming in for iron. Despite the curtailment in production, there is a healthy make of iron being noted in this district. The difference in make in May, with all the discussion as to curtailment was less than 9000 tons.

Basic and charcoal iron continue to be in good demand. There will hardly be any resumption of operations at the charcoal furnace of the Shelby Iron Company until next month.

The home consumption shows no change, cast-iron pipe makers, foundries, machine shops and others continuing steady operations. Cast-iron pipe makers were recently in the market for needs for three months.

Chicago

June 14—Sales of pig iron are fair, with founders gradually increasing their last-half purchase but not showing yet a disposition to buy heavily. Malleable continues in good demand and trade indications, on the whole, are encouraging to the furnace interests. Southern No. 2 is still quoted at $11.50@12, Birmingham, or $15.85@16.35, Chicago, and Northern No. 2 at $16.50@17. The tendency of prices seems to be upward, though there are those in the trade who say this tendency is being checked by the approach of summer quietness in manufacturing lines. Melters' last-half needs are not nearly contracted for yet. Perhaps half of them are buying third-quarter iron; the other half are supplied against all but extraordinary needs of their business in that quarter and are negotiating for the fourth quarter or watching the market closely with that in view. Inquiries about 1911 iron continue.

Sales of iron and steel products show quiet, steady buying, not notably changed.

Cleveland

June 13—May shipments of Lake ore were 6,081,358 tons, making a total up to June 1 of 7,601,665 tons, a record for so early in the season.

Pig Iron—Inquiries continue to come in, but few have resulted in sales so far. There have been, however, a number of small sales footing up a pretty good total. Prices quoted are $16.90 for bessemer; $15.50@15.75 for No. 2 foundry; $15.85@16.35 for No. 2 Southern; $15.25@15.50 for gray forge—with possible shading, especially on Southern.

Finished Material—Business is more active and good sales of bars, sheets and plates are reported, generally in lots of moderate size. A few structural contracts have been let.

Philadelphia

June 15—The opinion entertained generally among the larger consumers of foundry and forge irons is that lower prices are inevitable, and it is this that accounts for the few orders placed and the lack of inquiries for autumn requirements. The makers of iron express the belief that the lowest level has been reached and that a reaction is inevitable in steel irons. Only unimportant sales have been made. Eastern makers will prefer to permit stocks to accumulate rather than to shade prices. No. 2 X foundry is quoted at $16.75; gray forge $1 less, and basic is firmly held at $16 per ton.

Steel Billets—Eastern buyers have renewed arrangements for billets for summer and early autumn delivery. Makers have offered inducements to place large orders without meeting with acceptance.

Bars—Bars have weakened and business has been accepted at a slight shading. There is heavy consumption in all lines. Common iron is in better demand than refined.

Sheets—Reports today from mills show that some outside buyers in New York State and farther east are arranging to order stocks for the latter part of the year if desired concessions are granted.

Pipes and Tubes—Steam-engine and boiler work and all work involving tubes have recently received something an impetus in this territory.

Plates—An improving outlook is spoken of by makers in consequence of orders for steel cars recently placed. The demands in this territory have also improved though the orders for the most part are small. The tone of the market is strong.

Structural Material—Local requirements continue and while the orders are generally small the volume is good.

Steel Rails—There are rumors of large contracts for export but no domestic orders of consequence have been placed.

Scrap—Sales of scrap have been restricted to small lots of yard scrap, heavy cast scrap, cast borings and wrought turnings. The market is without interest.

Pittsburg

June 14—Sentiment in the iron and steel trade as a whole continues to be pessimistic, inasmuch as no influence can be discerned which would operate to advance prices, for the present position is that the industry has been working largely on the orders accumulated during the period of enthusiasm last year; production has already declined about 10 per cent. and is likely to decline as much more in the next 60 days, and the attitude of buyers is to buy from hand to mouth until some definite upturn brings them into the market in volume. It is apparent that the sentiment in the trade is more pessimistic than is justified, for investigation shows the total volume of production and movement of material to be very large. It is not lack of tonnage, but lack of advancing prices when ton-

nage is so large, that is responsible for the present chill.

Preparations are being made by mills for a more general shutdown July 1 than is usual. The mills have had a hard run and require repairs and as there is no great pressure for material July is generally chosen. The arrangements for closing apply to steel works and rolling mills, and since blast furnaces run continuously there is likely to be some accumulation of pig iron. However, there is likely to be some blowing out of furnaces.

Pig Iron—The Westinghouse Air Brake Company has taken iron in addition to that reported last week. Altogether it took about 15,000 tons, for prompt and third-quarter delivery, the bulk coming from Valley furnaces at $14.50, furnace, or less, for No. 2. This price can be done again for third quarter, and possibly it can be shaded. Inquiry is rather light locally. It is understood that Pittsburg buyers of basic can shade $14.75, Valley, through furnaces having a lower rate than the Valleys to Pittsburg. A sale of 10,000 tons of bessemer iron has been made for third-quarter delivery from a Valley furnace interest to a Valley consumer, subject to current market price at time of delivery. Other contracts of this nature are under negotiation. The Colonial Steel Company has inquired for 1000 to 1500 tons of basic monthly, for one year beginning July 1, but is understood not to have closed. We quote at Valley furnaces, 90c. higher delivered Pittsburg: Bessemer, $15.75@16; basic, $14.75@15; No. 2 foundry, $14.50@14.75; forge, $14@14.25; malleable, $15@15.25 per ton.

