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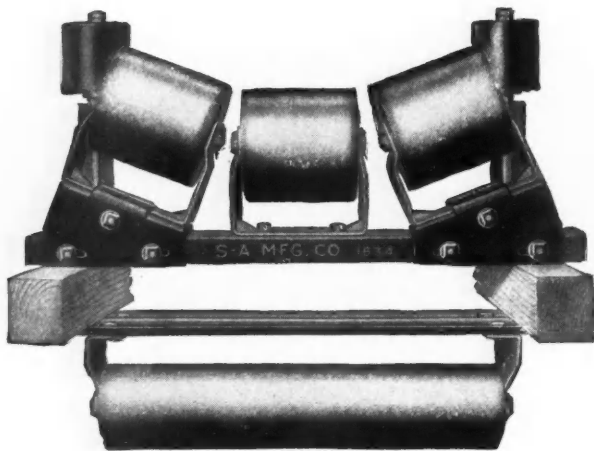
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Engineering and Mining Journal

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The Belmont Camp, Nevada

BY WILSON W. HUGHES*

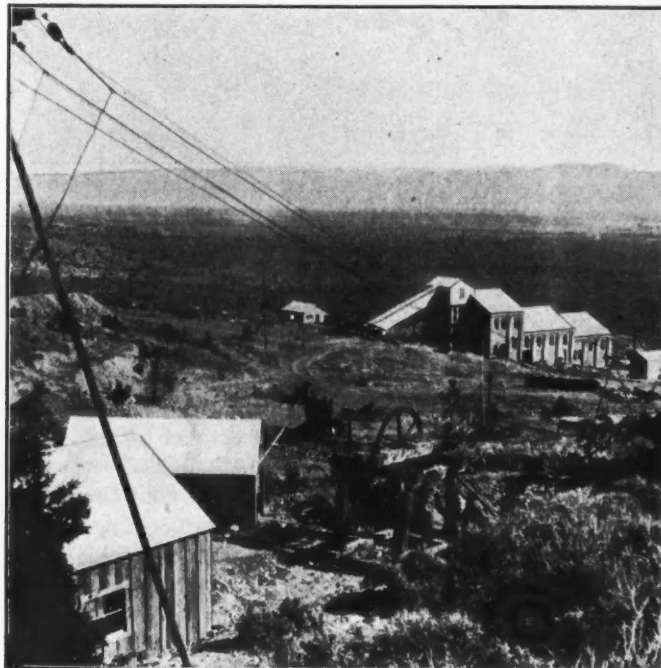
SYNOPSIS—The Belmont camp, originally organized as the Philadelphia mining district, was discovered in the early 60's, and mining was begun in 1864 on the Transylvania claim. The district was a large silver producer, the ores being treated by the Boss continuous pan process. There was a period, from 1885 to 1906, when the camp was dormant, and after this time mining began to grow until it reached the present stage of its development. The character of ore deposits and minerals is discussed.

The old mining camp of Belmont, Nye County, Nevada, was discovered in the early 60's, and the first mining of any consequence was begun in 1864 on the claim known as the Transylvania. The organization of the district

was attained and the lower grade of the deeper ore, forced a suspension of the work and the mines were closed down.

The old operating companies made use of the Boss pan-amalgamation process for ore treatment, and for the carrying out of this process there were three large mills in the camp, of solid brick construction, with tall brick smoke-stacks that even now dominate the landscape. So far as can be ascertained, the ores treated were silver chloride, with some stetefeldite and other sulphides. The value of the silver content varied from \$25 to \$250 per ton, which, with silver at the price of those times, would give approximately a minimum of about 25 oz.

From 1885 to 1906 the camp was dormant. In the latter year the present owners acquired an interest in some of the old properties and after another eight years were able to find the old owners and obtain title to the holdings they now control under the title of the Monitor-



MILL OF THE MONITOR-BELMONT MINING CO.



OLD HIGHBRIDGE HEADFRAME, STILL IN USE

as the Philadelphia mining district took place the following year. From this date to 1885 Belmont held rank as a large silver producer, with an estimated output of more than \$15,000,000 during the twenty or more years of its activity. In 1885 the declining price of silver, together with increased cost of pumping as depth

Belmont Mining Co. This company now controls all the old district, comprising 33 claims, water rights, mill rights, etc. Electric power was brought into the camp, and the erection of a 100-ton mill to treat the old dump was begun, while exploration and development of the underground workings was in progress.

The mill, completed in 1915, was actively at work during 1916. Flotation treatment of old silver dump

*Superintendent, Monitor-Belmont Mining Co., Belmont, Nev.

ores that had been exposed to the weather for at least 30 years presented problems that were of a highly interesting nature technically, but they were all solved up to a point where the dump treatment was economically possible. The average tonnage of 120 tons per day of 24 hours is crushed by ten 1600-lb. stamps.

The early workers had left a large amount of underground work already accomplished, which, although filled with water to a considerable height, was of much assistance in the development of the property. The three main shafts, of which the Belmont and High Bridge verticals were connected at the 300-ft. level by a 1600-ft. drift, were in excellent condition. Up to date they have been unwatered to the 200-ft. level, and the timber is as good as the day it was placed in position. The Belmont shaft was equipped with a Cornish pump and large, steam-driven hoist which, according to the wood contractor of those days, used an average of 12 cords of pine wood per day for a period of over 12 years. The wood cost \$7 per cord delivered at the boilers. The pump column, of riveted pipe, was found rusted out, but on the 200-ft. level the old bob was standing sentry as it had been left when the water rose above it. The 200-ft. level was in excellent shape, with heavy stulls in the old stopes still capable of carrying their load.

THE SHAFT AND ITS CONDITION

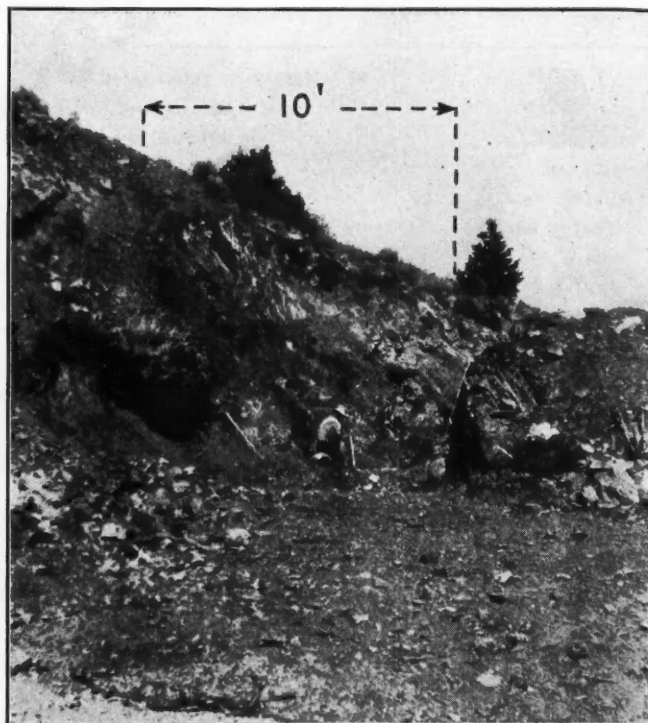
The High Bridge shaft is a three-compartment, heavily cribbed structure. The cribbing is of 6-in. sawn lumber 12 in. wide, the wall plates being 17 ft. long and the end plates 6 ft. long. The compartments are divided by buntons of the same material. Guides, 5 in. square, are fastened to the buntons and end plates by heavy lag-screws. The north compartment, previously used as a manway, was found to have had all the ladders removed from it. A new ladderway was installed, and the bottom of this compartment was found at 135 ft. There was apparently no connection between the ladderway and the mine. About 75 ft. down it was noticed that there was a considerable amount of what looked like plank and rope mixed up in the south hoisting compartment, so a hole was cut from the ladderway through the buntons, and it was found that there was a station at this level opening only into the south compartment. Here was found the old hoisting cage sitting on the chairs, with about 300 ft. of 3-in. manila cable piled on top of it where it had fallen when rotted off the hoist drum above. The station was well timbered and in good condition, with the old wooden, iron-strap rails running into the drift a distance of 250 ft. Evidently some station tender of artistic ability had been a great admirer of Gen. Stonewall Jackson, since his portrait showing him of ferocious aspect, attired in a top hat with waving plumes and carrying a curved and lengthy sword, was penciled on one of the posts, in addition to other creations of the same artist.

THE CHARACTERISTICS OF THE VEIN

The timber truck, ore cars with the ends nearly holed through by the candlestick points, an empty bottle, etc., were evidence of the former occupation and work that had been carried on. The old stopes on this level showed the kind of highly selective mining that the old miners used to carry out. Fills in the stopes and stacks in the levels gave ore of profitable grade for the present system of treatment. The vein in this level was found

to be 20 ft. wide and of milling-grade ore, so far as could be determined. The cage is at present in use and running on the same old guides. Conditions on the 200-ft. level were about the same as on the 75-ft. level.

The development of the property is to be carried out thoroughly and promptly. A compressor and air drills are being installed, and the mill is changed so as to meet the requirements of the ore. The Highbridge-Belmont vein averages from 3 to 20 ft. in thickness and has been proven for a length of 2400 ft. The depth, as shown by the old workings, is at least 500 ft. in the Belmont and Highbridge shafts, but of course there are no data



THE HIGHBRIDGE VEIN AT THE SURFACE

on the value of the ore in the vein below this point. Another vein, the Eldorado South, has been opened by workings to a depth of more than 500 ft. and over a length of 1400 ft. The Arizona vein is known over a length of 1000 ft. and a depth of 200 ft. The company intends to develop vigorously all these possibilities.

The geology of the portion of the district owned by the Monitor-Belmont Mining Co. may be briefly described as quartz veins and lenses occurring in slates and limestones at or near their contact with intrusive siliceous granites. The alteration of the intruded rocks to mica schists and jasperoid is noticeable. The metallic minerals occur in the quartz as bunches; no banding has been noticed. The silver contents are chiefly derived from stetefeldtite, an argentiferous antimonial copper ore, with lead and silver carbonates, silver chloride, etc.

The camp is 51 miles from Tonopah, which is the nearest railroad point and from which all freight has to be hauled by auto truck and horse teams. Early-day supplies were hauled by ox wagon from Sacramento, Calif. Belmont at one time was the county seat of Nye County and still retains the fine brick courthouse as a tangible sign of her former grandeur. Ten thousand people lived and worked in the district then; now her population numbers about 80, but she has hopes.

Pneumatic Concentrator and Amalgamator

BY FRANK A. STANLEY*

The accompanying illustrations show a pneumatic concentrator and amalgamator consisting of a helical conduit in which a circular air current is produced by an exhaust fan at the conduit terminal, the speed of the air current being varied as desired to suit the fineness of the gold to be amalgamated.

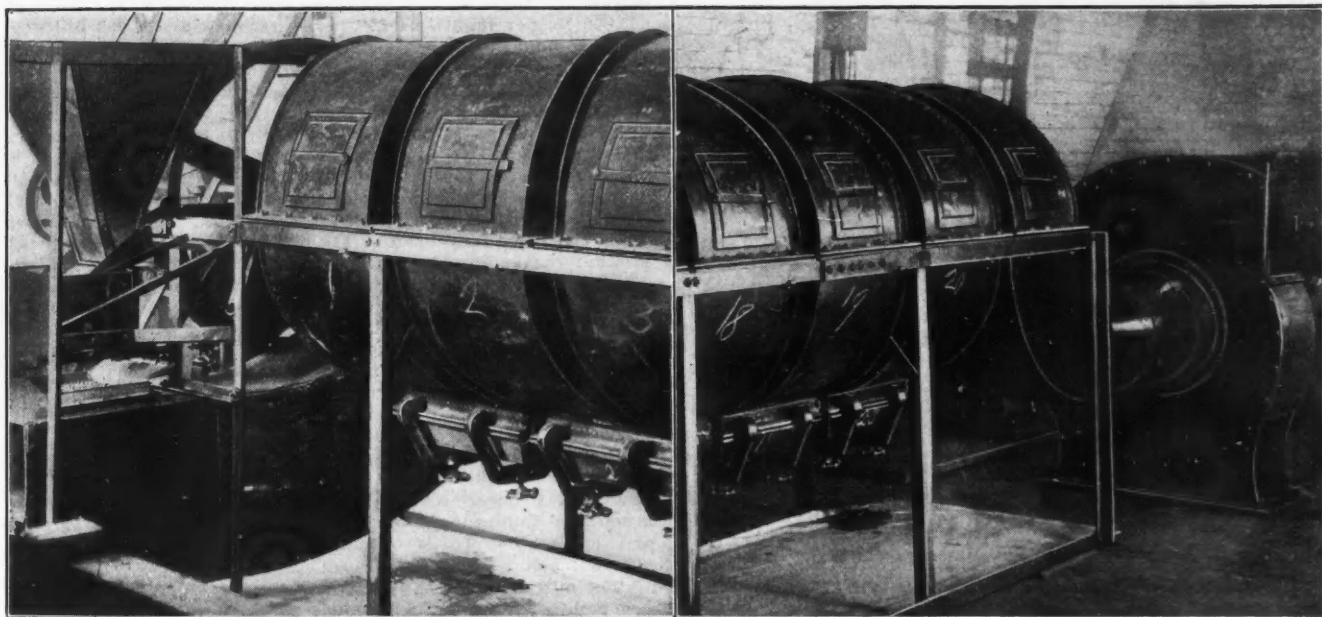
The material, which is finely pulverized in order to entirely free the gold, is fed at the intake in predetermined quantity, at a rate so that the air current will carry it in suspension in the form of a cloud throughout the whole length of the conduit. Mercury-charged eddying chambers are attached outside the path of the circular air current along the bottom of the conduit opposite each complete circle; and a set of revolving agitators are operated in each of these chambers to assist amalgamation.

The centrifugal force imparted to the finely pulverized material by the circular air current causes the heaviest material to crowd closest to the outer wall of the conduit and to leave its helical path on reaching the openings

ings and a total length of air passage of 210 ft. The cross-section of the conduit is rectangular in form, and the sections are constructed of sheet metal with flange and bolt connections along the horizontal center line. This enables a conduit of any desired length to be built up or readily taken apart.

The intake is in reality a horizontal extension of the first section of the conduit, and here the air is taken in to be drawn through the entire conduit with a speed dependent upon the nature of the material. The ground ore is introduced through a branch pipe over the mouth of which is placed a sieve, while directly above this sieve there is a hopper with a loose bottom, which is regulated to control the quantity to be fed. By means of the sieve the material is agitated and delivered into the conduit in a finely divided condition. Motion is imparted to the hopper bottom in the sieve by means of a camshaft, which agitates the sieve, which in turn actuates the hopper bottom.

The amalgam chambers extend across the entire width of the conduit, and perpendicular to each chamber there is a series of agitators calculated to facilitate amalgamation. These agitators are driven by spur-and-bevel gearing by a central shaft, an arrangement that



OPPOSITE ENDS OF THE PNEUMATIC CONCENTRATOR, FEED END AT THE LEFT, DISCHARGE AT THE RIGHT

to the eddying chambers—the heaviest gold first and the finer gold later on as it acquires accelerated centrifugal force and the full speed of the circular air current.

The design of the apparatus will be understood by reference to the illustrations, the first showing the feeding and the last the discharging arrangements. The exhaust fan is connected with the discharge end, which produces the circular air current for carrying the material through the apparatus. These views show the series of mercury-charged vessels along the bottom of the amalgamator in which the gold is amalgamated.

The line drawing shows important features of construction. To the lower part of lower sections are attached the amalgam chambers. Each section is so formed that two of them complete one turn, or winding. In the machine illustrated there are 20 wind-

ings simultaneously drives all the agitators in all the chambers. Each of the agitators is provided with projecting fingers which extend to the top of the amalgam chamber. The vessels may be removed, emptied and recharged with mercury.

It will be seen that there are few moving parts to break down or wear out. Instead of centrifugal force being imparted to the material, this force is created by the air current produced by suction of the exhaust fan; so that the material, instead of traveling where it is pushed, is in reality drawn through by suction and follows the current. The particles of material are therefore free to change their relative position in the current under the influence of centrifugal action.

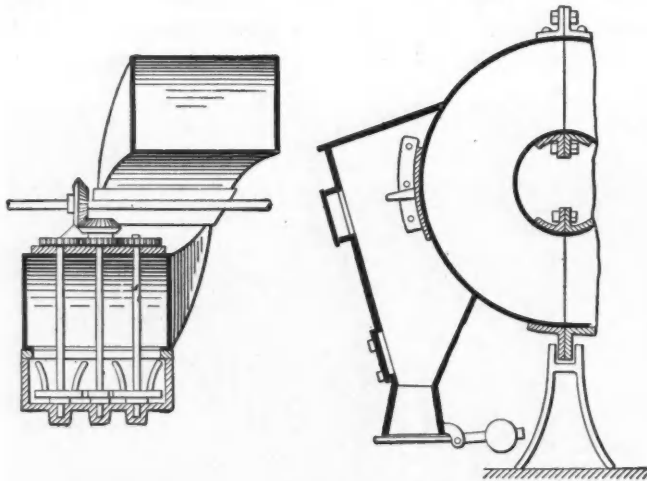
With this air current produced by suction, the barometric pressure is different at every point and increases gradually from center to circumference and is at all

*21 Mill St., Reno, Nev.

points lower than the external atmospheric pressure. These conditions greatly facilitate the separation of the gold by centrifugal force.

The material must be pulverized to a state of fineness so that the coarsest particle of gangue will not be heavier than the finest particle of gold to be separated. The pulverizing should be done by impact crushing, so that the gold, being malleable, will flatten, while the gangue will pulverize. A particle of gold and a particle of gangue each passing 150-mesh would be easily separated because the gold will be about eight times heavier than the gangue. In the same proportion any particle of gold up to eight times smaller than 150-mesh—that is, up to 1200 to the inch—will be collected in the eddying chambers and amalgamated. The agitators in the eddying chambers are intended to agitate the concentrates in order to bring the gold into intimate contact with the mercury which is below the concentrates and entirely away from the path of the circular air current.

Gold recovery is practically uniform when once the machine is regulated for the particular material. If



SECTIONS OF THE PNEUMATIC CONCENTRATOR

the gold is coarse, a 15-ton amalgamator may be speeded up to 20 tons per day, and if the gold is fine, the speed may have to be reduced to 12 tons per day. If there is any gold left in the tailings, the speed of the machine should be reduced until the exact point is reached when all the gold is recovered.

Actual results obtained with this machine show that from 95% to practically 100% of the gold can be recovered. The following test data are characteristic of numerous runs:

	First Run	Second Run
	%	%
First five amalgam pans.....	98.400	89.900
Second five amalgam pans.....	.940	6.480
Third five amalgam pans.....	.005	2.210
Fourth five amalgam pans.....	.004	1.200
	99.349	99.790

A pneumatic concentrator may be constructed on practically the same principle as the machine already described.

The concentrates are collected in side-compartments provided, from which they are discharged automatically through the channel by way of the counterbalanced gates, which in consequence of the suction are held closed until the weight of the accumulated concentrates overcomes the suction, when the gates open to discharge the material and then automatically close. By means of side

openings counter-currents may be effected, and in this way the discharge of the concentrate can be regulated.

The machines illustrated and described are the development of C. T. Heisel, 4 St. Clair Ave., Cleveland, Ohio, and are in practical operation in Reno, Nev., where several runs have been made on ores from Rye Patch, Nev., Breckenridge, Colo., Bodie and Big Pine, Calif.

The Duty on Tungsten

A plea for the retention by the Senate of the 10% duty provided for tungsten ore by the House revenue bill was made before the Committee on Finance by A. P. Ardourel, representing the producers of tungsten ore in Boulder County, Colo. In addition to his testimony, Mr. Ardourel summed up the tungsten situation in the following concise statement:

The average cost of production in Colorado is \$16.50 per unit. A unit is 20 lb. of tungstic acid.

Reasons for this high cost: 1. The large amount of development work necessary to keep up production. 2. Because the ore comes in lenses and not in ore shoots.

The cost of the ore laid down in New York from Bolivia is \$8 per unit. The reason for this low cost is that the tungsten veins in Bolivia occur in continuous ore shoots, and the large amount of development work is not necessary to keep up production. There should be a tariff of \$10 per unit placed on the ore coming from Bolivia, which ships about 600,000 lb. per month of 60% product, making 18,000 units of tungstic acid per month. At \$10 per unit, this would produce \$180,000 per month or \$2,160,000 per year revenue.

Other reasons why a tariff should be levied: First. Our mines should be developed, because this Government should know that we have sufficient tungsten to make the necessary high-grade steel to turn out our munitions of war, and it is impossible to do that without tungsten tool steel. There will be very little development done because our miners know of the cheap product coming in from Bolivia. He never knows when the price may drop to \$10 per unit. Second. This cheap product comes direct to the large manufacturing establishments, which are reaping enormous profits from this war.

The price received for tungsten tool steel is \$2.50 per lb., while the tungsten it contains is but 18%. Eighty per cent. of the tungsten ore produced in Colorado is produced by small leasers, and they are entitled to protection. Most of the mines, it is true, are owned by these same steel concerns which buy the cheap product from Bolivia, and thus bring pressure to bear upon our miners, constantly reminding him of the fact that the companies can get all the tungsten ore they need from Bolivia at a much lower price than they are now paying here. And it is a fact that they are paying the miners of Colorado on an average of \$17 per unit for 60% product, which proves conclusively that a tariff of \$10 per unit will not work a hardship on anyone.

The output in the United States averages about 19,000 units per month. This could be easily doubled if the miner could feel assured of a price near \$20 per unit. Of course, it is well known that this high-grade tool steel is not used by the common people of the country, but is consumed by the large establishments.

The horizontal increase of 10% in tariff duties applies to all imports of ores or metals with the exception of the ores of platinum metals, platinum itself, or as it may be fabricated into plates, sheets, wire, sponge, vases and apparatus for chemical uses.

The Bureau of Standards, Department of Commerce, Washington, D. C., is undertaking to compile the present state of knowledge and practice concerning the numerical values used by engineers and others for the properties of metals and alloys, with a view to making generally available the most acceptable values of these constants and also as a basis for further experimental investigation. Information is sought in the cases of all metals of the numerical values considered representative of and fair to the material for technical practice, rather than special values; as for instance the highest tensile strength, etc., that may be obtained. The bureau would appreciate all cooperation in assembling these data, which will be of great service in framing and interpreting specifications involving the use of metals.

The Mining Industry of Peru

By F. C. FUCHS*

SYNOPSIS—A detailed account of the production of minerals in Peru, together with a description of present activities and opportunities for expansion. Progress has been hindered in former times by wars and governmental changes and latterly through lack of European capital. Transportation from the cordilleras is a problem to be solved before extensive development is possible.

Nothing can give a better idea of the development of an industry than the statistical data referring to it. The mining industry in Peru, which acquired a large impulse during the reign of the Incas and enabled them to accumulate immense fortunes, did not decline during the period of the Spanish colonization but after independence. Civil war on the one hand and the easy way of making money from the guano and nitrate deposits on the other resulted in our not paying attention to the mining industry, which needed greater efforts and more capital to produce satisfactory results.

After the disastrous war with Chile the Peruvian mining industry was reestablished, but only during the last 15 years has the progress reached more than an indication of its possibilities. One of the factors that have contributed largely to this increase is the liberal

provinces of Sandia and Carabaya of the department of Puno and Quispicanchis and Paucartambo of Cuzco. The gold is found in veins and placers.

The Santo Domingo mine, owned by an American company, has exported metal to the value of \$8,000,000 and is far from being exhausted. Nearly all the rivers of this zone carry gold into the Inambari River, the great artery of that region, from which the Indians recover about 152 kg. per year, valued at \$100,770. Every year during the dry season they descend to the virgin forest (*montaña*) to gather coca leaves, and on the banks of the rivers they build a floor. In the next dry season they pick up the stones and wash the material that has settled in the crevices in a sluice covered with a sheepskin, finishing the washing in pans (*bateas*).

In the province of Cotabambas, department of Apurimac, there exists a very rich mine called "Cochasayhuas," belonging to the Cotabambas Auraria Co. This mine produces at present about \$20,000 worth of gold per month. In the coastal zone of southern Peru the Andaray and Posco mines are to be found. These belong to a Chilean company which has not been able as yet to produce an output. In the vicinity of Cerro de Pasco, in the ravine of La Quinua, the mines of the New Chuquitambo Gold Mines, Ltd., are situated, and their production at present is about \$3000 oz. per annum.

STATISTICS ON PERUVIAN METALS PRODUCTION, 1904 TO 1915

Year	Value of Product	No. of Claims Registered	Workmen Employed	Gold, Oz.	Silver, Oz.	Copper, Tons	Lead, Tons	Anti-mony, Tons	Bismuth, Tons	Vanadium, Tons	Tungsten, Tons	Mercury, Oz.	Salt, Tons	Borate, Tons	Coal, Tons	Petroleum, Tons
1904	\$6,693,796	8,236	.....	19,244.02	4,642,900	9,504	2,209	.....	.....	.....	.....	.....	18,545	2,675	59,920	38,683
1905	9,142,555	8,840	12,681	24,879.54	6,115,820	12,213	1,476	.....	.....	.....	.....	49,438	21,038	1,954	76,308	49,700
1906	12,725,560	9,782	13,961	39,928.94	7,364,600	13,474	2,569	92	.....	.....	.....	73,474	20,226	2,598	79,769	70,832
1907	15,595,870	29,582	16,936	24,911.56	6,660,160	20,681	5,525	114	9,600	351	.....	48,030	21,592	2,450	185,565	100,184
1908	12,091,205	33,484	16,849	31,283.54	6,371,980	19,854	2,633	12	8,580	1,800	.....	58,340	21,899	2,870	311,122	125,948
1909	13,692,595	22,853	.....	17,739.08	6,649,145	20,068	2,093	20	30,300	1,749	.....	11,207	22,715	2,715	321,502	188,128
1910	16,866,060	.....	.....	22,670.16	4,885,131	27,375	1,866	49	24,136	3,130	12.0	11,207	17,594	2,351	307,320	167,712
1911	18,498,075	21,656	.....	23,726.82	9,255,043	27,734	2,209	.....	24,431	2,251	48.5	17,931	24,857	1,923	324,000	195,276
1912	23,193,815	19,719	18,610	45,788.60	10,385,751	26,970	4,050	.....	51,038	3,048	195.0	12,808	23,292	1,674	278,927	233,600
1913	22,474,030	20,843	19,516	45,756.58	9,578,306	27,776	3,927	.....	25,300	.....	290.0	14,729	24,433	2,001	273,945	276,147
1914	20,834,990	.....	.....	52,508.00	9,171,200	.....	.....	.....	.....	.....	196.0	.....	25,933	.....	283,860	252,666
1915	27,046,140	.....	.....	56,952.00	9,434,600	.....	.....	.....	.....	.....	371.0	.....	25,729	.....	289,000	285,000

mining legislation. In this connection may be mentioned the mining code of 1900 and the construction of various railway lines with the assistance of foreign capital.

The question is frequently asked why no national capital is invested in this industry. The reason is to be found in the want of commercial education among the general public, who confuse the past with the present and who believe that mining is a game of hazard. Another hindrance to the development of the mining industry in Peru with national capital is the lack of means of easy communication, most of the mines being in the *cordillera* or in the *montaña*; that is, either in the mountain range of the Andes or the virgin forest on the eastern slope. Transportation is necessary across a mountainous country where the construction of railways would be very expensive and where considerable capital would be needed for the working of the mines. In my opinion the transportation problem may be solved by the installation of suitable cableways.

The mineral production of Peru, in the period from 1904 to 1915, is as shown in the accompanying table.

The auriferous zone lies in the southeast and is formed by the Silurian basin covering great portions of the

In the northern region bordering the Marañon River another rich zone of veins and placers is to be found. At Pataz the Buldibuyo mine is being worked with success although on a very small scale. This region produces about 1900 oz. per annum. Farther north a great number of the tributaries of the Marañon River, some of them descending from the Equatorial high plateau, also carry gold in the sand.

Silver ores are found all along the *cordillera* of the Andes, often associated with copper and lead.

The silver production for 1913 consisted of 258,529 oz. in bars, 3,003,476 oz. contained in copper bars, 81,747 oz. contained in lead bars, 3,696,388 oz. contained in copper mattes, 869,535 oz. contained in lixiviation sulphides, 1,624,886 oz. contained in concentrates exported, 21,645 oz. contained in lead slags and 21,997 oz. contained in copper cement.

Of the copper production for 1913, 20,334 metric tons, containing 2,985,920 oz. of silver and 24,896 oz. of gold was produced by the Cerro de Pasco Mining Co. The remainder of the production is distributed between the Backus & Johnston Co., which contributed 7555 tons of matte containing 3661 tons of copper and 1,840,224 oz. of silver, and several smaller smelting concerns.

*Professor, School of Mines, Lima, Peru.

The Cerro de Pasco Mining Co. produced, in 1915, about 27,000 tons of copper the value of which, with its silver and gold contents, is about \$10,894,500, based on copper at between 17 and 18c per lb., silver 50c. per oz., and gold \$20 per ounce. The net profits have been calculated at \$4,144,500. For 1916 it was expected that the output would reach 36,000 tons, valued at \$554 per ton, so that the net profit for that year would be \$10,944,000. The capital invested by this company in Peru is about \$20,000,000, and in two years it will be able to return 75% of this. I have made special mention of these facts because the company referred to is the largest American mining concern in Peru. The next in importance is the Backus & Johnston Co. with a production of 6000 tons per annum, containing 448 oz. of silver per ton, which would result in a profit of about \$3,000,000 for 1916.

Copper mines are very abundant in Peru, and along the mountain range (*cordillera*) various deposits of low-grade ore are known, as for instance that of "Ferrobamba." Rich veins occur at Huancavelica, Apurimac, Junín, Ancash and Cajamarca.

Of the 3927 tons of lead produced in 1913, 103 tons was exported in bars, 2705 tons in minerals and concentrates, 1108 in slags and 10 in copper mattes. Only lead minerals carrying enough silver are worked, and there are only two small smelting works for silver-bearing lead ores. Lead without silver or with only a small amount of that metal exists in quantity, but could be worked successfully only on a large scale.

ZINC AND ANTIMONY

No plant exists in Peru for the concentration and reduction of zinc ores. Zinc blende, generally in combination with copper and lead ores, is abundant. The Carahuacra mine, about 10 miles distant from the Central Railway line, has a vein width of about 300 ft. Flotation experiments have been carried out, and further developments may be expected.

Mining for antimony has taken place only when the price for the metal was exceptionally high. At present, and as a result of the high prices being paid for antimonial ores, a period of great activity is noticeable, especially in the deposits near the railway line to Cuzco. Nearly all the stibnite exported has been shipped to Japan.

Bismuth is exported as 20% concentrate. The San Gregorio mine of the Cerro de Pasco zone is the principal producer, but its production is limited and was controlled by the European bismuth trust, which is composed of the following refineries: Johnson Mathey & Co., London; The Royal foundries at Freiberg and Oberschlem in Saxony; and the Deutsche Gold und Silberscheide Anstalt at Frankfurt.

Peru produces approximately 80% of the world's vanadium and has the privilege of being the only country in the world where vanadium has been found as a main deposit.

This discovery was made by a Peruvian engineer, A. Rizo Patrón, and the mineral, sulphide of vanadium, is known as patronite.

The deposits at Minasragra, owned by the American Vanadium Co., oversupplied the market to such an extent that prices began to fall and exports were suspended from the end of 1912 until 1915. Numerous veins of asphaltite are to be found in the department of Junin, which are

analogous to the grahamite, gilsonite and albertite found in the United States. Nearly all these contain vanadium in a proportion up to 30% of vanadic acid in their ashes.

Molybdenite has been found in the regions of Ricran and Runatullo in the provinces of Jauja and Huancayo, and also in the district of Cascas in the province of Contumazá. Nothing was done, however, until 1915, when on account of high prices paid for this mineral, its exportation was begun and four tons with 83% of molybdenite was shipped, which sold for £700 a ton.

The principal difficulty encountered was the concentration of the mineral, but flotation experiments with a Minerals Separation machine at the School of Mines have demonstrated that it is possible to obtain concentrates with from 80% to 90% of molybdenite from ore containing from 1½ to 2%. Molybdenum, like vanadium, is common in Peru. A few months ago the River Moche having washed away the road leading from the railway station of Menocucho to the hydro-electric plant at Poroto that furnishes light to the city of Trujillo, a few blasts with dynamite were made to establish the roadbed in firm granitic rock, and it was found that this contained from 1 to 2% molybdenite. Another deposit of this mineral has been found on the Santa Clara estate, near Lima.

