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## Early Copper Mining and Smelting in Arizona

BY G. A. MARTIN\*

Copper was first commercially produced in Arizona by Spaniards who carried rich ores to Sonora and even to Mexico City, but serious mining was not instituted until 1871 or 1872, when H. Lesinsky and Robert Metcalf began prospecting and discovered payable ore near the head of what is now called Chase Creek, in the White Mountains of southeastern Arizona. Lesinsky came to San Francisco from Australia in 1871 and immediately started east with the idea of reaching New York, but with the intention of prospecting *en route*.

In Arizona, he met Metcalf, and the two formed a partnership, agreeing to share their privations and

By this means some profit was obtained and with the money a small, but at that time, modern, smelting plant was bought and installed. Profits thereafter increased and they were soon able to buy the materials for constructing and equipping a small railroad, 30-in. gage, which transported the ore from the Metcalf mine to the smeltery which was built on the present site of the city of Clifton where water was available. Under these favorable conditions the partners began to realize substantial profits, a condition which continued during their ownership of the mines.

In the early days Lesinsky and Metcalf endeavored to sell their interests in the mines but were not able to do so. When the discoveries of copper were made in Montana, however, the prospective profits of mining in general, and copper mining in particular, were so widely advertised that they were able to sell their property to



CONCENTRATOR NEAR CLIFTON, ARIZ.



SMELTER AT CLIFTON, ARIZ.

triumphs, if the latter should materialize; of the former, they were amply assured. In order to protect themselves from marauding Apaches, Geronimo and Victorio were at that time abroad with their bands, they slept hidden in caves. Their living cost them practically nothing, as it consisted of wild game shot in the mountains and Indian corn which they bought from the Mexican settlers in the valley below.

Metcalf's pick turned the first copper and the mine was named for him. Then ore was found seven miles south of Chase Creek, and because the ore streak appeared to be lengthy, it was called the Longfellow mine. The ore was at first shipped to New York, but while it paid its expenses, there was nothing left for the miners, so an attempt was made to smelt the ore on the ground, using a crude structure built of adobes made from the yellow mud deposited by the river in flood time. The copper derived thus was sacked and carried by burro to Pueblo, whence it was shipped to New York.

Scotch capitalists for a million dollars. Both Metcalf and Lesinsky went to New York, where the former soon died, and the latter is now a wealthy manufacturer of typewriters.

The new owners of the property, known as the Arizona Copper Co., have prospered and now produce about 40 million pounds of copper annually, which production will be largely increased when the smelter now under construction, and which will cost \$2,000,000, is completed. A \$1,000,000 concentrator has just been finished.

Upon recently visiting the scenes of his early efforts as a miner, Mr. Lesinsky found the Indians and wild game replaced by a town of 5000 people, with two smelters in operation and another under construction. Electric lights and automobiles replace the cruder methods of earlier days and mark the trend of progress in the West. Proceeding up the cañon toward Clifton, Mr. Lesinsky was able to point out the spot where Indians massacred his miners, a spot now cultivated by a Chinaman as a market garden.

\*El Paso, Tex.

## The Cornish Miner

By P. B. McDONALD\*

The race that has done the most in the actual digging of ore in the mines of the United States is the Cornish. The Cornishman has not done much in the financing department, nor has he any letters after his name, but he has made a reputation for getting out the ore. In nearly all of the mining districts, Cornish miners and Cornish foremen are prominent. This is particularly true of the iron and copper ranges of the Lake Superior district, where he is an important factor. He is often to be found in the "Captain's" office, but in older mining communities will be found in nearly every capacity underground. You may catch him sitting and "smokin' 'is pipe," but at quitting time he will "'ave hout 'is hore." To a Cornishman a mine is a "hore-body" that must be "got hout" of the ground. To him the mine means a "West Hend" and a "Heast Hend," and the "Blue Stope," and the "'ard Hore Drift."

It is natural for the Cornishman to be a good miner, for very likely his father and grandfather worked in the mines of Cornwall. Sometimes the Cornish mining-captain and the mining-engineer don't get along well. This is because each arrives at his conclusions by an entirely different course. The engineer reasons things out, the Cornishman just "sees 'em."

Of course, with all his good points, the Cornishman has his faults. His aversion to shoveling is well known. At a small exploration near Iron River, two men were employed underground on each shift, and the day shift (composed of Swedes) threw all the shoveling possible on the night shift, while the night shift (composed of Cornishmen) did the same or a little better to the day shift. One night the Swede foreman, who was on surface, noticed that no dirt was coming up as there should have been; he jumped on the bucket and went down. The Cornish miner and helper were drilling merrily away, regardless of the pile of dirt that should have been shoveled into the bucket.

"Who in h—l gave you instructions to drill?" roared the foreman. The Cornishman, a first-rate miner, looked around, "Hi'm d—d sure hit wasn't Presdunt Roozevelt!" he answered.

In the community where the Cornishman lives, he takes great interest in local politics and likes to represent his section as alderman or supervisor. Many stories are told of elections in the old days, held perhaps in the school-house, and of how, when the captain stood up, everybody else stood up. Another method much in vogue, was to vote by lining up on different sides of the room (where the captain could get a good look at each man); in outlying communities, this practice is still in use.

A Cornish miner who has worked a long time in a successful mine, will finally retire on a rocky little farm overlooking the scene of his former labors, and will live there happily in preference to moving into town. He likes to see daily the mine where he worked; if it is exhausted and closed down, he will tell you where he thinks the "hore" is, and will exhibit confident belief that the place will boom again some day. If the railroad has never been built there, he will predict its coming and will in-

dicating the site where he thinks the station should be located, ending by declaring that he only hopes to live to see it.

Throughout the Lake Superior region he can be seen driving into town on a sunny day, or going in for a glass of "'arf-and-'arf," or sending "five poun'" to a nephew in the old country to help him come across. Whether he was a foreman or a miner, he enjoys being called "captain" and is always willing to stop and discuss "minin'."

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## Hulett Iron Ore Unloader

The increasing tonnage of iron ores being brought down the Great Lakes in large freighters, together with the necessity for despatch in every operation connected with the handling of the ore at all points between the mines and the furnaces, led to the design and construction of the Hulett ore unloader. For many years prior to the adoption of this type, the most advanced design of unloader provided for a swinging bucket of some sort, suspended by cables, which was operated by a man at a considerable distance from the place where the bucket secured its load. When this free-swinging bucket entered the hold of a vessel, the only way of guiding its descent

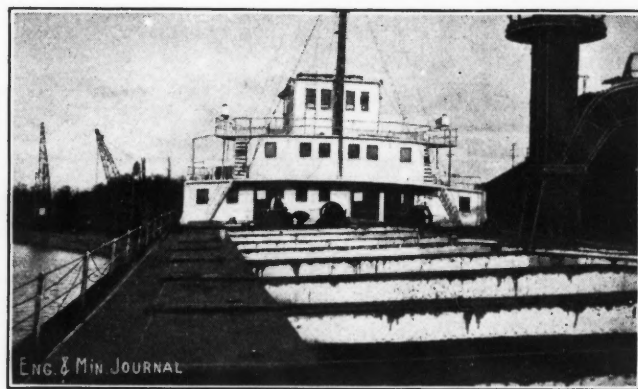


FIG. 1. UNLOADER, SHOWING LEG AND LOWER BEAM, BUCKET IN HOLD

and landing was by signals originating in the hold of the ship. The result was that the buckets often landed with considerable force, and in some cases with consequences disastrous to the bottom plates of the boat. This difficulty is entirely obviated with the Hulett machine which is now coming into general use at the lower Lake ports.

The unloader is of massive construction, being built up of structural plates. The bucket forms an integral part of a vertical leg, which is in turn supported from large beams, which are free to move in a vertical plane, on pivots at their central points. The lower beam acts as a steadying member, and the two are so placed that in any position of the bucket they are parallel to each other. The leg remains vertical, but can rotate on its axis in a ring attached to the lower beam, carrying the bucket with it, which can thus move around a complete circle in a horizontal plane. The leg and bucket are raised by the vertical motion of the beams and are then run back with the beams to the discharge point. The whole system runs on tracks parallel to the vessel and cars. The bucket is opened by the jaws swinging out and up. The lugs of the shaft shown in Fig. 3 engage slots in the bot-

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tom of the leg and run out in them so as to spread the jaws apart, thus giving an opportunity to scrape material over a considerable area. Fig. 2 shows the open bucket, with lips extended, about to descend into the hold. As can be seen, the operator is situated in a small compartment in the bottom of the leg and just above the bucket. From here he can command a full view of all operations, in and out of the boat. The operations of the unloader are governed entirely by electrical machinery, over which the operator in the leg has full control. The flexibility of the machine is at once apparent. Fig. 1 shows the leg supporting the bucket, the latter being in the ship, where it is collecting a load. The lower supporting beam can also be seen, and the circular iron ring, inside of which the leg revolves. Fig. 3 shows the loaded bucket leaving the vessel with 15 tons of iron ore.

The buckets at the Pennsylvania docks, in the outer harbor at Cleveland, have a capacity of 17 tons each. About 50 sec. are required for a complete trip of a bucket. The loaded bucket discharges into an ore hopper, which has a capacity of 70 tons and is provided with discharge gates at the bottom. At the Pennsylvania docks, the working capacity of the four machines is estimated at between 35,000 and 40,000 tons in 24 hr., an

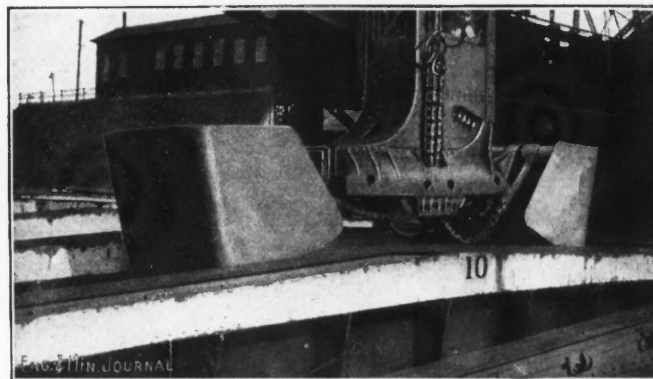


FIG. 2. DESCENDING BUCKET WITH JAWS SPREAD

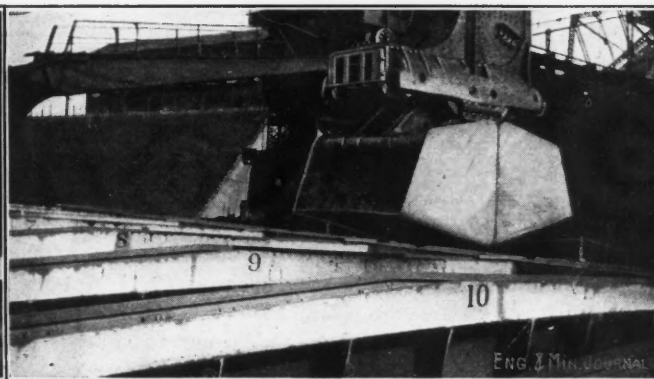


FIG. 3. FULL BUCKET RISING FROM HOLD

amount equal to the capacity of four of the largest ore steamers on the Lakes. Although these unloaders are of immense proportions, the ease with which they can be handled by one man on the unloader itself and one man at the machinery on shore, is remarkable. This is especially noticeable toward the end of a cargo. The buckets can be turned quickly, the lips extended at will, and a load scraped together with scarcely any aid from the men in the boat, and with little if any shock to the vessel.