Ferromanganese—The Jones & Laughlin Steel Company has bought 600 tons a month over next year at $40, Baltimore, and the Cambria Steel Company 5000 tons, chiefly for second half, at $40.25. Small prompt lots are available at $39.50, Baltimore, freight to Pittsburg $1.95 per ton.

Steel—The market is quiet, with quotations practically unchanged: Bessemer billets, $25@25.50; sheet bars, $26@26.50; open-hearth billets, $28@28.50; sheet bars, $29@29.50; rods, $31, all f.o.b. mill, Pittsburg or Youngstown.

Sheets—There is a fair jobbing demand. Some mills continue to shade regular prices on black and galvanized by $1 or $2 a ton and corrugated material is shaded almost as much, but these are no new conditions, and the number of mills making cuts is relatively limited. Eave-trough and conductor pipe continues to be cut deeply, eliminating all profit. Premiums on blue annealed sheets have practically disappeared, and at the regular price of 1.75c. deliveries in five or six weeks can readily be obtained. Regular prices are: Black sheets, 28 gage, 2.40c.; galvanized, 3.50c.; painted corrugated roofing, $1.70; galvanized, $3; blue annealed, 1.75c. for 10 gage.

FOREIGN IRON TRADE

United States Foreign Trade—Exports and imports of iron and steel in the United States for the four months ended April 30 are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1909.	1910.	Changes.
Exports	$48,108,590	$58,781,613	I.$10,673,023
Imports	7,988,275	14,070,683	I. 6,082,408
Excess, exp.	$40,120,315	$44,710,930	I.$ 4,590,615

The leading items were as follows, in long tons:

	Exports 1909.	Exports 1910.	Imports 1909.	Imports 1910.
Pig iron	10,960	25,341	39,533	84,631
Scrap	6,695	4,212	1,558	51,863
Billets, blooms, etc.	36,284	5,110	4,271	18,007
Bars	24,543	36,346	5,827	13,399
Rails	68,987	128,924	374	5,142
Sheets and plates	50,008	95,270	1,289	2,883
Structural steel	30,974	43,508	2,536	4,786
Wire-rods	6,456	11,932	4,157	6,992
Wire	45,956	51,956	.....	.....
Nails and spikes	16,040	17,973	.....	.....
Tinplates	3,060	4,478	17,675	23,677
Pipe and fittings	49,598	47,809	.....	.....

Imports of wire not given in quantities; values, $338,375 in 1909, and $529,365 this year.

French Iron Production—The production of pig iron in France for two years past is reported as follows, in metric tons:

	1908.	1909.	Changes.
Foundry	703,644	749,247	I. 45,603
Forge	534,398	538,053	I. 3,655
Bessemer	122,708	118,002	D. 4,706
Basic	1,979,999	2,172,718	I. 192,719
Spiegel and ferro	62,022	54,085	D. 7,937
Total	3,402,771	3,632,105	I. 229,334

The total increase last year over 1908 was 6.5 per cent.

Swedish Iron and Steel—Production in Sweden for the full year is reported by the *Jern-Kontorets Annaler* as below, in metric tons:

	1908.	1909.	Changes.
Pig iron	563,300	443,000	D. 120,300
Wrought iron	148,500	116,900	D. 31,600
Bessemer ingots	79,500	63,400	D. 16,000
Open-hearth ingots	347,000	247,200	D. 99,800

Exports for the year were as follows, also in metric tons:

	1908.	1909.	Changes.
Pig iron	107,100	105,700	D. 1,400
Other iron and steel	226,000	210,500	D. 15,500
Total	333,100	316,200	D. 16,900

The decrease in exports was much less than that in production. The output in 1909 was reduced by strikes.

Austro-Hungarian Trade—Imports and exports of iron and steel in Austria-Hungary, year 1909, metric tons:

	Imports.	Exports.	Excess.
Pig iron & scrap	150,629	53,027	Imp. 97,602
Other iron & steel	85,617	67,763	Imp. 17,854
Machinery	87,313	23,029	Imp. 64,284
Total	323,559	143,819	Imp. 179,740

Imports of iron ore were 392,388 tons; exports, 202,462 tons. Imports of manganese ore, 44,970 tons; exports, 787 tons.

METAL·MARKETS

New York, June 15—The metal markets do not show any improvement, and have been quiet during the week.