TUNGSTEN AND MERCURY

Tungsten, associated with gold, was discovered in a mine in Lircay, Ayacucho; and later in the mountain range (*cordillera*) of Pelagatos in the province of Santiago de Chuco, where four companies are now in operation. The mineral found in Lircay is wolframite (tungstate of iron and manganese), and the one found in the North is principally hubnerite (tungstate of manganese). The Peruvian production has increased with the value of the metal.

Recently Colonel Dogny, of the French army, came to Peru for the purpose of obtaining tungsten ores for the factories of Creusot belonging to Schneider & Co. In December, 1914, a discovery of wolframite was made at Puno.

In the beach sands at Pacasmayo the existence of monazite has been verified.

During the colonial period, when the only system for the treatment of silver and gold ores was by amalgamation, the famous deposits of Huancavelica produced large quantities of mercury. In the workings of the principal mine, Santa Bárbara, an excavation of such a size was made that during the celebration of some festivity a bull fight took place in it.

The production of mercury, for local consumption only, has been as shown in the table.

There exist two important deposits of nickel and cobalt, one in the province of La Convención, department of Cuzco, and the other in the district of Rapi, province of La Mar, department of Ayacucho. These deposits have not been properly worked on account of their minerals being arsenical and antimonial, entailing difficult metallurgical treatment, and on account of being distant from the coast without easy means of conveyance. The Rapi ore contains silver and is to a certain extent analogous with that of Cobalt in Ontario (Canada). Recently there has been discovered in the region of Cerro de Pasco a mine that contains sulphides of copper, nickel, cobalt and bismuth without arsenic or antimony.

There is an abundance of iron mineral appropriate for reduction. In the northern region, in Piura, the

deposits of Tambo Grande contain hematites with 51% of metallic iron. These are 59 miles from the coast, and 22 miles from a railway. In the southern region large deposits of hematites and magnetites have been discovered connected with the basaltic eruptions numerous along this coast. In the region of Nazca, 24 miles from the beach, the existence of several million tons has been verified. The ore is very pure and contains from 60% to 70% of metallic iron.

Investigations have shown the existence of manganese, as braunite or alabandite, but the deposits were situated at so great a distance from the coast that their working was economically impossible.

The wealth in tin of Bolivia is well known and that country holds the second place in the world for the production of this metal. It was to be expected that tin would also exist in Peru, as the granitic chain where it is found in Bolivia continues into Peru. On this assumption the Cuerpo de Ingenieros de Minas, an institution similar to the Geological Survey of the United States, organized an exploring expedition which, after studying the Bolivian deposits, returned to Peru for the purpose of investigating the provinces of Huanacán and Chucuito, where Raymondi had verified the presence of tin in combination with lead, antimony and zinc, but not in the form of cassiterite. The result of the exploration was a negative one, and oxides of tin were not found.

In my opinion it was an error to suppose that the tin-bearing chain would enter Peruvian territory in the neighborhood of Titicaca Lake. My geological studies in the Carabaya region incline me to believe that the tin-bearing formation enters Peru at the region of Sandía, hidden by the Silurian slates which I have mentioned.

ALKALINE SALTS

Chloride of sodium is a government monopoly worked through the Compañía Salinera Nacional. The deposits are very abundant along the coast and in the interior. Deposits of pure rock salt also exist; for instance, those of San Blas and Patacocha in Junin, where the depth of the salt stratum has not been determined, it being known only that the thickness is more than 160 ft. The production of salt since 1904 is shown in the table.

In the year 1913 great enthusiasm was caused in Peru by the news that important deposits of nitrate, similar to those of Tarapacá, had been discovered in the region of Caraveli. The government sent a commission to study these deposits and it was found that although the samples were rich in nitrate of sodium, only thin layers of secondary origin existed, which are not suitable for industrial working.

Nitrate of potassium is found in abundance on the northern coast of Peru between Pacasmayo and Huarney, near the beach. For many years these deposits were used for making black powder employed in native festivities. The deposits are shallow, up to 10 in. in thickness, and are formed by the action of nitrifying bacteria. The nitrate is reproduced very rapidly.

The most important borate deposit in Peru is at Salinas, in the department of Arequipa, near the Ubinas volcano. Borate is also found in Azángaro, department of Puno, and in the region of Ticaco in the Peruvian province of Tacna Libre. All these deposits are almost monopolized by the Borax Consolidated Trust, which intends to extend the work as soon as a railroad or cable-

way is constructed which will make the cost of transport cheaper.

Statistical data are difficult to obtain and records do not exist. Limestone is very abundant even in the hills surrounding Lima. Clay is found everywhere, from which *adobes* and bricks are made. Marble of good quality and fine appearance exists in the neighborhood of Lurin. Cement is not manufactured in Peru, notwithstanding the consumption in 1913 reached 1,447,747 bbl. with a value of \$390,815. For the purpose of facilitating the establishment of the industry in this country the government granted a special privilege for 10 years to a Peruvian engineer. He interested some capitalists in London, who sent a Swiss specialist to the country. This expert made his analysis in the laboratory of the School of Mines and reported favorably on the quality of the raw material locally obtainable and suitable for the manufacture of cement. The concessionary is now making efforts to obtain the assistance of national capital, as the European War has prevented the infusion of English capital into the enterprise.

THE CHEMICAL INDUSTRY

Peru has a number of raw materials suitable for chemical industrial enterprise. Sulphuric acid is not produced in this country, although sulphur exists as well as pyrites and blende. A deposit of halotrichite (alum of iron), a salt which by simple calcination loses sulphuric acid, leaving a residuum of peroxide of iron of a red color and salable as paint, is found in the region of Pallasea.

It would be quite easy to make nitric acid with sodium nitrate from Tarapacá. The nitrate of potash should not be used, on account of being more valuable. These two acids will necessarily have to be made in this country as they form the basis for the production of modern explosives for industrial as well as for war purposes. The production of natron in Pisco would introduce a certain quantity of carbonate of sodium into the market, as well as caustic soda.

The extraordinary increase in price of the bleaching hypochlorites has given rise to the installation of an establishment for the electrolysis of chloride of sodium, producing caustic soda and hypochlorite.

FUEL DEPOSITS OF THE COUNTRY

The largest part of the 1913 coal production, 237,170 tons, came from the Goyllarisquizga and Quishuarcancha mines of the Cerro de Pasco Mining Co. and was used in the smelting plant at Tinyahuarco. In 1913 there was imported 150,660 tons of foreign coal with a total value of \$1,506,600.

In an article published in the magazine *Peru Today*, August, 1911, I demonstrated the absurdity of coal imports into Peru and published a list of the known deposits containing many thousand million tons of coal. These deposits, bituminous as well as anthracite, stretch along a nearly continuous zone from Hualgayoc to the vicinity of Huancavelica. Nearly all the Jurassic or Cretaceous deposits are situated at distances from the coast varying from 40 to 244 km. (24 to 146 miles). The only deposit belonging to the Carboniferous formation and situated in a peninsula on the shores of the ocean, is the one of Paracas, which in my opinion, is of great importance, as it extends beneath the sea. The bituminous coal, located at 370 ft. by boring, was of excellent

quality. The exploration of this region is worthy of consideration. Imported coal is sold in Peru at present at a price of \$16 per ton and over. A company working the national coal could make considerable profit, as it could place its product in the markets of the whole of the coast of meridional America. The only coal now exported from South America proceeds from Chile and is of inferior quality. A company established here could not only count on the 200,000 tons of coal imported for internal consumption, but upon a large market with all the steamers trading in the South-Pacific.

The table showing petroleum is very suggestive, because it not only reveals the increase that has taken place within the 10 years, but it shows also what great development could be obtained by working the petroleum industry in this country. Results are obtained from only a small fraction of the petroliferous fields which extend from north to south, from Tumbes to the limits of the department of Lambayoque, comprising nearly three geographical degrees; and from East to West from the seashore to the *cordillera* of the Andes. The production of Peruvian petroleum was uncertain when only superficial wells were being bored, but with deep wells the conditions of working have completely changed. The mineral oil obtained is of exceptional quality. It is very rich in light oils (25% to 50%) and produces a lubricating oil free from paraffin and uncongealable even at very low temperatures. This gives it a very high value comparable only in that respect with the one produced in Franklin County, Pennsylvania, for which prices as high as \$2.50 per bbl. are paid at the mouth of the wells.

In Talara a modern refinery is being established with an output of 5000 bbl. per day. Here pressure stills will be employed. It has been demonstrated that with this new method the Peruvian petroleum can produce as much as 75% of benzine. In Talara there is at present an old refinery with a capacity of 1500 bbl. a day.

In many regions of Peru, especially in the department of Junin, not far from Cerro de Pasco, bituminous rocks are found which are used in their natural state as fuel. A short time ago these rocks were treated by a distilling process, which gave a shale-oil very rich in ichthyol. Regular export of this shale has been established.

The asphaltites, already mentioned, occupy an extension in the central region of Peru, where they are used as fuel. In some of the zones asphaltum of great purity is found, which is comparable with the refined product from Trinidad and Bermuda.

Some years ago I advised the municipality of Lima to employ it for the pavements in the city, and it has since been utilized in paving the roads surrounding the principal square (*plaza*) with excellent results.

MINING TAXES

During 25 years there has existed no other tax on mining properties but the payment of £3 per annum for each *pertenencia*, the *pertenencia* for vein deposits being 2 hectares (5 acres), and for fuels and auriferous placers and analogous deposits, 4 hectares (10 acres). Recently the following revenue law has been established:

Art. 1. Mineral products and those derived from their treatment shall be subject to the payment of duties in the form and proportion determined by this law.

Art. 2. (a) Metallic gold in any form shall pay a coinage fee of £3 per kilo of fine gold and, if exported, £10 per kilo. (b) Gold contained in bars of other metallurgical products shall pay an export tax of £2 per kilo of fine gold.

Art. 3. Metallic silver in whatever form shall pay for each kilo of fine silver exported a tax of one shilling, starting with the quotation of 23½d. per standard ounce (troy), 925-thousandths fine, increasing 2½d. per kilo for each one penny rise in the price of silver.

Sulphide of silver from the lixiviation process shall pay an export tax of 3d. per kilo of gross weight, starting from 23½d. per standard ounce (troy), increasing one penny per kilo for each penny increase in the price of silver.

Art. 4. Metallic copper, pure or impure and in any form, shall pay an export duty from the moment that the quotation of standard copper in London is £60 per ton, as follows: On the quotation of £60 to £65 a tax of 15s. per ton of 1016 kilos, gross weight, exported; and the duty shall increase by 2s. per ton for each one pound sterling increase in the quotation.

If the bars contain gold and silver, on the former there shall be paid the duty indicated in Clause (b) of Art. 2, provided that the assay is 10 grams or more per ton; and on the silver, in conformity with the following scale: Pence per standard ounce (troy), from 23½ to 24½, 6d.; from 24½ to 25½, 1s.; from 25½ or more, 2s. per kilo of fine silver contained when the assay is in excess of 2 kilos per ton.

Smelting products whose copper contents may be in excess of 80% and less than 90% shall pay as export tax on the fine copper contents based on the duty established for copper bars.

Cement copper and smelting products whose contents in copper may be in excess of 60% and less than 80% shall pay as export tax 50% of the duty established in this article for copper bars on each metric ton of gross weight.

Smelting products containing less than 90% copper but over 80% copper shall not be considered bars but shall pay the duty established for copper bars on the fine copper contents.

Mattes or "ejes," the contents of which in copper do not exceed 60%, shall pay per metric ton gross weight, 40% of the duty established in this article for copper bars.

The gold and the silver contained in the smelting products, the contents in copper of which may be in excess of 80% and not less than 90% in cement and mattes, shall pay an export duty as follows: Gold, the duties fixed in clause b, Art. 2 of this law; and silver, in conformance with the scale established in par. 3 of this article (Art. 4) pertaining to metallic copper.

Art. 5. Argentiferous lead bars shall pay only on the silver contents, conforming to the scale established in par. 1 of Art. 3; that is to say, a shilling for each kilo of fine silver, starting from the quotation of 23½d. per standard ounce (troy), 925-thousandths fine; and on this basis, 2½d. more for each penny rise in the value of the silver. This tax shall apply only to the lead bars containing more than two kilos of silver per ton.

Art. 6. All other minerals, metalliferous or otherwise, shall pay an export duty of 2½d. per 100 kilos, gross weight; and mechanical or chemical concentrates of any class, metalliferous or not, shall pay 5d. per 100 kilos.

Coal, sulphur, ores of iron, manganese and zinc, are hereby exempted from the effects of this article, as well as their concentrates. The latter, if containing other metals subject to tax, shall pay the duty.

Ores of rare metals, such as tungsten, molybdenum and vanadium and their concentrates, shall pay £1 per ton, whatever may be their price in the market.

Borates exported from Salinas, Arequipa, shall pay an export tax of 2s. per ton.

Art. 7. Crude petroleum and the residues and products of its distillation, shall pay an export tax of 1s. per metric ton, gross weight.

Art. 8. Mineral producers and exporters are obliged to declare the nature and grades of their products, and the government, either in the custom house or in the places of production or treatment, shall have the right to take samples and make assays that it may think convenient.

False declaration shall be penalized by a fine equivalent to four times the value of the duties fixed in this law; it being understood that there is falsity of declaration when the discrepancy between the grades shown by the assay made by the government and that declared by the exporter exceeds 50% of the copper contents in mattes and 15% for the gold and silver in same, and 10% for the silver contained in lead bars. In case of false declaration the government shall have the right to take for itself the lot to be exported, paying to the owner the value according to the assays declared by the interested party.

Art. 9. The exportation of amalgams of all classes is hereby expressly prohibited.

Art. 10. The duties shall be paid in drafts on New York, at 90 days' sight or, at the option of the shipper, in the equivalent in drafts on London. The drafts in which the payment of the tax is made, shall be to the satisfaction of the "junta de vigilancia," which shall receive them direct from the custom house, placing them at the disposition, for the present, of the Treasury; the "junta" shall sell the drafts in case the govern-

ment needs their value in currency. The "junta de vigilancia" shall be able to receive the duties in gold coin (£) instead of drafts on London or New York, when the amounts do not reach £40.

The Chamber of Commerce of Lima shall fix, weekly, the value of the ton of standard copper and that of the ounce (troy) of silver, from the quotations of the London Metal Exchange. This quotation shall rule for the following week.

Art. 11. This law shall be in force until the definite law on mining tribute is issued.

The statistical data compiled in this report have been obtained from official sources; the remainder, for the most part, are the result of professional experience during 23 years, both as resident and as consulting engineer for several mining companies and professor in the School of Mines; as member of the city council and recently as member of the Special Commission for Mines. In addition I published a series of articles during 1909 to 1914, in the magazine *Peru Today*, in which I dealt with the physiography, geology of the country, and the labor, laws, and other matters affecting the mining industry.

The Potash Situation in United States

The potash situation in the United States is reviewed by Hoyt S. Gale, in a recent bulletin¹ on "Our Mineral Supplies" from which the following notes are excerpted.

The greater part of the potash consumed in this country is used as fertilizer. For certain crops a special application of it has come to be regarded as almost essential, as is illustrated by the present demand, even at abnormally high prices, for potash for agricultural use. Much of the present small output in this country is being used in fertilizers, and the need of potash for particular crops is indicated by the fact that the scarcity and demand in the United States have not prevented considerable shipments of our own product to Cuba for agricultural use, presumably for tobacco.

The need of potash in certain industries is acute. It is essential in the manufacture of the best liquid soap and some higher-grade cake soaps and of some finer grades of glass. It is absolutely necessary in the manufacture of certain explosives, although the great bulk of modern explosives are made without potash. Potash now enters largely into the manufacture of matches. The several potash salts find many particular uses in industries so varied as tanning, dyeing, metallurgy, electroplating and photography. They are also used in medicine and for miscellaneous chemical purposes. On the whole, the chemical requirements, though minor as regards actual quantities consumed, are the most urgent of the demands for potash and in case of an abnormal restriction of the supply are the first to be provided for.

The output of potash salts and potash products in the United States during 1916 has been reported to the amount of 35,739 short tons, having a mean potash content of about 27% K_2O , or total potash content of 9720 tons of K_2O . This is almost exactly 10 times the production reported for 1915, although it is still perhaps less than 5% of the normal potash consumption. In 1913 the only potash known to have been produced within this country was made from wood ashes.

The largest output of potash in 1916 came from the alkali lakes in western Nebraska, which have afforded the most readily available supply of moderately high grade potash salts, obtained by direct drying of the raw material with perhaps as few technical complications as

could be involved in any chemical operation. The great deposit at Searles Lake, Calif., is only just being brought to the producing stage, the enterprise having suffered many reverses, technical and otherwise. The production of potash from alunite was fairly regular, without much expansion. Some progress was made in extracting potash from silicate rocks, at least one plant having successfully produced glassmaker's potassium carbonate from greensand. Some feldspar was mined, ground and so treated that a small percentage of its potash was rendered soluble and thus available for use in fertilizers, but no account of this material is included in the figures for 1916, as little of it was marketed within that year. So far as has been ascertained, none of the leucite, mica schist, sericite schist, or similar rocks high in potash have yet yielded any commercial quantity of water-soluble salts.

The production of potash from organic materials has been attempted in various forms. Much publicity has been given to the efforts to obtain potash from kelp, and a great deal of development work has been done in that connection. The manufacture of high-grade potash fertilizer salts from molasses distillery waste has also been developed and bids fair to be a permanent industry; in 1916 the output so obtained exceeded the production

SUMMARY OF POTASH PRODUCTION IN 1916*

	Available Potash (K_2O) Short Tons	Value at Point of Shipment
Natural salts or brines	3,994	\$1,937,600
Alunite and silicate rocks, including recoveries through furnace dust	1,850	715,000
Kelp	1,556	781,100
Wood ashes (potashes, pearlsh)	412	270,000
Distillery waste (molasses)	1,845	500,900
Miscellaneous organic sources	63	38,130
	9,720	\$4,242,730

* This list does not include many fertilizer materials previously on the market, such as cottonseed meal and tobacco stems, some of which are largely or chiefly valued for their potash content. These materials, being byproducts of other industries, are not produced primarily because of their content of potash.

from kelp. The manufacture of potash from wood ashes by the old-time methods continues with a small but significant contribution to the total tonnage.

The activity of private initiative in the search for sources of potash is increasing. Some very wide fields in the possibility of recovering potash as a byproduct—for example, from cement-mill and blast-furnace flue dusts—are now being opened. Although the prospects seem bright for some of these attempts, it cannot be said that knowledge has proceeded far enough to insure success on the extensive scale needed to make the country independent of foreign supplies. Perhaps, too, the real hope for a solution of the problem lies in the possibility of discovering, in association with some of the extensive and little-known domestic deposits of rock salt, a supply of potash that may compete with the foreign sources on equal terms. Valuable potash deposits exist in the Permian in central Germany, the Oligocene (Tertiary) in Alsace, the lower Miocene (Tertiary) in Galicia, the supposed Eocene or Oligocene (Tertiary) in northeastern Spain, and beds of undetermined geologic age in India—everywhere in conjunction with deposits of common salt, dolomite and gypsum—and it would be strange if occurrences of this sort were confined entirely to the salt deposits of Europe and Asia.

Revision of Atomic Weights—The report of the committee on atomic weights ("Journ. Am. Chem. Soc.," Vol. 38, p. 229) shows only one change in the accepted figures: Cb is now given at 93.1 instead of 93.5.

¹Bull. 666-N, U. S. Geol. Surv., Washington, D. C.

Occurrence and Utilization of Antimony Ores*

SYNOPSIS—An increased demand for antimony, and the decreased production of France, due to the War has made it profitable to open many of the mines which have heretofore been operated only when the prices were proportionately high. China has now assumed the lead in world's production. Production of other countries, and methods of treating. Properties, uses and alloys of antimony.

For many years before the war the available supplies of antimony ore far exceeded the demand and there was little to encourage the prospecting for, or development of, any deposits other than those from which high-grade ores could be obtained unless exceptional facilities existed for smelting and marketing the metal in the neighborhood of the mines. After the outbreak of the war there was a scarcity of the metal; certain of the French deposits were in territory occupied by the enemy, and of course no metal was exported from Central European countries. In these circumstances considerable activity sprang up and many deposits that had remained idle for long periods were again put in operation.

ANTIMONY MINERALS

The more important minerals of antimony are the following: *Stibnite* (Sb_2S_3), which contains, when pure, 71.4% antimony. Upon oxidization by exposure on the surface *kermesite* ($2Sb_2S_3 \cdot Sb_2O_3$) or red antimony is formed, further oxidization forming *valentinite* (Sb_2O_3) the oxide, and sometimes *cervantite* (Sb_2O_4) the yellow ocher is formed. *Valentinite* has the same composition as *senarmontite*, the difference being in the crystallization. *Jamesonite* ($2PbSSb_2S_3$) contains 29.5% Sb, 50.8% Pb and is found in Mexico in large deposits, which, owing to the conditions of the country are not being worked. Native antimony has been found associated with silver and other ores in Bohemia, Sweden, New Brunswick, the Harz mountains and Mexico.

Figures for the world's production of antimony since 1913 are not available. The production for 1911 and 1912 was as follows:

WORLD'S PRODUCTION OF ANTIMONY, 1911 AND 1912		
	Metric Tons 1911	Metric Tons 1912
Europe.....	37,994	24,641
Asia.....	13,894	15,657
Africa.....	7,428	4,661
America.....	5,997	4,710
Australasia.....	941	1,539
Total.....	66,254	51,208

In the table, the credit to Africa consists solely of exports from Algeria, while the amount credited to the United States was contained in hard lead and, exclusive of antimony recovered from old alloys, dross, etc., was 1403 tons, or approximately 23.5% of the product of all America.

The falling of in production during 1912 was principally in France (decrease 18,000 tons) and China (decrease 4000 tons).

Austria-Hungary at one time produced notable quantities of antimony, but during recent years prior to the

war, production was very irregular. At Pricov, near Selcan in Central Bohemia, the ore occurs as the antimony ocher cervantite and stibnite, in hornstone veins in kersantite dikes traversing granite, neither ore carrying any gold. Auriferous deposits that have been worked since the Fourteenth Century occurs at Mileschaw and Krasnahora, southwest of Prague in veins of lamprophyre and porphyry which traverse schists; stibnite is associated with iron and arsenic (mispickel) and carries 1 oz. an. per ton.

Another deposit yielding stibnite is that of Magurka, south of Tatra; veins occur in granite, while in the Rechnitz district the principal veins traverse crystalline schist, graphitic schists in contact with the veins carrying workable quantities of cinnabar. At Aran-yidke and Rosendu veins carry jamesonite associated with zinc blende and gold in a gangue of quartz.

Prior to the outbreak of the war France was one of the most important antimony producers. The chief deposits occur in the departments of Mayenne, Cantal and Haute Loire. In Mayenne, stibnite associated with pyrite and carrying about 1 oz. Au per ton is found in nearly vertical quartz veins between quartzites and Silurian schists. In the central plateau (Cantal, Haute Loire and Puy-de-Dome) the most important deposits are Brioude and Massiac. The veins occur in mica schists, gneiss and granite, and contain stibnite associated with quartz and pyrite.

The deposits of Freycenet occur in mica schists; seven veins in the district carry stibnite in needles in a bluish quartz in which there is some pyrite; three veins carry argentiferous antimonial lead ore and one yields argentiferous galena. The principal vein at Mercœur consists of massive stibnite with little quartz carrying traces of arsenic and silver.

GERMANY A SMALL PRODUCER

Only a small quantity of antimony is produced in Germany. Between Wintrop and Mentrop in Westphalia, stibnite penetrates beds of bituminous limestone interstratified with clay slates shales. In the Fichtelgebirge, antimony occurs in sericite schists, and is associated with auriferous mispickel, zinc blende and bournonite finely disseminated in a gangue of quartz.

In Italy, at Pereta, stibnite, together with sulphur, occurs in stringers and pockets in quartz dikes; near Montarrenti the mine Ceatine di Cotorniano contains stibnite and realgar (sulphide of arsenic) in a vein of blackish quartz. Antimony is often associated with cinnabar in Tuscany.

At one period Portugal was one of the foremost producers of antimony. The chief deposits occur in the Oporto and Braganza districts. The ore occurs in bedded masses in Silurian rocks. In 1912 Portugal's production was 100 metric tons.

Antimony ores have been mined in Serbia for many years, the principal deposits being found in the neighborhood of Kostainik. The country rocks are limestones, probably of Triassic age, overlain by slates; these are cut by biotite trachytes. Ores occur at tuffs and stringers in decomposed trachyte.

Russia, Spain, Sweden and the United Kingdom produce a small amount of antimony ore each.

*Abstract of an article by the same title, is the "Bulletin of the Imperial Institute," Vol. XIV, No. 3, 1916.

In Asia, Borneo, contains ore in many localities, but few shipments have recently been made, the export for 1915 amounting to but 350 tons.

China, now the largest producer of antimony, practically controls the market. All the southern provinces contain antimony ores, the most important and extensive deposits being in Hunan, Kwangsi, Kwangtung and Yunnan. In Hunan province the output exceeds that of the rest of China. The chief ore producing districts are Sinhwa, Ajiyang, Anhwa, Supu, Chenki and Pasa, the eastern boundary of the deposits being the Sieng River and the western boundary the Yuen River.

The ore, stibnite partly oxidized, occurs in seams and pockets distributed through a layer of limestone which varies up to 40 ft. in thickness. Picked ore contains about 65% Sb and often up to 0.75 oz. Au per ton.

The Panhsi mines are being worked for ore which occurs in shoots in fissure veins. The ore is sorted to about 30% Sb and shipped to Chaugsha for treatment.

In Russia in Asia, in the government of Yenissei antimony ore occurs in the placer deposits of the River Isikiyum in the Avginski district, as well as on the rivers in the Minusinsk district. In the Amur province, deposits occur along the hill crests, the veins attaining a thickness of 3.5 feet.

Small quantities of antimony have been produced from time to time from India, transportation difficulties hindering development of the few deposits known.

Once a producer of notable tonnages of antimony, Japan now confines activity to smelting Chinese ores.

In Africa, antimoniate of iron containing 40% Sb occurs in the deposits of Hamman N'Bails, situated on the right bank of the Seybouse River.

PRODUCTION IN AMERICA

Bolivia, producing not to exceed 312 tons annually during 1911 to 1914, produced 17,923 tons in 1915. The ores occur in fairly persistent veins and by hand sorting can be raised to 50% Sb. The most important deposit is at Palea, near La Paz.

One of the most important producing deposits in Canada is that of Westgore in Hants County, Nova Scotia, where the ores contain stibnite, kermesite valentinite and a small amount of galena with quartz and calcite gangue, and occur in veins in talcose slates. At Prince William, York County, New Brunswick is another important deposit of stibnite ore from which has been smelted in the neighborhood. Antimony has also been found in a number of other localities, but has not as yet been developed.

In Mexico, antimony has been found in many places, the most noteworthy deposits being at Catorce, S. L. P. Veins carrying oxides and sulphides occur along a contact of blue lime and porphyry. A smeltery at Wadley, about 100 miles from San Luis Potosi, reduced the ores, which were sent to England for refining. An important deposit of jamesonite occurs at La Sirena near Zimapan, consisting of a heavy sulphide ore with mispickel, pyrrhotite and zinc blende.

The only antimony produced for several years prior to 1915 in the United States, was in the form of a byproduct in smelting lead, copper, gold and silver ores. About 685 tons of 58% Sb ore was shipped from Fairbanks and about 130 tons from Nome, Alaska in 1915.

Hillgrove, N. S. W., Australia, a former antimony-producing district, has had its output overshadowed by

gold. Veins occur near the junction of slate and granite. Ores were mined from several shafts and tunnels in the district and smelted locally. In Victoria stibnite and valentinite occur in many districts in veins and in quartz traversing Ordovician and Silurian slates. During 1914 the Costerfield district produced 2283 tons of 48% Sb containing 2 oz. Au per ton.

CONCENTRATION OF ANTIMONY ORES

Stibnite is frequently submitted to a process known as "liquation," which is carried out as a rule near the mine. In this process the low melting point of the metal is taken advantage of. The usual method employed is to heat about 50 lb. of ore in a perforated clay pot in a furnace. As the sulphide of antimony melts, it drips into a second pot, from which it is ladled into molds. The process is very wasteful, the loss running as high as 30% of the antimony. The liquated material is marketed as "crude" or "needle" antimony and consists of antimony sulphide together with 1 to 4% iron sulphide and up to 3% arsenic sulphide.

Liquation has been carried on in reverberatory furnaces, and while cheaper than the pot method, losses are very high.

SMELTING OF ANTIMONY

There are several methods for the production of crude metallic antimony regulus from its ores. These involve the dry, or fusion, processes and the wet, or solution processes. The chief dry methods may be roughly divided into (1) smelting high-grade stibnite with iron as a desulphurizing agent (this is the so-called English process) and (2) sublimation processes for the treatment of mixed or low-grade ores, the oxides produced thereby being subsequently reduced to the metal by fusion with fluxes and carbon. Whichever process is used, the regulus produced has to be refined to give what is known as "Star" metal.

In the English process the ground high-grade or liquated sulphide ore is treated in two stages, termed singling and doubling.

In singling, the ore is heated with iron, salt and slag in crucibles, in a reverberatory furnace with condensing chamber. A typical charge is ore 42 lb., iron 16 lb., salt 4 lb., slag and from "doubling" 1 lb. The mixture is charged into the hot crucibles and kept molten for several hours, after which the regulus is poured into molds. The metal thus obtained contains about 91% antimony.

In doubling, the blocks of metal, termed singles, are broken up and mixed with 10% of liquated antimony sulphide, 5% salt, and fused as before for about 1½ hours. The slag is next ladled off and the metal run into molds. It is now termed "bowl metal" or "star bowls."

The loss of antimony during these processes of refining is from 2 to 5%.

THE SUBLIMATION PROCESS

Many sublimation processes are in use, most of them having for their object the production of the volatile trioxide (Sb_2O_3) from low-grade or mixed ores containing from 7 to 20% of antimony. The advantages claimed for the method are: Less fuel is required; losses due to volatilization and noncondensation are small; a good separation of the antimony from arsenic is af-

fect, owing to the greater volatility of arsenic trioxide; low-grade ores can be profitably smelted if the smelting is carried out near to the mine; and any gold or silver remains in the nonvolatile residues.

In the Chatillon process, which has been employed on a large scale in France, the furnace consists of two double cupolas terminating in a common flue from which the volatilized oxides are led to water-cooled condensing chambers made of sheet iron. The upper cupolas are charged with alternate layers of fuel and ore, and as the liquated sulphide melts and falls through to the lower cupola, it meets an upward current of hot air which converts it into the trioxide Sb_2O_3 . Before leaving the plant the gases are reduced to a temperature of $100^\circ C$. and passed through a baghouse. The sublimate obtained contains 98 to 99% antimony trioxide.

In the Herrenschildt process, which is used in France and China, the ore is broken into fragments varying from $\frac{1}{2}$ to $1\frac{1}{2}$ in. in size and roasted with about 4% coal or coke in a rectangular shaft furnace having a steep grate. The dust which is screened off is briquetted with clay before roasting. The volatile gases are drawn through a series of condensing chambers and finally upon a tower filled with coke over which water trickles.

The antimony oxide produced by sublimation methods can be reduced to the regulus by several processes.

At Seplèmes the reduction is carried out in reverberatory furnaces having deep and hollow beds that slope toward a central taphole. The charge consists of 500 lb. of a mixture of oxide ore, roasted ore and flue dust; 90 to 110 lb. of flux consisting of salt, soda and sodium sulphate; 60 to 75 lb. charcoal and 220 to 230 lb. old slag. The antimony volatilized during the operation amounts to about 14% of the quantity operated on, but some recovered as flue dust, which is resmelted.

REFINING OF ANTIMONY

The composition of specimens of regulus before refining is shown in the following table:

	English Process		Sublimation Process	
	Specimen 1, %	Specimen 2, %	Specimen 1, %	Specimen 2, %
Sb.....	94.50	84.00	97.20	95.00
Fe.....	3.00	10.00	2.50	4.00
S.....	2.00	5.00	0.20	0.75
As.....	0.25	1.00	0.10	0.25

The foregoing table shows that the crude metal contains a considerable proportion of impurities. All these as well as others that may occur, can be largely removed by fusing the metal with oxidizing and desulphurizing agents. Fusion with soda, potash or antimony oxisulphuride (antimony glass) removes sulphur and arsenic, while copper and iron may be partly removed by fusion with sodium sulphate (Glaubers salt).

Lead may be partly removed by roasting with chloride of sodium, potassium or magnesium, but this treatment may cause volatilization of antimony with the lead.

The operation of refining may be carried out either in crucibles or in reverberatory furnaces; the fuel in the former case is somewhat less, but loss by volatilization is less in reverberatories.