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### Bingham Mines Co.

The report of the directors of the Bingham Mines Co., operating in Utah, for the year ended Dec. 31, 1912, shows a production of gold, 3731 oz.; silver, 225,763 oz.; lead, 3,770,320 lb.; copper, 1,427,780 lb. The net earnings were \$144,022, being an average of \$12,000 per month, an increase of \$26,742 over the previous year. Although the Dalton & Lark and Commercial mines of the company were closed down for six weeks by reason of the strike, and the Commercial lost an additional three months on account of foul air, the combined output of the two properties exceeds that of 1911 by 3903 tons.

The Eagle & Blue Bell Mining Co., a subsidiary of the Bingham Mines Co., shows a total shipment of silver-lead ore of 22,341 tons, with a metal content of 5833 oz. of gold; 341,164 oz. of silver; 1,303,294 lb. of lead, and 50,913 lb. of copper. The net earning of the company amounted to \$91,912, which exceeds previous records and substantiates the statement contained in the last annual report respecting the excellent physical condition of the property.

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### Tin Mining in Federated Malay States

The importance of the tin-mining industry to the Federated Malay States is evidenced by the fact that in 1910 tin contributed over \$32,000,000 of the total exports, equivalent to 55½% of the whole. In 1911, according to *Special Agent Series No. 53*, of the Department of Commerce and Labor, the value of the tin exports rose to \$39,500,000. The production by states in 1911 is given as follows: Perak, 29,156 tons, Selangor, 15,412 tons, Negri Sembilan, 1949 tons, Pahang, 2930 tons.

While tin is found in place in quartz veins, the richer and more easily worked alluvial deposits receive the most attention. Nevertheless a 20-stamp mill for a quartz de-

posit is in process of erection by the Menglembu Lode Syndicate near Ipoh and another mill is being installed near Bentong. A reduction of the export duty on tin and ore varying up to 50% is granted to properties of too low a grade to show a profit under the full duty.

The alluvial deposits are found in valleys adjacent to tin-bearing granite. An excellent example is the Kinta Valley of Perak, 30 miles long with an average width of five or six miles between hills 300 to 400 ft. high. The tin-bearing ground is called "karang." The open-cast method of handling the ground is the most important; the underground method using shafts is going out of use; and the "lampan," or ground-slucing method, is of much less importance than the open-cast. Underground mining and ground slucing are usually conducted on a small scale by Chinese. Chinese also operate many of the open-cast mines, and it is estimated that 78% of the 1910 output was produced from mines operated and owned by them.

After removing the overburden, the material from the open-cast mines is hoisted on inclines and washed in circular tanks by mechanical agitation. The slime overflow from these tanks is concentrated by flowing over riffles, which catch the cassiterite. A small proportion of

the ore is found in quartz pebbles, which remain in the washing tank and must be crushed either by stamps or by more primitive methods for further treatment. It is said, however, that fully 90% of the ore in the "karang" is recovered on the riffles. The clean ore is dried in a perforated cylinder, placed around a cone-shaped stove. Wolfram, if present, is removed by ordinary horseshoe magnets. Power of various kinds is employed, even man-power in tread mills. Steam power is being gradually abandoned for gas producers and gas engines. Coal is obtained from Wales, China, Bengal or Borneo, this being the order of its excellence.

One of the best known mines is the Tambun, owned and operated by Towkay Leong Fee. This has produced as much as 3600 long tons of ore in a year. A contract system is employed with excellent results. The smelting plant for this mine is of a simple, primitive Chinese type, in which the blast is furnished by a single-acting piston in a wooden box five or six feet long. Satisfactory results are obtained, both in quality and in cost. A similar mine is the Lahat which produced 548 long tons of ore in 1910, averaging 74% tin. The most famous mine is the Tronoh, which in 1911 produced 2083 long tons of ore in four months. Nearly 6000 men are employed here.

For the hydraulic mines, natural water power is sometimes available and sometimes a power plant must be installed. Of the mines operating under a natural head of water the Tekka is the largest and best known. The system includes the use of monitors and hydraulic elevators with concentration on riffles, supplemented by hand concentration with an implement similar to a *batea*. Eight monitors are in operation.

The Pengkalen is the largest and most modern of the hydraulic mines using generated power. The equipment includes three 40-hp. water-tube boilers, engines and generators, electrically operated Worthington centrifugal pumps for the monitors, gravel pumps instead of hydraulic elevators, and drainage pumps. The cost of raising and treating the earth in this mine is about \$0.315 per cu.yd. In the Tekka mine it is \$0.07 and in the open-cast mine it varies from \$0.34 to \$0.52 per cu.yd. In the hydraulic mines the overburden is handled along with the karang.

Of the tin exports about 22¼% is in the form of block tin from local Chinese smelteries. Of the rest, exported as tin ore, about 80% is smelted by the Straits Trading Co. at Singapore, and the Eastern Smelting Co. at Penang. There is an export duty on ore and metal. The smelters buy the ore outright and pay for the contained tin less an amount varying from \$18 to slightly over \$20 per short ton.

In 1910 over 170,000 employees were credited to the tin industry, working under the contract, wages, tribute and "dulang" systems. Over 55% worked under the tribute or share system. Over 75% of the employees are Chinese, the remainder being principally Tamils, with some Malays, Javanese, and Punjabees.

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## The Fineness of Placer Gold

It is a generally recognized fact that the purity of alluvial gold is greater than that of the veins in the neighborhood. This superiority in fineness has generally been explained by the well known fact that silver is more read-

ily soluble in natural waters than gold, and is by them removed from the natural alloy, thus increasing its purity, say Chase Palmer and Edson S. Bastin in a paper presented before the February meeting of the American Institute of Mining Engineers. Mr. Lindgren has recently discussed this matter at some length in a report on the Tertiary gravels of California (*Prof. Paper* 73, U. S. Geol. Surv.; pp. 68-70), and has presented a large amount of statistical data leading to the same conclusion. It has been thought by certain geologists that this refinement of the gold was accomplished by solutions circulating through the gravels themselves, but Mr. Lindgren states that "so far as the Tertiary gravels of California are concerned, the conclusion of the writer is that solution and precipitation of gold have played an absolutely insignificant part." Under the conditions of experiments made on the precipitation of gold and silver by various metallic minerals it was found that nearly all of the metallic minerals common in precious-metal deposits were capable of precipitating gold, while a much smaller number, and these not the most common ones, were active precipitants of silver. When it is remembered that the source of the placer gold is the oxidized zone of the original deposit and that the gold may have been dissolved and redeposited several times within the vein before erosion carried it into the alluvium, it seems not improbable that such selective precipitation may be an important factor in this natural refining of gold.

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## Sicilian Sulphur

Messrs. Parsons & Pettit, New York, furnish the following figures for Sicilian sulphur for several years past. The figures cover the calendar year, and are in metric tons:

	1911	1912	Changes
Stocks, Jan. 1.....	640,711	551,442	D. 89,269
Production.....	376,171	357,547	D. 18,624
Total supply.....	1,016,882	908,989	D. 107,893
Shipments.....	455,826	447,292	D. 8,534
Stocks, Dec. 31.....	561,056	461,697	D. 99,359
Actual stocks.....	551,442	450,917	D. 101,525

The actual stocks reported show a difference from those required by the other figures. The difference is probably due to shrinkage and to discrepancies in reports.

The report of shipments for several years past is as follows, and in metric tons:

Exports	1909	1910	1911	1912
United States.....	14,706	12,205	8,482	2,856
France.....	90,239	93,229	114,868	104,109
Italy.....	49,602	61,209	72,959	84,652
United Kingdom.....	19,800	19,074	19,936	19,830
Russia.....	18,584	25,866	23,485	25,563
Spain and Portugal.....	21,036	18,758	25,121	21,314
Germany.....	28,538	30,225	28,664	32,286
Austria-Hungary.....	26,560	29,601	34,136	38,362
Greece and Turkey.....	16,300	21,435	24,933	15,436
Belgium.....	16,377	14,305	11,771	10,723
Scandinavia.....	19,905	20,354	20,741	35,111
Holland.....	8,708	9,731	10,549	14,019
North Africa.....	6,140	9,951	7,066	8,202
British India.....	4,613	4,382	5,057	4,587
Australia.....	2,312	8,203	13,383	11,590
South and Central America.....	6,814	5,702	5,003	10,325
Canada.....	2,266	360	29	37
South Africa and other countries.....	11,854	9,334	18,663	7,990
Total.....	364,513	393,987	453,826	447,292

Production has been kept down under the rule of the Consorzio which controls the operation of all the mines. Shipments keep up well, considering the almost entire loss of the North American trade. Stocks have been considerably decreased from the maximum reached in 1909, of 647,889 tons.



# Concentration of Telluride Ores

BY HENRY E. WOOD\*

*SYNOPSIS*—Tellurides objectionable in ore treatment. Boulder County veins too small to furnish economical tonnage for cyaniding. Table concentration results in large losses from small particles floating. This floating ability utilized for concentration by water flotation. Tailings treated on Wilfleys and then stored for cyanidation.



Tellurium, from a commercial point of view, is not attractive; regardless of its quotation at \$1 per oz.,<sup>1</sup> the demand is such that the production of a few hundred pounds would undoubtedly overstock the market. It has a limited use medicinally and its application to resistance wires has been patented. Metallurgically it is known as the "black sheep" among rare metals. Tellurides are objectionable in wet concentration, owing to their sliming tendency, and are an interfering element in cyan-

metric separation by either wet or dry methods. But the sylvanite with its blade-like monoclinic crystals has a hardness of only 1.5 to 1, while the gangue approaches a hardness of 7. To free the mineral from its matrix, fine crushing is necessary, ranging from 40-mesh to 60. Consequently, the very soft telluride combinations are pulverized to an exceedingly fine state by the hard gangue.