Our index number for the metals, calculated on the approximate production and sales of pig iron, copper, tin, lead, zinc and aluminum, was 127 for the month of January; 124 for February; 118 for March; 118 for April; 113 for May.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
April 1910	$36,283,625	$ 2,100,918	Exp. $34,182,707
" 1909	6,337,994	3,345,861	" 2,992,133
Year 1910	47,199,706	11,669,276	" 35,530,430
" 1909	44,316,626	15,504,136	" 28,812,490
Silver:			
April 1910	4,696,534	3,840,495	Exp. 856,039
" 1909	4,952,251	4,222,147	" 730,104
Year 1910	18,336,081	15,238,634	" 3,097,447
" 1909	19,426,181	14,675,365	" 4,750,816

Exports from the port of New York, week ended June 11: Gold, $55,745; silver, $878,008, chiefly to London. Imports: Gold, $64,818; silver, $125,300, from the West Indies, Mexico and Japan.

Exports and imports of gold and silver through the port of San Francisco, four months ended April 30:

Exports:	Coin.	Bullion.	Total.
Gold	.....	$1,970,208	$1,970,208
Silver	$1,500	2,372,600	2,374,100
Imports:			
Gold	16,068	575,627	591,695
Silver	538,713	331,121	869,834

The gold exports were all made in the month of January.

Gold and silver movement in France, three months ended March 31:

	Imports.	Exports.	Excess.
Gold ..Fr.	118,958,000	F. 79,812,000	Imp.Fr. 39,146,000
1909..	165,570,000	23,020,000	Imp. 142,550,000
Silver.	79,386,000	39,689,000	Imp. 39,697,000
1909..	32,709,000	26,563,000	Imp. 6,146,000

Imports of copper and nickel coins this year, 16,000 fr.; exports, 225,000 francs.

Exports of silver from London to the East from Jan. 1 to June 2, reported by Messrs. Pixley & Abell:

	1909.	1910.	Changes.
India	£2,216,200	£2,653,500	I. £ 437,300
China	1,075,100	1,113,500	I. 38,400
Straits	82,800	.....	D. 82,800
Total	£3,374,100	£3,767,000	I. £ 392,900

India Council bills in London brought an average of 15.97d. per rupee for the week.

Gold—The price of gold on the open market in London was unchanged, at 77s. 9d. per oz. for bars and 76s. 5d. per oz. for American coin. There was no special demand.

Platinum—The gradual advance abroad has been followed by higher prices here. Dealers are now asking $31.50@32 per oz. for refined platinum and $37 per oz. for hard metal.

SILVER AND STERLING EXCHANGE

June.	9	10	11	13	14	15
New York....	53⅛	53⅛	53⅛	53⅛	53⅜	53⅜
London	24 9/16	24 9/16	24 9/16	24 9/16	24⅝	24⅝
Sterling Ex..	4.8665	4.8675	4.8680	4.8680	4.8670	4.8660

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

Silver—The market has been steady, with hardly any fluctuation, closing at 24⅝d. in London, a very small advance.

Copper, Tin, Lead and Zinc

June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
9	12¾ @12⅞	12¾ @12⅝	55 15/16	32⅝	4.32½ @4.35	4.17½ @4.22½	4.95 @5.00
10	12¾ @12⅞	12¾ @12⅝	55 7/16	32¾	4.32½ @4.35	4 17½ @4.22½	4.95 @5.00
11	12¾ @12⅞	12¼ @12½	....	32⅞	4.32½ @4.35	4.17½ @4.22½	4.95 @5.00
13	12¾ @12⅞	12¼ @12¾	54 15/16	32¾	4.32½ @4.35	4.17½ @..22½	4.92½ @4.97½
14	12¾ @12⅞	12¼ @12⅜	55	32⅝	4.32½ @4.35	4.17½ @4.22½	4 92½ @4.97½
15	12¾ @12⅞	12¼ @12¾	54½	32½	4.32½ @4 35	4.17½ @4 22½	4.92½ @4.95

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

The New York Metal Exchange proposes to sell its building and remove to leased quarters at 111 Broadway.

Copper—During the past week there has been a quiet and sagging market. Consumers have maintained a hand-to-mouth policy and the business that has presented itself has been eagerly competed for by some of the sellers. In consequence, prices have suffered. At the lower level which is now ruling, considerably more interest is shown, both by the domestic and foreign consumers. At the close, Lake copper is quoted at 12¾@12⅞c., and electrolytic copper in cakes, wirebars and ingots at 12¼@12⅜c. Casting copper is quoted nominally at 12⅛@12¼ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 14¼c. base, carload lots at mill.

The market for standard copper is almost £2 lower than it closed last week. There has been considerable realization on the part of tired bulls and some bear selling. At the close, spot is quoted at £54 10s. and three months at £55 3s. 9d.

Refined and manufactured sorts we quote: English tough, £58; best selected, £59@59 10s.; strong sheets, £67@68 per ton.

Exports of copper from New York for the week were 3833 long tons. Our special correspondent gives the exports from Baltimore at 2158 tons.

Henry R. Merton & Co. write from London under date of June 4: "The copper market, until lately so entirely under the influence of events in Wall Street, has nevertheless shown a very firm attitude in the face of these untoward developments, and has given the best evidence of the sounder conditions which now prevail in this metal. The continued liquidation of bull commitments during April and May has eliminated a great deal of the weakness in the technical position of the standard market, and the very firm attitude of the leading producers has also helped to consolidate the situation. Thus, prices throughout the past week have kept very steady, showing at one time an advance of a few shillings in response to buying by dealers and covering by shorts. Toward the finish the tendency is slightly weaker in sympathy with the Stock Exchange, but little selling pressure was experienced."