When the refining is done in crucibles, the crude metal is broken into small pieces, freed from slag and melted with about 2% of its weight of antimony flux, which is prepared by melting two parts stibnite with three parts "potashes." The refining is usually complete at the end of one hour, when the metal is run into molds for star metal.

When reverberatory furnaces are used, the bed of the furnace is heated to bright redness and charged with 1200 to 1400 lb. of impure metal. When the metal is thoroughly melted about 5% carbonate of soda is added with a little coke. The furnace is maintained at a good heat for from one to three hours, when the slag becomes thick and is removed from the fused metal. Next a mixture composed of 3% antimony sulphide and 1.5% antimony tetroxide is added and then 4.5% potassium carbonate, these proportions being calculated on the charge of metal. This treatment removes the iron and sulphur, and at the end of about 15 min. the refining is complete.

As the quality of pure antimony is largely judged by the fernlike crystallization (starring) shown on its surface, it is important that casting should be done in such a manner as to produce the best starring effect on the metal. For this reason the metal should not come in contact with the ladle or mold, and this is accomplished by giving both a coating of slag. The surface of the antimony is protected in the same way when in the mold. The slag that is obtained in the final fusion is termed star slag and consists chiefly of antimony glass which carries 20 to 60% of antimony and is used repeatedly in refining.

The loss during the refining process, due to volatilization, amounts to 20 to 30% of the impure metal, much of the volatile antimony going into the flue dust as trioxide and tetroxide.

PROPERTIES, USES AND ALLOYS OF ANTIMONY

Metallic antimony has a bluish white color, a laminated structure and melts at about $630^\circ C$. It is extremely brittle and can be powdered readily. The solid metal is little affected at ordinary temperature by exposure to the air, but in the molten state undergoes rapid oxidization. One of its most valuable properties is that when alloyed with other metals, it expands slightly when passing from the liquid to the solid state.

Metallic antimony alone has but few uses. By treating an acid solution of an antimony salt with zinc, metallic antimony is produced in the form of a black powder known as "iron black," which is used for producing an appearance of polished steel on articles made of papier mâche, plaster of paris, or zinc.

Antimony readily forms alloys with most heavy metals, its effect being to increase their hardness and expansion on solidifying. This latter property enables very sharp impressions to be obtained in casting. The most important alloys are known as antifricition or white metal, type metal, hard metal and britannia metal. Lead-antimony alloys are used in manufacturing acid-resisting valves, and when added to copper, deepen the color and make the product capable of taking a better polish than ordinary brass. Naples yellow is an antimoniate of lead containing an excess of lead oxide and is used in oil paints, glass and ceramic industries. Antimony white, chiefly the tetroxide, has been suggested as a substitute for white lead. Antimony pentasulphide has a fine orange-yellow color and is employed in rubber manufacture as a pigment and sulphur carrier. Antimony compounds are employed in dyeing, both as acid and basic mordants, the salt employed being tartar emetic—double tartrate of antimony and potassium—and antimony fluoride. In medicine, tartar emetic and antimony trioxide are used.

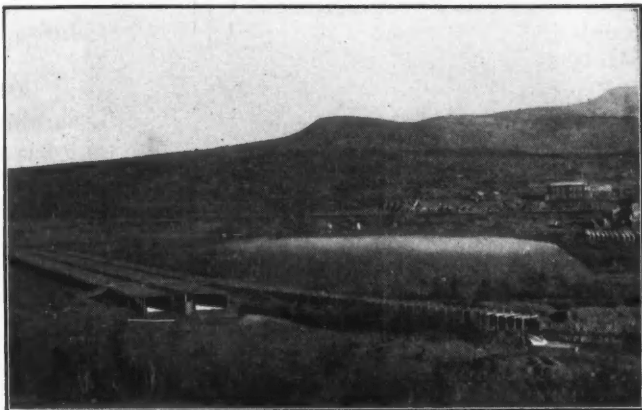
Siberian Mine-Timbering Methods

BY HENRY M. PAYNE*

SYNOPSIS—General method of recovering gold in Siberian mines has been to sink numerous shafts and working out one and proceeding to the next. Question of drainage is a troublesome one. Timbering and gobbing methods are antiquated and result in frequent cave-in and loss of ground.

The general method of recovering gold in Siberian rivers, where the paystreak lies too deep for opencutting, has been to sink shafts 700 to 800 ft. apart, quickly work out the area contiguous to each shaft, allowing it to fill in, continuing the work from the next shaft. If this were a single operation, always proceeding upstream, the question of drainage would be eliminated, but where a series of operations are found in a distance of a few miles, the problem of either unwatering the workings or diverting the water is a serious one.

The Andreevsky group, on the Bodaibo River, a tributary of the Vitim, in the Lena watershed, is typical. The rich paystreak varies from 105 to 175 ft. in width, and bedrock is found at 133 ft. below the surface. The



SURFACE FLUMES IN SIBERIAN GOLD FIELD

shafts are $4\frac{1}{2}$ x 8 arshines, or 10 ft. 4 in. x 18 ft. 5 in., and have three compartments. At this particular spot frost is rarely found deeper than 140 ft., although in other portions of the district, as in the Klondyke, drill holes to a depth of 250 ft. indicate indefinite and unbroken frost. It occasionally happens, therefore, that intermittent thawed areas are encountered, which add to the difficulties already existing. At the Andreevsky No. 84, although a relatively small operation, two pumps of 105 hp. each are required. The average amount of water pumped out of the mine is 174,350 gal. per 24 hours, which is pumped to the washing plant on the surface. Whenever the power is shut off, work has to be instantly abandoned and the motors taken out of the mine, as it will flood in three hours. An 80 hp. electric hoist is used, the cage weighing 3200 lbs. and the load 4000 lb. Time of hoisting is 30 seconds. At Andreevsky No. 7 less water is encountered, owing to frozen ground in advance. At both of these mines the rich paystreak is found in an irregular belt meandering from side to side of the valley.

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Fig. 1 shows a typical cross-section of the stream and Fig. 2 the ground plan. In order to carry the main stream away from the active operations, two or more parallel flumes are constructed from the main channel to a ditch alongside the workings and then into the abandoned operations below. These are shown in Fig. 3.

A series of test pits or drill holes having first been made to determine the line of maximum values, a shaft is then sunk, as indicated in Fig. 2, and a meandering entry driven each way therefrom, the lower entry usually breaking through at a short distance, into the preceding downstream operation, and thus affording drainage from above. At intervals of about 70 ft., cross-entries are

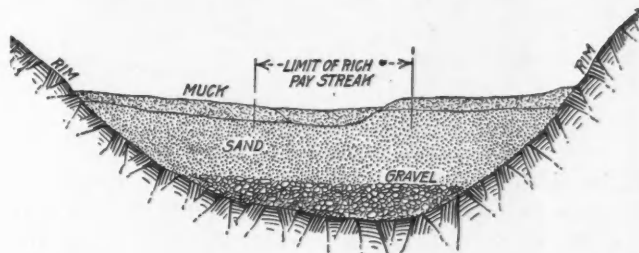


FIG. 1. TYPICAL CROSS-SECTION OF SIBERIAN GOLD-BEARING STREAM

turned and driven until the value of contents decreases to an amount equal to the cost of driving. In this manner the edges of the rich paystreak are defined and the direction of the main entry governed accordingly.

This main entry is driven first, from 14 to 21 ft. wide, and timbered, as shown in Fig. 4, by outside posts and caps called *stoiki* and *ognefti*, with secondary posts called *stolbi* inside these and in a double row in the center, surmounted by a row of caps extending lengthwise and called *podquati*. Track is first laid on the left-hand side, and a deep ditch is dug in the right-hand side. This ditch is extended down to the lower end of the operation as rapidly as possible, in order to hole through to the works below and save pumping. In this manner as many as six or seven separate mines may be drained through one another. Upon completion of this bedrock ditch, the track

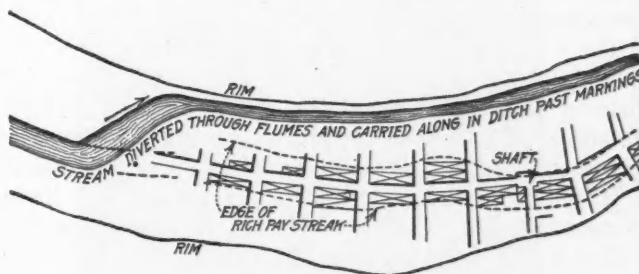


FIG. 2. GROUND PLAN OF MINE WORKINGS IN STREAM BED

is laid in the right-hand side of the entry. In the meantime the large pieces of rock from the ditch and the large boulders encountered in the development are gobbed in the center between the *stolbi*.

A peculiarity of Russian gob packing is the insertion, at frequent intervals, of large timbers laid horizontally, whose function is supposed to be the binding of the gob,

but which in reality crush under pressure and cause undue strain on the *stoiki* and *stolbi* remaining, with frequent cave-ins and consequent loss of considerable areas of high-grade gravel. As soon as one or two cross-entries have been turned, the ribs on either side of the main entry are slabbed, and as the slabbing advances, a row of single *stolbi* is set at the back and the entire area gobbled with boulders and timber laid horizontally, as indicated on the left in Fig. 3. In this manner an area from 38 to 50

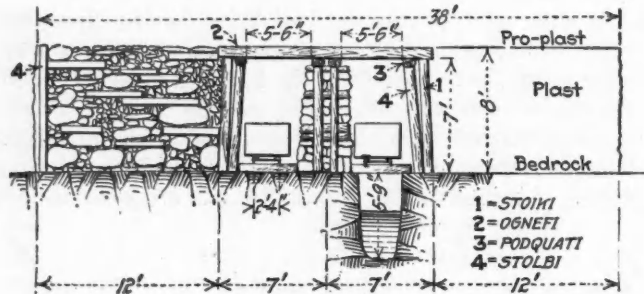


FIG. 3. SHOWING WATER DITCH AND TYPICAL SIBERIAN TIMBERING

ft. in width is excavated and packed. When the pressure becomes too great, the main ditch is tightly planked over and the mine is abandoned, to be operated by a similar entry driven parallel or from a new shaft.

A large part of the preparatory work for any season consists of the building of flumes in advance, on the surface, and the sinking of shafts. The gravel, when brought to the surface, is washed and the gold recovered in the usual manner.



Electric Smelting of Titaniferous Iron Ores*

Two miles west of the village of St. Charles, on the north shore of the Saguenay River, Province of Quebec, is a deposit of titaniferous magnetite estimated to contain from 1,000,000 to 5,000,000 tons of ore, sufficient in amount to operate an electric furnace for a number of years. Electric power may be obtained at two points on the river, one being approximately 9 miles west and the other approximately 12 miles east of the deposit. Charcoal and limestone, necessary for electric smelting, are conveniently located.

The ore contains approximately 50.53% Fe, 10.55 Ti, 0.02 S, 0.03 P and is susceptible to magnetic separation yielding a concentrate containing approximately 56.20% Fe and 8.3 Ti, by which it will be seen that either crude or concentrated, a titaniferous magnetite must be treated.

It is stated that 1.75 tons of concentrates treated in an electrometal furnace such as is used in Sweden, would, with the addition of 0.4 ton charcoal and 0.5 ton limestone (dolomite preferred) produce one ton pig iron containing 95.5% Fe, 3.5% C, 0.3% Si, 0.4% Ti, 0.01% and 0.04% P, with a slag containing approximately 34% Ti, 14% SiO₂, 7% Al₂O₃, 40% CaO MgO and 3% FeO and amounting to about 0.7 ton.

Electrical power required would be approximately 3000 kw.-hr. or, allowing for stoppages, etc., would approximate 0.55 hp.-year per ton of metal produced. To smelt

the original ore, assuming the slag not to contain more titanium than the preceding example, 0.4 ton of charcoal, 0.7 ton of limestone or dolomite would be required and about 3500 kw.-hr., or 0.54 hp.-year, per long ton of pig iron would be consumed. Two tons of ore would produce one ton pig iron containing approximately 96.5% Fe, 3.5% C, 0.3% Si, 0.4% Ti, 0.015% S and 0.08% P, and approximately one ton of slag.

COST OF MAKING PIG IRON

It is stated that any estimated costs must be decidedly uncertain. Assuming, however, a plant to consist of three furnaces of 4000 hp. each and an output of such a plant to be 80 tons per day, approximate costs would be:

COSTS OF MAKING PIG IRON

		Smelting Ore		Smelting Concentrates
Mining and royalties, 2 tons.....	\$2.50	2.30 tons	\$2.88	
Preparation of ore, crushing @ 20c.....		2.30 tons	.46	
Concentrating, @ 30c.....		2.30 tons	.69	
Sintering, @ 50c.....		1.75 tons	.88	
Freight, 2 tons @ 20c.....	.40	1.75 tons	.35	
<hr/>				
Smelting, 2 tons.....	\$2.90	1.75 tons	\$5.26	
Limestone @ \$1.00, 0.7 tons.....	.70	0.50 tons	.50	
Charcoal @ \$10.00, 0.4 tons.....	4.00	0.40 tons	4.00	
Power @ \$7.00, hp.-year 0.65.....	4.55	0.55 tons	3.85	
Electrodes @ 4c. lb., 20 lb.....	.80	18 lb.	.72	
Labor @ \$2.50.....	2.50		2.00	
Office expenses.....	1.00		.80	
Repairs.....	1.00		.80	
<hr/>				
Total cost per ton.....	\$17.45		\$17.93	

To this cost would have to be added depreciation, interest and general expenses on smelting and dressing plants.

Byproducts are also considered, such as acetate of lime and wood alcohol, derived from the charcoal-burning operations as well as the possible manufacture of ferrotitanium.

In conclusion the writer states that the total cost of pig iron would be about \$21 and would be marketable as an exceptionally high-grade iron.



Where Is Roosevelt?

Georges Clemenceau, formerly prime minister of France, in an open letter to President Wilson printed in his paper, *L'Homme Enchaîné*, appeals to the President to send over Theodore Roosevelt and "his companions." M. Clemenceau says:

"In invaded France at the present hour there is a name which represents, by I know not what force of intuition, the beauty of America's intervention—it is that of Roosevelt. You are too much a philosopher not to know that great popular leaders have influenced men out of all proportion to their own real value by the intangible atmosphere of legend which, with or without their assistance, has formed around them.

"Whatever may be the reasons, and without attempting to analyze the phenomenon, I yield to the imperious need to tell you that the name of Roosevelt has in our country at this time a legendary power. It would be an enormous error in my view to neglect a force which everything urges us to make use of as soon as possible.

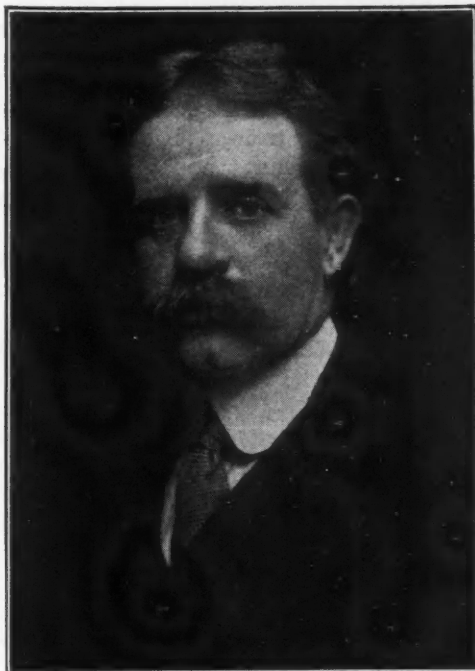
"We have learned that the first American unit has arrived at the front and with what zest generals and privates saluted the noble starred banner. However, you should know, Mr. President, that more than one stout, chevronned *poilu* said to his comrade in an astonished voice: 'But where is Roosevelt? I don't see him.'"

*Abstract of article by Albert Stansfield, professor of metallurgy, McGill University, Canada, Dept. of Mines, Geol. Sur. No. 92.

American Mining Engineers Prominent in
Chilean Mining



POPE YEATMAN
The great developer of the big copper mines



FRED HELLMANN
Consulting engineer for the Guggenheim interests



H. C. BELLINGER
General manager, Chile Copper Co.



S. S. SORENSEN
General manager, Braden Copper Co.

Some California Mother Lode Mines

By LEWIS H. EDDY*

The four groups of Mother Lode mines, situated in three adjoining counties in California, under the management of W. J. Loring, of San Francisco, are all in full development or productive operation with the exception of the Dutch-Sweeney-App. Mr. Loring says that owing to the present state of war it has been decided to go slow at this property, but he hopes that the enlargement of the Dutch shaft and the construction of the 600-ton mill will be proceeded with very shortly. The results of development of these properties are such as to warrant their equipment on a large scale, as there are large bodies of ore already available for treatment, which have been put in sight by the present operators. The three are adjoining mines, and all have been producers under former owners. The Dutch and Sweeney had been operated under one ownership, and the App was separately owned. The situation and physical relation of the properties make them an ideal combination for the development of one large mine. The Dutch-Sweeney Mining Co. has given more attention to exploration and development and the study of applied advanced metallurgical methods than to increasing production and has come to the point of knowing that there is a great mine in sight. The property is situated in the Jamestown district, Tuolumne County. Jamestown is the railroad shipping point, but the immediate mining camp and nearest post office is Quartz.

DEVELOPMENT AT CALAVERAS CONSOLIDATED

Calaveras Consolidated Syndicate is developing a group of old mines that were surface producers in early days and are now disclosing bodies of ore of medium average grade. The property is situated in the Melones or Carson Hill district, near the Melones mine, in Calaveras County, with Melones as the post office and railroad shipping point. Machine drills are employed, and recently a 3-stamp sampling mill was installed, which crushes about 18 tons a day with satisfactory results. The main tunnel is 2024 ft. long and is developing ore. The winze, 950 ft. north of the tunnel portal, is 275 ft. below the level of the tunnel, or 600 ft. below the surface. The first level on the vein is at 123 ft. below the tunnel level and is developing ore that averages better than \$5 a ton; the width is undetermined. Bore holes, both east and west, at various points over 232 ft. of drifting have proved ore of payable value for a width of 18 ft. A shoot of ore 550 ft. long has been developed at the tunnel level and adjacent to the winze which is directly beneath the surface; that also has proved pay ore over the same length. The winze level is directly under good ore proved at the surface and in the tunnel level. The second level, at 250 ft. below the tunnel level, will again prove the downward extension of this oreshoot. The ore developed in the main tunnel 2000 ft. in is another distinct shoot, separated by several hundred feet of blank ground from that developed in the winze section. Sinking in the Morgan shaft has reached a depth of 250 ft. below No. 3 tunnel, and the results there obtained have been also satisfactory. The Hardenberg mine, which is situated south of Jackson in

Amador County, recently optioned by the Hardenberg Mining Syndicate, was originally developed and operated through an inclined shaft. About four years ago the South Eureka Mining Co. reopened the property and sank a vertical shaft to the 1000-ft. level and extracted ore from this and intermediate levels and developed new ground. The ore was treated in a new 20-stamp mill electrically driven, and modern mining methods were applied. The present operators have deepened the shaft to the 1200-ft. point, crosscutted and drifted on the vein. The shaft is now being further deepened, and the vein will be developed at 1350 ft. depth by cross-cutting and drifting.

The Plymouth Consolidated Gold Mines, Ltd., operating the Plymouth group at the recently incorporated town of Plymouth in the northern end of Amador County, is the only one of the Mother Lode properties under Mr. Loring's management that is owned by a foreign company; the other operations and development were undertaken since the beginning of the European War, and the investments were obtained in the East. The Plymouth was one of the famous Mother Lode producers in the early days and was reopened and developed by the California Exploration Co. under the management of Albert Burch. Since the present owners have been operating, a modern mill, including stamps and Hardinge mills, and an electric hoist with a capacity of 5000 ft. have been installed. In 31 months 319,893 tons of ore has been treated, having a gross value of \$1,646,350 and rendering a profit over all expenditures of \$540,586. These figures show an average value of \$5.146 per ton of ore treated, and that is a fair general average of Mother Lode ores in the present-day mining at deep levels. So it is essential that modern methods of extraction and treatment be adopted in the reopening of the old mines and the continued operation of regular producers. There are mines along the Lode that produce high-grade ore, but there are others that yield a very small profit because of the low values of the ores and the high cost of treatment.

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South African Diamond Industry

By A. COOPER KEY*

That the diamond industry of South Africa is in better condition today than at any other time in its history is due to harmony among producers and the control of the production on the basis of "the fewer the higher."

At the outbreak of the war a small demand for diamonds sprang up, which steadily increased, and the producers, who had large stocks by reason of overproduction, were enabled to gradually dispose of stocks at prices not less than those prevailing before the war. Through the large interests he holds in De Beers, Jagersfontein and Premier mines, S. B. Joel was able to control sales and regulate the feeding of the market that showed signs of expanding with the increased wealth of the United States and other countries. When stocks were becoming depleted, he arranged with his colleagues that the three mines should restart operations on a reduced scale. Before the companies had reached the present scale of operations, all stocks had been cleared and the demand at improved prices, the best ever obtained, was just satisfied

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by the restricted output. This restriction and the control of the marketing of diamonds will enable the producers to make as much or more profit from the restricted output as they did from twice the quantity produced before the war, and at the same time double the lives of the mines. It has been announced that washings at the Premier mine would be restricted to the capacity of the No. 4 Gear (mill) and that the yearly increase in depth of 34 ft. in the opencut workings would be reduced to 17 ft., at which rate the life of the mine would be doubled.

Arrangements have been made for the sale of diamonds at prices considerably in advance of those of previous years, and producers are being advised to think in money and not in the quantity of diamonds produced. It is pointed out that the world spends a certain amount of money annually on diamonds and this amount increases or diminishes with the rise or fall in general prosperity. The aim must be to get the highest price possible for a smaller quantity of the gems rather than give more stones for the gross amount of money available. An increase in price or restricted output stimulates the desire to possess these much-prized gems. The close control exercised tends to enhance the value and stabilizes the investment.

In 1913 the demand for diamonds in the United States of America was abnormal, owing to the proposed increase in the import duty on both rough and cut stones, but as soon as these duties were imposed, prices fell and the output, which had been augmented to meet the abnormal demand, did not realize more than the gross amount available in normal times and toward the end of 1913 and the beginning of 1914 the average price per carat left little or no profit over and above the increased expenditure incurred in securing the larger production. Companies suffered severely and directors immediately realized the truth of the doctrine contained in the words "the higher the fewer," and busied themselves in the endeavor to secure cooperation to limit output and control sales.

LAST YEAR'S YIELD

The total production of diamonds within the Union of South Africa in 1916 was: Transvaal, 615,209 carats, valued at £933,643; Cape Colony, 1,510,756 carats, valued at £4,057,928; Orange Free State, 220,365 carats, valued at £736,820; a total of 2,346,330 carats, with a total value of £5,728,391. In the last normal years (that is, just before the war) the figures were: 1912, 5,071,882 carats, valued at £10,061,489; 1913, 5,163,547 carats, valued at £11,389,807.

The production from mines (De Beers at Kimberley, Premier near Pretoria, and Jagersfontein in the Orange Free State) was 2,170,348 carats, valued at £4,769,479, being an average of £2 3s. 11d. (\$10.65) per carat, against £1 17s. (\$8.90) in 1914, £2 1s. 6d. (\$10.00) in 1913, £1 17s. 1d. (\$8.95) in 1912, £1 13s. 8d. (\$8.10) in 1911 and £1 8s. 5d. (\$6.85) in the half-year to December, 1910.

De Beers washed 4,567,898 loads of 16 cu.ft. each, yielding 1,403,514 carats, valued at £3,393,311, or £2 8s. 4d. (\$11.70) per carat. Pretoria district mines, the figures for which for all practical purposes may be considered as those for the Premier mine, washed 1,621,140 loads of ground and 717,836 loads of tailings accumu-

lated in earlier years for 548,572 carats, valued at £652,715, equal to £1 3s. 10d. (\$5.75) per carat. Five or six mines in the Orange Free State produced £723,453 worth of diamonds equal to £3 6s. 1d. (\$16.05) per carat. Alluvial workers on the banks of the Vaal River produced 167,620 carats, value at £948,571, an aggregate only twice surpassed in recent years. The value per carat was no less than £5 13s. 2d. (\$27.40) compared with about £4 (\$19.40) in 1914 and 1915. Workers in the Barkeley West district produced 82,968 carats, valued at £554,896, and the comparatively new Klerksdorf field, a quarter of a million carats, averaging £5 6s. (\$25.65) per carat.

⌘

Quicksilver in California

According to a bulletin of the California State Mining Bureau, the production of quicksilver for 1916 amounted to 21,400 flasks of 75 lb. each, which were sold by the mine owners for a total of \$2,000,900. Quotations for the year varied from the high level of \$300 per flask in February, to about \$75 for the last six months of the year. The average quotation for the year was \$125; the actual sales however, averaged only \$93.50 per flask, owing to the rapid fluctuation of prices in the first six months of the year.

During the bureau's investigation, a wide variety of ores were tested by water concentration, by oil flotation and by leaching. Each method has shown some ores particularly amenable to it. High recoveries were made by water concentration of ores of friable crystalline cinnabar. When the cinnabar slimes badly, the saving is low, but in many cases the contents of these slimes can be won by flotation. Ochre in the slimes appears to be particularly difficult to overcome, largely on account of its colloidal nature.

One interesting development was the verification of information regarding selective separation of an objectionable amount of pyrite from concentrates. In one instance, a mixture of crude wood turpentine and a crude asphaltic base petroleum gave higher grade concentrates than any single oil used, less visible pyrite being present.

In the matter of leaching with an alkaline sulphide (Na_2S and NaOH) some astonishing results were obtained. On four widely varying ores assaying from 0.14% to 1.7% Hg, extractions of 86%, 96%, and 97% were obtained with approximately half hour contact of solutions.

One ore, assaying 0.31% Hg yielded 97% with but 15 minutes leaching. Ochre is detrimental to leaching as well as to concentration.

⌘

Transparency of Tracing Cloth

According to *Commerce Reports*, May 22, 1916, in response to the demands of several Government departments and of dealers in tracing cloth, the United States Bureau of Standards has developed and adopted a standard method for specifying the transparency of paper and tracing cloth. It has issued a circular stating definitely the form of the specification, explaining its significance, describing the apparatus and method of test and giving general information and instructions to applicants. This publication is Circular No. 63 of the Bureau of Standards. It includes a schedule of fees for those who make application to the bureau for tests.

Minerals Separation in the Miami Case

The opinion of the United States Circuit Court of Appeals in the suit of Minerals Separation against Miami Copper Co., written by Circuit Judge Victor S. Woolley and recently handed down, says that the first or oily frothing agents' patent is based upon the discovery of a then unknown and still unexplained phenomenon of froth flotation of metal particles developed by the reduction of oil to a low percentage, and that this discovery changed oil flotation from laboratory experiments and mill failures to commercial success. The prior adjudications in Australia and England are referred to as well as the litigation in the United States. It is said that the decision of the Supreme Court of the United States last December, in the suit of Minerals Separation against Hyde, sustaining the validity of the patent in a way that has already been discussed in the *Journal*, disposes of the question of validity, and that the only question to be considered is whether the defendant in the present suit has infringed the patent.

The first operations of the defendant were in a machine which reproduced that of the plaintiff and here infringement was not disputed, and therefore was not discussed by the court. The second operations of the defendant were in Callow pneumatic cells and appliances for mixing the ore pulp and oil before they entered the cells. These were also held to infringe after a very full discussion in which it was said that the use of Pachuca tanks, centrifugal pumps receiving air and pulp, or pulp elevators in conjunction with these cells involved an agitation substantially the same as that disclosed in the patent.

As to the second patent in suit, involving soluble frothing agents, the court found this patent to be clearly valid and infringed, and called attention to the fact that it was stated in the specification that air or gas could be "liberated in, generated in, or effectively introduced into" the ore pulp by any suitable means. This disposes of any possibility of limitation of this patent to any particular means of introducing into the pulp the air or gas which forms the bubbles of the froth.

As to the third patent, for the use of phenols in the cold and without acid, the court found this to be a substantial improvement and simplification in the agitation process of air flotation and held the patent to be valid and infringed, in this respect reversing the decree of Judge Bradford in the United States District Court.

Circuit Judge John B. McPherson concurred in this opinion, but Circuit Judge Buffington dissented as to infringement of the first patent in suit and wrote a long opinion giving his reasons for the belief that this patent should be limited to mechanical agitation and did not include pneumatic agitation. This dissent was limited to the first patent and apparently Judge Buffington is in accord with his colleagues as to the second and third patents.

When the decree of Judge Bradford in the District Court was filed last September, it was consented by both parties that an injunction should be stayed pending the decision of the appeal upon the filing of a bond for \$250,000 and the filing of sworn monthly statements showing the extent of the flotation operations of the defendant. These statements have been filed every month and show a gradual increase from about \$250,000 to \$330,000 in the

value of concentrates produced by the flotation process during each month.

The decree is interlocutory in its nature, and directs the case to be sent to the court below for the issuance of an injunction and the ascertainment of profits and damages, and it is not expected that the Supreme Court of the United States will entertain a writ of certiorari, in any event, until there is a final decree adjudicating all questions, including profits and damages.



Chronology for Mining for May, 1917

May 1—Wages in California gold mines increased to maximum of \$3.50 and minimum of \$3 per shift.

May 4—Interim receiver appointed in London for North West Corporation, following receivership on Apr. 24 of the parent Granville Mining Co., which controls important properties in the Klondike.

May 6—Cable dispatches announced destruction by fire of nickel-refining works of A. S. Kristianssands Nikkelraffineringsverk at Christiansand, Norway.

May 12—Grand Forks, B. C., copper smeltery of Granby Consolidated company forced to curtail operations and finally to cease smelting on account of lack of coke resulting from strike in the Crows Nest Pass coal region.

May 17—Sub-committee on copper, appointed by Bernard M. Baruch, chairman of committee on raw materials of the National Defense Council, membership of copper committee including John D. Ryan, chairman, Murry Guggenheim, Charles M. MacNeill, Rodolphe L. Agassiz, James McLean and W. A. Clark.—Closing arguments in flotation case of Minerals Separation, Ltd., vs. Butte & Superior heard in U. S. District Court in Butte; decision not expected for several months.

May 21—Heinze interests lost in Supreme Court proceedings for \$15,000,000 treble damages, under Sherman anti-trust law, against Amalgamated Copper and Lewisohn interests who were alleged to have attempted a monopoly of Montana copper industry and to have conspired against Heinze's United Copper Securities Co.

May 23—Announcement that Greene Consolidated Copper Co. would be dissolved and that Greene Cananea would become the sole holding company for the copper operations at Cananea, Son. Mexico.

May 24—Production in Jerome, Ariz., copper mines stopped by miners' strike.—Utah Apex mine in Bingham Canyon resumed shipping, after two months shutdown due to fire and flooding of mine.

May 25—Announcement that Bunker Hill & Sullivan Mining and Concentrating Co. would erect a 10-ton electrolytic zinc plant, after its new lead smeltery at Kellogg, Idaho, is in operation.—Case of Minerals Separation, Ltd., vs. Miami Copper Co. in U. S. Circuit Court of Appeals, Philadelphia, for flotation-patent infringement decided in favor of plaintiff.

May 26—Peruvian troops sent to quell strike disorders at Cerro De Pasco copper smeltery at La Fundicion; smeltery strike settled May 31.

May 31—"Smoke" damages allowed against smelting companies in Sudbury nickel district, Ontario, but injunction restraining operation of the Canadian Copper and the Mond Nickel smeltries was denied, on ground of greatest good to the community.

Details of Practical Mining

Safety Device for Inclined Shafts

BY R. J. SAMPSON*

As yet, within our knowledge, there has been no application of an automatic safety device to cars or skips which run on inclined rails without auxiliary guides. The following description and sketch pertain to such a device. This particular design is for a skip which operates on rails under which stringers are used, which type of shaft timbering is common in inclined shafts where heavy loads are hoisted at high speed.