## FINE CRUSHED SYLVANITE FLOATS ON WATER

Under a microscope it is evident that each particle of sylvanite still retains, to a certain extent, its original crystalline tabular shape and is, therefore, subject to the supporting influence of its enveloping layer of air when placed in water or upon it. When a wet crushed telluride ore is concentrated upon any standard concentrator, a persistent and continuous line of mineralized slimes can

TABLE I. TESTS ON THE CONCENTRATION OF TELLURIDE ORES

	Weight Grams	Ratio of Concentration	Contents		Value per Ton	Distribution of Contents		Recovery		FeS <sub>2</sub> %	Partial Analysis			
			Gold, Oz.	Silver, Oz.		Gold, %	Silver, %	Gold, %	Silver, %		SiO <sub>2</sub> %	Te %	Au %	Ag %
(1) 40-mesh; Wilfley Table														
Wet feed.....	4536		2.49	2.21	\$51.13					5.35	91.60			
Concentrates.....	236	19.22:1	22.47	20.73	461.84	46.95	42.82							
(2) 40-mesh; Flotation and Wilfley Table														
Crude ore, dry.....	4536		20.38	12.77	415.26									
Flotation concentrates.....	30	151.2 :1	1748.80	863.20	36,213.92	57.92	44.71			43.70	21.20	24.40	6.12	2.96
Wilfley concentrates.....	207	21.9 :1	115.20	88.80	2,357.28	25.80	31.73							
Tailings.....	4177		3.06	2.22	62.53	13.83	16.01							
Unaccounted.....	122				2.45	2.45	7.55							
Combined concentrates.....	237	19.14:1	326.56	186.63	6,643.30			83.72	76.44					
(3) 40-mesh; Flotation and Wilfley Table														
Crude ore, dry.....	4536		2.24	2.96	46.57									
Flotation concentrates.....	16	283.5 :1	332.60	270.80	6,814.48	52.37	32.27			70.00	22.30	25.61	1.16	0.93
Wilfley concentrates.....	158	28.7 :1	17.70	21.70	367.02	27.52	25.53							
Tailings.....	4009		0.59	0.80	12.28	23.28	23.91							
Unaccounted.....	353				18.29									
Combined concentrates.....	174	26.07:1	46.66	44.61	959.97			79.89	57.80					
(4) 60-mesh Flotation and Wilfley Table														
Crude ore, dry.....	4536		2.24	2.66	46.40									
Flotation concentrates.....	25.5	177.8 :1	248.00	187.80	5,072.68	62.26	39.70							
Wilfley concentrates.....	268	16.9 :1	7.04	13.46	148.88	18.57	29.91							
Tailings.....	3857		0.46	0.54	9.52	17.49	17.30							
Unaccounted.....	385.5				1.68	1.68	13.09							
Combined concentrates.....	293.5	15.45:1	27.97	28.60	576.56			80.83	69.61					

<sup>a</sup> Estimated.

idation. It is the aim of this paper to demonstrate that some of their characteristics can be utilized in the recovery of its commonly associated gold and silver.

### SMALL TELLURIDE VEINS IN BOULDER COUNTY

The somewhat extensive and well known telluride veins of Boulder County, Colo., offer to the metallurgist a most interesting problem hitherto unsolved commercially. The difficulty and expense of cyanidation practically eliminate its adoption, because the veins, with some exceptions, are too small to assure the tonnage necessary to secure the lowest milling costs.

Numerous attempts at gravity separation have been disappointing and costly. The siliceous gangue is of unusual hardness and the actual mineral content to be separated rarely exceeds 5% by weight, which calls for the fairly high concentration ratio of 20:1. The portion which it is desired to recover is the telluride, usually a sylvanite present in quantities much less than 1 per cent.

The specific gravity of sylvanite is close to 8.94, while that of the gangue is less than 3, a divergence wide enough, one would infer, to be ideal for a perfect gravi-

be seen upon the surface of the water on its way out of the mill. Its quantity is small, especially when coming from a low-grade ore, but its value per ton is extremely high.

### SURFACE TENSION OF WATER FOR CONCENTRATION

Most attempts to recover it commercially have been abortive, but if it is dry crushed to either 40-mesh or 60-mesh or finer, and the simple properties of the surface tension of water alone are utilized, there are obtained conditions favorable for successful concentration by a combination of flotation and subsequent gravity separation; as over 50% of the sylvanite will float, while the siliceous gangue with some coarser mineral instantly sinks.

As illustrated in the accompanying tables the flotation concentrate from a 2-oz. gold-telluride ore is clean and will assay \$6000 per ton and higher. As its concentration ratio is close to 300:1, it represents a recovery above 50% of the contents of the original ore. A 20-oz. gold ore of this nature will, at the rate of 150:1, yield a \$36,000 product and account for nearly 60% of the gold, silver and tellurium. After flotation, the tailings passed to a standard reciprocating table will yield an additional 20 to 25%. From the table tailings, 66% of the

\*1734 Arapahoe St., Denver, Colo.

<sup>1</sup>The Mineral Industry, 1911.

remaining gold will readily respond to ordinary cyanide treatment if reground to 150-mesh.

If the original ore had been prepared by tube-mill grinding at 100-mesh or finer, possibly a higher total extraction would ensue, but this has not been determined. Grinding finer than 40-mesh or 60-mesh in the first place is not recommended at present on account of the mechanical difficulties which follow in securing a uniform rate of feed, conditions which largely influence the capacity of the flotation machines.

#### PRODUCT SUITABLE FOR REFINING

It is obvious that the rich flotation concentrate obtained by this system would be saleable to a refiner rather than to an ordinary smelter. We are not aware of any attempts to recover the tellurium contents, but as this class of concentrate consists, so far as the sylvanite is concerned, of 62% of tellurium and 38% of gold, its recovery should be considered. It is soluble in acids which do not affect the gold and silver present. With the tellurium in solution and filtered off, the gold and silver are ready for direct smelting and refining methods.

The ores used in the tests at 40-mesh were prepared in a Krupp ball mill; but No. 4, treated at 60-mesh, was

TABLE II. RESULTS ON CYANIDATION OF WILFLEY TAILINGS  
Test on 40-Mesh Wilfley Tailings from Test No. 3

	Gold	Silver	Value per Ton
Heads.....	0.59 oz.	0.80 oz.	\$12.28
Tailings.....	0.20 oz.	0.30 oz.	4.18
Extraction.....	66.1%	62.5%	
	At Start	End 40 Hr.	Consumption
	Lb. per Ton of	Lb. per Ton of	Lb. per Ton of
	Solution	Solution	Ore
Cyanide.....	2.5	2.0	1.0
Lime.....	5.0	0.7	3.6

Note—Material ground to 150-mesh. Ratio of solution to ore. 2:1. Time 40 hours.

ground by an automatic muller and plate. A screen analysis of the 60-mesh ore gave results as follows: 60-mesh to 100-mesh, 25% by weight; 100-mesh to 200-mesh, 47% by weight; 200-mesh and finer, 28% by weight.

This indicates that for a hard siliceous ore, since no sizing is required before flotation, any apparatus which will deliver a 60-mesh and finer product, can be used. Whether a satisfactory cyanide extraction can be made without regrinding has not been determined, although it is assumed, since some telluride compounds are still probably present in the tailings after concentration, that the use of bromocyanide will be found more advantageous than cyanide alone.

#### SMALL-SCALE MILLS NECESSARY

For the reason that the veins in Boulder County, although numerous, are restricted in tonnage, the small unit scale of 10 to 15 tons per day is recommended for a mill. This means that the tailings for cyanide treatment should be impounded to await custom-mill arrangements.

The formation of dust in the preparation of the ore is the most common objection to this method of concentration, but that is largely eliminated by grinding under cover. The drying of the concentrates is the same as in wet mills. In a larger plant operating under this system the flotation concentrates would be dewatered as produced. One most important and distinct advantage of this plan for the milling of telluride ores is the avoidance of heavy ore-sorting expense, as all vein matter, both high and low grade, goes to the mill.

The comment may be made that the results given here would come under the head of laboratory tests, as they were made on 10-lb. charges. Such tests, however, in nearly all cases, have been confirmed upon the commercial machine. Furthermore, a 1-ton test of Boulder County telluride ore was treated by the same plan and with corresponding results.

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## Dr. Raymond and the Institute

The April bulletin of the American Institute of Mining Engineers contains the following announcement:

The Report of the Committee of Five of last year called attention to the fact that under the old constitution, the creation of the office of Secretary Emeritus of the Institute was irregular, not having been specifically authorized by the membership at large. This has been remedied in the new constitution, adopted on Feb. 18, 1913 (Article V., Section 5), and the Board of Directors at its first meeting unanimously elected Dr. Rossiter W. Raymond to this position. It has seemed to the President and Executive Committee that this was an appropriate time to place upon the records of the Institute some description and appreciation of the services of Dr. Raymond for more than 40 years. The President, therefore, requested certain of Dr. Raymond's associates from early days in the affairs of the Institute to prepare a statement based on their own knowledge concerning these services of Dr. Raymond's.

The statement, which appears in the same bulletin, is as follows:

New York, March 18, 1913.

Charles F. Rand, President,  
American Institute of Mining Engineers.

In connection with the official notice of Doctor Raymond's unanimous election by the directors as Secretary Emeritus, we wish to place upon record certain statements concerning his services to the Institute which we think have not been published, and may not be generally known to the majority of our fellow-members.

When the Institute was formed in 1871, Dr. Raymond acted as Secretary of the Founders' Meeting, and became the first Vice-President of the Institute, and, by request of the aged and beloved David Thomas, who was the first President of the Institute, Dr. Raymond discharged all the duties of the office of President, to which he was later formally elected in 1872, and which he held for three years. During that time, he visited Europe, and through his acquaintance and reputation abroad, established those international relations of the Institute which proved so important in later years.

He also enlisted the support of the mining engineers and metallurgists of the Pacific slope, who would not otherwise have been disposed to join a society originating in the East. And for 12 years he attended, at his own expense, nearly every meeting of the Institute, wherever held, giving to it without remuneration his best service, and sacrificing for it many professional and private interests.

From the retirement of Doctor Drowne as Secretary in June, 1883, up to February, 1905, Doctor Raymond practically managed, under the general direction of the Council, the ever-increasing business of the Institute, as the executive officer of an unincorporated, voluntary association, the members of the Council of which were individually liable for any debts incurred. For many years he paid all current expenses (except the larger bills of the printer, etc.), recovering the amounts subsequently from the Treasurer upon drafts approved by the Finance Committee, which audited monthly the receipted vouchers presented by him. Any oversights or improper expenditures which occurred were his own personal loss.