Tin—The market in London developed a declining tendency. To this there was an interruption on Friday last when large American orders created a firmer tone. Since then, however, prices have been sagging again, and close weak at £147 10s. for spot, and £148 12s. 6d. for three months.

Business among dealers in this market developed at the end of last week and transactions were fairly large. A feature of the domestic market at this time is the scarcity of spot material. The incoming tin seems mostly to go into the hands of the larger consumers and but little remains for outside consumption. Quotations are made at about 32½ cents.

Visible stocks of tin, including tin afloat, reported on June 1 were: United States, excluding Pacific ports, 4249; Great Britain, 11,540; Holland, 3209; total, 18,998 long tons, showing an increase of 1066 tons during May. Of the total stocks reported 11,855 tons were in warehouse and 7143 tons afloat.

Lead—The market is quiet. There is some business doing from day to day at about the last prices, 4.17½@4.22½c. St. Louis, and 4.32½@4.35c., New York.

The London market for Spanish lead continues firm at £12 12s. 6d. and English lead is held for £12 15s. per ton.

Spelter—The market is very quiet. The galvanizing business appears to be falling off somewhat, and as manufacturers are well covered they are buying sparingly. Prices have again eased off and at the close St. Louis is quoted at 4.92½@4.95c. and New York at 5.07½@5.10 cents.

New York quotations for spelter on June 9-11, inclusive, were 5.10@5.15c.; June 13 and 14, 5.07½@5.12½c.; June 15, 5.07½@5.10 cents.

The London market for good ordinaries is £22 and £22 5s. for specials.

Base price of zinc sheets is $7.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Sales are fair only, and the market is generally more quiet. We quote 23½c per lb. for No. 1 ingots in large lots, New York delivery. The foreign market continues active, with prices firm.

The Aluminum Company of America is at present operating at its full capacity, using all the power it can get.

Antimony—The market remains quiet. Cookson's is quoted lower at 8.15@8.20c. per lb. Other prices are unchanged at 7⅞@8c. for U. S.; 7⅜@7½c. for outside brands.

Quicksilver—New York quotations are $47 per flask of 75 lb. for large orders; $48@49 for jobbing lots. San Francisco, $46@46.50 for domestic orders and $2 less for export. The London price is £8 15s. per flask, with £8 12s. 6d. quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot, from 50c. for 500-lb. lots, up to 55c. for 200-lb. lots. The price for electrolytic is 5c. higher.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Cadmium—Current quotations are 65@70c. per lb. in 100-lb. lots at Cleveland, Ohio.

Zinc and Lead Ore Markets

Platteville, Wis., June 11—The highest price paid this week for zinc ore was $41.50; the base price, 60 per cent. zinc, was $40@41 per ton. The base price paid for 80-per cent. lead ore was $48@50 per ton.

SHIPMENTS, WEEK ENDED JUNE 11.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	850,390	52,230	325,500
Cuba City	256,595	109,820	266,385
Mineral Point	217,900	.....	.....
Shullsburg	195,000	.....	.....
Galena	160,500	.....	.....
Benton	70,000	.....	.....
Highland	63,000	.....	.....
Linden	.....	.....	84,930
Total	1,813,385	162,050	676,815
Year to date	37,612,041	2,813,739	8,377,095

In addition to the above there was shipped during the week to the separating plants, 2,947,395 lb. zinc concentrates.

Joplin, Mo., June 11—The highest settling price of the week was $46 for ore purchased last week, the base price this week for zinc sulphide ore being $40@41.50 per ton of 60 per cent. zinc. The base price of zinc silicate was $20@22 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $38.66 per ton. The high price for lead was $49, with deductions of $1 per ton for each 1 per cent. under 80 per cent. lead. All lead grading 80 per cent. and higher is now regularly selling at one price.

Excessive rains this week practically shut out all shallow mining in Aurora, Granby and the vicinity of Joplin, materially lowering the output. In the face of this zinc prices were lowered $2 per ton for advance deliveries.

SHIPMENTS, WEEK ENDED JUNE 11.

	Zinc, lb.	Lead lb.	Value.
Webb City-Carterville	4,173,530	1,339,780	$116,294
Joplin	2,035,330	241,010	47,628
Duenweg	713 970	289,950	19,712
Galena	761.510	31,400	15,985
Granby	705,260	22,100	12,090
Oronogo	428,500	59,990	11,126
Badger	365,800	45,790	8,610
Spurgeon	422,900	54,680	7,110
Carthage	224,630	.....	4,717
Carl Junction	201,880	13,660	4,674
Aurora	183,720	.....	2,860
Alba-Neck	127,100	.....	2,796
Miami	126,910	57,070	2,639
Cave Springs	65,970	16,560	1,717
Sarcoxie	57,640	.....	1,181
Quapaw	55,010	.....	697
Seneca	55,820	.....	586
Wentworth	28,000	.....	310
Totals	10,734,480	2,171,990	$260,732
24 weeks	263,932,020	38,598,800	$6,295,474