The bail is attached as usual to the skip body by means of pins about which it is free to turn, but instead of round holes for the pins, slots are provided in the bail. In each of these slots a spring *A* is placed. A connecting-rod is fastened to the bail at *G*, for which purpose a lug and pin are made on the bail. The other

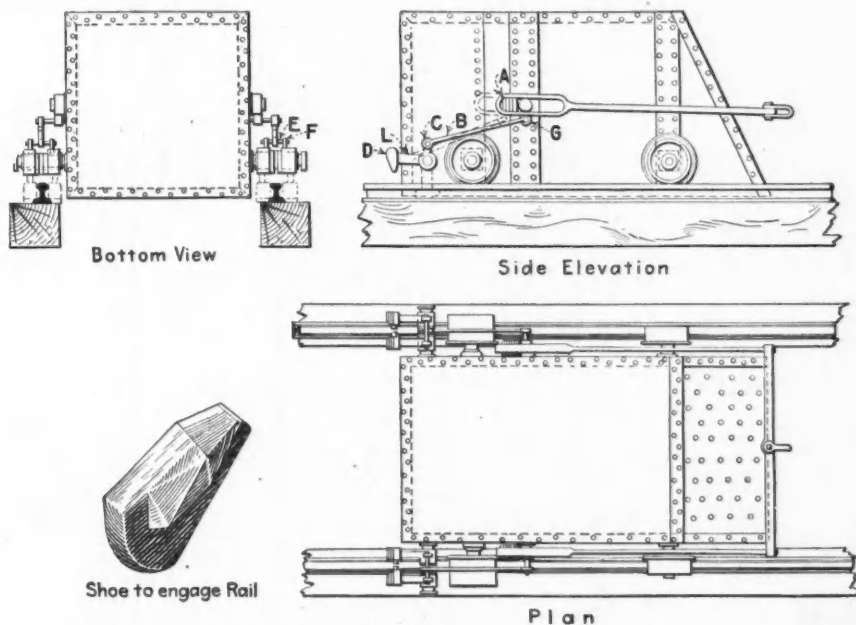
position, and movement of rod *B* throws the shoes *D* into the rails, as shown.

The small perspective picture shows the shape of these shoes, and for the sake of clearness the remainder of the casting is not shown. The lug on the side is of such depth and thickness as to just fit between the head and flange of the rail, each lug completely filling this space on one side of the rail. These dimensions are of course governed by the rail used in the shaft. Since there is a shoe for each side of the rail, the rail section is filled solidly for a length of 6 to 8 in., when the shoes are in position.

These shoes, when in position above the rail, have the sides of their lugs separated by a distance equal to the thickness of the web of the rail. When they are forced against the head of the rail, the shape of the under side of the lug, which first comes in contact with the rail, is such that it forces the two shoes apart far enough to allow them to pass over the head of the rail. When the lugs have cleared the head of the rail, the small spring draws the two castings together so that the lugs fit snugly into the rail. An further movement downward of the skip tends to rotate the castings, pressing the top of the lug against the bottom of the head of the rail and the bottom of lug against top of rail flange—the greater the pressure the stronger the grip. Since rails are rolled with the bottoms of their heads and the tops of their flanges at a slight angle to the horizontal, there is a tendency for the lugs to slip out. To obviate this difficulty, the shoes are made with an extension below the lug and offset far enough to clear the flange of the rail. This extension is so made that, at the instant the lugs are pressed upward to the rail, it comes in contact with the stringer under the rail. On

account of its shape further rotation presses it more tightly against the stringer, and it then serves to hold the lug tightly against the web of the rail.

If stringers are not used and the rails are simply on ties or wall plates, the shoe assumes the shape of the lug and has corrugations lengthwise, top and bottom, to increase friction. In this case there is also provided, on the side of the skip, a bracket so placed that when the lugs are in contact with the rails, the arms carrying the shoes are held by the sides of the bracket so that they cannot slip sidewise. The lug *G* is so placed that it will be directly under the point about which the bail is pivoted when the load is on the rope. This is done so that there will be a minimum movement of the rod *B* when the bail moves up and down during the period of acceleration of the hoist.



SAFETY DEVICE FOR SKIPS OR CARS

end of rod *B* is connected to the arm *C*, which, together with the shoe *D*, its arm and bearing, form one casting. There are two of these castings on each side. They are fastened to the skip in the same manner as the bail. On the pin about which these castings rotate, there is a light, short spring between the bearings of the castings and fastened to each. The pins are made with a shoulder, and the castings are so placed that they can move away from each other on their bearings a maximum distance equal to the width of the head of the rail minus the thickness of the web.

As long as the load is on the rope, the spring *A* is compressed and the shoes *D* are held in the position shown by the full lines, by means of the rod *B*. When load is taken off the bail, the spring *A* assumes the dotted

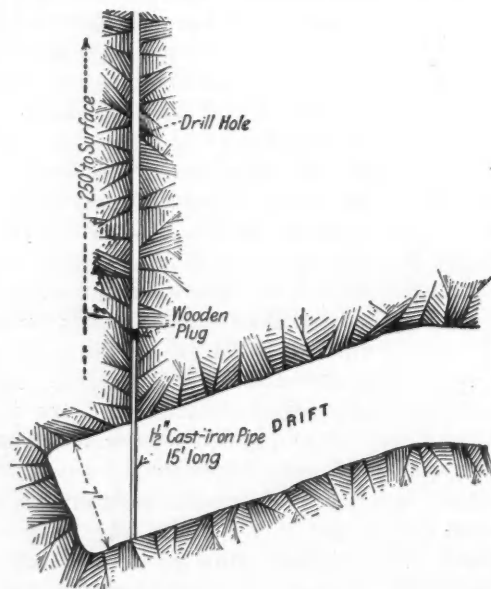
*1702 A Ave., Douglas, Ariz.

The length of the slot in the bail depends upon the load to be carried and the diameter of the spring steel used, which will in turn depend upon the length required to be developed by the spring over its length when compressed. Assume a load of 16,000 lb., spring steel 1 in. in diameter, the coil having an outside diameter of 4 in., there will be required 10 coils to develop a length of $3\frac{1}{2}$ in. over its compressed length. This $3\frac{1}{2}$ in. is the horizontal movement at *G* necessary to rotate the shoes into position. The slot will then have a length comprised of 10 coils. Length = $10 + 3\frac{1}{2} + 4$ in. (the diameter of pin to which bail is fastened) = $17\frac{1}{2}$ in. If a 65-lb. rail is used and the lugs are made 6 in. long, there will be a total of 84 sq.in. of cast steel to support the load. The lugs are so shaped that, in case the skip is set on chairs, the mechanism will operate as usual, gripping the rails, but when the rope picks up the load they will slip out from the rail without binding and with no shock.

While the description of this device is lengthy, the operation is simple, and for the result sought the cost is small. There is one bad feature; that is, in case the lugs strike the rail at a rail joint. However, even in this event, the operation should be immediate and effective, as the rail splices are not opposite each other and one pair of shoes would always be effective, and if properly designed, these would be amply sufficient to support the load.

Concreting a Diamond-Drill Hole

A surface diamond-drill hole in the Flat River country, Missouri, cut by an underground prospect drift drained so much water from the surrounding country that it was found necessary to concrete it from the surface to



METHOD OF PLUGGING DIAMOND DRILL HOLE

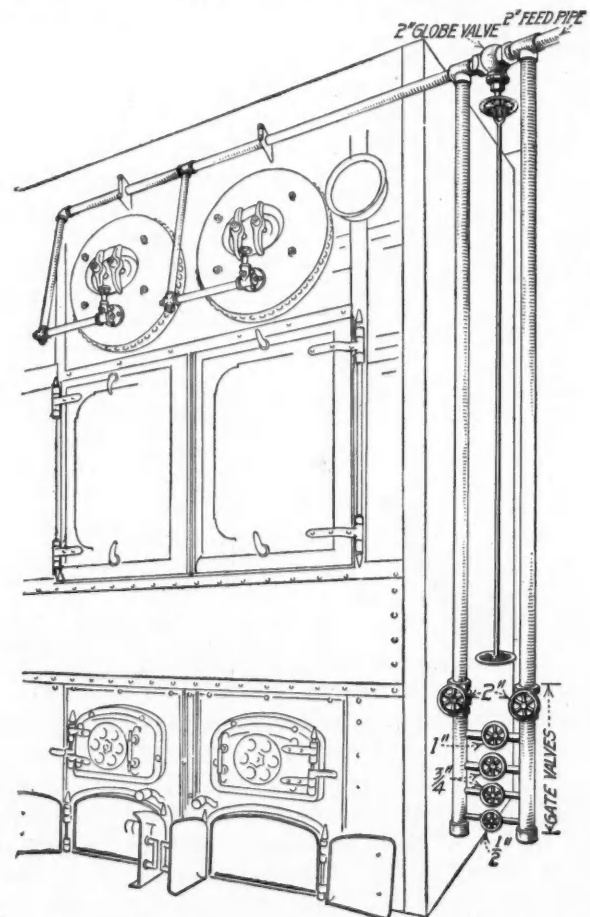
keep it from flooding that part of the mine workings. Owing to the fact that the drift was driven at an angle of 20° downward, it was filled with water soon after breaking into the drill hole, thus making it impossible to plug the hole from the drift prior to filling it with concrete. The following method, shown in the illustration, was successfully used for plugging the hole from

the surface: A 15-20-ft. length of pipe about an inch less in diameter than the drill hole was closed at one end with a wooden plug, and after making sure that the drill hole was clear, it was dropped into the hole with the plugged end of the pipe up, forming a base for the concrete to rest on, and the part of the pipe projecting into the drift was easily cut off when the drift was unwatered. The concrete was made rather thin to facilitate pouring into the hole and was composed of one part portland cement to three parts of sand or chat.

Feed-Water Control for Power-Plant Boilers

BY LINDSAY DUNCAN*

The sketch shows a method of regulating the boiler-feed water in use at the Nevada Consolidated, which has shown considerable advantages over the standard method of a single globe valve kept partly closed at all times. The device consists essentially of a double manifold with gate valves of various sizes connecting the two branches. As many of the valves as are necessary are opened wide, and the needed regulation is secured by opening or clos-



VALVE ARRANGEMENT FOR FEED-WATER CONTROL

ing combinations of the different sized valves. This method does away with cutting out the seats of the partly opened gate valves and also enables the water tender to tell at a glance the quantity of water being fed. The illustration shows an arrangement suitable for a 400-hp. Babcock & Wilcox boiler and can be modified to suit any size. Should finer regulation be required a couple of $\frac{1}{4}$ -in. valves may be added to the manifold.

*Mechanical engineer, McGill, Nev.

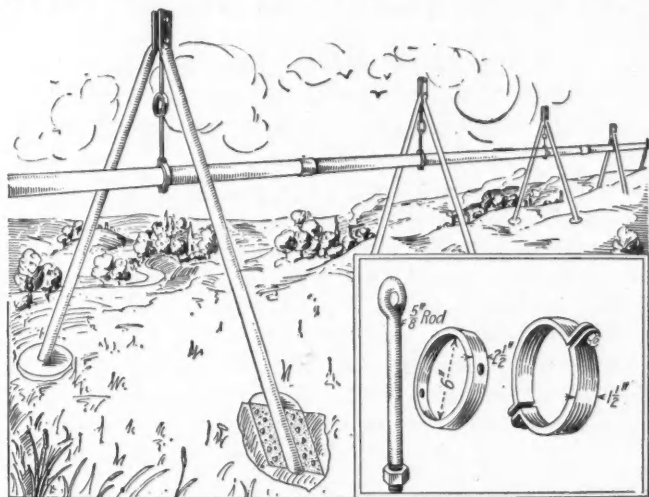
Details of Milling and Smelting

A Useful Type of Pipe Hanger

By RAYMOND B. LADOO*

A type of pipe hanger devised at the shops of the Low Moor Iron Co. of Virginia has proved very successful. The construction is simple, cheap, substantial and efficient. The details of a typical installation for a 6-in. pipe are shown in the accompanying sketch. The dimensions can be altered for other sizes of pipe.

The two legs are made from old 3-in. wrought-iron pipe or boiler tubes cut in 8- to 15-ft. sections depending on slope of ground. One end of each pipe is flattened for a distance of about 8 in. and the flattened portion drilled for $\frac{1}{2}$ -in. bolts. Two $\frac{5}{8}$ -in. rods about one foot long are bent into an eye at one end to admit a $\frac{1}{2}$ -in. bolt, and threaded at the other end. A ring, 6 or 7 in. in diameter, $2\frac{1}{2}$ in. wide and $\frac{3}{8}$ in. thick is then bored to admit loosely the $\frac{5}{8}$ -in. rods, the two holes placed diametrically opposite each other. This ring can either be made of



LOW MOOR TYPE OF PIPE HANGER

strap iron bent and welded, or cut from 6- or 7-in. pipe or couplings. The pipe ring is held by two straps about $1\frac{1}{2}$ in. wide and $\frac{1}{4}$ or $\frac{3}{8}$ in. thick. Each is bent in a semicircle, and the ends are flattened and bored to receive $\frac{1}{2}$ -in. bolts.

The manner of assembling the hanger is evident from the sketch. The purpose of the 6-in. ring is to allow the pipe to swing free from its support in any direction. This provides for expansion and contraction in the line and prevents the force of wind sway from shaking the hangers. By using long threads on the rods, the pipe may be leveled up by tightening or loosening the nuts. The legs are embedded in concrete piers about 1 ft. square and 2 ft. deep and given a spread of about 6 ft. Hangers of this size are spaced on about 25-ft. centers.

Hangers of this type have been in use here for several years and have proved very satisfactory. The one used as an example is one of a series supporting a 6-in. com-

*Mining engineer, Low Moor, Va.

pressed air line about a quarter mile long. Most of the material used, with the exception of the concrete, was scrap and consequently cost but little. The advantages of this type of construction are low cost, durability, flexibility and ease of installation.

Coal Gas for Heat Treatment

The use of coal-gas furnaces for annealing, melting and tempering metals is increasing in England, says a consular report. Hadfields, Ltd., consumes, entirely for war work, not less than 500,000,000 cu.ft. of gas per annum. A furnace commonly in use takes a load of 4 tons of cold steel and consumes 2750 cu.ft. of gas per hour at a cost of 48c. per 1000 cu.ft. A ton of metal can be reduced in 4 hours with a consumption of 850 cu.ft. of gas.

The advantages claimed for the furnace are that it is compact, self-contained, mobile and economical. No space is required for ashes, and it can be brought close to the worker. It necessitates no special alterations in the factory. The temperature is easily controlled, permitting the time required for each operation to be definitely ascertained.

Riffles on Concentrating Tables

By ALGERNON DEL MAR*

Nearly every combination of riffles has been tried on concentrating tables in straight lines or in curves, so that not much can be new to the ore dressing experts, but I believe the combination here shown on a Wilfley table

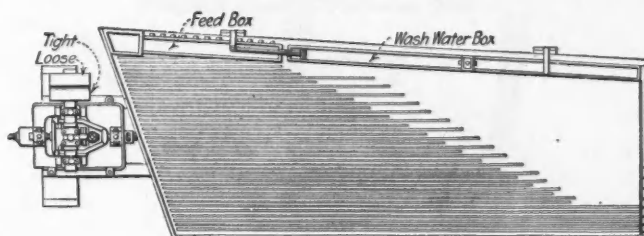


FIG. 1

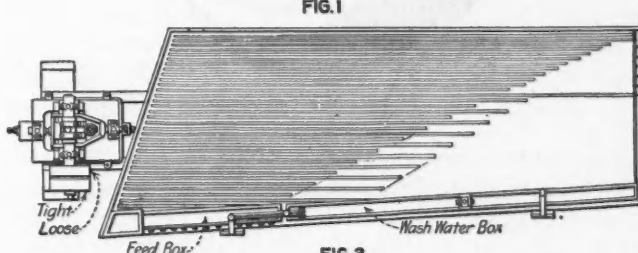


FIG. 2

MODIFICATION OF RIFFLES ON WILFLEY TABLES

may contain an element not already tried by some millmen, and it is well worth the experiment.

The idea originated by first extending the last eight or longest riffles to the end of the table, as shown in Fig. 1, and from the corner A extending a new line to

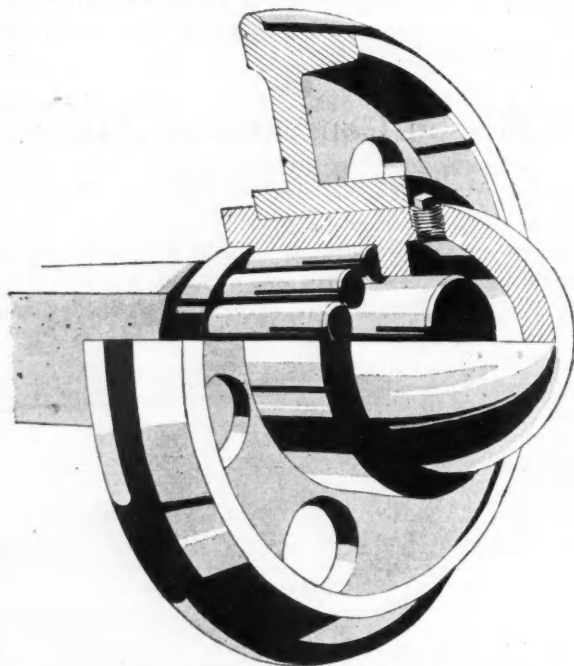
*Mining engineer, Dewey Mines, Gazelle, Calif.

the shortest riffle and then extending every alternate riffle to this new line. This combination was unsatisfactory, so six of these riffles were cut out and only two extended to the end of the table. This worked well with an ordinary load of concentrates, but when the table became overloaded, the dividing line between waste and concentrates was not well defined. Then one riffle was extended to the end of the table about one third the way up, as shown in Fig. 2. Now if the table became overloaded, this riffle separated clean concentrates, leaving the lower one third to take care of the heavier portion not thrown forward on the upper riffles. With this added riffle our tables take care of themselves whether full or underloaded, the upper extended riffles taking off clean fine concentrates. This improvement acts to a certain extent as a classifier, taking off the fine concentrates at the top and leaving the adjustment more especially for the coarser concentrates.

New Self-Lubricating Roller-Bearing Mine-Car Wheel

By BEN J. MORGAN*

In the construction of a new self-lubricating roller-bearing mine-car wheel, the hub member is made (cast and machined) separately and shrunk into the central hole of the wheel proper. A roller-bearing assembly is mounted in the hub member and forms an antifriction con-



SELF-OILING ROLLER-BEARING CAR WHEEL

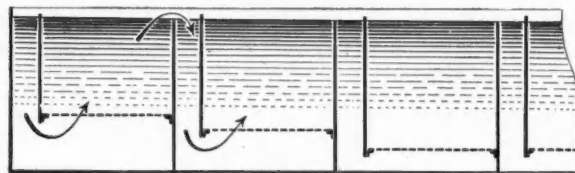
nection between it and the axle. The hub member and roller-bearing assembly are standardized and may be used interchangeably. Provision is made for carrying in the hub member a surplus of hard oil, which is drawn on automatically as needed and works into the roller-bearing assembly. The separate manufacture of the hub assembly is a good feature. If the flange, tread or web of any wheel proves defective or is broken from any cause, its hub assembly is not lost, but may be transferred to and used with another wheel. Thus the salvage covers the most expensive and important parts of the wheel.

*Mining engineer, 505 Polk Building, Des Moines, Iowa.

Zinc-Box Arrangement for Silver Precipitates

By A. W. ALLEN*

In general practice the unsmelted screen oversize from the zinc-box, usually termed "short" zinc, is returned to the box to be further consumed with cyanide solution. It is always advisable to keep the amount of this "short" zinc on hand as low as possible and not to distribute it with the coarse zinc in the compartments. The maximum solution of zinc occurs at first contact with fresh solution. By arranging the zinc-box in the manner



ZINC BOX FOR SILVER PRECIPITATES

shown, it is possible to keep the "shorts" in the first compartment, distributed in a shallow layer permitting the free percolation of the solution. Maximum precipitation invariably occurs in the first two compartments, and by raising the screens in the manner shown there is more space available for an accumulation of product. [By an unfortunate inadvertence the wrong cut was published with this article in the *Journal*, May 5, 1917, p. 797, which destroyed the value of the article. To correct this the text is reprinted with the correct drawing.—Editor].

X Rays in Steel Metallurgy

The important rôle X rays may play in steel and non-ferrous metallurgy was dwelt upon by Professor Bragg, a pioneer in this work, in a recent address on the subject at Sheffield, England, says *Iron Age*, May 3, 1917. He referred to investigations on the crystalline structure. The perfect crystal has a definite internal geometrical form and a definite atomic symmetry, but the latter is beyond the range of microscopic vision. The more powerful X rays may, however, enable the metallurgist to determine the atomic structure of his metals. Students of the new method predict that it will throw light on some places in metallurgy where nothing is now known.

The commercial value of the researches remains, of course, to be proved, but the progress of the work is being followed with deep interest in various countries. Chemistry tells the metallurgist what are the constituents of his metals, but X rays are going to help him to find and study the atoms of the substances. The actual arrangement of these and the distances at which they lie apart are of considerable importance, but have hitherto been beyond human vision. The X rays have made it possible to see the architecture of a number of substances, said the speaker. Iron and steel present difficulties, but there is a good prospect of getting useful information about them before long. The work was going ahead in the United States, where there was no war to interrupt it, and the speaker had received from American physicists particulars of interesting results obtained in respect to iron and steel crystals.

*Metallurgical engineer, 309 Broadway, New York.

The Cost of Doing Things

Pipe Laying Costs in Detroit

Nearly 50 miles of water main were laid in Detroit last year at a total cost of \$864,732, says *Engineering News-Record*, Apr. 12. Deducting replacements of 0.95 mile there was a net gain of 48.23 miles, making a total of 1004.84 miles in the entire system. The unit cost per foot of various sizes, shown in the following table, are from the last annual report of Theodore A. Leisen, general superintendent:

Size, In.	No. of Feet	COST PER FOOT			Total
		Material, etc.	Labor	Overhead Expense	
4	804	\$0.56	\$0.37	\$0.05	\$0.98
6	118,523	.64	.45	.05	1.14
8	81,010	.70	.45	.05	1.20
10	2,055	1.28	1.02	.11	2.41
12	3,908	1.58	.96	.11	2.65
16	208	2.64	1.13	.13	3.90
24	5,095	3.74	1.98	.25	5.97
48	29,581	11.74	7.21	.84	19.79

Costs at the Nipissing Mines, Cobalt

The report of the Nipissing Mining Co., of Cobalt, Ont., for 1916, gives many interesting and valuable data on the costs of operating and producing silver. The total production was 4,044,668 fine ounces of silver, the cost of which, per ton of ore and per ounce of silver, is shown in the accompanying table.

COST OF PRODUCING SILVER

Based on Production of 4,044,668 oz., and 77,915 Tons Ore Milled

Department	Cost per Ton of Ore	Cost per Oz. of Silver
Diamond drilling	\$0.014	\$0.00027
Development and exploration	1.886	0.3631
Stopping	1.265	0.2436
Assaying and engineering	.113	0.0218
Administration and office	.480	0.0925
Surface and dwellings	.122	0.0235
Insurance and taxes	1.756	0.3383
General and legal	.285	0.0549
High-grade mill	.799	0.1539
Low-grade mill	4.535	0.8737
Handling dumps	.097	0.0187
Shipping residues	.015	0.0029
Depreciation	.779	0.1500
Marketing product	.831	0.1602
Corporation, New York and traveling	.175	0.0338
	13.152	2.5336
Less rents and interest	.623	0.1201
Total cost of production	\$12.529	\$0.24135

The gross value of the production was \$3,027,669, and the total cost was \$976,186, or 32.24%, leaving a difference of \$2,051,483, or 67.76%. The total production was 78,120 tons, of which 1269 tons was high-grade and the remainder, 76,851 tons, low-grade.

The high-grade mill ran at full capacity and treated 1064 tons of Nipissing ore and metallics, assaying 1800 oz. per ton, and 598 tons of custom ore assaying 3113 oz. per ton. The precipitates from the low-grade mill were refined at the high-grade plant. Treatment cost was higher than in the previous year on account of war conditions, but as a counterbalancing factor the whole of the Cobalt residence was sold and the production of 1917 contracted for.

The low-grade mill treated 76,851 tons of ore averaging 29.60 oz. silver, with a recovery of 86.76%. This recovery, however, does not include that saved by floating

the cyanide residues. Forty stamps ran 286.7 days, or 78.33% of the possible running time. The milling was at the rate of 268 tons per day, or 6.7 tons per stamp per day.

Experiments with flotation on the tailings from the cyanide plant have been carried on throughout the year, but results have not been satisfactory. The extraction is low, in spite of the various means employed. By supplementing the treatment with gravity concentration, either before or after flotation, better results can probably be obtained, and experiments are being made on that line.

TREATMENT COSTS ON LOW-GRADE ORE

Including Transportation, Sorting Plant and Low-Grade Mill

	Cost per Ton
Crushing at Mine	\$0.156
Aerial tramway	.053
Surface tramway	.097
Sorting plant	.187
Crusting	.044
Battery	.264
Tube mills and classifiers	.695
Desulphurizing and slime collecting	.193
Intermediate filtering	.102
Cyanide treatment	1.526
Cyanide filter	.142
Precipitation and clarifying	.391
Refining	.117
Heating	.127
Water supply	.029
Construction	.191
Residue dam	.045
Flotation and research	.187
Consulting	.052
	\$4.598

CONSUMPTION OF SUPPLIES AT LOW-GRADE MILL

	Lb. per Ton	Cost per Ton
Sodium cyanide	5.078	\$1.2936
Lime	6.822	.0272
Caustic soda	1.806	.0919
Aluminum dust	.265	.1215
Aluminum plates	.023	.0056
Aluminum ingots	.155	.0776
Pebbles	5.537	.0555
Coal	32.269	.1038
Borax	.116	.0095
Sodium sulphide	1.958	.0422
Soda ash	1.304	.0491
Power, kw.-hr.—58.975		.6378
		\$2.5153

The production was about the same as that for the previous year, but on account of the high price of silver, 68.79c. per oz. received in London, the profits were \$610,000 more. Costs and taxes were higher than in the previous year. Underground developments were satisfactory, and the ore reserves are now estimated to contain 9,153,000 oz., more than the reserve of the preceding year.

Shattuck-Arizona Unit Costs

Most mining reports stop at costs per foot or per ton, and few figure out the cost per trip of hoist or the cost per car for station tending on top landing; still fewer have any idea of the cost of compressed air. The Shattuck-Arizona works this out in greatest detail. Some data are given herewith, supplied by the courtesy of T. O. McGrath, the company's auditor. He remarks that the tramping cost per car of ore and waste should be based instead on the car of ore and waste per thousand

car-feet, as the development work and stopes gradually work farther away from the hoisting shaft and of course increase the cost of tramping per car.

SUNDRY SHATTUCK-ARIZONA OPERATING COSTS AND FACTORS FOR 1916

Account	Cost per Unit
Drifting per foot.....	\$8.21
Raising per foot.....	11.32
Stoping per wet ton.....	2.44
Tramming and tracks per car, ore and waste.....	1856
Station tending and caging per car ore and waste.....	0.423
Hoisting per trip.....	2355
Top landing and tramping per car ore and waste.....	0.545
Pumping per 1,000 gal.....	5186
Assaying per assay unit.....	0.587
Boiler-horsepower per month.....	12.81
Compressor per 1,000 cu. ft. free air.....	0.413
Air drills per hour operation.....	1.12
Tramway per tram bucket.....	0.657
Unit Factors	
Feet advanced per man-shift drifting.....	1.17
Feet advanced per man-shift raising.....	1.02
Wet tons stoped per man-shift stoping.....	3.03
Feet development per wet ton stoped.....	.12

Mining Costs at Bunker Hill & Sullivan

The 29th annual report of the Bunker Hill & Sullivan Mining and Concentrating Co., at Kellogg, Idaho, for the year ended Dec. 31, 1916, sets forth in tabulated form some exceedingly interesting data of operating costs. The costs in detail for 1916 and 1915 are shown in comparison. Practically all departments are represented, and the figures will be of great value to mine operators as a basis for comparison with their own work.

KELLOGG OPERATIONS

The mine was in operation for the full period of 12 months and produced 467,012 tons of concentrating ore and 8772 tons from exploration at a cost of \$1,124,773, as follows:

Details of Labor and Supplies	Average Cost per Ton for the Year	Last Year
Superintendent and foremen.....	\$0.023	\$0.022
Shift bosses.....	0.042	0.035
Machinemen.....	0.166	0.138
Chuck tenders.....	0.079	0.061
Miners.....	0.191	0.176
Shovelers.....	0.354	0.308
Carmen and trammens.....	0.034	0.038
Motormen.....	0.024	0.019
Timbermen and carpenters.....	0.151	0.136
Hoistmen and skipmen.....	0.037	0.034
Pumpmen.....	0.010	0.009
Pipemen.....	0.003	0.003
Nippers.....	0.010	0.009
Supplymen.....	0.042	0.030
Repairmen.....	0.009	0.008
Timekeeper.....	0.004	0.003
Contractors.....	0.003	.....
Concretemen.....	0.008	.....
Miscellaneous.....	0.003	0.002
Powder.....	0.108	0.077
Fuse and caps.....	0.020	0.014
Illuminants.....	0.008	0.010
Lubricants.....	0.002	0.002
Timber and lagging.....	0.227	0.205
Miscellaneous supplies.....	0.102	0.051
Cement.....	0.006	.....
Machine-shop repairs.....	0.041	0.049
Electrical repairs.....	0.017	0.023
Building repairs.....	0.008	0.015
Tool-shop repairs.....	0.015	0.016
Electric power.....	0.025	0.023
Compressed air.....	0.086	0.078
Electric light.....	.....	0.012
Heating.....	0.014	0.018
Surveying.....	0.018	0.013
Train service.....	0.015	0.001
Tramming.....	0.001	0.001
Tramming ore.....	0.052	0.049
Tramming men into mine.....	0.003	0.003
Tramming supplies into mine.....	0.004	0.004
Contingent expense.....	0.046	0.036
Legal services.....	0.032	0.006
Depreciation.....	0.085	0.070
Administrative expense.....	0.082	0.068
Free light, water and rent.....	0.001	0.001
Taxes and insurance.....	0.123	0.084
Fire protection.....	.....	.....
Total normal expense.....	\$2.333	\$1.973
Litigation and other extraordinary expense.....	0.031	0.026
Total.....	\$2.364	\$1.999

The mining costs have been subdivided under the following heads: Exploration, Stopping, Tramming, Hoist-

ing, Pumping, General Mine Expense and Underground Improvements, detailed costs of which follow.

EXPLORATION

Thirty-nine hundred forty-four (3944) feet of drifts, raises, crosscuts and shaft work were driven at a cost of \$38,954.06.