When the entire cash funds of the Institute were tied up by the suspension of the bank in which, with the approval of the Council, they had been deposited, he made a deposit of some thousands of dollars of his own funds in another bank, and carried the whole business of the Institute for several months, until, through the ultimate recovery of its funds, he could be reimbursed. And from the annual appropriation made to him in lieu of salary, he expended large amounts for assistance in his work.

During the period named, he presented to the Institute his valuable professional library, which with the two libraries of Clarence King and Richard P. Rothwell, purchased and presented by John Hays Hammond, constitutes the Alfred



Raymond Memorial collection (so named in honor of his son, who died in 1901, while serving as his editorial assistant), and forms a large part of the Institute Library.

During that period, he so managed the business of the Institute as to enable it to carry the expense of publishing and distributing the "Transactions" (the volume of which increased more than three-fold in size), twice issuing two volumes in one year, and twice furnishing complete consolidated indexes; he also managed to meet, out of current funds of the Institute, the demands of the memorable joint meeting of 1890, with the Iron and Steel Institute, and of two sections of the International Engineering Congress of 1893—amounting to some \$23,000—no part of which was spent on social entertainments or excursions, the whole being laid out for the hire of halls, the employment of stenographers, the printing and circulation of programmes and papers, and other items strictly germane to the technical sessions. In connection with the International Engineering Congress, two sections—those of Mining and of Metallurgy—were assigned to the Institute, and neither could be refused without the abandonment of our national position as representing both. In this dilemma, with the approval of the Council, the burden of these two sections was assumed, together with the translating and editing of the many important papers both from American and foreign authorities, and their publication in two volumes, which greatly enhanced the international reputation of the Institute.

Moreover, during the whole history of the Institute, his professional contributions to its "Transactions" have exceeded in number those of any other author.

In 1904, after all these ordinary and extraordinary outlays, and without having received any assistance from outside sources, the Institute was out of debt, had acquired a large library, and held an invested fund of some \$18,000. This was the result of his management for 20 years.

In that year, an overwhelming vote of the members dictated the acceptance of the generous gift of Andrew Carnegie, and of the consequent obligations imposed upon the Institute. In this respect, we owe to Doctor Raymond the rejection of the first plan proposed, under which the Institute would have become directly a joint owner with other societies of the new building, and the whole property might have been subject to a partition-sale, as the result of a judgment against either of the joint owners. It was he who averted this situation, and the result was the creation of a separate corporation, of which, as owner of the new building, the so called Founder Societies should be simply tenants under lease.

Concerning the so called land debt, it should be said that the Institute was obliged to accept its share thereof without any alternative except the refusal of Mr. Carnegie's liberal offer. However, we are now all glad of the final result, which has given to the Institute a permanent home in a situation of social importance. The proximity of the Engineers' Club, and the use by numerous scientific and technical organizations of the United Engineering Society's building, and of its commodious and convenient auditoriums, has made it a recognized headquarters for such societies.

Nevertheless, the adoption of this scheme, and the acceptance of a land debt of \$180,000, presented to the Institute a serious problem. At that time, it was estimated that we could manage to pay from the ordinary income the increased cost of rent or its equivalent—at first \$7000 per year, instead of about \$3000. But it was never expected that the Institute could pay, from its ordinary revenues, either the principal or the interest of the land debt. The Institute accomplished more than was expected, paying not only the increased current expenses, but also a considerable sum on interest account; and this was done by hard work on Dr. Raymond's part and on that of the office force, for which both he and they are entitled to recognition. During this period he continued to pay from his own salary a considerable sum annually for editorial assistance.

The system of Institute excursions, concerning which many criticisms have been offered on the basis of incomplete knowledge, requires consideration, since in our opinion the holding of meetings at distant points has had and will continue to have an important influence in maintaining the national, and international position of the Institute. We believe that the excursions in the past have had much to do with the success of our meetings, and we hope that in connection with any plans to be adopted for the future, you will ask Doctor Raymond to prepare a complete statement on the subject such as has never been made.

Finally, we are confident that you share our belief in Doctor Raymond's disinterested and tireless devotion to the Institute, and our opinion that the Institute has been for

more than 40 years a debtor to Dr. Raymond, for far more than can be expressed in dollars and cents.

HENRY S. DRINKER,	ANTON EILERS,
WILLARD P. WARD,	KARL EILERS,
JAMES DOUGLAS,	B. F. FACKENTHAL, JR.,
JAMES GAYLEY,	WALTER R. INGALLS,
JOHN HAYS HAMMOND,	HENNEN JENNINGS,
ROBERT W. HUNT	BENJAMIN B. LAWRENCE,
CHARLES KIRCHHOFF,	EDMUND C. PECHIN,
EBEN E. OLCOTT,	DENIS M. RIORDAN,
ROBERT H. RICHARDS,	IRVING A. STEARNS,
FRANK LYMAN,	ROBERT M. THOMPSON,
JOHN A. CHURCH,	SAMUEL T. WELLMAN,
ARTHUR S. DWIGHT,	WILLIAM H. WILEY,
GARDNER F. WILLIAMS.	

The signers of this letter include two of the three surviving founders of the Institute and seven former presidents.

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## Goldfield Consolidated Mines Co.

The report to the stockholders of the Goldfield Consolidated Mines Co. of Nevada contains figures covering a period of 14 months ended on Dec. 31, 1912. The change was made in order to have the fiscal year identical with the calendar year which contributes to convenience.

During the period mentioned the property produced 415,786 tons of ore of an average value of \$19.77, or a total of \$8,220,238. The metallurgical losses and the cost of a small amount of ore purchased from a neighboring property leaves the amount realized from the production in that period \$7,652,045, or \$18.40 per ton. The gross expenses of the period which include mining, milling, transportation, construction, taxation and general expense, were \$2,765,646, leaving net realization from operation \$4,886,399.

The costs per ton during the 14 months' period were less by \$1.36 than during the previous fiscal year. The noteworthy items in making up this figure are reduced costs of 28c. per ton in milling, 61c. per ton in marketing concentrates and 8c. per ton in marketing bullion and 10c. per ton in general expense. Two dividends at 50c. each per share and two dividends at 30c. each per share, or a total of \$1.60 per share, were distributed within this period, this distribution amounting in total to \$5,694,636, and although these disbursements exceeded the net realizations during the period, the excess realizations of previous years made them possible. The company closes the period with cash balances of \$728,823, with bullion and miscellaneous products, settlements outstanding of \$214,773. The company has no debts.

Additional milling facilities costing approximately \$79,000 were put into operation in February, 1912. These facilities refer to the concentrate treatment plant, by means of which 50c. per ton of ore milled has been saved through the elimination of the marketing of concentrate.

Depreciation of plant and equipment has been written off to the extent of \$140,790. Arbitrary depreciation of mine property at \$16.36 per ton has also been written off as was formerly done. The company's property holdings have not changed from last year.

Development work has been performed within the period to the extent of 48,146 ft. The mining costs \$3.39 per ton; that for transportation, \$0.09; for milling, \$1.66; for concentrate treatment, \$0.39. This makes a total of \$5.53 on all operations.

Owing to the fact that the orebodies in this mine occur in irregular masses, also that a large portion of the ton-

nage is being mined from the old caved lease workings, it has always been considered impossible accurately to estimate the ore reserves. The present exposures, however, justify an estimate of ore of good grade in reserve amounting to 300,000 tons, with an additional large tonnage of low-grade ore, which has been mined and milled at a profit.

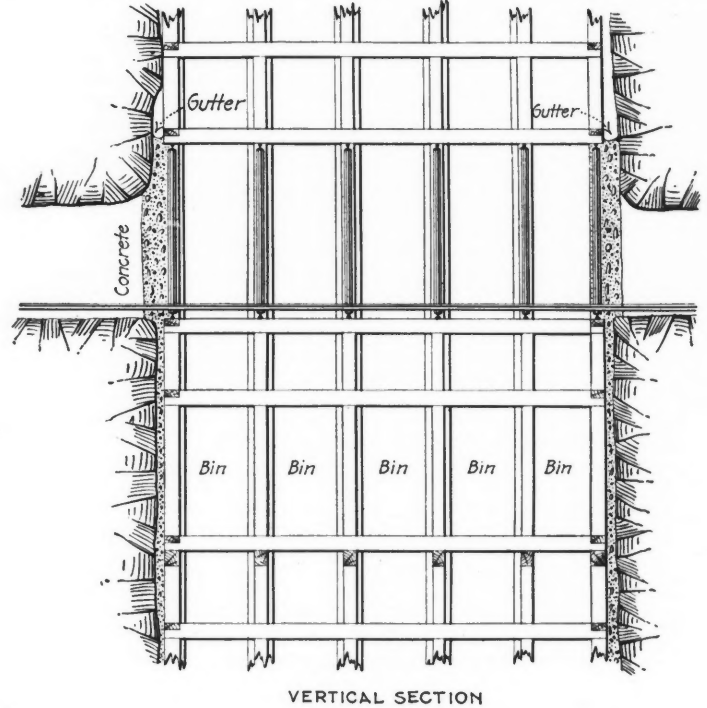
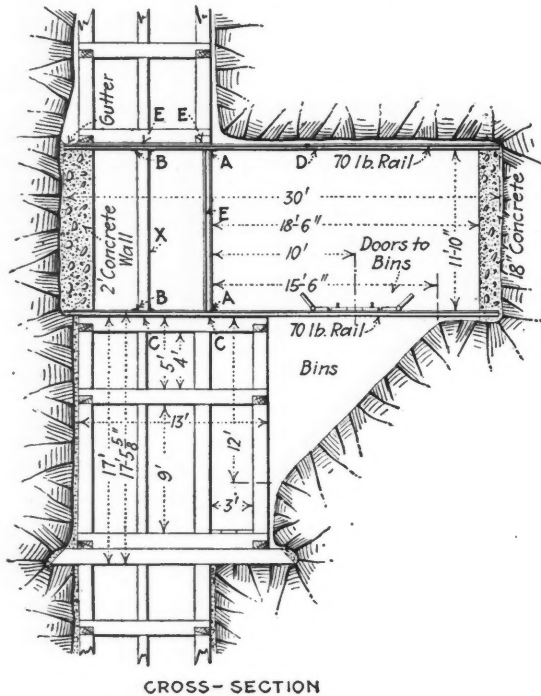
The dividend disbursements of the company up to this time have amounted to \$23,839,067, the first dividend having been paid on Oct. 25, 1907, and the last Oct. 31, 1912. While the average value of the ore treated is less than was formerly the case, there is no reason to

stone was later shown to a Dutch engineer who obtained a large concession and proceeded to the place where the diamond was discovered. The evidence seems to point to the existence of diamonds in Dutch Guiana, although the extent and value of the deposits are quite unknown.