Zinc value, the week, $207,565; 24 weeks, $5,287,569
Lead value, the week, 53,167; 24 weeks, 1,007,905

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$41.25	$47.31	$38.46	$45.16	$52.17	$56.99
February	36.94	40.69	34.37	39.47	50.50	53.64
March	37.40	43.60	34.71	39.71	50.82	51.26
April	38.63	41.00	37.01	39.33	55.63	49.72
May	40.06	40.19	37.42	37.51	56.59	48.16
June	44.15	.....	40.35	.....	57.52	.....
July	43.06	.....	41.11	.....	53.74	.....
August	48.25	.....	44.54	.....	57.60	.....
September	47.70	.....	44.87	.....	56.11	.....
October	49.50	.....	45.75	.....	55.02	.....
November	51.31	.....	48.29	.....	53.94	.....
December	49.45	.....	47.57	.....	55.26	.....
Year	$43.98	.....	$41.20	.....	$54.60	.....

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

Other Ore Markets

Iron Ore—Current quotations for Lake Superior ores, on dock at Lake Erie ports are: Bessemer ore—base 55 per cent. iron and under 0.45 phosphorus—$5 per ton for old Range and $4.75 for Mesabi; non-bessemer—base 51.5 per cent. iron—$4.20 for Old Range and $4 for Mesabi.

Manganese Ore—The base price, as fixed by the large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent. or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess of phosphorus and silica.

Pyrites—Domestic furnace sizes fetch 11@11½c. per unit, delivered at eastern acid works; fines, 10¾@11c. Pyrites containing arsenic realize from ½@1½c. per unit less.

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. for ore containing 60 per cent. of tungsten trioxide. For scheelite ores, 50c.@$1.50 per unit less.

Zinc Ore—For Rocky Mountain blende, delivered at Kansas smelting points, the current price is for the zinc content, less eight units, at the St. Louis price for spelter, less $14@15 per 2000 lb of ore, according to quality, especially as to iron and lead content. See also Joplin and Wisconsin ore markets.

CHEMICALS

New York, June 15—The general market is quiet and rather inclining to the usual summer dullness.

Copper Sulphate—Business is steady and prices unchanged at $4 per 100 lb. for carload lots and $4.25 per 100 lb. for smaller parcels.

Arsenic—The market is dull. On small sales prices are unchanged at $2.30@2.40 per 100 lb. for white arsenic.

Nitrate of Soda—Business is on a moderate scale. Spot nitrate is rather lower at 2.10c. per lb. The same price, 2.10c., is quoted for futures.

MINING STOCKS $

New York, June 15—The general stock market has been less active, but stronger in quotations, though the movement of prices has been irregular all through the week. Fractional advances were made, but there has been no general upward movement on a large scale.

Sales of Homestake were recorded, 150 shares changing hands at $87.25@89 per share.

The Curb followed the course of the Exchange rather closely. Copper shares were stronger; Chino, Miami and Ray Central being the more active issues. Cobalt stocks held their own well and were active, with many sales.

Sales of securities at auction in New York, June 9, included $10,000 Columbus & Hocking Coal and Iron collateral trust bonds at $4000 (40); 300 shares same company, common stock, at 4¼; 100 shares Colonial Silver Mines, $26 for the lot; 16 shares Tintic Company, old stock, $7 for the lot; 100 shares McKinley-Darragh-Savage Mining Company, 94c. per share.

Boston, June 14—Copper stocks had a weak period due to the large increase in the visible supply of the metal during May. North Butte has been the particular feature with an $8.50 break for the week, making a low-record mark at $24.50. Inadequate margins were responsible for a good part of the selling but the belief is general that the next dividend will be cut. Calumet & Arizona had a sympathetic drop of $11, touching $50, but the volume of business in this specialty was light.

The weakness of coppers has been largely in the dividend payers, due to the

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company.	March.	April.	May.
Arizona, Ltd.	2,886,000	2,340,000	2,610,000
Balakiala	1,263 733	1,109,311	1,148,762
Boleo (Mexico)	2,148,383	2,777,800	2,735,680
Copper Queen	10,809,488	9,920,000	.....
Calumet & Ariz.	2,820,000	2,400,000	.....
Cananea (Mexico)	3,700,000	4,262,000	.....
Detroit	1,698,975	1,930,000	.....
Imperial	825,000	800,000	.....
Nevada Con. (Est.)	5,339,466	5,500 000	5 500,000
Old Dominion	2,674,000	2,325,000	2,174,000
Shannon	1,468,000	1,288,000	1,326,000
Superior & Pitts.	2,370,000	2,130 000	.....
Utah Copper Co.	7,853.288	7,902,643	.....
Butte District	24,000,000	25,000,000	27,000 000
Lake Superior	19,250,000	16,250,000	19,250,000
Total production.	89,366,867	86 934.754	.....
Imports, bars, etc.	20,178,202	21,180,396	.....
Imp. in ore & matte	6,181,476	12,527,371	.....
Total	115,726,545	120,642,521	.....