Details of Labor and Supplies	Average Cost per Foot for the Year	Last Year
Shift bosses.....	\$0.249	\$0.199
Machinemen.....	1.352	1.260
Chuck tenders.....	0.963	0.849
Miners.....	282	278
Shovelers.....	1.853	1.263
Carmen and trammens.....	0.012	0.009
Timbermen and carpenters.....	0.400	0.143
Supplymen.....	.....	0.022
Contractors.....	0.284	.....
Powder.....	1.948	1.468
Fuse and caps.....	0.250	0.155
Illuminants.....	0.040	0.041
Lubricants.....	0.001	0.001
Timber and lagging.....	0.449	0.206
Miscellaneous supplies.....	0.841	0.556
Machine-shop repairs.....	0.183	0.228
Electrical repairs.....	.....	.....
Tool-shop repairs.....	0.063	0.113
Compressed air.....	0.615	0.460
Surveying.....	0.092	0.066
Totals.....	\$9.877	\$7.317

DETAILS OF EXPLORATION WORK

Work	Feet	Labor	Explosives	Illuminants	Timber and Lagging	Miscellaneous	Machine-Shop Repairs	Tool Shop	Sundries	Total
Pike raise.....	80	1.577	1.174	0.012	.....	.....	.....	.....	0.782	3.545
Pike drift.....	134	4.876	1.898	0.036	.....	.....	0.149	0.056	0.870	7.885
Pike cross-cut.....	317	3.756	1.728	0.028	0.048	0.174	0.367	.....	0.480	6.581
Duncan drift.....	191	6.356	2.050	0.042	0.855	0.222	0.105	0.037	0.727	10.394
Koster drift.....	79	6.331	2.470	0.042	0.939	0.027	.....	0.010	0.693	10.512
France drift.....	182	4.748	2.017	0.033	.....	0.011	.....	.....	0.673	7.482
Day drift.....	292	5.115	2.487	0.037	0.307	0.968	0.034	0.085	1.486	10.519
Hawes drift.....	800	5.527	2.596	0.041	0.445	0.501	0.158	0.007	1.221	10.496
Summer raise.....	237	8.983	2.842	0.068	3.018	2.483	0.088	0.072	1.248	18.802
Scott drift.....	114	5.265	2.025	0.040	0.183	0.320	0.175	0.061	0.729	8.798
Davis drift.....	185	5.798	1.986	0.049	0.789	1.019	0.131	0.121	1.554	11.447
Plemmons drift.....	312	3.960	1.581	0.031	0.168	0.842	0.103	0.123	1.368	8.176
Mills drift.....	105	6.275	2.394	0.054	0.729	0.393	0.152	0.162	1.097	11.256
West miller drift.....	25	8.649	3.712	0.079	.....	.....	.....	.....	0.832	13.272
Gray drift.....	20	2.768	0.653	0.025	.....	.....	.....	0.244	1.390	5.080
Cherry drift No. 14 Sta. drift.....	150	4.270	2.060	0.031	0.494	0.185	.....	.....	1.326	8.366
Zuber drift.....	392	4.661	1.974	0.036	0.077	0.614	0.034	.....	0.497	7.893
Dauven crosscut.....	96	2.723	1.453	0.021	0.159	1.065	0.410	.....	0.622	6.453
Kochan drift.....	40	2.585	1.257	0.020	.....	0.500	0.514	.....	0.617	5.493
Victor cross-cut.....	144	3.899	1.837	0.030	0.423	0.403	0.554	.....	0.495	7.641
Kellogg tun. shaft.....	49	22.836	6.078	0.107	1.733	14.811	3.220	1.469	3.833	54.087

STOPPING

Details of Labor, Supplies, Etc.	Average Cost per Ton for the Year	Last Year
Shift bosses.....	\$0.040	\$0.033
Machinemen.....	0.158	0.122
Chuck tenders.....	0.072	0.052
Miners.....	0.193	0.175
Shovelers.....	0.345	0.292
Carmen and trammens.....	0.035	0.038
Motormen.....	0.026	0.018
Timbermen and carpenters.....	0.139	0.116
Hoistmen and skipmen.....	0.012	0.012
Nippers.....	0.010	0.009
Supplymen.....	0.023	0.025
Powder.....	0.093	0.058
Fuse and caps.....	0.019	0.013
Illuminants.....	0.008	0.009
Lubricants.....	0.001	0.001
Timber and lagging.....	0.224	0.199
Miscellaneous.....	0.070	0.039
Machine-shop repairs.....	0.026	0.024
Electrical repairs.....	0.010	0.013
Tool-shop repairs.....	0.010	0.011
Electric power.....	0.002	0.002
Compressed air.....	0.078	0.072
Surveying.....	0.006	0.004
Total.....	\$1.612	\$1.351

TRAMMING

The electric railroad was in operation the entire year, delivering to the concentrators 475,784 tons of ore at a cost of \$28,090, as follows:

Details of Labor, Supplies, Etc.	Average Cost per Ton for the Year	Last Year
Tramming ore.....	\$0.052	\$0.049
Tramming men into mine.....	0.003	0.003
Tramming supplies into mine.....	0.004	0.004
Totals.....	\$0.059	\$0.056

HOISTING

There were hoisted from the shaft 416,689 tons of ore, at a cost of \$22,751.84, as follows:

Details of Labor, Supplies, Etc.	Average Cost per Ton for the Year	Last Year
Hoistmen and skipmen	\$0.029	\$0.025
Lubricants	.001	.001
Timber and lagging		
Miscellaneous	.011	.001
Machine-shop repairs	.004	.008
Electrical repairs	.002	.004
Electric power	.007	.008
Electric lights		
Total	\$0.054	\$0.047

PUMPING

The cost of pumping for the year amounted to \$15,356.24, as follows:

Details of Labor, Supplies, Etc.	Average Cost per Ton of Ore Hoisted	Last Year
Pumpmen	\$0.012	\$0.011
Lubricants		
Miscellaneous supplies	.002	
Machine-shop repairs	.003	.004
Electrical repairs	.001	.001
Electric power	.019	.018
Total	\$0.037	\$0.034

GENERAL MINE EXPENSE

Details of Labor, Supplies, Etc.	Average Cost per Ton Mined for the Year	Last Year
Superintendent and foremen	\$0.023	\$0.022
Shift bosses		
Miners		
Timbermen and carpenters	.011	.018
Pipemen	.003	.002
Supplymen	.008	.005
Repairmen	.009	.009
Timekeeper	.004	.003
All other labor	.012	.002
Powder		
Fuse and caps		
Illuminants		
Lubricants		
Timber and lagging	.003	.006
Miscellaneous supplies	.016	.005
Cement	.005	
Machine-shop repairs	.007	.008
Electrical repairs	.004	.005
Building repairs	.008	.015
Tool-shop repairs	.004	.004
Electric power		
Electric lighting		
Heating	.014	.012
Surveying	.012	.012
Train service	.016	.013
Teaming		.001
Contingent expense	.047	.036
Legal services	.032	.006
Depreciation	.086	.070
Administrative expense	.082	.068
Free light, rent and water	.001	.001
Taxes and insurance	.122	.084
Fire protection		
Litigation and other extraordinary expense	.031	.026
Total	\$0.560	\$0.433

COMPARISON OF MINING COSTS

Stope	Tons	Labor	Explosives	Illuminants	Timber and Lagging	Miscellaneous Supplies	Machine-Shop Repairs	Total Shop	Sundries	Total
Vann	4,102	1.422	.188	.011	.074	.060	.025	.006	103	\$1,889
Ramsey	9,192	1.142	.097	.009	.134	.069	.024	.014	093	1,582
Selley	2,944	1.443	.146	.011	.087	.017	.024	.008	103	1,839
Flood	7,937	1.019	.267	.008	.106	.043	.027	.018	099	1,587
Pike	1,672	1.516	.550	.011	.036	.024	.028	.044	126	2,295
Dobbins	7,840	1.679	.175	.013	.235	.070	.026	.025	151	2,374
Martin	3,714	1.776	.128	.013	.448	.053	.025	.011	145	2,599
Gay	7,036	1.471	.087	.011	.170	.048	.026	.007	140	1,960
Temby	12,149	1.497	.084	.011	.255	.043	.024	.014	175	2,103
Francis	3,940	1.098	.114	.007	.308	.122	.025	.039	190	1,903
Johnson	1,544	1.814	.220	.012	.238	.119	.025	.028	202	2,658
Koster	802	1.913	.896	.014	.208	.137	.026	.007	220	3,421
Iver	5,864	1.017	.315	.008	.054	.052	.026	.033	187	1,692
Cameron	72,976	1.134	.077	.009	.264	.054	.025	.012	180	1,755
France	30,578	1.208	.056	.009	.210	.061	.025	.010	186	1,765
Zuber	1,567	1.127	.171	.008	.170	.052	.028	.006	206	1,768
Ole	102	1.507	.062	.014		.025	.010		197	1,815
East Ole	1,477	1.225	.293	.009	.290	.039	.031	.021	204	2,112
Murphy	35,279	.922	.041	.007	.191	.027	.023	.009	185	1,405
Rabb	36,461	1.367	.107	.010	.392	.078	.024	.008	189	2,175
Larson	15,487	2.001	.295	.015	.219	.088	.024	.014	202	2,858
Lee	14,281	.811	.068	.006	.247	.036	.025	.005	184	1,382
Miller	142,914	.757	.066	.006	.206	.040	.026	.006	184	1,291
Porter	10,251	.834	.156	.006	.220	.127	.025	.014	186	1,568
Mike	6,677	.797	.126	.006	.253	.152	.025	.014	189	1,562
East Porter	3,825	1.090	.297	.008	.043	.093	.026	.012	183	1,752
Rock	3,981	.947	.314	.007	.135	.153	.025	.020	186	1,787
Plemmons	11,638	.798	.289	.006	.184	.136	.028	.022	198	1,661
Day	8,103	.774	.410	.006	.099	.155	.027	.023	196	1,690
Spur	2,679	1.068	.102	.007	.262	.008	.006	.012	286	1,751

Milling at the Tough Oakes Mine

According to the annual report of the Tough Oakes Mining Co., Ltd., of Kirkland Lake, Ont., ores consisting of approximately 85% hard feldspar porphyry, the balance being quartz with some conglomerate and graywacke, are reduced by ball and pebble mills so that 85% will pass through a 200-mesh screen. During the year, the following details were recorded:

MILL OPERATION RECORD, 1916

Dry tons ore treated	37,263
Dry tons tailings treated	2,600
	39,863
Ball mill running time	93.4%
Pregnant solution precipitated, tons	187,868
Tons solution per ton ore	4.7
Net weight precipitate recovery, lb.	10,429
Average assay value per lb.	\$67.16
Average daily tonnage treated	109.22
Total cost per ton	\$2.43

MILLS SUPPLIES PER TON OF ORE TREATED

	Lb.
Steel balls	1.57
Flint pebbles	4.29
Sodium cyanide	1.24
Lime	3.26
Zinc dust	0.77
Zinc dust per ton solution	0.16

BULLION RETURNS

	Troy Oz. Recovered	Value
Fine gold	33,171.641	\$685,721.70
Fine silver	13,051,060	8,864.76

The cost of mill supplies was \$1.15 per ton including balls, pebbles, cyanide, lime, zinc, dust, lubricants, tube and ball mill liners, crusher jaws, etc., all of which have increased from 15 to 400%. Cost of labor and superintendence was 54c. per ton, of grinding, 84c. per ton.

Butte & Superior Mining Co.

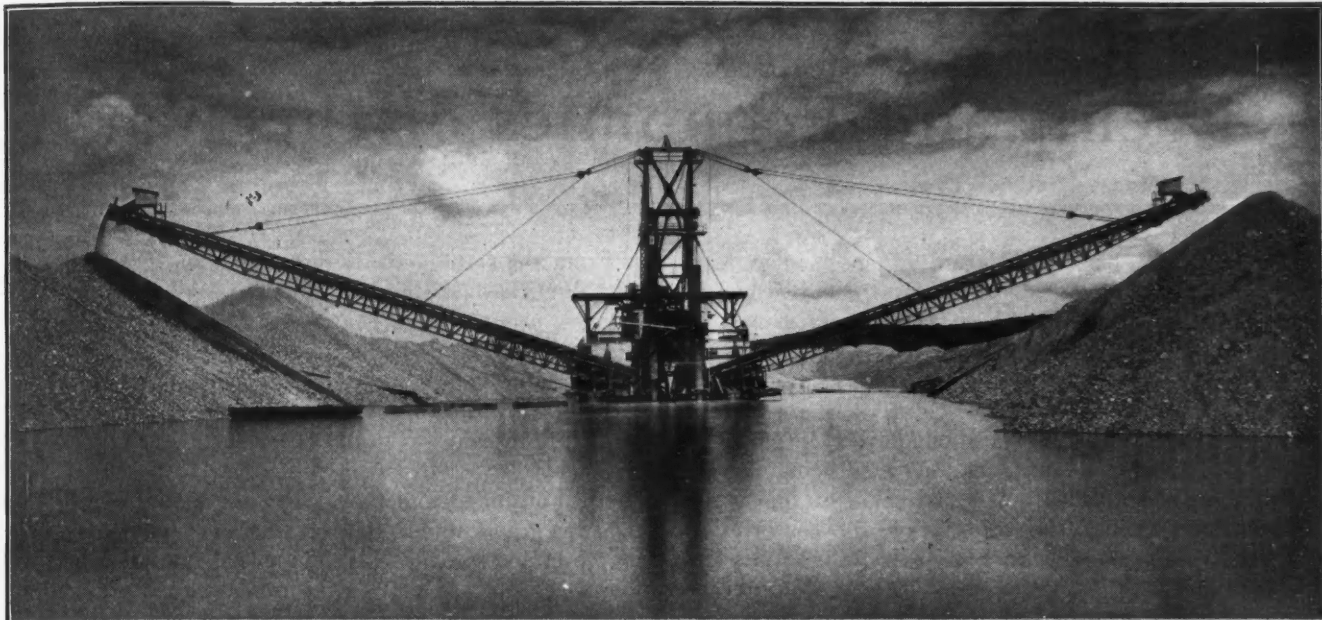
The report of the Butte and Superior Mining Co. for the first quarter of 1917 shows a production of 148,935 dry tons of ore averaging 15.4911% zinc and 5.7733 oz. silver per ton. The mining cost was \$4.6889 per ton and the milling cost \$2.6496. The production was 16,535 tons less and the cost of mining and milling exclusive of taxes 82c. per ton more than for the previous quarter, due to the short month of February and to interruptions and changes in the apparatus shrdlu vbgAfN etaion and changes in the flotation apparatus and methods. New concentrates produced totalled 42,521 tons averaging 47.131% zinc and 17.256 oz. of silver. The mill recovery of the zinc was 86.821%. The net value at the mill of zinc and lead concentrates and residues was \$2,233,317.53. Miscellaneous income was \$42,302.42 making the total net value for the quarter \$2,275,619.95. Operating costs and taxes were \$1,214,599.12, leaving a profit of \$1,061,020.83. The decrease in profits compared with the previous quarter was \$1,248,047.26 which was due mainly to the increase in the reserve for taxes and the absence of any credit in this quarter for metal inventories and quotations as against a credit of \$650,000 under this heading last quarter. The amount reserved for taxes, based on existing laws, was \$119,943.39. The earnings included a credit of \$35,000 representing a dividend of \$1 per share paid on the stock of the American Zinc Lead & Smelting Co. The regular quarterly dividend of \$1.25 and an extra dividend of \$1.25 per share were paid leaving net quick assets of \$2,754,718.01, of which \$788,679.94 was cash and \$1,536,542.69 was estimated net value of products on hand and in transit. The price of spelter used in estimating the returns was 9.5955c. per lb.

Yuba No. 16 Double-Stacker Gold Dredge



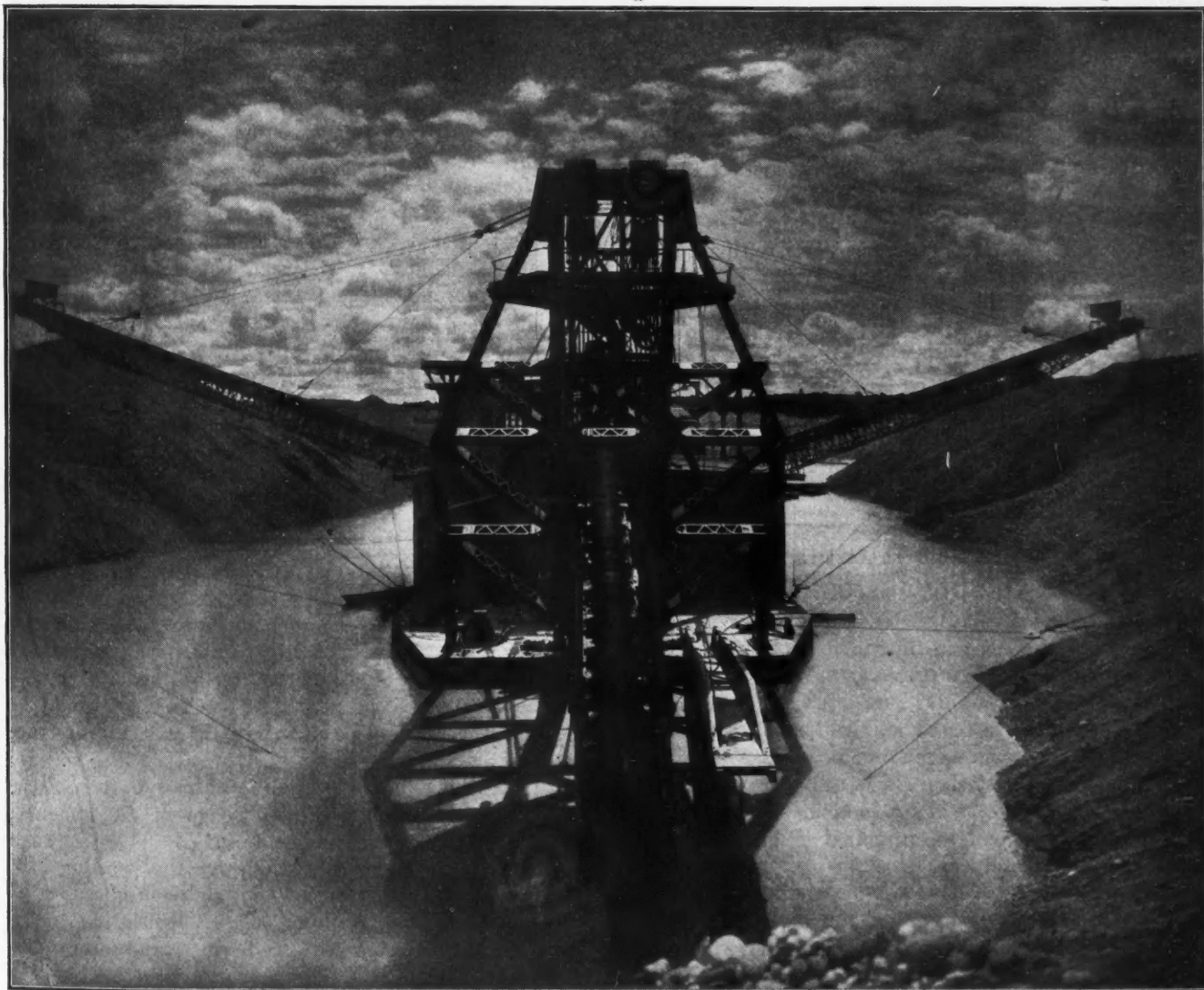
YUBA NO. 16 DOUBLE-STACKER GOLD DREDGE WHICH STARTED DIGGING AT HAMMONTON, CALIF., IN APRIL

The accompanying illustrations which naturally have lost something in reproduction are remarkably fine examples of dredge photographs; they were taken by Gabriel Moulin, of 153 Kearny St., San Francisco, Calif. Yuba No. 16 is the largest capacity gold-placer dredge of its type in the world. It is equipped with double-tailing stackers and is designed to dig to a depth of 82 ft., leave a navigable channel and to strengthen the banks against floods. The upper illustration on this page shows a starboard-and-bow view which gives some idea of the full length of the twin tailing stackers. The lower illustration is a stern-starboard view, showing the starboard staker in operation, the cleared runways on either side of the staker, together with details of the hangers, the stern gantry with safety platform at the top, also the spuds with safety platform at the top of the spud support. The traveling crane, athwartship, should be noted.



YUBA NO. 16 ALL-STEEL DOUBLE-STACKER GOLD DREDGE, HAMMONTON, CALIF.

This stern view of Yuba No. 16 shows the full length of both stackers, the distance between the outer or upper ends at maximum extension being 416 ft. 6 in. The approximate height of the stacker gantry above the water line is 103 ft. The weight of each stacker is about 80 tons. This view shows the port stacker only in use as tailing is not required on the starboard bank



BOW VIEW OF YUBA NO. 16 DOUBLE-STACKER GOLD DREDGE IN YUBA BASIN, CALIFORNIA

This view was taken with the camera facing the sun, as indicated by the shadow of the bow gantry in the pond. The clear freeboard of the hull is finely outlined. Note the commodious safety platform on the bow gantry

Events and Economics of the War

The last week has been devoid of spectacular features. The great Italian drive appears to have come to a standstill and there has been relative quiet on the British and French fronts.

An encouraging feature was the further diminution in sinkings by submarines.

In the United States, preparations have been going on steadily. Probably a good deal more is being accomplished than is published. The attention of the public has been focussed on the registration for conscription on June 5. There were minor disorders in several parts of the country and a few arrests of persons who may be charged with treason. The Government has exercised a firm hand on this situation.

There has been most alarm over the situation in Russia, where some of the socialists and many of the trades unions are behaving in a senseless and unpatriotic way. Yet we have the feeling that on the whole the situation in Russia is improving.

✽

The U-Boat

The menace of the submarine seems on the decrease, but it is wise not to be carelessly optimistic. The Admiralty states that U-boats claimed but 69 British vessels during the 3 weeks ending May 27. In the same period there were 16,030 "ship movements;" that is, arrivals and departures from British ports. This gives a ratio of ship movements to sinkings of 231 to 1.

In the Adriatic, the Italians have recently sunk 13 submarines, largely, it is said, through the genius of Marconi.

That our exports increased in April in spite of the submarine is evidenced by figures just issued by the Custom House. The total for last month is \$216,009,802 as against \$175,754,291 in February, the bulk of which went to France and England.

✽

The Government's Attitude Toward the Steel Men

A certain steel man, says the *Wall Street Journal*, gave the following opinion as to the statement that the Government will name its own price for the steel it needs for war purposes:

"This proposition is based on the idea that the steel manufacturers are making enormous profits. While it is true that prices of steel products are abnormally high, it is also true of the cost of production. This is clearly shown by comparison of the principal elements entering into the cost of producing steel.

"In fixing the prices, however, the manufacturers feel that there is grave danger in any policy which attempts to arbitrarily fix the prices received at a low figure.

"Such a course must inevitably have a disturbing influence on many lines of trade, as we must assume that the Government will attempt to fix arbitrarily prices on all commodities required for national defense.

"From the standpoint of revenue alone, it would seem to be ill-advised; if the manufacturers are not permitted to make profits, there can be no revenue from either the income tax or the excess profits tax.

"The safer and more profitable method would be to place the Government business at current market rates, less such a discount as would be given to any other large responsible buyer; insist on preference being given over all other business; and then, when the manufacturer has made his profit under fair competitive conditions, take from him by taxation his fair proportion of whatever may be necessary to provide the funds for the prosecution of the war.

✽

The Liberty Loan for Wage Earners

To popularize the War Loan, which means to bring it within the reach of the man in the street, the Federal Reserve Bank of New York has been asked by the Liberty Loan Committee to arrange to issue ten dollar certificates convertible into the fifty dollar bonds. The Reserve Bank will probably issue these certificates in return for the deposition of an equivalent amount of Loan bonds with itself.

To facilitate the sale of bonds where the buyer wishes to pay at once for his securities, the Treasury Department has ordered that subscriptions for one \$50 bond or one \$100 bond may be accomplished by payment in full, if so desired. The transfer will be completed by the delivery of an interim certificate. The bonds so represented will bear interest from June 15 and will be issued in exchange for the certificates as soon as they can be prepared.

✽

Senator Weeks on War Taxation

Senator Weeks says: "If we raise by taxation an amount sufficient to pay civil expenses of the government, interest on the public debt, and about one-twentieth of cost of the war, we would be going as far as we should in immediate taxation. There is no particular reason why this generation should not pay for the war, but there is every reason why it should not pay one-quarter or one-half the expense in one year. In one case we would be following a businesslike course; in the other a destructive one.

"I am afraid personal prejudice, animosity to particular industries, and lack of knowledge of fundamental reasons surrounding success or failure in business have actuated some of those responsible for the pending bill, and cannot too strongly urge a thorough consideration of basic principles and framing of tax legislation along such lines that no one will be harmed and every one benefited. I do not think for a moment the business of this country desires to avoid responsibilities incident to the war. It is willing to be taxed for any amount the government believes necessary for efficient prosecution,

but does wish to have its business organization in shape when normal times are restored, so it can operate as efficiently and successfully as conditions at that time warrant. In other words, we can temporarily take any part of the profits of business for governmental purposes, but cannot afford to destroy one atom of the means of producing those profits."

Navy Shells Not Defective

An official statement issued on May 22 by Secretary Daniels said that all shells intended for naval use that were manufactured since 1900 are as good today as when they were first made. It admitted, however, that the premature explosions on the steamships St. Louis and St. Paul were due to old shells made in 1898 for use in the Spanish war. Possibly the fatal accident on the S. S. "Mongolia" is traceable to the same cause. However it is difficult to see how any part of even a defective shell, could return to the ship in the manner claimed.

The Food Administration Bill

A new Food Administration bill was introduced in the House, on May 22, by Chairman Lever of the House Agricultural Committee. In its power to control the production, distribution and consumption of the necessities of life is strongly centralized in the President.

It is such power as this that the President said must be placed in his hands when he named Mr. Hoover Food Administrator. It will be remembered that the latter said that the mere possession of such power by the Executive would probably be sufficient to gain the desired ends and that occasion might never arise for using it were it once granted. The bill according to Mr. Lever, "declares every business dealing with necessities to be affected with a public interest."

Mr. Hoover is unalterably opposed to introducing outside issues, such as prohibition in its ethical aspect, into the situation.

Efficiency of Great Corporations

"War trusts, organized despite the Sherman law, probably will be tolerated by the United States Government during the period of hostilities, on the ground of 'national emergency,'" said a statement purporting to be authorized by officials of the Department of Justice, May 23. According to the *Evening Sun*, it is apparent there is an understanding between the Government and the large corporations that the latter will not be molested unless they flagrantly abuse their privileges.

The reasons given for permitting organization and pooling of interests by the great monopolies of the country during the war are twofold. First, that drastic action taken against them at this time might seriously upset business. Second, that by combining it is believed they can deliver more cheaply, more efficiently and more quickly supplies needed by the Government for the war.

If such efficiency be good in war time, why not in all time?

Nevertheless, in spite of the "national emergency" plea in favor of combinations during the war, there is distinct uneasiness in Congress as to the matter. Representatives and Senators assert that if the Sherman law is

to be passed over, action by Congress temporarily suspending it should be taken. Some Government officials are strongly opposed to such action, however, and this will not be done unless the hand of the Administration is forced.

Why not then suspend, or greatly modify the Sherman law? If Congress should want to do that, what have Government officials—the bureaucrats—got to say about it?

Labor More Plentiful

It is reported that in several sections of the country there seems to be a more satisfactory labor condition. This is probably due to the completion of many of the European War contracts which have resulted in a release of labor that may now go into other channels. This is gratifying because many classes of construction, particularly roads, should go on uninterruptedly during the war period.

A recent report of the State Highway Engineer of Wisconsin says that there is a slight advance in pay, averaging throughout the state about 25c. a day for men, and 50c. a day for man and team, over prices paid a year ago. Contractors on outside work have reported that men were easier to obtain than at the same time last year. It would be a very poor proposition to suspend or curtail public work of any kind at the present time.

The Neutral States

Revocation of the decree of neutrality in the war between the United States and Germany is recommended to the Brazilian Congress by President Braz.

A shake-up in Chinese official circles has resulted in the appointment of Wu Ting-Fang as acting Premier with authority to form a new cabinet. This will probably break the deadlock and make possible a declaration of war against Germany.

Obregon says Mexico is neutral though in sympathy with the Latin races fighting in Europe. The German Government is said to have received a protest from Mexico against the submarine campaign.

Railway Economy

The Railroad War Board in a recent bulletin suggests certain economies such as the reduction of the number of locomotives under repair, greater speed, careful steaming to save fuel, the use of full engine loads and shorter loading and unloading time for freight cars.

The bulletin claims that through such means the railroads can increase their engine and car supply from 20 to 30%.

War Risk Insurance

The Senate on May 22, passed the bill for the creation of a Bureau of War Risk Insurance in the Treasury Department, with an appropriation of \$5,000,000 to carry it on. The bureau is to insure American merchant vessels, officers, and crews of the vessels against accident, loss of life or loss of their effects.

Chile Copper Co.

The first annual report of the Chile Copper Co., covering the period from the beginning of operations to Dec. 31, 1916, for both the holding company and its operating company, the Chile Exploration Co., states that since the first bonds of the company, amounting to \$15,000,000, were sold in 1913, extraordinary developments have taken place at the property. At that time construction was started on a 10,000-ton per day plant to treat the Chuquicamata orebody, estimated to contain 95,657,000 tons of 2.41% copper ore. The plant was started on May 18, 1915, since which time 82,804,000 lb. of copper has been marketed and 6,864,000 lb. additional produced, the latter amount being constantly used in the treatment process.

This production, within 4½ years from the time that the main properties were purchased, speaks for itself, and this, in spite of the fact that the company had to devise and apply an entirely new process of treatment to its ores, which differ radically from any other known copper deposit; that the plant is in a foreign country and remote from any market for material; that the deposit is in what was formerly a desert, which has now been made into a thriving mining town of some 7000 inhabitants; that water was piped 37 miles and power transmitted 84 miles; and that machinery vital to the plant, was blocked in belligerent and neutral ports at the time of the outbreak of the war.

SUCCESS OF THE PROCESS

After 19 months' operation, it has been found that very few changes, of minor importance only were necessary in the process. The usual mechanical troubles in starting up a metallurgical plant were augmented on account of difficulties in obtaining prompt deliveries for minor changes in equipment were made still worse by slow deliveries due to the war. This has, for the time being, materially retarded the bringing of the plant up to capacity.

For the next few years, the ore mined will contain approximately 1.8% Cu, compared to the average grade of the now developed orebody of 1.89% Cu from which a final recovery of 88% of the copper content is expected.

Ore reserves are estimated by Fred Hellmann, consulting engineer, to consist of 232,900,000 tons of oxidized ore of 1.89% Cu; 73,100,000 tons of mixed ore of 2.98% Cu; 48,700,000 tons of sulphide ore of 2.36% Cu, or a total of 354,700,000 tons of an average of 2.18% Cu.

To this, probable ore estimates add 345,300,000, making the total ore 700,000,000 tons of an average of 2.12% Cu.

On account of this development of ore reserves, immediate steps are to be taken to increase the capacity of the plant to 27,000 tons per day, for which \$35,000,000 6% convertible bonds are to be issued, the approval of the stockholders having been secured for a total issue of \$100,000,000 for this or further improvement work. Construction work, plans for which are well under way, will be under the direction of S. B. Williamson, formerly in charge of the construction of the Pacific division of the Panama Canal.

The company has acquired by purchase, the holdings of Compañia Minera de Calama, for which \$1,508,368 was paid, also two steamships, for the joint account of the Chile Exploration Co. and the Braden Copper Co.

The following comparative table gives the more important data covering from the beginning of operations. Costs are calculated before deducting interest on bonds and loans, depreciation or writing off plant accounts:

Period	Tons Copper Produced	Dry Tons Ore Treated	Daily Average in Ore	% Copper in Ore Treated	% Net Saving	Net Cost per Lb. Copper at Plant	Total Cost of Production Including Selling, Delivery and Miscellaneous Expenses
7½ mos. 1915.....	5,472	625,394	2,743	1.71	66.87	16.34c.	18.55c.
1st Quarter 1916	4,374	354,612	3,897	1.66	74.82	12.52c.	15.43c.
2nd Quarter 1916	5,487	372,256	4,091	1.80	75.87	11.81c.	15.04c.
3rd Quarter 1916	5,344	392,390	4,265	1.83	85.24	10.52c.	15.20c.
4th Quarter 1916	5,448	623,490	6,777	1.70	73.42	12.29c.	16.17c.
12 mos. 1916.....	20,653	1,742,748	4,762	1.74	77.15	11.75c.	15.46c.

The gross "price delivered" for copper produced during the year 1916 was 25.56c. per lb.

Although mining and treatment cost has been constantly decreased since operations began in May, 1915, it is still high, due to comparatively small production.

Transportation and insurance costs are excessively high, being approximately 2c. per lb. above those before the war.

The preliminary figures, for the first four months of 1917, which will probably not differ materially from the final figures, are included below, inasmuch as they give a much truer indication of the present status of the company than the figures above:

Period	Tons Copper Produced	Dry Tons Ore Treated	Daily Average in Ore	% Copper in Ore Treated	% Net Saving	Net Cost per Lb. Copper at Plant	Total Cost of Production Including Selling, Delivery and Miscellaneous Expenses
1st Quarter.....	11,263	588,879	6,543	1.88	83.30	9.01c.	12.53c.
April.....	4,014	224,926	7,497	1.79	80.70	8.06c.	11.31c.

For the period from the beginning of operations, May 18, 1915, to Dec. 31, 1915, the total income of both companies was \$30,468.74, less interest \$176,642.37, resulting in a net deficit of \$146,173.63.

For the year 1916 the total income was \$4,173,049.10, less interest on bonds and loans of \$1,463,676.18 and reserve account for plant depreciation \$772,981.19, leaving a balance of \$1,936,391.73.

Forfeiture of Mining Locations

BY A. L. H. STREET*

The Washington Supreme Court vouches for an inclination of the judiciary to give effect to bona fide attempts of the locator of a mining claim to comply with the laws relating to the marking of the location on the ground giving of notice, etc., although there may not have been strict technical compliance with the statutes. (Gold Creek Antimony Mines and Smelter Co. vs. Perry, 162 Pacific Reporter, 996.)

The court declares that one who claims rights as a locator against a prior locator on the ground that the latter has failed to comply with the location statutes is bound to make out a clear and strong case, if it appears that claimant knew the ground well, was previously familiar with its workings and assisted the prior locator in doing assessment work.

It is also decided that as against subsequent locators it is sufficient that an original location be so distinctly marked on the ground that the boundaries can readily be traced.