### A Hancock Shaft Station

By CLAUDE T. RICE

The Hancock No. 2 shaft was sunk vertically to a depth of 2600 ft., using buckets to raise the broken



doubt that the mine has a long period of profitable operation ahead of it.

### Diamonds in Dutch Guiana

By DAVID E. HEADLEY\*

The first authentic discovery of diamonds in Dutch Guiana was made by Messrs. Fenley and Smith about 15 or 20 years ago at a concession which they held on the Surinam River. Extensive prospecting, however, was not undertaken, and the matter was allowed to drop. Since that time, discoveries of diamonds have been made, from time to time, by tributors. One discovery was reported by a Portugese miner at the Gond Guyana placers, but a rather extensive examination failed to confirm this discovery. Five years ago, on taking over the management of the Compagnie Francaise du Maroni, of St. Jean, I prospected some conglomerate in the vicinity which showed possible diamond indications and found one small octohedral stone. This was on the Maroni River, and on the same stream there are similar conglomerates which appear to be possibly diamondiferous. A search of the tailing piles at the recent cinnabar discovery, on the Maroni River, revealed a beautiful diamond. Late in 1912 a certain Mitchel Clarke reported to me that, while working with his partner on Paramatta Creek, a stone believed to be a diamond was found. This

\*Albina, Dutch Guiana.

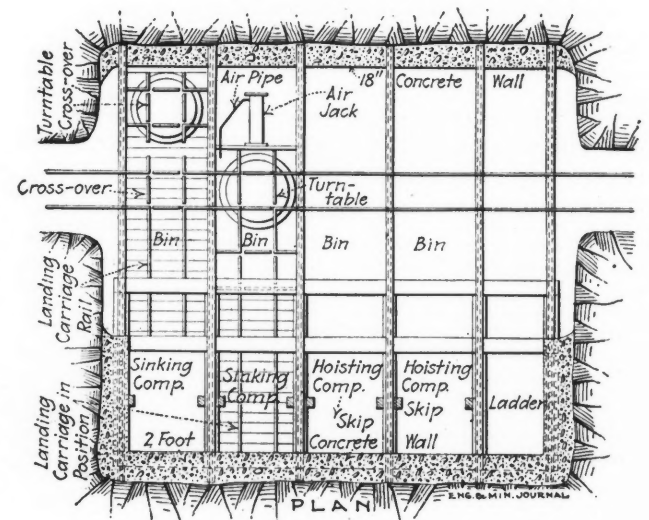


FIG. 1. LAYOUT OF HANCOCK NO. 2 SHAFT STATION

ground to the surface. At about this depth the 34th-level station was cut; bins were built and thereafter sinking was continued, the muck or spoil being raised in buckets to the bins at the 34th level, from which it was afterward loaded into large skips and raised to the surface. The shaft was sunk with five compartments, four for hoisting and one for pipes and ladders.

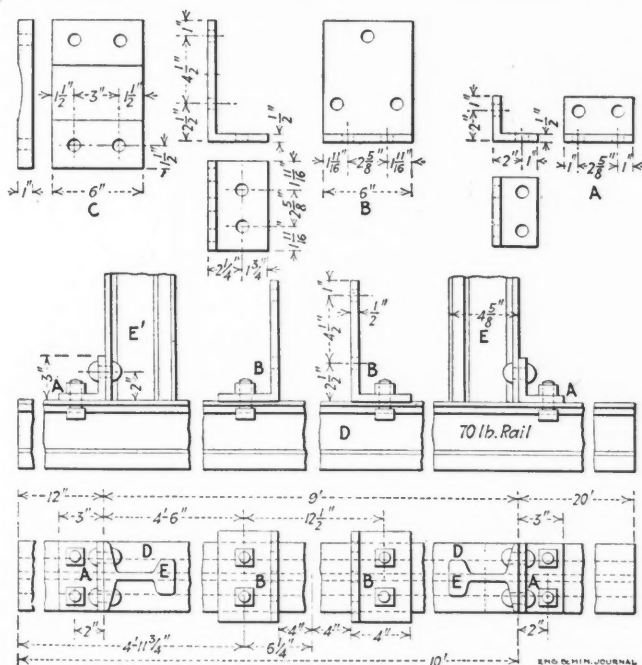


Weathering of the rock was guarded against by concreting the sides of the station soon after it was cut. In supporting the roof of the station, no timber was used that would later have to be replaced, an operation that would be attended by the necessity of taking down much slabby ground that would be found resting upon the lagging.

ROOF SUPPORTED BY RAILS

Concreting of the roof was not considered necessary. Instead, a series of 70-lb. rails, placed with their flanges downward so that they could be bolted easily to the supports, were carried across the station between the compartments of the shaft. The ends of these rested upon the concrete walls, while they were supported at the brow of the station by rails coming up from the floor rails. These sill rails, in turn, rest upon the timbers of the shaft at their middle and in hitches at the ends. These lower rails carry the floor of the station. The details of the station timbering are shown in Fig. 1, in which the different supports are marked by letters.

The details of the methods of fastening these rails to-



for the gate plate to bind in its guides, owing to the fact that the chute bottom is sloping. A short chain carries the plate from the crosshead, while the crosshead connects directly to the piston of the air cylinder. This cylinder is placed so that the top comes just a little above the floor of the station, and is carried by the floor.

The reason for corrugating the front space of the gate plate is to diminish the friction of the ore on the plate as, owing to the corrugations, the pieces of ore have a tendency to bridge across the corrugations and touch only the high places. The gate opens easily, and its weight, together with the weight of the crosshead and the plunger of the air cylinder, closes the gate, as there is no drive of the air in shutting the gate.

In order to allow the men to lift the dogs on the ratchet that controls the descent of the apron without any

## The Assault on the Lucky Tiger Mine

The annual report of the Lucky Tiger-Combination Gold Mining Co. may contain an interesting reference to the attack by Mexican rebels on the Tiger mine.

On Sept. 11, 1912, the authorities at the mine received information that 500 rebels under Inéz Salazar were on their way to attack the camp. On the morning of Sept. 12, a scouting party was ambushed by the rebels six miles from the mine and two of the men were killed, two captured and two made their escape. In defending the camp there were two volunteers for every rifle available and the local armed force was found to consist of only 122 men. These men took positions along two ridges on each side of the camp, this being the best position for defense. The attack by the rebels commenced at daylight on

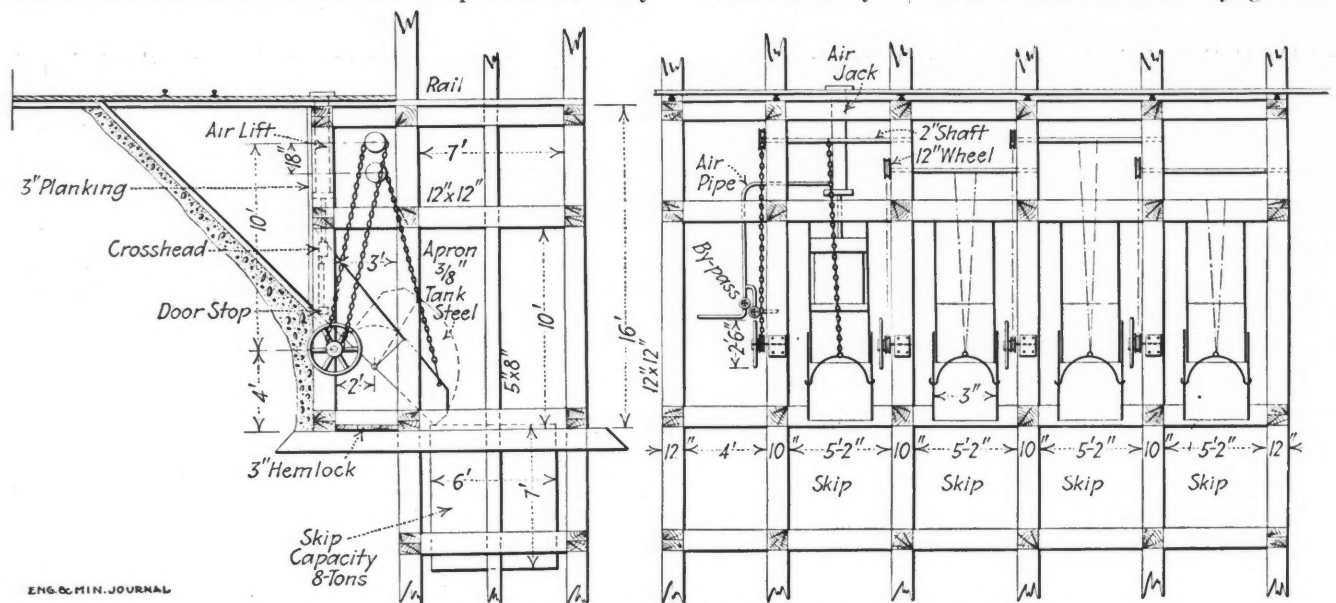


FIG. 3. BINS AND LOADING CHUTES, HANCOCK NO. 2 SHAFT STATION

danger, the dogs are provided with handles. Consequently, the men lift the dog out without getting their fingers near the ratchet.

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## Interstate Commerce Decision

WASHINGTON CORRESPONDENCE

The Interstate Commerce Commission has handed down a decision, which holds that proposed increases in the rates on pig iron from the Michigan Upper Peninsula and from Wisconsin to the Missouri River rate points are unreasonable. Incidentally the Commission promulgates the important opinion that an investment made in an industrial enterprise in reliance upon an existing rate or relation of rates cannot act as a bar to the readjustment of a rate structure found to be unreasonable.

In speaking of the merits of the case, the Commission says that it is claimed that the present \$2.50 rate was put into effect in order to move a surplus of pig iron at the head of the Lakes, and that the proposed rates are intended simply as a restoration of conditions existing prior to Sept. 16, 1904. They also call attention to the fact that an increase is warranted in this case, but not to the full extent proposed by the railroads. The new rates are ordered to be put at \$3.58 to Kansas City and \$3.08 to Omaha, about 50c. less than was proposed.

Sept. 13, but after two hours' fighting a lull occurred and Salazar sent in a letter, saying that he had two cannon, one machine gun and 500 men, and demanding the surrender of the camp. This being refused, the bombardment began, but one of the 3-in. cannon soon burst, owing to the premature explosion of a shell, and the bombardment continued with the remaining gun. On Sept. 13, the rebels charged the two ridges several times and on more than one occasion not more than 150 ft. separated the defenders and the rebels.