Butte district and Lake Superior figures are estimated; others are reports received from companies. Imports duplicate production of Cananea, and that part of Copper Queen production which comes from Nacozari. Boleo copper does not come to American refiners. Utah Copper report from February includes the output of the Boston mill.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
VI, 1909	116,567,493	60,591,116	70,966,457
VII	118,277,603	75,520,083	75,018.974
VIII	120,597,234	59,614,207	48,382.704
IX	118,023,139	52,105,955	50,077.777
X	124.657,709	66.359,617	56,261,238
XI	121,618,369	66,857,873	55,266,595
XII	117,828,655	69,519,501	59,546,570
Year	1,405,403,056	705,051,591	680,942,620
I, 1910	116,547,287	78,158,387	81,691,672
II	112,712,493	66,618,322	37,369,518
III	120,067,467	62,944,818	40,585,767
IV	117,477,639	67,985,951	31 332,434
V	123,242,476	59.305,222	45,495,400

	Visible Stocks. United States.	Europe.	Total.
VI, 1909	169,848,141	127,352,960	297,201,101
VII	154,858,061	150,928,960	305,787,021
VIII	122,596,607	171,492,160	294,088,767
IX	135,196,930	197,993,600	333,190,530
X	151,472,772	210.224.000	361,696,772
XI	153,509,626	222,566.400	376,076,026
XII	153,003,527	236,857,600	389,861,127
I, 1910	141,766,111	244,204,800	385,970,911
II	98,463,339	248,236,800	346,700,139
III	107,187,992	254,150,400	361,338 392
IV	123,824,874	249,625,600	373,450,474
V	141.984,159	246,870,400	388.854,559
VI	160,425,973	239,142,400	399,568,373

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

uncertainty regarding a continuance of the present rates. Amalgamated fell $5.75 this week to a low of $61.62½. The newer Lake stocks have been weak, but not to the extent of those mentioned above. Lake stock fell $3.50 to $48, but the stock shows buoyancy at times. President Paine, of the Copper Range Consolidated, is slated for president of the Lake at the approaching annual meeting.

Old Dominion became weak today on the reduction of dividend of the New Jersey corporation, the holding company, from $1 to 50c. The Maine corporation, the operating one, takes dividend action tomorrow.

The $1 assessment levied on Davis-Daly stock had no effect on the market price as it had been expected and to an extent, discounted. The Curb market shows generally lower prices.

Assessments

Company.	Delinq.	Sale.	Amt.
Alameda, Ida.	June 10	July 2	$0.00½
Amador, Ida.	Feb. 24	June 30	0.01
Andes, Nev.	May 31	June 21	0.10
Beck Tunnel, Utah.	June 14		0.01
Black Jack, Utah.			0.01
Brownstone, Utah.	Apr. 15	June 10	0.00½
Butte-Alex-Scott.	July 1		1.00
Caledonia, Nev.	June 17	July 8	0.10
Crown Point, Nev.	June 26	July 20	0.10
Davis-Daly, Mont.	July		0.50
Davis-Daly, Mont.	Sept.		0.50
East Tintic, Utah.			0.01
Hancock Con., Mich.	Au.Oct.		3.00
Helvetia, Ariz.			0.50
Ojibway, Mich.	Oct.		1.00
Reindeer, Ida.	May 31	Aug. 1	0.00½
Rhode Island Copper, Mich.			0.50
Scottish Chief, Utah.			0.01
Sierra Nevada, Nev.	June 21	July 12	0.10
Union, Nev.	June 9	July 1	0.10
Utah Con. of Tintic, Utah.	May 15		0.01
Yankee Cons., Utah.	June 24		0.02
Yellow Jacket, Nev.	June 9	July 11	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January	51.750	52.375	23.843	24.154
February	51.472	51.534	23.706	23.794
March	50.468	51.454	23.227	23.690
April	51.428	53.221	23.708	24.483
May	52.905	53.870	24.343	24.797
June	52.538	.....	24.166	.....
July	51.043	.....	23.519	.....
August	51.125	.....	23.588	.....
September	51.440	.....	23.743	.....
October	50 923	.....	23.502	.....
November	50.703	.....	23.351	.....
December	52.226	.....	24.030	.....
Total	51.502	.....	23.706	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER.