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Editorials

Cost of Producing Copper

Most of the American copper-producing companies have now submitted their reports for 1916, and from them it is possible to summarize the costs of producing copper in 1916, as reckoned severally by themselves, with one or two exceptions, however. Such a summary is found in the following table:

Company	Production	Cost per Lb.
Kennecott Copper Corp.	108,372,783	5.10c.
United Verde Extension Mining Co.	36,402,972	6.4†
Utah Copper Co.	187,531,824	6.95
Champion Copper Co.	33,601,136	7.8
Braden Copper Co.	42,153,270	8.03*
Chino Copper Co.	72,319,508	8.706
Shattuck Arizona Copper Co.	18,161,763	8.716
Mohawk Mining Co.	18,468,100	8.85
Calumet & Arizona Mining Co.	74,898,788	9.04
Inspiration Consolidated Copper Co.	120,772,637	9.294
Nevada Consolidated Copper Co.	90,735,287	9.44
Miami Copper Co.	53,518,331	9.523
Ray Consolidated Copper Co.	74,983,540	10.267
Allouez Mining Co.	10,219,290	10.47
Magma Copper Co.	8,473,580	10.803
Baltic Mining Co.	12,425,804	10.85
Trimountain	8,720,558	11.1
White Pine Copper Co.	4,207,449	11.22
Greene-Cananea Copper Co.	62,250,067	11.352
Ahmeek Mining Co.	24,142,158	11.47
Calumet & Hecla Mining Co.	76,762,240	11.63
Old Dominion Copper Mining and Smelting Co.	17,654,643	11.69
Oseola Consolidated Mining Co.	19,586,501	11.69
Chile Copper Co.	41,305,476	11.76*
Quincy Mining Co.	21,065,612	12.642
Centennial Copper Mining Co.	2,367,400	13.44
Superior Copper Co.	3,034,656	13.78
Tennessee Copper and Chemical Co.	9,404,295	14.36
Ile Royale Copper Co.	12,412,111	15.32
Mass Consolidated Mining Co.	4,752,588	15.37
North Butte Mining Co.	24,498,181	15.57†
East Butte Mining Co.	18,340,713	16.8†
Shannon Copper Co.	9,364,968	18.461
Victoria Copper Mining Co.	1,661,832	19
La Salle Copper Co.	1,380,352	19.96
Franklin Mining Co.	3,116,566	20.22
Total	949,709,359	

* Cost at the plant. † Estimated. Owing to high insurance, freight rates, etc., the cost delivered was much higher.

It will be observed that from the list are missing, among the great companies, Phelps, Dodge & Co., Anaconda Copper Mining Co. and Arizona Copper Co. None of these reports formally its cost of production per pound.

Some comments on the figures tabulated are necessary to a correct understanding of them. In the first place they are, with two or three exceptions, as given by the companies themselves. In some cases they are true costs; in other cases they are not. We do not mean to imply by this that there is any intention to deceive. It is a matter of bookkeeping. Some companies reckon their cost of construction and get a quotient that is the true cost. But other companies reckon only direct costs of operation and dispose of other necessary charges in ways that make their reports look very good year by year, but not so good over a series of years, when the real cost must appear.

Another point to be noted is that in several cases the cost of production per pound of copper is made to appear unusually low by giving the mine credit for the earnings of subsidiary companies, such as railways, smelteries, etc., which represent large investments of capital. Nearly all these companies—except those of Lake Superior—produce some gold and silver as well as copper and make the copper cost appear unduly low by reckoning gold and silver cost at 100% of their value. If profits were pro-

rated, the companies' books would show some profits from gold and silver and less profit from copper—in other words, a higher cost for copper—than they do.

In no case does any company's report allow for charges on the use of capital, nor for the purpose of a commercial business should they do so. However, in viewing an industry as a whole to determine whether it be profitable or not, there should be consideration of that matter. The probable cost for plant and equipment in connection with our modern copper mines may be generalized at something like 15c. per lb. of annual product. In other words, a mine producing 100,000,000 lb. of copper per annum will generally require development, plant and equipment costing about \$15,000,000. The use of such capital, including the amortization of it, must be figured at 1½c. per lb. of copper at the least.

Chile Copper Co.

The appearance of the first annual report of the Chile Copper Co., which owns what has been characterized as the "world's greatest copper mine" is naturally an event of interest. Especially is it so in view of the fact that it is the first complete official statement of the financial and technical history of one of the boldest and largest ventures in the annals of mining and metallurgy. We may usefully summarize some of the important things.

Construction was begun in the early part of 1913. The plant was started on May 18, 1915. This was only 4½ years after the purchase of the property. It is a remarkable record that so huge a development in a distant country, involving the provision of such elaborate accessories as the piping of water supply 37 miles and the transmission of electrical power 84 miles should have been done in so short a time.

Equally marvellous is the fact that the treatment of this ore was to be done by a new metallurgical process that previously had not been employed in practice. Yet so carefully was the preliminary experimental work done, and so intelligently, that Mr. Cappelen-Smith, the consulting metallurgical engineer, is now able to say that after 19 months of operation the success of the process has been fully proved. It is expected that a final recovery of 88% of the copper of the ore will be made, and that by a process that is unique in that refined electrolytic copper is produced at the mine itself.

On the subject of ore reserves, Mr. Hellmann, the consulting mining engineer, estimates that there is at present a development of 354,700,000 tons of ore averaging 2.18% copper. Estimating both positive and probable ore he computes 700,000,000 tons averaging 2.12% copper. These staggering figures afford some solid ground for the claim that this is the largest known copper deposit of the world.

The present plant is designed for the treatment of 10,000 tons of ore per day, or say 3,500,000 tons per year. The developments of the mine have been so im-

mense, however, that now it is contemplated to increase to 27,000 tons per day, but the 17,000-ton extension will not be completed before some time in 1919, or so it was estimated before the United States entered the war. However, during 1916 the operation of plant did not attain present capacity, the ore treatment during the last quarter having been at the rate of about 2,500,000 tons per annum. The net cost of the copper at the plant—12.29c per lb.—was also much above the figure that is expected when everything is in regular running order. Thus, in the first quarter of 1917 the cost per pound at the works was down to 9.01c.

When the 10,000-ton plant is operating at full capacity, treating ore averaging 1.89% copper and extracting 88% thereof, it is expected that the annual production of copper will be about 110,000,000 lb. In providing the plant to do that there was expended 2,025,524 for interest and general charges during the development period, \$1,470,653 for development and experimentation, and \$15,471,350 for plant and equipment. The last figure is about 14c. per lb. of annual product, which approximates the usual cost of enterprises of this kind and this magnitude.

The Annoying Neighbor

Mexico continues to run true to form as a nuisance to the United States. Whether in one way or another, our "Sister Republic" has the faculty of proving at every turn that she has little regard for our good will. The great number of laws recently enacted and proposed show that the government at Mexico City is attempting to provide, under the guise of high-sounding ideals, a situation highly pleasing to those individuals who are in a position to enforce their claims, but which diverges widely from idealism. Some of the laws appear to be so worded that their observance would be largely left to individual judgment, and others are so tightly drawn that they cannot be strictly enforced. Such a condition induces veniality, which has always been official Mexico's besetting sin.

It is not Mexico's laws, however, that are most annoying to us now, but rather her official blindness in failing to recognize the mess of German plots and spy activities that are flourishing there now. Now it appears that German spies are using the country as headquarters, transmitting to Germany by underground means information illicitly obtained in this country. It is even asserted that a wireless station, capable of reaching Germany, has been installed and is being used. If official Mexico does not know of this condition, it ought to, and certainly could if it wanted to. Spoken idealism does not square with underhand maliciousness, and we hope soon to see the end of the condition now said to obtain.

Canadian Smelting Smoke Decision

The recent decision in the Sudbury smoke cases has brought out a point that was not given as much weight by the courts in this country as many felt it was entitled to. The Canadian court has awarded certain damages to land owners surrounding the smelting plants of the Canadian Copper Co. and of the Mond Nickel Co., but the court declined to grant an injunction against the

operation of these works, Mr. Justice Middleton ruling that though the smoke from the smelteries might constitute a nuisance, there were circumstances under which individual rights could not be maintained in opposition to the good of the whole community. The court felt that it ought not to destroy the mining industry of Sudbury, even though a few farms were damaged or destroyed. In this connection, the fact was brought out by the mining companies that they had always stood ready to purchase the holdings of the individuals suffering from their operations at a price in excess of the value.

In the United States it has apparently been the policy to estop the operations of million-dollar plants when damage amounting to a few thousand dollars at most was done to surrounding land, which in many instances had attained value only through the community built up by the mining or smelting companies. It seems to us that the Canadian court in dealing with this matter has found a broader and more logical point of view than have our own courts.

Suspension of assessment work on mining claims during the period of the war is provided in a bill introduced at Washington by Senator Shafroth, requiring, however, that \$100 worth of labor or the sum of \$100 be expended in the raising or manufacturing of products necessary for the maintenance of the army, navy or people of the United States. We favor this idea, but think the administration of the law would be much simplified by making it straight suspension for the period of the war. Most of the claim holders in this country are engaged in the production of metals, in which work they are now most proficient, and for those who are not, the expenditure of money for assessment work is mainly a waste of money that might be better applied to Liberty bonds.

Speaking about the reduction of waste, the Government at Washington might well make a beginning with itself. It is commonly conceded by engineers acquainted with the subject, also by experienced economists, that the railway valuation now going on, under orders from Congress, at a cost of many millions of dollars annually, is money thrown away. Let Congress stop this costly leak. Also, there is the matter of useless printing to which both Congress and the bureaus might well direct their attention. The states also may do something in the way of avoiding waste. A general repeal of the full-crew law, with which the railways were needlessly saddled at the behest of the labor unions, would be a good thing to begin with, as indeed has been done by the State of New Jersey.

The subscriptions to Belgian Kiddies, Ltd., have reached a total of \$94,520. The United States Government has accepted the burden of providing for relief in Belgium and northern France, but since this is through the agency of loans to Belgium and France, and since Mr. Hoover, Mr. Honnold and other American engineers connected with the work will continue to give their services without charge, J. V. N. Dorr, chairman of the Belgian Kiddies Committee, announces that it seems right that subscriptions should be continued until the amount originally proposed, \$120,000, has been reached.

BY THE WAY

Distillers' waste obtained after the distillation of black-strap molasses in the manufacture of alcohol is a source of considerable potash. This method of obtaining potash is just coming into notice. The waste is evaporated to a solid residue. The dry product is used as a fertilizer. Since this residue contains practically all of the potash content of the molasses (about six per cent) it makes a fertilizer said to be equal in every way to the high grade potashes.

It is stated that \$100,000 of the amount necessary has been raised to build a permanent road between Joplin, Mo., and Miami, Okla., a distance of 35 miles. This initial contribution comes from those on the 12-mile stretch that lies in Missouri. Due to hauling oil-drilling machinery and to the teaming involved in zinc mining operations, this is a heavily traveled route and the expense of maintaining it is becoming so unbearable that the communities along the way feel that a good road is necessary.

Professor Seligman, of Columbia University, one of the most expert taxation students in the country, figured recently that if we were to put into effect the same internal revenue measures by stamp tax, taxes on luxuries, etc., as prevailed at the end of the Civil War, the government would be in receipt from those sources alone of \$2,000,000,000, as contrasted with an amount of only \$350,000,000 now received from those sources. These are undoubtedly the great form of taxes that fall indirectly on the people, form no really serious burden, and do not become a heavy drag on industry.

A striking instance of the quality of the reserve engineers, says the *New York Times*, was furnished at the recent ceremonies when Columbia University conferred honorary doctorates on Marshall Joffre, Vice Premier Viviani, Lord Cunliffe, and the Right Honorable A. J. Balfour. One of the chief dignitaries at that ceremony was William Barclay Parsons, chairman of the board of trustees of the university and one of the most distinguished engineers in the city, who presided in his khaki uniform as a major of engineers. Another prominent figure was Arthur S. Dwight, also one of the board trustees, internationally known as a metallurgist, who is a major in the 1st Reserve Engineer Regiment.

The Hon. John Barrett, after his return from Europe, where he visited the front-line trenches, said of the "tanks": "They are the most diabolical looking things I have ever seen, a mighty metal monster, a sort of reincarnated, so to speak, ancient battering ram converted into an up-to-date self-moving offensive fortification. Although the idea came originally from America, the machines that they are now using have been built in England and they are indeed extraordinary. They stand 12 or 14 ft. high; they weigh from 20 to 30 tons; and they are from 25 to 30 ft. long. Great caterpillar tractors run over both sides. The entire car is incased in chilled steel, carrying a crew

of eight men, the driver operating a 100-hp. motor which propels it. He looks through a periscope—not through a slit. That monster can negotiate a ditch 10 ft. wide, no matter how deep it is, and can climb over an obstacle 8 ft. high, or anything it can get its nose over! It will crush down an average small house. It will break down an average tree. Artillery fire is the only thing that can stop it. Rifle and rapid-fire guns' fire has no effect upon it. It is no wonder, therefore, that it has caused such consternation in the fighting force of the enemy. At the present time it is the most marvelous machine that this modern warfare has created."

While making an examination in the Joplin district a Houghton engineer was harried by the following ideas, which he sat down and tapped off on his Corona: "Why not reform Joplin? Joplin is getting rich, haughty and automobily, and it is time that Billy Sunday came out here. Besides, I think Joplin ought to be brought into the United States and made to use our language; I am told that it is being rapidly introduced into the Philippines, and that where the natives know anything besides their own language, English is spoken. Why couldn't this be brought about in Joplin? I hope the new glossary of mining, which I understand will include Spanish words, will also embrace 'Joplinese.' Down here an ore-bucket is a 'can,' a bin is a 'hopper,' ore is called 'dirt' and the Joplin name for concentrate is 'ore.' The attention of the Society for the Prevention of Cruelty to Words should be directed to this sad case."

THE DRY CAMP

By Berton Braley

Here and there we hear complaining
Now the camp's gone dry,
For the lawyers' work is waning
Now the camp's gone dry;
There's less work for mine inspectors
And for cops and crime detectors,
Jobs are few for bill collectors
Now the camp's gone dry.

Trade in guns and knives is falling
Now the camp's gone dry,
And the pawnshop men are wailing
Now the camp's gone dry;
Though the place of late has grown some,
Business of that sort has flown some
Other camp. Loan sharks are lonesome
Now the camp's gone dry.

Men don't show up gray and dizzy
Now the camp's gone dry,
Ambulances aren't so busy
Now the camp's gone dry;
Hands are steady, eyes are truer,
Accidents in mines are fewer,
But—the undertaker's bluer
Since the camp's gone dry.

Grafters view the fact with loathing
That the camp's gone dry,
But there's bully trade in clothing
Now the camp's gone dry;
All the red-light gang may blow, sir,
But the baker and the grocer,
Are they kicking any? No, sir!
Now the camp's gone dry.

Wives and children aren't disgusted
Now the camp's gone dry,
Fewer hearts and heads are busted
Now the camp's gone dry;
As for mining—that goes faster,
With less trouble and disaster,
We've dethroned an evil master
Now the camp's gone dry.

Personals

D. M. Riordon is in New York.

George H. Garry, who has been examining mines in Arizona and New Mexico, is now in Colorado.

Walter G. Swart has received the honorary degree of E. M. from the Colorado School of Mines.

Louis Garbrecht has entered upon his duties as consulting engineer for the Tunky Mining Co., Nicaragua.

Prof. G. H. Clevenger, of Leland Stanford, Jr. University, Palo Alto, Calif., was in New York this week.

D. H. Newland, Assistant State Geologist, and Kirby Thomas, have made a visit to the zinc deposits in Sullivan County, New York.

H. W. Hardinge received the honorary degree of E. M. from the Colorado School of Mines at its commencement on May 25.

Julius M. Cohen, manager for the Croesus Gold Mines, Ltd., Matheson, Ont., has been commissioned a first-lieutenant in the Reserve Engineer Corps.

Paul W. Gaebelein, lately of the Baker Mines Co., Cornucopia, Oregon, has joined the staff of Anderson, Baker & Baker, with headquarters at Boise, Idaho.

John Sartagusa, an American mining engineer, who has operated in Sonora for some time, is in Brazil making investigations for American interests.

Dr. Edgar Marburg, secretary-treasurer of the American Society for Testing Materials, is seriously ill and has had to relinquish his duties temporarily.

Bernard MacDonald will go to Chile on professional business, remaining several months. After July 5 his address will be Casilla No. 20, Antofagasta, Chile.

F. M. Wichman is engaged in the practice of mining engineering in Salt Lake City, Utah, and will have offices in Rooms 406 and 407, Dooly Block, after June 1.

M. H. Kauffman has resigned as superintendent at the Durango, Colo., plant of the American Smelting and Refining Co. His address for a few months will be 1115 Eighth Avenue, Denver.

Samuel W. Cohen, manager for the Crown Reserve Mining Co., Ltd., and Porcupine-Crown Mines, Ltd., has returned to Montreal after a trip of two months to California.

D. D. Homer, until Feb. 1 general superintendent for Butters Divisadero Mines, Salvador, is now general superintendent for the Jerome Del Monte Copper Co., at Jerome, Ariz.

Alden H. Brown, of New York, has been accepted for service in the Cuba army and will leave soon for Cuba. Mr. Brown has been identified with several mining undertakings in Cuba.

W. J. Pike, for five years superintendent of the Jim Butler Tonopah Mining Co., has resigned to accept a similar position with the Consolidated Spanish Belt Silver Mining Co., of Tonopah, Nev.

R. P. Reynolds, formerly assistant to L. G. Eakins, general manager of Colorado department of the American Smelting and Refining Co., has been appointed superintendent at the Durango lead smelter, vice M. H. Kauffman.

V. C. Suckow, Chief Inspecting Engineer with Falkenborg & Laucks, Seattle, Wash., has received a captain's commission in the Reserve Engineers and has reported for duty at the Presidio at San Francisco.

J. A. Lovington, of the engineering department of the American Ore Reclamation Co., New York, has joined the officers' training camp at Plattsburg, N. Y. He holds a commission as second lieutenant in the Reserve Engineers and he was formerly a member of the 22nd Engineers, of New York City.

Ernest Woakes, consulting engineer for John Taylor & Sons, of London, has returned to England after a trip of inspection to Argentine and Brazil. In Brazil Mr. Woakes visited the Passagem mine, in the State of Minas, operated by John Taylor & Sons, under the local management of Arthur J. Bensusan, formerly of Australia.

E. L. Pierce has been elected president of the Solvay Process Co., succeeding Frederick R. Hazard, deceased. Mr. Pierce has heretofore been vice-president; he is also vice-president of the Semet-Solvay Company. R. G. Hazard, Peacedale, R. I., has resigned as vice-president to become chairman of the Board of Directors, a new position which has been created. Nathan L. Miller has been elected vice-president to succeed Mr. Hazard. R. W. Swift, heretofore

assistant treasurer, has been elected treasurer to succeed R. O. MacDaniels, resigned.

Thomas Chope, one of the best-known mining men in Butte and for the past three years foreman of the High Ore-Modoc mine of the Anaconda Copper Mining Co., has resigned his position. He declares that he will take a vacation before deciding on what he will do next. Chope came from the mining district of Michigan 20 years ago to Butte and had worked up from an ordinary miner to the position of shift boss at the Gagnon mine. Five years ago he was made assistant foreman of that mine and then was promoted to the foremanship of the High Ore, in which position he had over 1000 men under him. During the last year he won the second prize, amounting to \$250, given by the Anaconda company to the foreman of the mine making the best relative showing in accident prevention. He had but 14 accidents in a year with 269,286 shifts working, the largest number in any one of the Butte mines. The company management accepted his resignation with regret. His successor has not yet been decided upon.

Obituary

Washington S. Tyler, 82, founder of the W. S. Tyler Co., Cleveland, died suddenly, May 27. He was one of the pioneer manufacturers of Cleveland. He organized the W. S. Tyler Wire Works in 1872, from which the present company, employing about 1100 men, has grown. Mr. Tyler was born in Ohio City, O., and was educated in the public schools of Connecticut. He came to Cleveland when 16 years old to enter the firm of E. I. Baldwin & Co., where he worked his way up to a partnership. As an employer, Mr. Tyler was admired and respected for his fairness and benevolence. He was a trustee of the Children's Aid Society, Lakeside hospital and a member of the governing boards of Western Reserve University, Workingmen's Loan Association and other similar institutions. He was also a director of the National Commercial Bank, Cleveland, and a member of the Union and Clifton Clubs.

Societies

American Society of Civil Engineers held a meeting at the society house, 220 W. 57th St., New York, on June 6, at which E. F. Robinson spoke on "The Work of the 22nd N. Y. Engineers at the Mexican Border," illustrating his lecture with lantern slides.

Engineers' Society of Western Pennsylvania held a special meeting in the lecture hall of the Pittsburgh Carnegie Library on Monday evening, June 4. Moving pictures were shown, illustrating the manufacture of high-explosive howitzer shells. Descriptions of the pictures was given by C. L. Lucas, associate editor of "Machinery," by the courtesy of which periodical the pictures were shown.

The Colorado School of Mines Alumni Association held its annual banquet and business meeting on May 26th at the Denver Athletic Club, Denver. The retiring president, H. J. Wolf, was toastmaster. The following officers were elected for the ensuing year: James H. Steele, president; John G. May, vice-president; Arthur H. Buck, treasurer. Orville Harrington is permanent secretary. A resolution was passed to invest one thousand dollars of the funds of the association in Liberty Bonds of the United States in honor of the students of the school who have enlisted in the military service of the Government. Other resolutions were passed in the interest of the School of Mines.

Industrial News

Gaston, Williams & Wigmore, Inc., has removed to 120 Broadway, New York.

Cia. Ingeniera, Importadora y Contratista, S. A., has removed to larger quarters at 3a de la Palma No. 34, Mexico, D. F.

Asbestos Protected Metal Co., Pittsburgh, has temporarily closed its Atlanta and St. Louis offices, since the officers in charge of both stations have entered military training.

Charles A. Schieren Co., New York, manufacturer of Duxbak Waterproof and Steam proof Leather Belting, has recently opened branch offices at 72 Congress St., West Detroit; 18 South Broadway, St. Louis; 475 South Main St., Memphis; 272 Marietta St.,

Atlanta, in addition to those already established.

Denver Quartz Mill & Crusher Co., Denver, Colo., has sold mills since the first of the year to Neill MacDonald, New York, for installation at Hemet, Calif.; J. G. Dawson, Chicago, for installation at Sweetwater, Nev.; Kentuok Consolidated Mining Co., Hudson, Nev.; Union Zinc Co., Knoxville, Tenn.; John H. Rudd, Anchorage, Alaska; Mohaw Mining Co., Anchorage, Alaska; Antimony & Silver Mines Co., Salt Lake City, Utah.

Trade Catalogs

Magnetic Separator. Magnetic Manufacturing Co., Milwaukee, Wis. Bulletin No. 12. Pp. 4; 6 x 9 in.; illustrated.

Concrete Mixers, Hoists, etc. Waterloo Cement Machinery Corp., Waterloo, Iowa. Catalog. Pp. 48; 8 x 10 in.; illustrated.

Leather Belting, Belt Lacing, Belt Dressing, etc. Chas. A. Schieren Co., 30 Ferry St., New York. Catalog. Pp. 40; 6 x 9 in.; illustrated.

Drill Sharpeners Numa Rock Drill Sharpener Co., 1024 Windsor Ave., Salt Lake City, Utah. Catalog. Pp. 8; 6 x 9 in.; illustrated.

Ponflex Metal Hose. Pennsylvania Flexible Metallic Tubing Co., Peoples Gas Building, Chicago, Ill. Catalog. Pp. 32; 5 x 8 in.; illustrated.

New Patents

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

Aluminum—Process of Treating Aluminum Skimmings, Screenings, Dross, Slags, or Analogous Aluminous Materials. James Wright Lawrie, Milwaukee, Wis., assignor, by mesne assignments, to William F. Jobbins, inc., Aurora, Ill. (U. S. No. 1,228,119; May 29, 1917.)

Concentrator. John F. Isbell, Los Angeles, Cal., assignor, by mesne assignments, to George L. Knight, Los Angeles, Cal. (U. S. No. 1,227,792; May 29, 1917.)

Copper-Lead Alloy. Edward D. Gleason, Asbury Park, N. J., assignor to Neu-Metals and Process Co., Brooklyn, N. Y. (U. S. No. 1,228,017; May 29, 1917.)

Drilling—Rock-Drilling Engine. Gustaf Anderson, Stockholm, Sweden, assignor to Nya Aktiebolaget Atlas, Stockholm, Sweden, a Corporation of Sweden. (U. S. No. 1,227,564; May 29, 1917.)

Filtration—Filter-Press. Henry A. Vallez, Bay City, Mich. (U. S. No. 1,227,983; May 29, 1917.)

Flotation of Minerals. Harry P. Corliss, Pittsburgh, Pa., assignor to Metals Recovery Co., New York, N. Y. (U. S. No. 1,228,183; May 29, 1917.)

Flotation—Treatment of Ores. Arthur Howard Higgins, London, England, assignor to Minerals Separation, Ltd., London, England. (U. S. No. 1,227,615; May 29, 1917.)

German-Silver-Alloy Products and Manufacture of Same. Rasmus Beck, Düren, Germany, assignor to the Firm of Dürener Metallwerke Aktien-Gesellschaft, Düren, Germany. (U. S. No. 1,227,569; May 29, 1917.)

Refractory Materials—Production of Refractory Materials. Paul Ralph Hershman, Chicago, Ill., assignor to Armour Fertilizer Works, Chicago, Ill. (U. S. No. 1,227,909; May 29, 1917.)

Roasting Ores—Apparatus for Roasting Ores. Gottwerth L. Tanzer, Seattle, Wash. (U. S. No. 1,226,923; May 22, 1917.)

Sampling—Recording - Sampler. Arthur E. Truesdell, Adams, Mass. (U. S. No. 1,228,078; May 29, 1917.)

Settling Apparatus. Alfred L. Blomfield, Denver, Colo. (U. S. No. 1,227,107; May 22, 1917.)

Smelting—Process of Reducing Metal-Bearing Substances. George L. Fogler, Pittsburgh, Pa. (U. S. No. 1,227,127; May 22, 1917.)

Smoke-Preventer. Henry G. Kosel, New York, N. Y. (U. S. No. 1,227,057; May 22, 1917.)

Steel—Cementation Compound. James H. Allen and Joseph C. Christen, St. Louis, Mo.; said Christen assignor to Orion S. Miller, St. Louis, Mo. (U. S. No. 1,226,739; May 22, 1917.)

Zinc-Smelting Furnace. Julius W. Hegeler, Danville, and Herman Hegeler, deceased, Danville, Ill., by Louise S. Hegeler, executrix; assignors to the Hegeler Zinc Co., Danville, Ill. (U. S. No. 1,227,050; May 22, 1917.)

Editorial Correspondence

SAN FRANCISCO—May 31

Samples of Mine Explosives used in California mines are being obtained by the U. S. Bureau of Mines. These samples are to be sent to Pittsburgh for examination and perhaps for decision as to their safety in use in the metal mines in this state. The recent fatal accident in the Mountain King mine in Mariposa County, in which a number of men lost their lives through subjection to powder fume, is an illustration of the necessity of a careful examination as to the proper use of powder, or the use of proper powder in the deep metal mines of California.

Safety Rules for Quarry Men were discussed by employers and employees at a recent meeting with the State Industrial Accident Commission. The industry was represented by A. R. Wilson, president Granite Rock Co.; J. H. Colton, superintendent Trojan Powder Co.; Mr. Gaskell, of the Hercules Powder Co.; J. H. Colton, superintendent, Pacific Portland Cement Co.; Joseph Lacey, International Brotherhood of Steam Shovelmen; Mr. Wilde, representing same organization; G. C. Brown, deputy mine inspector. The committee made good progress in discussion of the rules already prepared by the Industrial Accident Commission and will be ready on June 4 to continue the work, at which time it is expected that representatives of the Healy-Tibbets Co. and the McGilvray Stone Co. will also be in attendance. It is the purpose of the commission to have all industries represented in these meetings of conference or discussion over the rules governing the safety of the men employed.

Concentration of Quicksilver Ores has been investigated by Walter W. Bradley, engineer and statistician of the California State Mining Bureau, under direction of Fletcher Hamilton, state mineralogist. The work has included water concentration, flotation with oils and a wet method, by solution with an alkaline sulphide; each of these methods has shown that some ores are particularly amenable to it. High recoveries were obtained by water concentration on tables, with certain friable ores in which the cinnabar is distinctly crystalline. In those pulps in which the cinnabar slimes—either from "paint" ores, or by reason of having to crush finely to release the sulphide—the extraction by tables is low. The slimed cinnabar can, in many cases, be economically won by flotation, provided there are no interfering elements in the gangue; ochre appears to be particularly difficult to overcome, largely on account of its colloidal nature. One interesting development was the verification of information that had come to the investigator of a selective oil combination for ores carrying objectionable amounts of pyrite. In the case of one such ore tested, a mixture of crude wood turpentine and a crude asphaltic-base petroleum gave a higher-grade concentrate with less pyrite in it than any single oil used. In the matter of solution by an alkaline sulphide (Na₂S and NaOH) some rather astonishing results were obtained. On four widely variant ores, assaying from 0.14% to 1.7% mercury, extractions of 86, 96, 97% were obtained with but approximately 1-hr. contact. On one of these ores, assaying 0.31% mercury, an extraction of 97% was obtained with only a 15-min. contact. Ochre, again, is detrimental if present in excess. The foregoing indicates the character of the investigation and the results obtained. The full report on the study of concentration of quicksilver ores will be under way shortly and form a portion of the new bulletin on "California's Quicksilver Resources," expected to be ready for distribution by the bureau within the present year.

BUTTE—May 31

Manganese Ore Opened in Davis-Daly property has created much excitement in the Butte district. At the Hibernia mine of the company, a great body of manganese ore, 100 ft. in width has been opened and between 700,000 and a million tons of ore is regarded as possible. This ore is at or close to the surface and will probably be handled by open-cut mining. The complete analysis of the ore is not announced, but W. L. Creden, general manager of the Davis-Daly company, has gone

east to close contracts with big steel concerns for the ore. Two large steel companies are negotiating for the entire output. In addition to the orebody on the Hibernia claim, a body of manganese ore has been found in the New Republic claim close by; this is also owned by the Davis-Daly company. The opening of these two bodies of manganese ore has started a hunt in scores of claims in the west Butte district and is expected to result in an important output of manganese from this camp during the period of the war.

Remarkable Growth in Enlistments was experienced in Butte this week. The day before Memorial Day nearly 200 young men applied at the recruiting offices to be accepted. A large proportion of these were young miners. The spirit of enlistment is contagious and is reaching such proportions that the managements of the mining companies are becoming somewhat concerned over the length to which it will go. It is estimated that in the mines of Butte out of a total force of 20,000 men, fully 6000 are between the ages of 21 and 30. Those who are enlisting range in age from 18 to 45 years. The understanding here has been that the great need of copper and zinc for munitions, would exempt from draft the men engaged in the mining of these metals. The volunteering of the men before the conscription was started was not anticipated. In the last two days men have been coming in to the recruiting office in bunches. Often they are a crowd from some one mine who have become enthused and all want to go. So far the drain has not been too heavy but should these conditions continue for another week or 10 days, the mines will begin to feel it and there will be a crippling of the output. When recruits were first called for, there was a surprising apathy among the miners. Days passed with but one or two men showing up to enlist and the fear was widespread that Butte would make a sorry showing. The big mining companies did their share to arouse interest but they did not anticipate that their efforts would meet with such overwhelming success and that they would be the first ones to fear that they had started something they could not stop. German sympathizers are becoming more and more scarce. Many whose sympathies were with Germany last year are now among its most active antagonists.

Butte & Superior's Quarterly Report for the first quarter of the year 1917 showed a falling off in profits of \$1,248,648 from the profits of the last quarter of 1916; the actual reduction was only about \$600,000, as in the report for the months of October, November and December, 1916, an item of \$650,000 entitled "metal inventories" is included in the profits. The principal cause for the \$600,000 decline was the reduction in the amount of zinc produced. There was a falling off in tonnage milled in the first quarter of 1917 from the last quarter of 1916 of 16,500 tons of ore. The ore was lower in grade and the recoveries were less. The estimated zinc in concentrates was 6,200,000 lb. less than in the previous quarter. Payrolls, taxes and the cost of supplies were higher this year than last and this added several thousand dollars more to the quarter's expense. The litigation with the Minerals Separation Co. while not charged up as far as the direct expenses were concerned made necessary a large extra expense in the first three months of this year. A large amount of experimental work was done at the plant that was expensive and interfered materially with the regular operations. The building of a miniature flotation plant, the experiments with increased quantities of oil and the taking of men from regular work involved added expenses. In addition to the above, the average price received for spelter was slightly lower, making another item in the list of causes of the drop. The two new shafts are now practically complete and it is expected that both of them will be in operation down to the 1600-ft. level within the next three weeks. The old shaft is now in the best condition that it has been in three years. During the last few months the entire shaft has been retimbered. The quality of the ore being taken out this month and that taken out during April will run on the average better than that mined in the first quarter of this year.

DENVER—May 30

Construction of New Dredge, near Breckenridge, for Evans Placer Mining Co., of Denver, will be commenced soon on the Lambing ground. This will make the fifth dredge in district. The construction-camp outfit of Yuba Manufacturing Co., which will build the dredge, has arrived from California and is at Braddocks switch. The ground to be dredged consists of a strip 2½ miles long on Blue River between Breckenridge and Valora. An attempt was made to work this ground, years ago, with clam-shell dredges, but failed.