Most of the shells fell near the cyanide plant, and the acting Japanese consul was killed by the explosion of one of them while standing in front of his house. The rebels retreated down the valley to their camp at nightfall, Sept. 13, and the defending force followed them most of the way. During the night the bombardment continued and general firing was resumed at daybreak, Sept. 14. By this time, however, the ammunition of the defense began to run low and by 10 a.m. the outposts were brought in to assist in the main defense.

### THE DEFENDERS RETIRED SLOWLY

All the morning the rebels concentrated their attack on the south ridge and Salazar, with 200 men, led an attack at noon. The defenders had little ammunition and the rebels gradually advanced until they reached the No.



4 tunnel, the defenders retreating up the mountain side. All the defending force retreated in good order to a distance of six miles east of the camp, where they awaited reinforcements.

During the final attack just mentioned, Salazar's secretary was killed and Salazar himself was grazed by a bullet. The head shift boss of the mine, Juan Muñoz, one of the oldest employees of the company, and the head blacksmith, Dolores Aldaco, were both killed within a few minutes.

Reinforcements consisting of about 150 men began to arrive on Sept. 14, but immediately retreated. Had even 25 of them remained and maintained their advance, the camp would never have been taken. They fell back upon the second reinforcement, consisting of federal troops, who finally retook the camp.

The entire fight was watched by the manager, L. R. Budrow, and other Americans from his residence until the bullets began to come too thick, about 12 of them hitting the house. All the American men and women and many of the Mexicans were placed in the mine for shelter, together with 30 rifles and 3000 rounds of ammunition. The last of the men going into the mine made the trip through a heavy rebel fire. Seven of the American women and many of the men remained in the mine from the morning of Sept. 13 to the evening of Sept. 16, when the federal relieving forces finally reached the camp. A supply of mattresses, blankets and food had been placed in the workings for the comfort of the besieged. Armed guards were placed at points in the mine which could have been readily defended for several weeks. It would have been impossible to storm the mine and no harm could have been done with dynamite, the situation underground having been selected so that those imprisoned would not have suffered.

#### REBELS PERFORM CUSTOMARY LOOTING

Among a thousand other things, Salazar accused Mr. Budrow, the manager, and Mr. Mishler, the assistant manager, with supplying arms and ammunition to the defense and placed Mr. Budrow under arrest. The guard, however, was taken away toward evening. The company's storeroom looked as though a cyclone had struck it. The rebels took 350 pairs of shoes and when they left camp every man had a complete outfit in addition to all his horse and the pack animals could carry. One building, a saloon and billiard room, was burned, and the store was looted to the extent of \$20,000. The night of Sept. 14, Mr. Budrow was taken from his bed and brought before Salazar, who demanded \$100,000 ransom by the next day. Being informed that the company kept no cash at the mine, he said he would take that amount in bullion. Much of this had, two days earlier, been remelted into 400-lb. ingots and strange to say the mill was run all through the bombardment of Sept. 13, with bullets and the men, including 30 Americans, remained at work and shells flying thick. During the first day of the fight all in the melting room Mr. Minier made every effort to melt all the bullion into 400-lb. ingots. Work was only stopped toward evening when the Kelly filter house became a target and the bullets began to hit within a few feet of the men operating the presses. After dark, Mr. Maycumber, the mill superintendent, called for volunteers to go to the melting house and hide the remainder of the bullion, as a night attack was expected. Several men

responded and the bullion was concealed as well as possible.

On Sept. 14, Mr. Budrow arranged to give Salazar \$2000 in cash and checks on condition that he would not molest the bullion. He did not definitely decide that day and that night three bombs were fired at the rebel camp and at once all became activity at the mine, this being the signal that the federal reinforcements were arriving. Salazar then said that he would retire and take what money and checks were handy, and everybody expected to awake next day and find the federals in camp. Next morning, however, 40 rebels, 15 of them officers, appeared at eight o'clock and demanded the bullion, although the federals could be plainly seen approaching. Twenty-two of the smaller ingots were seized and loaded on donkeys, 40 large bars being left, and the rebel officers then endeavored to secure \$10,000 in checks, but did not have time to wait for them.

As soon as the rebels left, local men were selected to police the camp, which contained about 1200 inhabitants, but these men had not taken their places before some looting began. The federals arrived at 4 p.m., Sept. 16, never having fired a shot. They refused to follow the stolen bullion, and Mr. Budrow offered a reward of \$5000 for its return.

#### THE STOLEN BULLION ALL RECOVERED

Two days later two dead donkeys were found with bars of bullion still tied to them, and at once half the population and a good many of the soldiers went out to hunt for the silver. It was all found, some of it in the partially decayed carcasses of the donkeys. The \$5000 was divided among a dozen people, several soldiers getting over \$500 each. The value of the stolen bullion was \$50,000.

The rebels left their cannon and machine gun at El Tigre, but took away with them \$3000 worth of horses and mules. It is difficult to say how many rebels were killed, but the mine hospital was full and overflowing for many days after. The defenders had seven men killed and 15 wounded. It was gratifying to see how the men gallantly turned out and fought to defend the town, and a monument is now being erected in front of the school house to the memory of those killed. Many Americans were anxious to assist in the defense of the camp, but it was considered best for them to take no hand in the affair unless personally molested. The men had received orders to defend the mine and to protect the women and children there whose position was such that six men could have stood off the entire army for many days, as they were provided with plenty of food and water.

During the first few hours of the siege the telephone lines were not cut, but it was evident that the rebels were hearing everything over a line phone. A Chinaman was then stationed at the mine telephone and messages sent to the railroad, 30 miles away, in Chinese. Three minutes after this change was made the line was cut. The Chinese code was evidently unappreciated.



**The Hardinge Mill Installed at the Plant of the Winona Copper Co., Winona, Mich., varies from the standard 8-ft. mill in that the width of the cylindrical portion is 36 in. The usual dimensions for the large Hardinge pebble mills are 8 ft. by 22 or 30 in., the first figure referring to the diameter of the cylinder and the others to the width or length of the cylinder. The total length of the mill, including cylinder and cone, is not given and the above explanation seems advisable, since some engineers accustomed to thinking of cylindrical tube mills in terms of length and diameter may interpret the stated dimensions of the Hardinge mill incorrectly.**

# Rapid Silver Estimation in Mill Solutions

BY G. H. CLEVENGER\*

*SYNOPSIS*—A rapid volumetric method for estimating the amount of silver in the usual solution encountered in cyanide mills. It is based on the method of Volhard and is simple enough to be performed in half an hour. The method will be of great value in zinc-dust precipitation in that the proper quantity of zinc dust may be used to conform with the requirements of amount of silver contained in the solution to be precipitated.



The quantitative determination of silver in cyanide mill solutions, by a method which is more rapid than the ordinary fire assay is of importance in connection with the disposition of the various solutions about a mill treating silver or silver-gold ores. Fire-assay results are usually not available until the urgent need for them has passed. Hence a rapid volumetric method, which can be carried out by the millman at any time is desirable. It is of particular importance in connection with zinc-dust precipitation, where it is necessary to know the silver content of the solution before it is precipitated, if the most efficient results as regards "barrens" and zinc dust consumed are to be realized. The method herein described has been developed by me to meet this need, and investigation has shown it capable of giving accurate results upon the solutions ordinarily met with in mill practice.

## METHOD BASED ON VOLHARD'S VOLUMETRIC SILVER DETERMINATION

The method is based upon the fact that when a cyanide solution containing silver is filtered through a thin layer of zinc dust, the silver in the solution is completely precipitated, and further that the silver thus precipitated can be dissolved in nitric acid and determined quantitatively by the well known Volhard volumetric method. The excess of zinc from the precipitant and other impurities which are likely to be precipitated from the solution do not interfere with the determination.

The estimation is most conveniently carried out by means of the apparatus shown in the accompanying drawing. A 32-oz. filtering flask is connected by means of heavy vacuum rubber tubing to an ordinary laboratory filter pump or some similar apparatus. The small end of a glass filtering tube is introduced into a one-hole rubber stopper which is of such a size as to snugly fit the neck of the filtering flask. About half way over the large end of the filtering tube draw a small section of pure gum tubing of slightly smaller diameter and turn down inside the tube the portion which projects. Into the packing ring thus formed set a 30-c.c. porcelain gooch crucible having a removable perforated porcelain bottom. The solution to be assayed may be delivered into the gooch crucible by pouring from a beaker or other container, but most conveniently by means of a 500-c.c. dispensing burette which has been calibrated to hold 20 assay tons of solution. This is mounted so as to deliver into the gooch crucible. Provide a small measuring spoon which will just hold 5 grams of the precipitant.

For carrying out the determination, zinc dust of good quality is required and c.p. nitric acid. A solution of potassium sulphocyanate is made by roughly weighing 10 grams of the crystalline salt and dissolving it in 1000 c.c. of distilled water. This solution is to be standardized according to the method described later. There is also required a solution of ferric alum, made by saturating cold distilled water with the salt and adding nitric acid, a few drops at a time until the brown coloration disappears. Prepare some round filter papers slightly larger in diameter than the bottom of the gooch crucible and also a supply of silver foil.

## SOLUTION FILTERED THROUGH ZINC DUST

To make the determination, fill the dispensing burette with the solution to be assayed, so that the bottom of the meniscus is at the 20-a.t. mark. Turn on the suction and place two or three of the small filter papers upon the perforated bottom of the gooch crucible. Moisten and carefully fit and press down around the edges so that a tight joint is made with the sides of the crucible. Measure out 5 grams of the precipitant into a small beaker, add about 50 c.c. of distilled water, stir until thoroughly pulped and then pour into the gooch crucible, rinsing out the last of it by means of a jet of water from a wash bottle. This will form a layer of precipitant in the bottom of the crucible about  $\frac{1}{8}$  in. thick. Just as the last of the water is disappearing from the surface of the cake of precipitant, open the stop cock of the dispensing burette and allow the solution to enter the gooch as rapidly as it filters. Always keep the surface of the precipitant completely covered with solution. This is an extremely important detail.