	New York.				London.	
	Electrolytic		Lake.			
	1909.	1910.	1909.	1910.	1909.	1910.
January	13.893	13.620	14.280	13.870	61.198	60.923
February	12.949	13.332	13.295	13.719	57.688	59.388
March	12.387	13.255	12.826	13.586	56.231	59.214
April	12.56¼	12.733	12.93¾	13.091	57.363	57.238
May	12.893	12.550	13.238	12.885	59.338	56.313
June	13.214	.....	13.548	.....	59.627	.....
July	12.880	.....	13.363	.....	58.556	.....
August	13.007	.....	13.296	.....	59.393	.....
September	12.870	.....	13.210	.....	59.021	.....
October	12.700	.....	13.030	.....	57.551	.....
November	13.125	.....	13.354	.....	58.917	.....
December	13.298	.....	13.647	.....	59.906	.....
Year	12.982	.....	13.335	.....	58.732	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1909.	1910.	Month.	1909.	1910.
January	28.06	32.700	July	29.125	.....
February	28.29	32.920	August	29.966	.....
March	28.727	32.403	September	30.293	.....
April	29.445	32.976	October	30.475	.....
May	29.225	33.125	November	30.859	.....
June	29.322	.....	December	32.913	.....
			Av. Year	29.725	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1909	1910.	1909.	1910.	1909.	1910.
January	4.175	4.700	4.025	4.582	13.113	13.650
February	4.018	4.613	3.868	4.445	13.313	13.328
March	3.986	4.459	3.835	4.307	13.438	13.063
April	4.168	4.376	4.051	4.225	13.297	12.641
May	4.287	4.315	4.214	4.164	13.225	12.550
June	4.350	.....	4.291	.....	13.031	.....
July	4.321	.....	4.188	.....	12.563	.....
August	4.363	.....	4.227	.....	12.475	.....
September	4.342	.....	4.215	.....	12.781	.....
October	4.341	.....	4.215	.....	13.175	.....
November	4.370	.....	4.252	.....	13.047	.....
December	4.560	.....	4.459	.....	13.125	.....
Year	4.273	.....	4.153	.....	13.049	.....

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

SPELTER

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	5.141	6.101	4.991	5.951	21.425	23.350
February	4.889	5.569	4.739	5.419	21.562	23.188
March	4.757	5.637	4.607	5.487	21.438	23.031
April	4.965	5.439	4.815	5.289	21.531	22.469
May	5.124	5.191	4.974	5.041	21.975	22.100
June	5.402	.....	5.252	.....	22.000	.....
July	5.402	.....	5.252	.....	21.969	.....
August	5.729	.....	5.579	.....	22.125	.....
September	5.796	.....	5.646	.....	22.906	.....
October	6.199	.....	6.043	.....	23.200	.....
November	6.381	.....	6.231	.....	23.188	.....
December	6.249	.....	6.099	.....	23.094	.....
Year	5.503	.....	5.352	.....	22.201	.....

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

PRICES OF PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$17.18	$19.90	$16.40	$17.98	$16.26	$17.94
February	16.73	18.96	16.09	17.21	15.90	17.38
March	16.40	18.53	15.84	16.93	15.62	17.00
April	15.79	18.28	15.05	16.84	15.06	16.75
May	15.77	17.10	15.02	15.94	15.08	16.18
June	16.13	.....	15.84	.....	15.63	.....
July	16.40	.....	15.90	.....	15.96	.....
August	17.16	.....	16.17	.....	16.20	.....
September	18.44	.....	16.80	.....	17.03	.....
October	19.75	.....	17.84	.....	18.02	.....
November	19.90	.....	18.37	.....	18.09	.....
December	19.90	.....	18.15	.....	17.90	.....
Year	$17.46	.....	$16.46	.....	$16.40	.....

STOCK QUOTATIONS

COLO. SPRINGS June 14

Name of Comp.	Bid.
Listed:	
Acacia	.06⅞
Cripple Cr'k Con.	.02½
C. K. & N.	.17
Doctor Jack Pot.	.09½
Elkton Con.	.79½
El Paso	.85
Fannie Rawlins.	.05½
Findlay	.08
Gold Dollar	.15
Gold Sovereign	.03½
Isabella	.19½
Mary McKinney	.58
Pharmacist	.03½
Portland	1.25
Vindicator	.99
Work	.03½
Unlisted:	
Golden Cycle	1.00
United Gold Mines	.08½

SALT LAKE June 14

Name of Comp.	Clg.
Carisa	‡.45
Colorado Mining	.49
Columbus Con.	.65
Daly Judge	3.50
Grand Central	1.00
Iron Blossom	.89
Little Bell	1.25
Little Chief	.45
Lower Mammoth	.35
Mason Valley	7.00
Maj. Mines	‡.58
May Day	‡.05½
Nevada Hills	.98
New York	‡.13
Prince Con	.63
Red Warrior	6.00
Silver King Coal'n	2.60
Sioux Con.	.17
Uncle Sam	.34
Victoria	1.07½

SAN FRANCISCO. June 14.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Atlanta	.11
Belcher	.60
Best & Belcher	‡.25
Caledonia	.40
Challenge Con.	.19
Chollar	.13
Confidence	.75
Con. Cal. & Va.	.89
Crown Point	.62
Exchequer	.18
Gould & Curry	.18
Hale & Norcross	.31
Mexican	1.07
Ophir	.89
Overman	.70
Potosi	.40
Savage	.21
Sierra Nevada	.19
Union	.31
Yellow Jacket	.85

Name of Comp.	Clg.
MISC. NEVADA	
Belmont	3.75
Daisy	.06
Jim Butler	.29
MacNamara	.27
Midway	.28
North Star	.06
West End Con.	.57
Atlanta	.11
Booth	.15
C.O.D. Con	.08
Columbia Mt.	.06
Comb. Frac.	.50
Great Bend	.03
Jumbo Extension	.19
Oro	.07
Red Hill	.03
Sandstorm	.01
Silver Pick	.06
St. Ives	.12
Tramps Con.	.04½