Smelter and Ore-Sales Investigation is being continued by the committee—mentioned in the "Journal" of May 5—appointed by the governor to aid in adjusting differences which now exist between the ore producers on the one side and the smelters, samplers and mills on the other. For the purpose of securing first-hand information from ore producers and ore buyers, the committee has mailed to all operators a questionnaire or form of report in which questions are asked with the view of bringing out facts likely to have a bearing on the controversies which usually arise between ore producer and ore buyer. The committee will hold a public hearing in any community where there is sufficient demand to justify such a hearing.

Remodeled Independence Mill of the Portland company has been placed in operation up to the fourth unit of 250 tons capacity and 1000 tons daily are now being treated at this plant. When the plant is running at its full capacity it will treat from 1250 to 1500 tons per day. The Victor mill is handling over 600 tons daily. In the treatment of low-grade ore this company has established a new record for the district. The largest scale mining operations that have ever been contemplated in the Cripple Creek district are now being developed by the Portland company. A main haulage tunnel has been driven from the level of the top of the storage bins of the Independence mill. This tunnel has been well timbered and equipped with heavy rails and trains of automatic dump cars. The tunnel is connected underground with the main working shafts of the Portland mine. Laterals are driven from the tunnel, and from these openings raises will be made into the large dumps on the surface. A system of glory-holing will be started, and eventually steam shovels will be used to deliver the low-grade ore from the surface into the raises. Underground bins and rapid loading facilities have been provided, so that the cost of handling the material will be reduced to a low figure, perhaps as low as 5c. a ton. The remodeled Independence mill has been provided with the most efficient and up-to-date equipment for crushing ore. Several flotation schemes have been tried, but all have been temporarily discarded for cyanidation. It is estimated that eventually a considerable portion of the company's property on Bull Hill, from the surface to a depth of several hundred feet, will be put through this mill. The average value of the material is supposed to be about \$2 a ton. The company anticipates the purchase of large quantities of custom ore from various neighboring properties in the district.

SALT LAKE CITY—June 1

Workmen's Insurance Rate for metalliferous mines, as provided under the Workmen's Compensation Act, has not yet been settled. The rate of \$5.59 for every \$100 of payroll, tentatively established by the state industrial commission, was adopted from figures forwarded by the Workmen's Compensation Service Bureau. At the instance of the Utah chapter of the American Mining Congress, L. L. Rubinow, president of the Casualty and Actuarial Statistical Society of America, is in this section with a view to giving an opinion. He has been in conference with the industrial commission in regard to the question of a rate, and is at present visiting mining camps. It is understood that the actuary of the Workmen's Compensation Service Bureau will also visit the state in this connection.

Deep Creek District—now shipping several hundred tons of ore daily—is to be examined by the U. S. Geological Survey. Frank L. Hess, of the Survey, is in this

section for that purpose. Besides producing the usual valuable metals, the district offers rare ores such as tungsten, bismuth, molybdenite, etc. The Seminole Copper—operated by the Wilson Bros.—has made shipments of tungsten ore from time to time, and there is said to be a good tonnage of ore of this character on the dumps. The chief shipper of the Deep Creek district is the Western Utah-Copper—at the instance of whose management the Deep Creek railroad recently completed was undertaken—with a daily output of about 200 tons of copper ore. The Pole Star is opening a good body of copper ore, developing lead-silver ore and making shipments regularly. The Queen of Sheba is considering a mill for low-grade ores. Another promising property is the Keno group of five claims. The Kimball Mining Co. expects soon to be making shipments over the Deep Creek road.

WALLACE, IDAHO—May 31

Bunker Hill Smeltery will be blown in some time during the month of June, according to announcement made by Pres. F. W. Bradley, who is now at Kellogg and will remain there until the big plant is in operation. The company is under contract to handle the product of several other mines beginning the first of July. The smeltery will have an initial capacity of 600 tons per day, and the plan of construction contemplates enlargement to meet the requirements of increased business without marring the original design. The refinery is completed. In making the announcement, Mr. Bradley sprung a real surprise by stating that as soon as the smeltery and refinery were in operation, the Bunker Hill & Sullivan company would begin the construction of an electrolytic zinc plant. The Bunker Hill is not a large producer of zinc, but zinc has become an important factor in the Coeur d'Alene district, the ore invariably being in combination with lead. The Bunker Hill company will therefore be in position to compete successfully for much of the lead-zinc which now goes to smelters under contracts which discriminate against one or the other metals. The Bunker Hill zinc plant will be especially favorably situated to handle the ores of Pine Creek, much of which is lead-zinc of the complex variety but which may be successfully treated by the electrolytic process. Whether the Bunker Hill electrolytic process will be the same as the Anaconda is not known. For several years the Bunker Hill company has given much attention to experimental work for the electrolytic recovery of both lead and zinc, and it is possible that it has evolved a system of its own.

Dredging on Prichard Creek, near Murray, Idaho, by the Yukon Gold Co., a Guggenheim organization, is not only assured, but some of its tributaries may also be worked again for placer gold. The company's 1916 report described the Coeur d'Alene Mining Co.'s property as having 8,500,000 cu.yd. developed, containing over \$1,350,000 gross. Part of this ground was systematically prospected last year, the results of which evidently form the basis for the estimate made in the report. The tract covers the entire length of Prichard Creek, about 12 miles, which drains a canyon or narrow valley ranging from a few hundred feet to a mile in width. The slight fall to the creek has prevented the ground from being successfully worked by hydraulicking. Many years ago, an attempt was made to exploit the ground by means of a great bedrock flume, which failed through financial reasons before pay ground was reached but which was doomed to failure, if it had been completed, for want of sufficient grade and adequate dump. Later the ground was secured by the Coeur d'Alene Mining Co. and an effort was made to overcome the grade and dump difficulties by the adoption of the hydraulic elevator, but this also proved a failure. Since that time nothing has been done toward working the ground. Last summer the sleepy old camp of Murray was suddenly stirred to find two Keystone drills churning holes to bedrock below and above the town, and this work went on night and day until cold weather last fall forced a suspension. It was generally understood that this work was being done by the Guggenheims, but no official information was received until the publication of the annual report of the Yukon Gold Co., containing the extract quoted. A representative of the Yukon company visited Murray a few weeks ago and completed all preliminary arrangements for the installation of a dredge this summer. It will be built and floated in an old pit made by the former company in experimenting with the hydraulic elevator, about a mile below the depot at Murray, and where the railroad company is now putting in a side track to accommodate handling the heavy machinery and material which will soon be coming in. The Yukon company has closed

a contract with the Washington Water Power Co. to extend its electric power line to Murray, right-of-way for which was secured recently and the construction of the line will proceed as rapidly as possible. At the same time prospecting the ground has been resumed with the two drills. It is also reported that the Yukon company has taken an option on another large tract along Eagle Creek, a tributary of Prichard, and that prospecting this ground will soon be undertaken. Numerous side gulches tributary to Prichard and Eagle Creeks were worked by the early miners and proved rich. The gross value mentioned in the company's announcement is understood to represent only a small part of the Prichard Creek ground.

ST. LOUIS—May 31

Mine la Motte, which went into the hands of the receiver, is again being operated. It is the oldest lead mine in the United States. In 1712, Louis XIV. of France, granted a charter to Monsieur Guzinot. In 1715, de la Motte Cadillac, while prospecting, discovered the ore on Monsieur Guzinot's land. It is now in the hands of the Missouri Metals Corporation, which has secured control of about 25,000 acres. Ores of lead, copper, nickel, cobalt and silver are found, but the principal one mined is lead. Both sulphide and carbonate are mined. The carbonates are mostly near the surface. These surface deposits are mined with steamshovels. The company has two mills, one to treat the clay ore, and the other for the limestone ore. The clay ore is treated on a washing floor; the coarse material then is sent to trommels, the oversize going to a picking belt, and the undersize to the jigs. The limestone mill treats the ore with crushers, trommels, rolls, Hancock jigs, Harz jigs for middlings, tables (Wilfley and Butchart), and then by flotation. The milling capacity will soon be increased; a new power plant is also under way.

JOPLIN, Mo.—June 2

First-Aid Field Meet at Webb City will be held on July 4. This meet will be held at Lakeside Park and over 130 men have already signified their intention of participating in the contests. A large list of prizes has been offered by business firms of the district. The meet is being promoted by Dr. W. A. Lynott, late of the U. S. Bureau of Mines.

Railroad Building in Oklahoma Field is progressing rapidly. The Southwest Missouri R.R. Co., with headquarters at Webb City, Mo., which announced some time ago its decision to extend its line from Galena, Kan., to Baxter Springs, has now announced its further intention of extending its lines to Picher, Okla. The actual work of making the extensions is already well under way, and it is probable that the connection between Picher and Baxter will be completed before that between Galena and Baxter. The Mineral Belt R.R. also is expediting building operations in the Oklahoma field as much as possible. It has completed its line between Quapaw, Okla., and Century, Okla., and is building a depot at Century. It also is working on an extension to the eastern part of the Tar River camp, and will later tap Picher and other new mining camps in this section. It handled its first car of ore during the week, getting it from the Welsh mine at Century and delivering it to the Frisco, at Quapaw. It has an arrangement with the Frisco to use its lines from Baxter to Joplin and other points. J. A. Frates, at one time an executive officer of the Frisco, is building the road. He expects to get the line to Tar River during the coming week, and to Picher by June 15. This summer an extension will be made to Columbus, Kan., if present plans are fulfilled.

SUMMITVILLE, N. Y.—May 31

Old Zinc and Lead Mines of Sullivan County are receiving attention as a result of the high prices for these metals. The St. Nicholas Zinc Co. will soon start operations at the old Wurtzboro lead mine, near Summitville. This property was opened and worked for lead prior to 1869. It has been idle since that time, until about a year ago, attracted by the zinc ore in the old workings and by prospective conditions, a New York interest bought the property and is now completing a mill, including a crusher, a Marcy mill and Wilfley tables; treatment of the dumps at the rate of 75 to 100 tons daily is to be undertaken soon. The mine is opened by two tunnels, one 250 ft. long and a lower one—800 ft. below on the vein—1200 ft. long. The ore carries zinc and lead sulphides and a few ounces of silver to the ton. J. McDonald Mitchell is manager. At Ellenville, about eight miles west on the same structural belt, a similar deposit is being drilled. This property was worked

for zinc about 10 years ago and is equipped with a small mill. The New York Zinc Co. is developing a similar area at Graham in Orange County between Port Jervis and Summitville.

WASHINGTON, D. C.—June 2

Explosives Bill, providing regulations for the safe manufacture, distribution, storage, use and possession of explosives, was passed by the House of Representatives, May 31, by a vote of 116 to 63. The main fight was made on Sec. 3 of the bill. That section authorizes the Bureau of Mines, with the approval of the President, to carry out the provisions of the act. The Bureau is authorized to employ such persons, without regard to civil-service requirements, as may be necessary to carry out the provisions of the law. The vote was largely along party lines, but a number of Representatives desired to place themselves on record against the bill as granting too great power to the director of the Bureau of Mines and establishing a "precedent for regulation that might interfere with legitimate industry."

Manganese Mining in Virginia has had a great stimulus from the successful results already attained and active prospecting is in progress in the manganese area of the great Valley of Virginia, according to D. F. Hewett, of the Geological Survey, who has just returned from an investigation of the region. In the past, Virginia has supplied less than 1% of the manganese needs of the United States, but the output for 1917 will show a substantial contribution to the manganese production of the country. Geological investigations made in the manganese-bearing regions give warrant for the belief that deposits may be expected in a zone several miles wide that follows the line where the Tertiary penneplain merges with the slopes of the Blue Ridge and other ridges in the great valley. Search for new deposits, therefore, should be made in the remnants of the Tertiary penneplain in this zone.

TORONTO—June 2

Assessment Work Suspended for 1917 in Ontario. In order to lessen the labor shortage the Ontario government has issued an Order-in-Council postponing the performance of assessment work on mining claims required to be done this year for 12 months. It is believed that this action will relieve the labor situation in Porcupine as well as elsewhere.

Smoke Damages have been awarded against the smelting companies in the Sudbury nickel-copper district, but an injunction restraining the smelteries from operating was denied on the grounds that the welfare of the community transcends that of the individual. This judgment was delivered on May 31 by Judge Middleton in actions brought by residents of the Sudbury district against the Canadian Copper Co. and the Mond Nickel Co. for damages done to their properties by poisonous fumes from the smelting plants of the companies. These actions were consolidated for one trial, which was conducted without a jury and extended over a period of 34 days at special sittings at Sudbury and Toronto. Damages were awarded to the various plaintiffs as follows: Against the Canadian Copper Co., J. F. Black, florist, \$1000; Joseph Belanger, farmer, \$750; Maria Taillefer, \$800; Sudbury Dairy Co., \$1000; against the Mond Nickel Co., Andrew Ostrosky and Justine Ostrosky, \$500 and J. H. McLary, \$1400. Other actions are pending for damages.

Dome Report Not Encouraging, if one may judge from the summary just received of the report of Dome Mines, Ltd., for the year ended Mar. 31. This report has been awaited with much interest, as semi-official information was to the effect that the statement of ore reserves would show the company to be in an exceptionally strong position. After reading the telegraphed summary, however, the most pronounced sensation is that of "an aching void." Last year's report showed ore reserves of 2,600,000 tons of an average grade of \$6.20, a total of \$16,120,000. During the last 12 months there was milled 459,530 tons, which gave an average recovery of \$4.72. Ore reserves this year are estimated at 2,250,000 tons, having a gross value of \$11,979,000, or an average of \$5.32 a ton. Taking into consideration the gain in tonnage of over 100,000 tons, there remains a discrepancy of about \$2,500,000 in the gross value of the reserves as compared with last year. It would appear that the shareholders are entitled to an explanation which does not seem to have been given. Things like this create a bad impression and have a tendency to destroy confidence. The report states, however, that the limited amount of development has disclosed new orebodies, one of which appears to be important.

The Mining News

ALASKA

TANANA VALLEY R.R. will be purchased by the Government. This road runs from Fairbanks to Chatanika, with branch to Chena. Will become part of the Government railroad system now under construction in Alaska.

ALASKA GASTINEAU (Juneau)—In May milled 227,900 tons, averaging \$1.12 per ton; extraction 81.13%; loss in tailing, 22c. In April milled 212,200 tons, averaging \$1.09.

ARIZONA

Gila County

OLD DOMINION (Globe)—Production at smelter in May increased to 4,430,000 lb.; in April copper output was 3,516,000 lb.

MIAMI (Miami)—May copper production was 4,985,363 lb.; in April, 5,128,195; May, last year, 4,729,328 lb.

Mohave County

UNITED EASTERN (Oatman)—Milled in April, 6706 tons, comparing with 6584 in March, 5383 in February and 3800 in January; extraction was 94.56% in January, 95.26 in February, 96 in March and 96.97% in April. Gross value of ore milled in April, \$143,787 or \$21.441 per ton; working costs and losses, \$7,498; profit, \$13,943 per ton. Mill handled an average of 223.5 tons daily; two additional thickeners being installed, one for settling tank for high-grade solutions and one to reduce dissolved loss in tailing. Rough sorting is practiced both underground and at surface, but proportion of waste is small. New Imperial compressor being installed at mine, after which shaft sinking will be resumed. On 465-ft. level, stoping only is being done. On 565-ft. level, hanging-wall drift No. 520 had progressed 100 ft. in good ore, 2 to 5 ft. wide, parallel to main orebody; foot-wall drift No. 521 in main orebody was extended 60 ft. in milling ore and drift No. 522 is proceeding on a low-grade vein 3 to 5 ft. wide. On 665-ft. level, north drift was extended 61 ft. and the south drift 46 ft. both in medium-grade ore, the former 2 to 4 ft. wide and the latter exposed 5 ft. of ore with hanging wall not in sight. J. A. Burgess, general superintendent.

Pinal County

BOBTAIL (Ray)—Bonded recently to Pittsburgh men, already interested in district.

U. S. VANADIUM (Kelvin)—Recently shipped car of ore to the Arizona Rare Metals Co. at Tucson.

BROKEN HILLS (Ray)—Shaft has reached depth of 122 ft. New hoist and compressor to be installed.

RAY SILVER LEAD (Ray)—Company plans shipments as soon as road can be finished. Over 40,000 tons of ore reported developed during May.

AMERICAN SMELTING AND REFINING (Hayden)—Work under way on new reverberatory furnace. Other improvements contemplated.

ARIZONA - HERCULES (Ray)—Steel framework for No. 1 hoist house, machine shops and warehouse completed. Steel headframe and the ore bins at No. 1 shaft will be finished about June 1.

RIPSEY (Kelvin)—Taken over by the South Ray Copper Co., of Washington, D. C.; J. A. Robertson, of New York, president. Opened up many years ago to 523 ft. as a gold mine. Preparing to unwater and mine for copper.

COPPER STATE MINING (Copper Creek)—This company, which has properties in Pinal and Graham counties, 30 miles southeast of Hayden, is installing a 285-hp. McIntosh & Seymour Diesel engine and complete electrical equipment; five carloads new equipment delivered in May. Remodeling its mill, installing six Callow flotation cells, Marcy ball mill and much additional machinery. Has shipped to International smelter at Miami, this year, 350 tons of concentrates averaging 24% copper. Martin E. Tew, 411 Metropolitan Life Building, Minneapolis, Minn., president.

Yavapai County

COPPER MINES AT JEROME resumed operations, without recognition of the union, after nine-day shutdown due to the strike. Miami scale of wages conceded from the first, but recognition of union and

similar union demands were the points mine operators were unwilling to grant.

CALIFORNIA

Amador County

ORIGINAL AMADOR (Amador)—Milling resumed at this mine and at the Keystone, which was interrupted in order to make improvements to tailing dams.

CENTRAL EUREKA (Sutter Creek)—Report for month of April shows 3582 tons of ore milled; recovery of \$4296 from plates and \$4765 from concentrates, other earnings making the total \$9437. Cost of mining, \$3337; milling, \$1088; pumping and general expenses, etc., \$1730, making total operating \$6155. During the month development charges were \$5116; shaft repairs, etc., \$1285. Total expenditure in the month, \$12,557. Development included opening 3350-ft. station and crosscutting on 2540-ft. level.

Butte County

TWO STEAM SHOVELS have been installed in American ravine in the Magalia district on land said to be controlled by men connected with the United States Steel Corporation. Milling plant also installed. H. M. Thompson is superintendent. Gravel deposits in this district have been operated by most of the known methods except dredging.

Nevada County

ALLISON RANCH (Grass Valley)—No. 4 level unwatered and retimbering in progress. Expected milling plant will not be ready before July, though work is being prosecuted as fast as possible.

Shasta County

VICTOR POWER AND MINING (Knob)—Midas shaft in Harrison Gulch, flooded at time of fire two or three years ago, is being unwatered. Development in upper abandoned levels is encouraging company to proceed with complete unwatering. Adjoins the Victor. It is stated that there are 700,000 tons of low-grade ore on dumps, estimated to run \$1.50 per ton, which is to be treated by flotation if experiments prove satisfactory.

Siskiyou County

CINNABAR DEPOSITS, west of Oak Bar in northern edge of county on Klamath River, are under consideration by men said to represent the Oceanic Quicksilver Co. of San Luis Obispo County. Deposits controlled by H. J. Barton of Oak Bar. Worked in a small way by Chinese more than 20 years ago. There are other deposits on the river and some 10 miles north. At one point, small furnace was installed; but there has never been commercial output from any of the deposits.

COMMODORE (Yreka)—After being idle several years, property situated on Barkhouse Creek, is being reopened by New York men. Strong vein reported to have been disclosed by recent development.

Tuolumne County

NEW PROVIDENCE (Tuolumne)—Property formerly a producer, but long time idle, reported sold by Fred Sutton to Mrs. Anna Bluett of Oakland.

COLORADO

Boulder County

BARKER (Boulder)—Stevens & Barker have opened body of payable tungsten ore.

LITTLE MARY (Boulder)—Good-grade silver ore being opened in development.

LEFT HAND (Boulder)—Developed during winter by C. E. Brandenburg and associates. Rich gold ore opened. Preliminary 50-ton shipment of \$80 ore has been made.

Custer County

BISMUTH (Westcliffe)—Lessees making shipments of good-grade ore. Considerable ore developed.

PASSIFLORA (Westcliffe)—Stated milling plant will be built this summer to treat lower grade ore; 15 men now employed. First-class ore shipped.

KING OF THE CARBONATES (Westcliffe)—New drift being run from 178-ft. level to cut oreshoot opened in level 50 ft. above. Ore contains gold, silver and copper.

Gilpin County

RUNNING LODE (Black Hawk)—Mine being unwatered; progress not satisfactory

on account of water although bailing is being done to capacity.

GILPIN EUREKA MINES CO. (Central City)—Preparing for increased production; installing three No. 6 Wilfley tables and one Deister sizer, three hydraulic classifiers; for the mine, two new Chipper 1-in. drills and water tank for 500-ft. level. Lately, in cleaning out sump of main shaft, about 60 tons of concentrates were secured; in sinking from 600 to 800 level, first round of shots opened 31-ft. vein of milling ore; now planned to extend shaft to 1000-ft. point. E. L. Clark, general manager. Norton E. Isbell, consulting engineer.

San Juan County

COMING WONDER (Silverton)—Shipments will be resumed soon.

GOLD KING (Silverton)—Mill now treating 125 tons daily. Property operated under lease by J. H. Slattery.

SUNNYSIDE (Eureka)—Warehouse, track shed, blacksmith and machine shops and other surface buildings at mine destroyed by fire on night of May 20. Total loss about \$50,000, covered by insurance. Rebuilding will commence at once, but mine operations will be suspended for several weeks.

San Miguel County

STANDARD CHEMICAL CO. (Telluride)—Wet process for treating carnotite ore being installed in place of dry process formerly used.

CARRIBEAU (Ophir)—New milling plant will be built at once. Flotation plant of 30 tons capacity will be included in process to re-treat old mill tailings. Estimated 25,000 tons tailings assaying \$6 in gold and silver can be profitably treated.

Teller County

ROOSEVELT TUNNEL heading has entered the Old Ironsides property, owned by the United Gold Mines Co. Passing through a mineralized dike carrying small amounts of gold.

CARBONATE HILL SECTION in western part of district, due north of the town of Cripple Creek, again active. Two properties, Golden Terry and Kitty Wells No. 2, being worked by lessees.

PALACE LODE (Cripple Creek)—Boiler, steam hoist and compressor will be installed at this property on Squaw Mountain.

SACRAMENTO (Goldfield)—Lessees Schoolcraft, Butler & Musser, opened body of high-grade gold ore in drift on Sacramento vein.

IDAHO

Shoshone County

GERTIE (Burke)—Will resume on June 1. Long crosscut will be continued to search for east extension of Hecla vein. Ground joins Hecla. L. W. Hutton, of Spokane, chief owner.

TARBOX (Seltice, Mont.)—Manager of company, who maintains office in Wallace, states that shaft will be deepened 200 ft. from 600 level. Much ore developed on the 600 and company will have mill under construction by time the 800 is reached. Will develop water power.

MICHIGAN

Copper

ADVENTURE (Greenland)—Has 22 drills in operation.

OSCEOLA (Osceola)—Because of scarcity of men, one stamp closed down at the mill at Hubbell.

AHMEEK (Ahmeek)—Still low in tonnage, but not enough to shut down any stamp heads yet.

TRIMOUNTAIN (Trimountain)—Sinking No. 2 shaft from the 27th to the 28th level to test quality of lode.

ISLE ROYALE (Houghton)—Will build 20 modern houses this summer. Thus hopes to take care of shortage of men.

MASS (Mass)—Working on a mass of copper on the seventh level in the Evergreen lode. A short time ago it was 23 ft. long and 14 ft. high and extended back into the lode. Having considerable trouble in trying to get it out; using compressed-air cutter. Crosscut on third level driven through to the Evergreen, and now the lode is being worked on the third, fifth and seventh levels. Crosscutting on the ninth.

MISSOURI**Joplin District**

LUCKY ELEVEN (Carthage)—Sold mine southeast of Carthage, having only one shaft and horse whim, to I. P. Jones, Fayetteville, Ark., for \$30,000.

T. A. BALDWIN (Joplin)—Purchased Barnett lead mine at Duenweg; now producing two tons lead concentrates daily. Will drill and probably sink new shafts.

WIRECK (Miami, Okla.)—Mill and lease near Bethel, sold to F. Childress and associates of Galena, Kan., for \$250,000. Mill capacity, 300 tons in 8 hr. Mining at 240 ft.

ETHEL GRAY (Joplin)—Sinking new field shaft west of mill to 210 ft. Mine now making from 40 to 50 tons concentrates weekly. Mine owned by Lincoln Zinc, Lead & Smelting Co. Benjamin Smith, superintendent.

ANDAYER (Galena, Kan.)—Drill holes show excellent deposit ahead of workings. Cuttings from one hole ran 43.40% blende for 50 ft. Ore cut at 40 ft.; extended to 90. Ore now being milled gives 12% recovery. Owned by M. J. and R. C. Andrew of Joplin, Mo.

WILLIAM FOSTER WHITE (Joplin)—New mill, 600 tons daily capacity has begun operation on lease just west of Picher-Netta tract at Picher, Okla. Mining at 189 ft. Plant has slime department consisting of nine tables, two Dorr thickeners and one Dorr classifier.

MONTANA**Granite County**

MANGANESE shipments from the Philipsburg district now approximate 100 tons per day; ore carries higher silica content than Brazilian product.

GRANITE BIMETALLIC CONSOLIDATED (Philipsburg)—This company now working about 135 men. Thomas B. Holmes, superintendent.

Lewis and Clark County

BARNES-KING DEVELOPMENT (Butte)—May returns not yet available but first three weeks' results indicate month will be best in history. The Boyer claims are now being developed.

Madison County

PLACER PROSPECTING is being done on several ranches below the holdings of Conroy Placer Mining Co., by T. D. Frier, superintendent for a Virginia City syndicate headed by Karl Elling. Brayton & Moore have a force at work preparing for resumption of sluicing on the placer leased from Alder Gulch Consolidated Mining Co.

J. S. GRANT (Virginia City)—Harraman Brothers, lessees, have encountered good ore and are shipping.

SHAFTER (Virginia City)—Working 15 men in mine and expects to start mill in a few weeks. A. H. Jones, manager.

ATLAS (Virginia City)—This group, owned by Charles Ryden, is being put in shape for examination. Test mill may be erected this summer.

E. M. SMITH (Virginia City)—Has completed amalgamation-concentration plant on his claims in Williams Gulch; water power, with gasoline auxiliary.

WINNETKA (Virginia City)—Tunnel contract completed at this mine owned by Hall Brothers. Planning to work the low-grade milling ore now developed.

KEARSARGE (Virginia City)—Tunnel on Rough Rider claim is to be extended 1000 ft. to tap rich vein encountered at surface. W. B. Millard, of Chicago, Ill., is owner.

EASTON (Virginia City)—Cyanide plant, operating on tailing from this mine of the Elling Estate company, has started for the season. Frederick M. Field, superintendent.

Silver Bow County

EAST BUTTE (Butte)—May output was 2,008,060 lb. copper; 59,345 oz. silver.

ANACONDA (Butte)—Copper production in May is estimated at 28,400,000 lb. as against 29,300,000 in April; reduction due to mine fires. High Ore mine still closed, as fire in Modoc shaft smouldering. Repairs being rapidly made and in a few days the High Ore will be reopened.

NEVADA**Lyon County**

YERINGTON MOUNTAIN COPPER (Yerington)—Shipping about 25 tons daily of 5% copper ore.

PITTSBURGH-DOLORES (Yerington)—Milling regularly ore from above tunnel level; new 50-hp. hoist being installed at tunnel face to permit of sinking and development of main vein. Bullion shipped to Selby smeltery. About 50 men employed. E. J. Schrader, superintendent.

Nye County

TONOPAH PRODUCTION for week ended May 26 was 9493 tons valued at \$170,874, as compared with 8750 tons for previous period. Shippers were: Tonopah Belmont, 2929 tons; Tonopah Mining, 2000; Tonopah Extension, 2380; Jim Butler, 800; West End, 976; Rescue, 257; Montana, 99; Cash Boy, 52 tons.

TONOPAH EXTENSION (Tonopah)—April operating profit \$29,574; gross receipts, \$112,646.

TONOPAH BELMONT (Tonopah)—Leasers on the slime ponds have begun the 1917 "sweeps" season and have been getting a 30-oz. silver product by sweeping top crust of the old slime ponds. "Sweeps" are treated by Belmont Milling Co.

TONOPAH MINING (Tonopah)—Sinking in old Merger winze. When Merger company ceased this winze was 55 ft. below its 12th level—equivalent to the 1150-ft. level of the Sandgrass shaft. In mineralized ground but not of commercial grade.

White Pine County

CONSOLIDATED COPPERMINES CO. (Kimberly)—New contract made with Nevada Consolidated whereby latter agrees to mine and treat from the Ora claim 425,000 tons before Aug. 15, 1918, and for period of five years 75,000 tons per annum and such additional amount as economical operation of Nevada Consolidated's Liberty pit will warrant; Ora claim controls entrance to Liberty pit. Company has also contracted with Nevada Consolidated to smelt 4500 tons monthly of Coppermines concentrates on a sliding scale varying with the price of copper.

OREGON**Josephine County**

UNITED COPPER (Selma)—This Falls Creek mine will be operated under company management with Charles Buchner in charge.

COLLARD, MOORE & COLLARD (Kerby)—This chrome mine preparing for active season; new concentrator installed.

COW BOY-MAYBELL-LITTLE (Takilma)—Has been leased by C. E. Tucker and G. B. Fife. Ships to Tacoma smeltery via Grants Pass.

UTAH**Beaver County**

MAJESTIC (Milford)—Company shipped 17 cars—about 850 tons—in May.

Juab County

TINTIC STANDARD (Eureka)—Shaft down about 1000 ft. Ultimate depth, 1300 feet.

TINTIC PRODUCTION during May was 889 cars, and for five months—just ended—4337 cars.

EUREKA MINES (Eureka)—Seventh car being prepared for market. Sixth car brought \$2265.

DRAGON CONSOLIDATED (Silver City)—About 250 tons daily of iron ore for fluxing being shipped. Higher grade coming from north end; also siliceous ores for Tintic Milling Co.'s plant.

IRON BLOSSOM (Silver City)—Copper ore being mined on 900, 1000, 1100, and 1200 levels. Carries 4 to 5% copper and 90 to 100 tons shipped daily. Also, good tonnage of siliceous ores being sent to Tintic Milling Co.

EAGLE & BLUE BELL (Eureka)—May shipments, 71 cars; April, 62; March, 99; February, 62; and January, 55; total, first five months, 349, as compared to 470 for whole of 1916 and 563 for 1915. Promising new orebody has been opened on 1700 just below productive ground on 1550.

Salt Lake County

UTAH COPPER (Bingham)—Twenty steam shovels working; mills treating 35,000 to 36,000 tons daily.

OHIO COPPER (Bingham)—Flotation department treating 400 to 600 tons daily. Although still in experimental stage, stated to be making saving of 75 to 80 per cent. Old mill treating about 2200 tons daily.

CARDIFF (Salt Lake)—Spring thaws are again halting shipments from this property—Big Cottonwood's principal producer. Road from mine to bins at South Fork impassable, although tractors are able to reach South Fork and take ore accumulated here and lower down canyon.

MICHIGAN-UTAH (Alta)—Forty-six cars of ore were shipped recently and total shipments by July 1 will be almost equal to the 1916 output of 7000 tons. At Copper Prince tunnel—worked on company account—there is considerable accumulation of ore. Said to be considering extension of aerial tramway—now as far down as Tanner's Flat—to Wasatch.

MONTANA-BINGHAM CONSOLIDATED (Bingham)—This company, which recently acquired the Valentine and Tiawauke groups and a large interest in the Bingham Amalgamated, has now consolidated with the Fortuna, making the total territory controlled 640 acres adjoining the Utah Copper, Ohio Copper, Bingham Mines, and Starless group owned by Col. Wall. The Montana-Bingham tunnel is now in 5000 ft. in Bingham Amalgamated ground, and will soon cut the Fortuna, when raising—about 1200 ft.—will be done to connect with the Fortuna workings. The latter property has been under bond and lease to J. M. Higgins, and machinery has been ordered for a flotation mill.

Summit County

PARK CITY SHIPMENTS, according to estimates for May, 8447 tons. Heaviest shipper, Silver King Coalition, with 2506 tons; next Daly-Judge, with 2376 tons; and third, Silver King Consolidated, with 1595 tons.

Utah County

AUSTIN MINING (American Fork)—Company incorporated to develop 20 acres patented ground.