## PRECIPITATE AND ZINC DISSOLVED IN NITRIC ACID

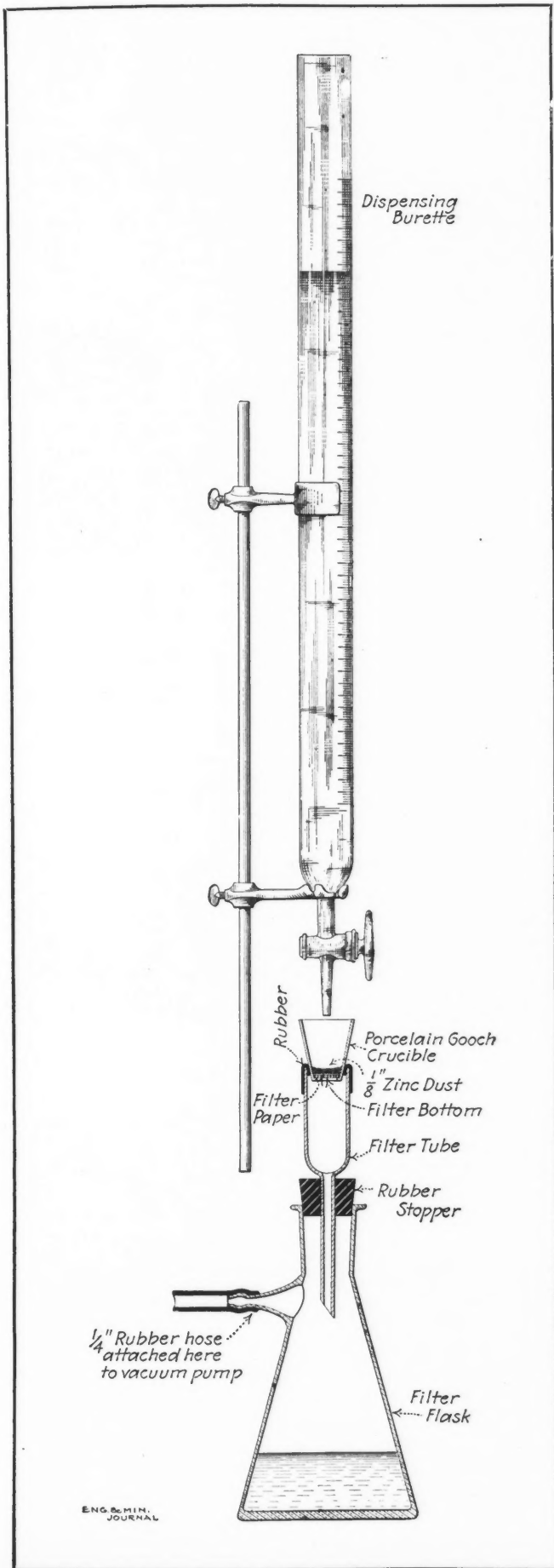
After the whole of the solution has passed the filter, wash 3 or 4 times with distilled water. Lift the gooch crucible out of the packing ring and place over a No. 3 beaker. Lift up the porcelain disk, together with the precipitate, from beneath with one finger, and slip off the filter papers and the precipitate into the beaker, rinsing off the disk with distilled water. Usually a small amount of precipitate sticks to the sides of the gooch crucible. Pour through it into the beaker, which should contain 10 to 15 c.c. of distilled water and which contains the major portion of the precipitate, 15 c.c. of strong nitric acid, a little at a time, until the violent action has ceased. Keep the beaker covered as much as possible by a watch glass, wash down the sides of the gooch by means of a jet of distilled water from a wash bottle, allowing the washings to drain into the beaker.

Do not attempt to dissolve the precipitate by pouring the nitric acid into the gooch and turning on the suction, as an explosion is almost sure to take place.

Place on a hot plate and heat until all action has ceased and all the nitrous fumes have been expelled. Black specks in the solution may be due to the presence of carbon or gold. Adjust the volume of the solution to about 100 c.c. by the addition of distilled water. Add 5 c.c. of the ferric-alum solution and run in the sulphocyanate solution from a burette, with constant stirring,

\*Associate Professor of Metallurgy, Stanford University, 10 Alto, Calif.





APPARATUS FOR RAPID SILVER DETERMINATION

until there is a faint red coloration throughout the whole solution which is permanent for a few minutes. Read the number of c.c. of solution used, multiply this result by the number of milligrams of silver to which each cubic centimeter is equivalent and divide the number of assay tons of solution taken. This gives mg. of silver in 1 a.t. of solution, or, as in the ordinary fire assay, oz. of silver per ton of solution.

To standardize the sulphocyanate solution, weigh accurately upon a button balance two portions of 200 to 300 mg. each of c.p. silver foil; add five grams of zinc dust, and dissolve in 15 c.c. of nitric acid. Add distilled water to make 100 c.c., heat and titrate as directed in making the regular determination. To obtain the number of mg. of silver to which each c.c. of the solution is equivalent, divide the weight of silver foil taken by the number of c.c. of sulphocyanate solution required. The sulphocyanate solution may also be standardized by making an assay of a sample of solution in which the silver has been accurately determined by the fire method.

COMPARISON OF FIRE AND VOLUMETRIC METHODS

Solution No.	Ounces Silver per Ton		
	Fire assay by "A"	Volumetric by "B"	Volumetric by "C"
1.....	6.20	6.10	6.15
2.....	4.12	4.17	4.14
3.....	1.39	1.43	1.41

The time in which the determination can be made is to a large extent governed by the time required to filter the solution through the precipitant. Under normal conditions the time required to make a determination by the ordinary operator is about one-half hour.

INTERFERENCES

Mercury interferes with the method, on account of its sulphocyanate being insoluble. Metals whose salts are colored, such as nickel, cobalt, etc., must not be present. Copper may be present up to an amount equal in weight to that of the silver. Copper in small amount is a frequent constituent of mill solutions, but it is not probable that it would be precipitated sufficiently by the zinc dust to interfere with the determination.

In order to test the accuracy of the method, fire assays for silver were made upon the solutions noted in the accompanying table by operator A, while operators B and C determined the silver in the same solutions by the volumetric method, not knowing the results obtained by each other or by A.

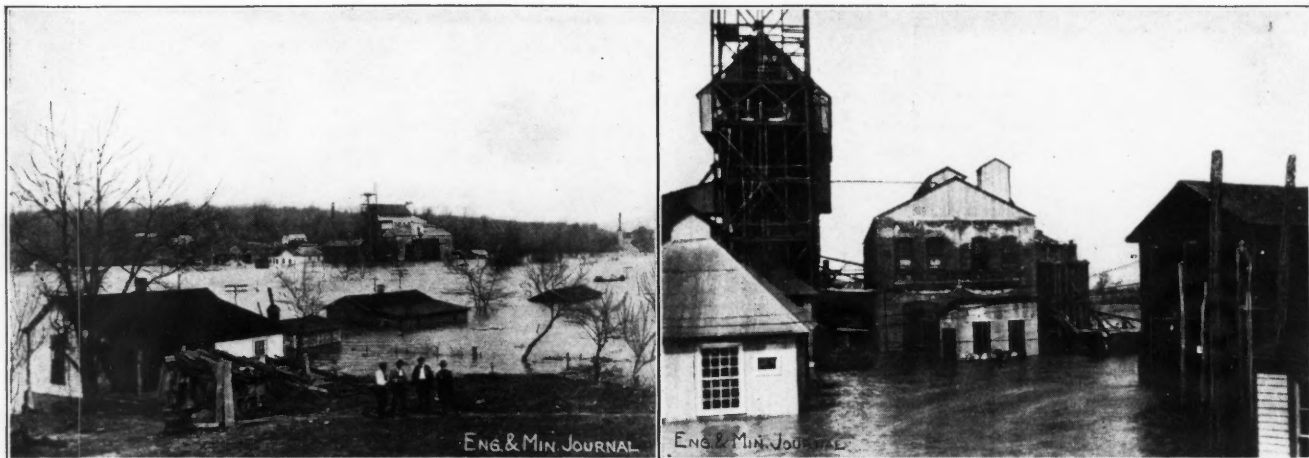


Mining in Indo-China

According to the *Mining Journal*, Mar. 15, 1913, Indo-China possesses considerable mineral resources. Zinc mining is increasing in importance, the ore production in 1911 having totaled 28,241 tons, against 22,721 tons in 1910. The tin and tungsten ore output, on the other hand, has receded from 212 tons, in 1910, to 199 tons. The Bong-min (Anam) gold mine is now producing. Numerous zinc deposits in the districts of Yenn-lang, Chodon, Cho-dien and Yenn-dinh are now objects of energetic prospecting operations, and the Nganson silver-lead-zinc mine continues producing on a fairly large scale. As regards the result of the prospecting and exploration operations in progress in the copper districts of Son-la, Ven-bag, Lang-son and Son-tay, nothing definite can as yet be said.

ENG. & MIN. JOURNAL

PHOTOGRAPHS FROM THE FIELD



ROSICLARE FLUORSPAR MINES, ROSICLARE, ILL.

(The back water of the Ohio River rose to 18 in. above the collar of the shaft and completely flooded the mines.)



ROSICLARE WATER FRONT

(View looking down the river. Showing almost complete inundation of this part of village.)



COMPANY HOTEL

(This is on Main St., running at right angles to river. In background high part of village.)



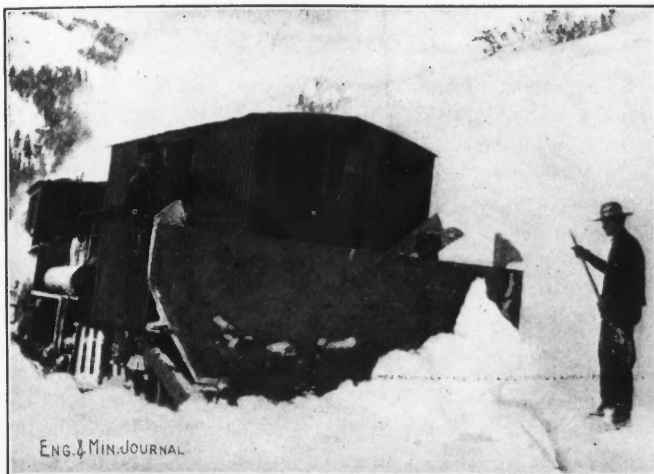
VIEWS FROM HOTEL VERANDA

(Looking down Main St. toward river.)

(Looking toward mines. Mine superintendent's house on knoll.)

SCENES AT ROSICLARE, ILL., DURING RECENT FLOOD





HOME-MADE SNOW PLOW COUPLED TO TWO 31-TON SHAY LOCOMOTIVES, USED BY THE EMPIRE COPPER CO.,



EMPIRE COPPER CO., MACKAY, IDAHO

(Large ore bin where the Shay road cars are loaded. The tramway down which ore is brought is shown in background.)

(Engine bringing up a trainload of mine timbers complete and ready to go in. A heavy load for the little engine.)



TRANSPORTATION UNDER DIFFICULTIES

(Mail contractor getting through with mail in Greenhorn, Ore., mining district during severe snowstorm in January. This method was not featured by Mr. Hitchcock on the parcel post stamps.)

SAWMILL NEAR WISEMAN, ALASKA

(Method devised by miners for getting out boards using an ordinary crosscut saw. The man at lower end of saw should essentially be of cheerful disposition, not easily annoyed by flying sawdust.)