N. Y. EXCH. June 14

Name of Comp.	Clg.
Amalgamated	63⅝
Am. Agri. Chem.	43
Am.Sm.&Ref.,com	75⅞
Am. Sm. & Ref., pf.	103⅜
Anaconda	40
Bethlehem Steel	27⅞
Col. & Hock. C. & I.	6½
Colo. Fuel & Iron.	34⅝
Du Pont P'd'r, pf.	87½
Federal M. & S.	41
Great Nor., ore ctf.	‡58¼
Nat'nalLead,com.	73⅛
National Lead, pf.	108
Nev. Consol.	19
Pittsburg Coal.	‡17½
RepublicI&S,com.	30⅝
Republic I & S, pf.	95½
SlossSheffi'd,com.	‡69½
Sloss Sheffield, pf.	117½
Tennessee Copper	25⅞
Utah Copper	42⅞
U. S. Steel, com.	77¾
U. S. Steel, pf.	115⅜
Va. Car. Chem.	59½

N. Y. CURB June 14

Name of Comp.	Clg.
Bonanza Creek	‡3
Boston Copper	18
Braden Copper	4½
B. C. Copper	5⅛
Buffalo Mines	2½
Butte Coalition	18
Caledonia	1¾
Chino	11¾
Cobalt Central	.10½
Cobalt Prov.	‡59
Con. Ariz. Sm.	1 1/16
Cumberland Ely.	‡9
Davis-Daly	1⅜
Dominion Cop.	7
Ely Con.	.52
El Rayo	4¼
Florence	‡2.22
Gila Copper	5⅞
Giroux	6⅞
Gold Hill	⅞
Goldfield Con.	8⅞
Greene Cananea	7¾
Guanajuato	1⅝
Guggen. Exp.	185
Kerr Lake	.08 3/16
La Rose	4 7/16
McKinley-Dar-Sa.	1.00
Miami Copper	20
Mines Co. of Am.	65
Mont. Shoshone	‡⅞
Mont.-Tonopah	.70
Nev. Utah M. & S.	⅞
Newhouse M. & S.	‡3½
Nipissing Mines	11¼
Ohio Copper	2
Pacific Sm. & M.	3/16
Ray Central	2½
Silver Queen	.35
Standard Oil	620
Stewart	11/16
Tonopah	9 1/16
Tonopah Ex.	.90
Tri-Bullion	11/16
W. Va. Wyo. Cop.	2 1/16
Yukon Gold	4 7/16

LONDON June 15

Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 3 3
Camp Bird	1 8 6
Esperanza	2 15 3
Tomboy	1 0 0
El Oro	1 7 6
Oroville	0 8 0
Mexico Mines	8 8 9

BOSTON EXCH. June 14

Name of Comp.	Clg.
Adventure	5¾
Allouez	39
Am. Zinc	‡24½
Arcadian	4¼
Arizona Com	15
Atlantic	6¾
Boston Con.	17
Butte & Balak.	14⅜
Calumet & Ariz.	53
Calumet & Hecla.	550
Centennial	15⅝
Con. Mercur	.10
Copper Range	60
Daly-West	8
East Butte	7⅛
Franklin	11¾
Granby	38
Hancock	17
Helvetia	2½
Indiana	16¼
Isle Royale	17
Keweenaw	3½
Lake	50¼
La Salle	11
Mass	7⅛
Michigan	4½
Mohawk	47½
Nevada	19
North Butte	26⅛
North Lake	10
Ojibway	7
Old Dominion	32¼
Osceola	130
Parrot	13½
Quincy	70
Shannon	10¼
Superior	40
Superior & Bost.	9¼
Superior & Pitts.	10¾
Tamarack	45⅛
Trinity	5
U. S. Smg & Ref.	.39¼
U.S.Sm. & Re., pd.	49
Utah Apex	3⅛
Utah Con.	21
Victoria	3
Winona	7
Wolverine	110
Wyandotte	1¾

BOSTON CURB June 14

Name of Comp.	Clg.
Ahmeek	‡165
Bingham Mines	‡3
Boston Ely	2¼
Boswycocolo	.08
Cactus	2 3/16
Calaveras	7 1/16
Champion	.05¼
Chemung	‡8
Chief Cons	1⅜
Cons. Ariz.	2
Corbin	.06⅞
Crown Reserve	‡3
First Nat. Cop.	3½
Indiana	‡17½
Inspiration	7¼
Mackinaw	‡.06
Majestic	.48
Nat'l Mine	.26
Nevada-Douglas	2¾
New Baltic	‡6¾
Oneco	3¼
Raven Copper	.37
Ray Con	‡17
Rhode Island Coal	6⅞
San Antonio	‡7¼
Shattuck-Ariz	‡25
South Lake	4¼
Superior & Globe	‡.38
Trethewey	‡1¾
Tuolumne Copper	3¾
Vulture	9¼
Yuma	.70

‡Last quotation.