Washington County

SILVER REEF CAMP is experiencing a revival. The Dixie Mining and Development, owning nine claims—formerly, the Blue Ribbon mine—one and a half miles northwest of Leeds and 50 miles from Lund station, has dumps of considerable size, which it expects to utilize. Test shipment made recently. The Adah Copper is making shipments of ore carrying copper and some silver. Shipments are expected from the Silver Reef Extension, owning the Vanderbilt and Silver Hill.

CANADA**Ontario**

CHARETTE (Boston Creek)—Discovery of free gold made on this claim.

SYLVANITE (Kirkland Lake)—Has closed down owing to shortage of labor and high cost of materials.

HURONIA (Larder Lake)—Option taken by a Montreal syndicate on this property which closed down last year.

LA ROSE (Cobalt)—Will expend \$30,000 in developing the Violet, one of the company's Cobalt claims that has never been worked.

TOUGH OAKES (Kirkland Lake)—Mill now treating about 120 tons daily with recovery of 97%. Daily production approximately \$2000.

NEWRAY (Porcupine)—The 10-stamp mill in operation; capacity, 40 tons per day. Recovery by amalgamation 87%; storing residue for treatment by chemical process.

CHAMBERS-FERLAND (Cobalt)—Vein No. 18, where opened 30 ft. above contact, is 3 in. wide and carries from 2000 to 3000 oz. of silver to the ton; wall rock of milling grade.

GIFFORD (Cobalt)—Resuming operations; surface water controlled and shaft house nearly completed. Sinking will be continued to about 450 ft., where the contact is expected.

BELLE ELLEN (South Lorrain)—Shaft will be continued to contact which is expected at 600 ft. Vein dipped out of shaft; crosscut will be run to pick it up when contact is reached.

McINTYRE (Schumacher)—During four months ended Apr. 30, treated 56,567 tons of ore; average grade, \$10.43; operating cost, \$4.97 per ton; operating profit, \$279,563. In April production was \$153,029, a new high record.

DOME (South Porcupine)—Party of directors visited mine looking into labor conditions in order to determine policy to be pursued, as it is considered that operations cannot profitably be maintained unless additional labor can be obtained.

CONIAGAS (Cobalt)—Installation of 250-ton flotation plant progressing. Coarser crushing will be practiced at the stamps with recrushing in Hardinge mill. When these changes have been effected the capacity of mill will be increased to approximately 500 tons per day.

MEXICO

SANTA GERTRUDIS (Pachuca, Hidalgo)—Milled in April 28,109 tons; estimated profit, \$40,700.

NICARAGUA

TONOPAH NICARAGUA CO. (Bullitt Bldg., Philadelphia, U. S. A.)—This new subsidiary of Tonopah Mining Co. will operate the old Santa Rita gold mine, now known as the Rosita, in the Tunky district. M. B. Huston will be in charge.

The Market Report

Metal Markets

May June	Sterling Ex- change	Silver		Sterling, June	Ex- change	Silver	
		New York, Cents	Lon- don, Pence			New York, Cents	Lon- don, Pence
30			38	4	4.7550	75½	38½
31	4.7550	74½	38	5	4.7550	75½	38½
1	4.7550	74½	38	6	4.7550	75½	38½
2	4.7550	75½	38½				

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May June	Copper		Tin		Lead		Zinc
	Electro- lytic	Spot.	N. Y.	St. L.	N. Y.	St. L.	St. L.
31	29½ @ 30½	64	@ 11 10½	@ 11 10½	@ 9½ 10½	@ 9½ 10½	9½
1	@ 30½ 29½	63	@ 11 10½	@ 11 10½	@ 9½ 10½	@ 9½ 10½	9½
2	@ 30½ 29½	62½	@ 11 10½	@ 11 10½	@ 9½ 10½	@ 9½ 10½	9½
4	@ 30½ 29½	61	@ 11 10½	@ 11 10½	@ 9½ 10½	@ 9½ 10½	9½
5	@ 30½ 29½	60½	@ 11 10½	@ 11 10½	@ 9½ 10½	@ 9½ 10½	9½
6	@ 30½ 29½	61	@ 11 10½	@ 11 10½	@ 9½ 10½	@ 9½ 10½	9½

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

May June	Copper		Tin		Lead		Zinc
	Standard	Electro- lytic	Spot	3 Mos.	Spot	3 Mos.	Spot
	Spot	3 Mos.	Spot	3 Mos.	Spot	3 Mos.	Spot
30	130	129½	142	253½	250½	30½	54
31	130	130½	142	253½	250½	30½	54
1	130	130½	142	248	246½	30½	54
2							
4	130	130½	142	239½	237	30½	54
5							
6	130	129½	142	237	234½	30½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21c.

NEW YORK—June 6, 1917

The metal markets this week were dull and uninteresting, but continued very strong. The delay of the Government in communicating information about its requirements for copper, lead and zinc create a general condition of uncertainty.

Copper, Tin, Lead and Zinc

Copper—Business this week was much less in volume than in the previous week. Some orders were placed on May 31 and on June 1 there was considerable activity, but after that transactions were relatively few and sporadic. The buying of the week

was largely by domestic brass makers. There were some foreign inquiries in the market, but they have not yet developed into business. As in the previous week, the bulk of the business this week was for third-quarter delivery. July sold at 31c., August at 30½, September at 30c., and the entire third quarter at 30½c., all regular terms. Two round lots of June copper offered by a consumer, reselling, fetched 33c., r.t. Some business for October delivery was done at 29½c., r.t. Some business for far forward delivery was taken at lower prices, but it, like the nearby business, was relatively insignificant, the major market being still for third-quarter delivery. However, July copper is now becoming scarce, and certain producers report the sale of all their expected production up to the end of September.

Copper Sheets—The price of copper sheets continues at the same figure as noted last week. We quote hot rolled at 38c. per lb., cold rolled 1c. higher. Wire now quoted 34@26c., f.o.b. mill.

Tin—This market declined on very small business. Interests associated with the trade are making every effort to facilitate importations. In this they are being ably assisted by the Government at Washington. Dr. Pratt of the Department of Commerce and Labor has the matter in charge and will hereafter work through a Committee of the Trade to be appointed at a meeting to be held next week. The British authorities have agreed to furnish the required quantity, if possible, and the proposed committee will allocate supplies on arrival.

Information collected by the American Iron and Steel Institute through replies to its recent circular will form the basis of our requisitions on the British Government, and it is supposed that the bothersome question of permits will now be done away with. Control of the metal after arrival will be vested in the proposed committee working under the authority of the Department of Commerce and Labor instead of in the hands of the British Consul as heretofore.

Lead—The business that was reported by producers was of relatively small proportions. Some producers made no sales. Others who sold in the early part of the week withdrew in the latter part. The market was in the shadow of the uncertainty as to what the Government is going to require. Producers tell their customers frankly that after the Government has requisitioned for its needs there is probably not going to be enough lead for everybody unless consumption is curtailed. The high level of prices will operate naturally in the direction of curtailment. Consumers will best serve their own interests as well as the common interest by not trying to grab supplies in an exhausted market. During this week some small lots of lead for prompt and June delivery were sold at 11½c., but such business was insignificant. The major transactions in lots of 200 and 300 lb., for June and July delivery having been made at prices ranging from 10½ to 11c. In the afternoon of June 6 the A. S. & R. Co. advanced its price to 10½c. This was simply a readjustment, that company having been filling orders only on its running contracts, and not accepting new business. In spite of the apparent acuteness in the situation there were some signs during the week of an easier tendency in near-by lead.

Zinc—A fairly large business was done, there being what was apparently some speculative buying of important character. This was reflected immediately by less pressure from producers to sell. Evidently an effort was made to lift this market out of its rut, but toward the close of the week this seemed to have failed, and the market was again dull, and easier in tone, without there having been any change in quotations. Prompt zinc was available right through the week at 9½c., while July-August realized 9½c.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at \$19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Antimony—This metal was considerably weaker. We quote spot at 20½@21c.; June-July shipment from China, at 15@15½c., c.i.f., New York, duty unpaid.

Aluminum—The aluminum market continues quiet and devoid of any features of special interest. Quotations continue at about the same level. 59@61c. per lb. for No 1 ingots at New York.

Bismuth—Quoted at \$3 per lb.

Cadmium—Quoted at \$1.50 per lb.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb.

Quicksilver—This market was dull and weaker. We quote \$90. San Francisco reports, by telegraph, \$95, market weak.

Gold, Silver and Platinum

Gold—According to a report from Samuel Montagu & Co., London, May 10, 1917, the Bank of England gold reserve against its note issue shows a decrease of £119,425, as compared with last week's return. For the first time for several weeks gold to the value of \$16,000,000 has been received in New York. The outgoings amounted to \$8,120,000, either transferred for shipment or engaged for export, chiefly to Japan.

Silver—The market continues steady without any special feature. Supplies are going forward to the Orient, chiefly by way of San Francisco.

Mexican dollars at New York, May 29, 58½c.; 31, 58½c.; June 1, 58½c.; 2, 58½c.; 4, 58½c.

Platinum—The tone of this market was a little weaker, but the quotation remained nominally unchanged at \$105.

Palladium—Market continued strong at \$105.

Zinc and Lead Ore Markets

Platteville, Wis., June 2—Blende, basis 60% Zn, \$78 for premium ore down to \$72 for medium grade. Lead ore, basis 80% Pb, \$128 to \$130 per ton. Shipments reported for the week are 3354 tons of zinc ore, 97 tons of lead ore, and 318 tons of sulphur ore. For the year to date the figures are: 58,103 tons of zinc ore, 2451 tons of lead ore, and 11,137 tons of sulphur ore. Shipped during the week to separating plants, 3834 tons of zinc ore.

Joplin, Mo., June 2—Blende per ton, high, \$81.65; basis 60% Zn, premium ore, \$80; medium to low, \$75@70; calamine, per ton 40% Zn, \$45@40; average settling price, all grades of zinc, \$73.15 per ton.

Lead, high \$123.90; basis 80% Pb, \$125@115; average settling price, all grades of lead, \$119.04 per ton.

Shipments the week: Blende, 10,215 tons, calamine, 455 tons, lead, 1531 tons.

Late developments and improved methods of concentration in the Oklahoma field have produced concentrates of premium-grade blende that compete with the best ore in the older camps, and the smelters demanding high-grade ore are shifting a portion of their purchasing power in that direction. The large bodies of ore, carrying 8% to 16% blende, make it possible to produce at a less cost per ton than in the sheet-ground mines with ore 3% to 5% blende.

Other Ores

Antimony Ore—Contracts for ore from South America were made at \$2.35@2.40 per unit.

Iron Ore—Prices, delivered lower Lake ports, Old-range bessemer, \$5.95; Mesaba bessemer, \$5.70; old-range non-bessemer, \$5.20; Mesaba non-bessemer, \$5.05.

Manganese Ore—This market is very firm. Ore of 49% is quoted at \$1 per unit, which price was paid.

Molybdenum Ore—Business was done at \$2.20 per lb. of molybdenum sulphide in molybdenum, assaying 90%. This market is very firm.

Pyrites—Spanish ore, furnace size, remains at 15½c. per unit on basis of 103 freight, buyer paying war risk and excess freight. Domestic fines, mainly under contract, at 10@10½c., but spot pyrites commands up to double that price.

Carnotite—Firm and unchanged at \$3 per lb. of U₃O₈ content. Nitrate firm at \$5.1

¹Quotations supplied by Foote Mineral Co., Philadelphia.

Tungsten Ore—A large business was again done, and the American producers of scheelite now appear to be sold out for early delivery. No more is offered at present. There was also a large business in wolframite and it is said that only material of inferior grade is now available for prompt shipment. We quote superior grades of ore at \$20 per unit, but that quotation is merely nominal, supplies being unavailable. Ore of inferior grade was sold as low as \$17 per unit.

Iron Trade Review

NEW YORK—June 6

Pittsburgh has signaled the arrival of \$50 pig iron by one of the most exciting weeks in the Bessemer iron market since the beginning of the war, says "Iron Age." Sales have amounted to 75,000 tons, of which one steel company took 40,000 tons at prices ranging from \$46 to \$50. At the latter figure at least 20,000 tons has been sold.

Not only pig iron, but semi-finished and finished steel markets, have been affected by the developments at Pittsburgh, since they confirm what has been well-considered opinion in the trade for some weeks, that future war advances were likely to come as abruptly as any that have come in the past two years, and might go to lengths even now thought impossible.

PITTSBURGH—June 5

The steel market continues to grow less active. To the decrease in the volume of contracting for forward deliveries there is a decrease, in many lines, in the volume of specifications filed against current contracts. In the case of one large interest the volume of shipping orders entered last week was the smallest for any week in a year and a half. Building operations are expected to drop to a very low level and most of the common activities of the people, which account for a great deal of steel ordinarily, will be curtailed. Contract obligations now on mill books represent, on an average, their full output a little distance into the new year, while in many directions the consumption in the second half of this year is certain to be less than the rate recently. On the other hand there will be larger and larger requirements for war purposes. Including steel for shipbuilding, railway equipment for American, French and Russian railways, shells, etc., for the European Allies, and steel for our own Government, the total may easily exceed the 20% of the output that was guessed a couple months ago as the outside limit.

Steel prices are practically stationary, and indeed there has been relatively little advancing tendency for 30 days. This in itself would take the edge of the market, which in the past has thriven largely upon the excitement of continued price advances.

Pig Iron—The situation in pig iron is becoming more and more tense. Production is restricted somewhat by coke scarcity, while requirements are heavier on account of additions to steel making capacity. In previous market movements pig iron has always stopped advancing before steel, but now pig iron is advancing sharply while steel is practically stationary. Until a week ago bessemer was quotable, on the basis of actual sales, at \$44 or \$45 for fair sized lots and \$46 to \$48 for small lots, but since then two lots, 10,000 and 9,000 tons respectively, have brought \$50, valley, the buyer being a large steel interest with large blast furnace capacity of its own. A week ago a steel works without blast furnaces bought two lots of basic aggregating 12,000 tons at \$45, valley, \$3 above the level of previous transactions, and now there are no sellers at less than \$48, with prospects that basic will be above \$50 before long. Foundry iron is quiet, at \$43@45, valley, malleable being \$44 as minimum. Southern foundry has sold for first quarter delivery into this territory at \$38, Birmingham, or \$42.55 delivered. W. P. Snyder & Co. compute average prices obtained in all sales in May at \$45.9917 for bessemer and \$41.8947 for basic, f.o.b. valley furnaces, representing increases over April of \$4.66 and \$3.90 respectively. The average quoted price on foundry iron during May was \$42.65, valley.

Iron Ore

Iron Ore—May shipments down the Lakes were probably two or three million tons short of the eight million moved in May of last year, on account of the late continuance of ice in Lake Superior. Furnaces are reporting how much ore they will actually need to run them to the 1918 season and shipments to some will be cut below their purchases.

STOCK QUOTATIONS

Table of stock quotations for N.Y. EXCH. and BOSTON EXCH. listing various companies and their prices as of June 4.

N. Y. CURB† June 4

Table of stock quotations for N. Y. CURB listing various companies and their prices as of June 4.

SAN FRAN. June 1

Table of stock quotations for SAN FRAN listing various companies and their prices as of June 1.

Table of stock quotations for BOSTON EXCH. listing various companies and their prices as of June 4.

BOSTON CURB* June 4

Table of stock quotations for BOSTON CURB listing various companies and their prices as of June 4.

SALT LAKE* June 5

Table of stock quotations for SALT LAKE listing various companies and their prices as of June 5.

TORONTO* June 5

Table of stock quotations for TORONTO listing various companies and their prices as of June 5.

STOCK QUOTATIONS—Continued

Table of stock quotations for COLO. SPRINGS and LONDON listing various companies and their prices as of June 5 and May 21.

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Table showing monthly average prices of metals (Silver, Copper, Tin) for New York and London from January to December.

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

Table showing monthly average prices of metals (Copper, Tin) for New York and London from January to December.

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

Table showing monthly average prices of metals (Lead, Spelter, Pig Iron) for New York and St. Louis from January to December.

† As reported by W. P. Snyder & Co.

Current Prices—Materials and Supplies

IRON AND STEEL

Drill Steel—New York price in cents per pound is:

Solid	12	Hollow	22@24..
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Structural Material—The following are the base prices f.o.b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Pittsburgh	New York		San Francisco
	June 4, 1917	June 4, 1917	One Year Ago	Chicago
Beams, 3 to 15 in.	\$5.00	\$5.00	\$3.50	\$5.00
Channels, 3 to 15 in.	5.00	5.00	3.55	5.00
Angles, 3 to 6 in., ¼ in. thick.	5.00	5.00	3.50	5.00
Tees, 3 in. and larger.	5.05	5.05	3.55	5.05
Plates	7.00	8.00	4.10	7.00

New York extras on other shapes and sizes per lb. are as follows:

I-beams over 15 in.	\$0.10
Angles over 6 in. on one or both legs.	.10
Angles, 3 in. on one or both legs less than ¼ in. thick.	.70
Cutting to lengths, under 3 ft. to 2 ft. inclusive.	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive.	.50
Cutting to lengths, under 1 ft.	1.55

No charge is made for cutting to lengths 3 ft. and over.

Sheets—Quotations are in cents per pound in various cities from warehouse, also the base quotation from mill:

Blue Annealed	Large Lots, Pittsburgh	Chicago	San Francisco	New York	
				June 4, 1917	One Mo. Ago
No. 10	7.25	8.00	9.50	9.00	6.80
No. 12	7.50	8.05	9.55	9.05	6.85
No. 14	7.75	8.10	9.60	9.10	6.90
Black					
Nos. 18 and 20	7.30	7.80	9.57	9.30	7.30
Nos. 22 and 24	7.35	7.85	9.60	9.35	7.35
No. 26	7.40	7.85	9.60	9.40	7.35
No. 27	7.45	7.95	9.70	9.50	7.45
No. 28	7.50	8.00	9.75	...	7.50
Galvanized					
No. 10	8.50	9.20	...	10.95	8.45
No. 12	8.55	9.20	11.68	11.00	8.50
No. 14	8.60	9.20	11.68	11.05	8.55
Nos. 18 and 20	8.90	9.40	11.98	11.35	8.85
Nos. 22 and 24	9.05	...	...	11.55	9.05
No. 26	9.20	9.70	10.27	11.70	9.20
No. 27	9.35	9.85	10.42	11.85	9.35
No. 28	9.50	10.00	10.56	12.00	9.50

Steel Rails—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh		Chicago	
	June 4, 1917	One Month Ago	June 4, 1917	One Month Ago
Standard bessemer rails	\$38.00	\$38.00	\$38.00	\$38.00
Standard openhearth rails	40.00	40.00	40.00	40.00
Light rails, 8 to 10 lb.	63.00	58.00	63.00	58.00
Light rails, 12 to 14 lb.	62.00	57.00	62.00	57.00
Light rails, 25 to 45 lb.	60.00	55.00	60.00	55.00

Track Supplies—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh		San Francisco	
	June 4, 1917	One Year Ago	Chicago	San Francisco
Standard railroad spikes	\$3.85	\$2.65	\$5.00	\$5.00
Track bolts	6.00	3.25	6.25	6.25
Standard section angle bars	3.50	2.00	4.00	6.50

Wire Rope—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York		Chicago	San Francisco
	June 4, 1917	One Year Ago		
Galvanized	10-2¼%	25-2¼%	10-2¼%	5%
Bright	20-2¼%	35-2¼%	20-2¼%	15%

Bar Iron—Prices in cents per pound at the places named are as follows:

Pittsburgh, mill	4.00	2.65
Warehouse, New York	4.60	3.25
Warehouse, Chicago	4.50	3.10

Swedish (Norway) Iron—This material per 100 lb. sells as follows:

	June 4, 1917	One Year Ago
New York*	\$13.00@19.00	\$6.00
Chicago	11.50	5.25

In coils an advance of 50c. usually is charged.

Note—Stock scarce generally.

Cold Drawn Steel Shafting—From warehouse to consumers requiring fair-size lots, the following quotations hold:

	June 4, 1917	One Year Ago
New York	List plus 25%	List plus 20%
Chicago	List plus 5%	List plus 10%

Pipe—The following discounts are for carload lots f.o.b. Pittsburgh, in effect May 1, 1917:

Inches	Steel		Iron	
	Black	Galvanized	Black	Galvanized
2	42%	29½%	23%	8%
2½ to 6	45%	32½%	30%	16%
			31%	17%
			33%	20%
			33%	20%

From warehouses at the places named the following discounts hold for steel pipe:

	New York		Chicago	
	Black	Galvanized	Black	Galvanized
¾ to 6 in. lap welded	28%	10%	38.8%	24.8%

Malleable fittings, Class B and C, from New York stock sell at 5 and 5% from list prices. Cast iron, standard sizes, 34 and 5%.

MISCELLANEOUS

Flotation Oils—New York prices of oils for flotation, in cents per gallon:

Pure steam-distilled pine oil	53½
Pure destructively distilled pine oil	48
Pine tar oil	23
Crude turpentine	38
Hardwood creosote	24
Hardwood creosote in Michigan costs	16c.

Sodium Cyanide—New York price is 37c. per lb.

Zinc Dust—New York price is 18c. per lb.

Calcium Carbide—Price f.o.b. cars at warehouse points east of Mississippi (except in Alabama, Georgia and Florida) is \$82.50 for Cameo, \$87.50 for Union. In territory between Mississippi River and the Rockies and in Alabama, Georgia and Florida, add \$5; west of Rockies, add \$10 to \$15.

Hose—	Fire	50-Ft. Length		
		First Grade	Second Grade	Third Grade
Underwriters' 2½-in.	60c. per ft.			
Common, 2½-in.	50-10%			
		¼-in., per ft.	\$0.50	\$0.28
			\$0.28	\$0.20

Steam—Discounts from list
First grade.... 30% Second grade.... 30-5% Third grade.... 40-10%

Rubber Belting—The following discounts from list apply to transmission rubber and duck belting:

Competition	50-10%	Best grade	25%
Standard	40-10%		

Leather Belting—Present discounts from list in the following cities are as follows:

	Medium Grade	Heavy Grade
New York	40%	35%
Chicago	40-5%	35-10%

Rawhide Lacing—40%.

Packing—Below are prices each per pound in cities named:

	Asbestos	
	New York	Chicago
Valve	\$0.65@0.70	\$1.00
Twisted plain, 25-lb. cartons	.90	1.35
Twisted graphite, 25-lb. cartons	.80	1.20
Box	1.00	1.55

Asbestos wick in balls, ¼-, ½-, 1-, 25- and 50-lb. cartons, \$0.65@0.70, New York; \$1, Chicago.

Rubber asbestos, compressed sheet, medium grade about \$0.80, New York; \$1, Chicago.

	Steam	
	New York	Chicago
Following in 25- and 50-lb. cartons:		
First grade	\$0.83	\$1.10
Second grade	.55	.85

	Rubber and Duck	
	New York	Chicago
High grade	\$0.44	\$0.55
Cold water	.28	.30

	Piston	
	New York	Chicago
Asbestos, duck and rubber	\$1.75	\$2.00
Flax, first grade	.94	1.00
Rubber and duck	.90	1.00

Manila Rope—Price in coils per lb. in cities named, ¾ to 1½ in.:

Boston	\$0.30	Los Angeles	\$0.28½
Cincinnati	.29	San Francisco	.27
Kansas City	.28½	Seattle	.28½
New Orleans	.28	Denver	.30

Cotton Waste—The following prices are in cents per pound:

	New York		Chicago
	June 4, 1917	One Year Ago	
White	13.00@15.00	12.50	13.00@15.00
Colored mixed	10.00@12.00	9.00	10.00@12.00

Linseed Oil—These prices are per gallon:

	New York		Chicago	
	June 4, 1917	One Year Ago	June 4, 1917	One Year Ago
Raw in barrels	\$1.31	\$0.73	\$1.30	\$0.73
5-gal. cans	1.41	.83	1.35	.83

White and Red Lead in 500-lb. lots sell as follows in cents per pound:

	Red		White	
	June 4, 1917	One Year Ago	June 4, 1917	One Year Ago
100-lb. keg	12.25	10.50	12.00	10.50
25- and 50-lb. kegs	12.50	10.75	12.25	10.75
12½-lb. keg	12.75	11.00	12.50	11.00
1- to 5-lb. cans	14.25	12.50	13.50	12.50

Greases—Prices are as follows in the following cities in cents per pound for bbl lots:

	New York	Chicago
Cup	5@7	7½
Fiber or sponge	5@7	7½
Transmission	5@7	6½
Axle	3@7	5
Gear	4@5	6½
Car journal (S. & F.)	6½	6

Nuts—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Chicago	
	June 4, 1917	1 Year Ago	June 4, 1917	1 Year Ago
Hot pressed square	List	\$2.50	\$3.00	\$3.00
Hot pressed hexagon	List	2.50	3.00	3.00
Cold punched square	List	2.00	2.50	3.00
Cold punched hexagon	List	2.50	3.00	3.50

Semifinished nuts sell at the following discounts from list price:

	June 4, 1917	One Year Ago
New York	50%	50-10%
Chicago	50%	65%

Machine Bolts—Warehouse discounts in the following cities:

	New York	Chicago
¾ by 6 in. and smaller	33½%	35-5%
Larger and longer up to 1 in. by 30 in.	20%	20-2½%

Wrought Washers—From warehouses at the places named the following amount is deducted from list price:

New York	\$4.00	Chicago	\$5.00
For cast-iron washers the base price per 100 lb. is as follows:			
New York	\$2.50	Chicago	\$3.00

Nails—The following quotations are per keg from warehouse:

	New York		Chicago	San Francisco
	June 4, 1917	One Year Ago		
Wire	\$4.10	\$3.15	\$4.00	\$4.60
Cut	4.40	3.15	4.50	5.65

EXPLOSIVES AND ACCESSORIES

Dynamite—Price in cents per pound at cities named:

	Low-Freezing		Gelatin Dynamite	
	20%	40%	60%	80%
Los Angeles	21	27	34	...
Seattle	15½	21¾	26¾	33
Chicago	16¾	23	28	34¼
St. Paul	17	23¼	28¼	34½

Prices per pound f.o.b. nearest railroad stations in Ohio, Indiana, Illinois, Michigan, Wisconsin and Dubuque County, Iowa, are as follows:

	Carload of 20,000 lb.		Ton Lots		200-Lb. Lots*	
	Low-Freezing Ammonia	Low-Freezing Gelatin	40%	60%	40%	60%
40%	15½	18	17	18¼	23	25½
60%	19½	25	21	22¼	28	28

*Less than 200 lb., f.o.b. shipping point.

Blasting Powder—Price per keg:

	Carload Lots Delivered
Ohio, f.o.b. Columbus	1.74½
Indiana, f.o.b. Aetna	1.79½
Indiana, f.o.b. Indianapolis	1.82
Illinois, f.o.b. Chicago	1.84½
Iowa points on Mississippi River, f.o.b. St. Louis	1.87
Iowa points on Mississippi River, f.o.b. Fond du Lac	1.84½
Missouri points on Mississippi River, f.o.b. Des Moines	1.87
Missouri points on Mississippi River, f.o.b. Saginaw	1.94½
Michigan, South Peninsula only, f.o.b. Kansas City	1.84½
Iowa points not on Mississippi River, f.o.b. Duluth	1.84½
Wisconsin (except Counties of Ashland, Bayfield, Douglas, Florence and Iron)	1.84½
Minnesota, f.o.b. Minn. Transfer, Kansas City, Omaha	1.84½

Above prices are for CC, C, F, FF, FFF sizes. Price on FFFF size 5c. per keg advance over above prices.

Safety Fuse—Prices f.o.b. New York, Chicago, per 1000 ft., less quantity discount:

Cotton	\$6.65	Beaver	\$6.75
Single tape	6.85	Anchor	7.65
Double tape	7.75	Crescent	7.65
Triple tape	8.60		

Blasting Caps—List price of blasting and electric blasting caps f.o.b. shipping points in states named:

	Electric Blasting Caps, Copper Wire					No. p. 1000
	No.	4 Ft.	6 Ft.	8 Ft.	10 Ft.	
New York, Ohio, Indiana, Illinois, Kentucky and So. Michigan	6	\$6.00	\$7.00	\$8.00	\$9.00	5 \$14.00
Missouri, Iowa, Minnesota, Wisconsin and No. Michigan	6	6.10	7.11	8.12	9.13	5 14.15
Kansas, Nebraska, North and South Dakota	6	6.15	7.16	8.17	9.18	5 14.30
	8	8.15	9.16	10.17	11.18	6 17.30
						8 28.55

CONSTRUCTION MATERIALS

Rosendale Natural Cement—Price to dealers for 500 bbl. or over, f.o.b., including bags:

New York	\$1.15
30c. allowed for bags.	

Portland Cement—These prices are for barrels in carload lots including bags:

	June 4, 1917	One Month Ago	One Year Ago
New York	\$2.32	\$2.32	\$1.72
Chicago	2.31	...	1.81
Pittsburgh	2.31	...	1.81
San Francisco	2.60	2.00	2.30
Denver	...	2.80	...

Brick—The price per 1000 in cargo or carload lots is as follows:

	Common		
	June 4, 1917	One Month Ago	One Year Ago
New York	\$10.25	\$8.25	\$10.25
Chicago	8.00	6.00	6.00
San Francisco	10.00	...	10.00
Seattle	7.50	...	7.00
Los Angeles	7.50	...	7.50

Lumber—Price per M in carload lots:

Rough Douglas Fir, No. 1 Common—More than carload lots in San Francisco:	Size in Inches		
	15 Ft. and Under	16 to 24 Ft.	25 to 32 Ft.
3 and 4x4	\$20.00	\$21.50	\$22.50
3 and 4x6 and 8	20.00	20.50	21.50
6x6 to 8x8	20.50	21.50	21.50
3 and 4x10	20.00	21.50	22.50
6 and 8x10	21.00	22.00	22.00
10x10	21.00	21.00	23.00
3 and 4x12	20.00	21.50	22.50
6 and 8x12	21.50	22.50	22.50
10 and 12x12	21.00	21.00	23.00
3 and 4x14	21.00	23.00	24.00
6 and 8x14	22.50	23.50	23.50
7 and 9x14	23.50	24.50	24.50
10 and 12x14	22.00	22.00	24.50

1-In. Rough, 10 In. x 16 Ft. and Under

	Y.P.		Hemlock		2-In. T. and G., (10 In. x 16 Ft.)	
	Y.P.	Fir	Y.P.	Fir	Y.P.	Fir
Boston	\$72.00	...	...	...	\$41.00	...
Cincinnati	25.00	...	...	...	34.00	...
Kansas City	43.25	\$44.50	\$43.50	...	48.00	\$18.50
Seattle	18.50	18.50	18.50	...	18.50	18.50
Los Angeles	...	30.00	30.00	...	...	...
New Orleans	36.00	...	...	...	30.00	...
Chicago	32.00	...	...	...	30.00	...
St. Paul	60.00	54.00	33.50	...	65.00	57.00

8 x 8-In. x 20 Ft. and Under

	Y.P.				12 x 12-In., 20 Ft. and Under	
	Y.P.	Fir	Hemlock	Spruce	Y.P.	Fir
Boston	\$46.00	...	...	\$37.00	\$53.00	...
Cincinnati	30.00	...	...	...	24.00	...
Kansas City	38.00	\$35.00	\$35.00	...	42.50	\$35.00
Seattle	18.50	18.50	18.50	18.50	18.50	18.50
Los Angeles	...	30.00	...	...	...	30.00
New Orleans	40.00	...	...	...	40.00	...
Chicago	30.00	35.00	27.00	...	32.00	35.00
St. Paul	...	38.00	31.00	...	...	38.00

Roofing Materials—Prices per ton f.o.b. New York or Chicago:

	Carload Lots	Less Than Carload Lots
Tar felt (14 lb. per square of 100 sq.ft.)	\$59.00	\$60.00
Tar pitch (in 400-lb. bbl.)	14.00	16.00
Asphalt pitch (in barrels)	29.00	30.00
Asphalt felt	60.00	61.00

Prepared Roofings—Standard grade rubbered surface complete with nails and cement costs per square as follows in New York and Chicago:

	1-Ply		2-Ply		3-Ply	
	c.l.	l.c.l.	c.l.	l.c.l.	c.l.	l.c.l.
No. 1 grade	\$1.15	\$1.30	\$1.45	\$1.60	\$1.75	\$1.90
No. 2 grade	1.00	1.15	1.25	1.40	1.50	1.65

Asbestos asphalt saturated felt (14 lb. per square) costs \$5.35 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs \$1.85 per roll in carload lots and \$2.10 for smaller quantities.

Shingles, red and green slate finish, cost \$4.75 per square in carloads, \$5 in smaller quantities, in Philadelphia.