## Nevada Consolidated Copper Co.

The report of the Nevada Consolidated Copper Co. for the year ended Dec. 31, 1912, shows that additions to the mining area of the property during the past year have been the Watson No. 1, containing 2.9 acres and also certain areas on which dumping privileges have been obtained in order that the overburden stripped from the company's properties may be deposited there. Small additions to the ore reserves have been made during the year, the estimate of total ore in reserve as of Dec. 31, 1912, being 38,853,551 tons with an average copper content of 1.67 per cent.

Mining both by steam shovel and underground has been carried out, the first in three pits, namely, the Eureka, Hecla and Liberty, and the second in the Veteran mine. The Eureka continued to furnish the largest tonnage. During the fiscal year the following dry tons of sulphide were mined and shipped to the concentrator: From the Eureka pit, 2,054,758 tons; Liberty pit, 170,748 tons; and from the Hecla pit, 371,485 tons, the average copper content of all this extraction being 1.603%. From the Veteran mine, 253,365 tons, with an average copper content of 2.605%, were extracted, making a total of 2,850,356, with an average copper content of 1.690%, sent to the concentrator.

The direct costs for mining at the pits, including charges of every description, such as labor, supplies, repairs, management, taxes, proportion of general and New York expenses, etc., have been 17.35c. per dry ton. Strip-ping costs have been reduced to 33.64c. per cu.yd. Cost for mining carbonate ore was 68.80c. per dry ton, as compared with 74.4c. for the preceding year.

The Steptoe Valley Smelting & Mining Co.'s plant worked successfully during the year and showed improvements in all departments, except for the unfortunate occurrence of the strike. In addition to the treatment of the Nevada Consolidated ore, 133,933 dry tons from the Giroux Consolidated Mines Co. were concentrated and the concentrate smelted.

Although treating a lower grade of material the concentrator obtained better extractions, owing to improvements which had been foreshadowed in the last report. There were treated 2,852,515 dry tons of ore, with an average copper content of 1.692%. The extraction of copper was 68.25% and the ratio of concentration 9.09. The assay in gold of this ore was 0.016 oz., and of silver 0.049 oz. Gold extraction was 45.84% and of silver 50.11%. The average gold and silver recovered per ton of ore in cents was 16.48, and the average copper in the concentrate was 10.49%.

All the reverberatory furnaces are now oil fired and their capacity has been greatly increased. Additions have also been made in the converting department and there are now two Peirce-Smith basic converters in which considerable improvements have been made in the way of operations. The production of copper amounted to 63,063,261 lb. of copper for the year, and its total cost was 8.86c. per pound.

Gross revenue includes 63,063,261 lb. copper, sold at 15.979c., \$10,076,872, and for gold and silver produced, \$521,278, a total of \$10,598,150. Operating and other expenses, \$7,316,231, leaving a profit of \$3,281,919, to which is to be added \$1,541,920, producing a net profit of \$4,823,839 for the year.

## Premier Mine

The report of the Premier diamond mine for the year ended Oct. 31, 1912, shows that 10,404,378 loads of 16 cu.ft. of blue ground and waste were mined and hauled, and 9,707,098 loads crushed and washed. The average per day was 33,347 and on some days over 40,000 loads were hauled. This is believed to be the largest scale on which mining operations are carried on anywhere in the world, even the Bingham copper mines, with the aid of steam shovels, do not produce this tonnage. The yield per load dropped to 0.205 carat, but an improvement is expected. The average value per carat, owing to an improved market was 20s. 11½d. and the value per load 4s. 1d. The cost per load washed was 2s. 4.8d. The working profit reached £840,656, and there were diamonds valued at £402,806 in hand. Dividends were £480,000. The mine is worked to an average depth of 178 ft. To a depth of 310 ft., the lowest level opened, 24,000,000 loads remain for treatment.

Costs rose owing to removing 697,280 tons of "floating reef," that is, masses of country rock from walls of pipe lying inclosed in the diamond breccia. The cost of recruiting rose to 82s. per head for 18,255 natives engaged.

In 10 years 54,872,296 loads have been washed for a yield of 14,347,721 carats, of a value of £12,633,177. Profits have been £5,972,611 and of this, the Union Government has taken £2,079,336 and the shareholders £1,760,000, the remainder having been spent on equipment. Hammer drills are being introduced for blockholing large boulders and for drilling on the benches, though jumper drilling by natives is done cheaply. Barnato Bros. have acquired large interests in this mine and they have large interests also in De Beers and Jagersfontein, so that in future more harmony will prevail.



## Bolivian Tin Production in 1912

According to Dr. Casto Rojas, superintendent of Bolivian customs, the exports from Bolivia of tin concentrate (*barrilla*) amount to 38,390,902 kg. during 1912. While the official estimates of the tin contained are based on a tin content of 60%, the *Mining Journal*, Mar. 15, 1913, states that 57% is probably nearer the truth. There is now an export duty on tin as follows:

BOLIVIAN EXPORT DUTY ON TIN		
Straits Tin Price £ per ton	Barrilla Duty Bolivianos <sup>1</sup> per 100 kg.	Tin Bar Duty Bolivianos per 100 kg.
Up to 100.....	2.00	3.25
100 to 110.....	2.20	3.50
110 to 120.....	2.85	4.37
120 to 130.....	3.50	5.24
130 to 140.....	4.15	6.11
140 to 150.....	4.80	6.98
150 to 160.....	5.45	7.87
160 to 170.....	6.10	8.74
170 to 180.....	6.75	9.61
180 to 190.....	7.40	10.48
190 to 200.....	8.05	11.35
200 to 210.....	8.70	12.22
210 to 220.....	9.35	13.09
220 to 230.....	10.00	13.96
230 to 240.....	10.65	14.85
240 to 250.....	11.30	15.70
250 to 260.....	11.95	16.57
260 to 270.....	12.60	17.44
270 to 280.....	13.25	18.31
280 to 290.....	13.90	19.18
290 to 300.....	14.55	20.05
300 and up.....	15.20	20.92

<sup>1</sup> One Boliviano = 38.9c. = 18½ d.

These export duties replace the 3% tax on profits. A new tariff also increases the export duty on copper and imposes one on wolfram ore.



# DETAILS OF PRACTICAL MINING

## Setting Timbers in Vertical Shafts

By C. W. MACDOUGALL\*

The following method of setting timber in a vertical shaft was used during practically the entire sinking period of one of the largest shafts in the Michigan copper country, and was found thoroughly reliable. It possesses certain advantages over the usual method.

The shaft in question is about 4000 ft. deep with a rock section of about 10x31 ft., or 9x30 ft. outside the timbers, and has four hoisting compartments besides a ladderway. The long axis of the shaft lies about north and south. All plates are 12x12 in. and the dividers 10x12 in.; the hoisting compartments are 5 ft. 2 in. by 7 ft. over-all and 4 ft. 4 in. between the guides. The guides are 5x8 in., with a groove 2 in. wide and 1½ in. deep down the center. The framing of all the timber was done from templates.

A vertical saw-mark was made on the inside of the wall and end plates, that on the wall plate being in the center of the timber, and that on the end plate being 4 ft. from the foot-wall end, so that the lines will clear the guides.

The sets were hung and temporarily blocked approximately in place in succession, and when all that were re-

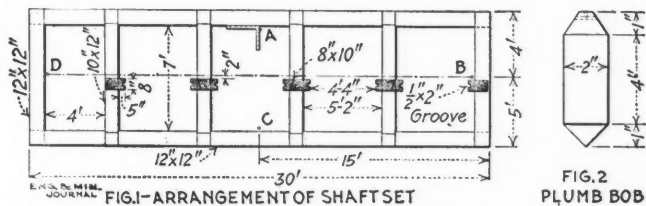


FIG. 2  
PLUMB BOB

DEVICES FOR LINING UP SHAFT SET

quired had been assembled, plumb lines were dropped as shown in Fig. 1 at points A, B, C, D, from reference points in the sets previously placed above. Each set was then shifted by means of wedges at the four corners until the saw marks on the timbers were in line with the plumb lines, this being determined by means of an ordinary carpenter's square, held as shown at A, Fig. 1. After the four corners were blocked into place, a line was stretched the full length of the shaft from B to D, just above the tops of the dividers. The set was then blocked at points opposite the ends of the dividers until the east side of the guide staddle on each divider was 2 in. from the line. The object of having the lines stretched from B to D and taking measurements on each divider was to keep the wall plates from bending in the middle, as would be the case if the wedges were not driven evenly on both sides of the shaft.

By using this method the distance the plumb lines are hung from the inside face of the timbers is immaterial, the practice in this case being to hang the lines from 60-d. nails about 3 in. from the timber and to use 4-lb. plumb

\*Chief engineer, Hancock Consolidated Mining Co., Hancock, Mich.

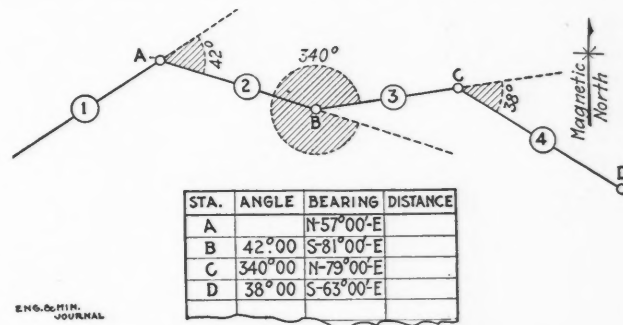
bobs, of the design shown in Fig. 2, for weights, the plumb lines being of No. 30 trot line, corresponding to a heavy mason's line. The reference points by which the plumb lines are set are copper tacks with their heads flattened until parallel with the long axis of the shank, these points being marked by aluminum tags nailed to the timbers just over them.

This method of lining up the timbers proved to be far quicker than the method of hanging the lines in the four corners of the shaft, and using wooden blocks for gages; for the wooden blocks would invariably touch a line, set it swinging and make it necessary to steady it again, costing considerable time; whereas, in the method shown, the lines are seldom disturbed and there is far less danger of error.

❖

## Computation of Bearings

In the best practice of underground surveying, it is customary to double all horizontal angles read. For this



SIMPLE TRAVERSE AND NOTES

reason it is impossible to run an "azimuth traverse" so that the angles will automatically add on the circle and read the azimuth direct for each course as sighted. This makes it necessary to work out in the office the azimuths or bearings. The shifting of the bearings for various courses from one quadrant to another, combined with the fact that angular notation is not decimal, renders this process of working out bearings a fruitful source of error. A check which does not repeat the original calculation is necessary. Such a one, suggested by H. G. Henderson, principal of the Truro School of Mines, Cornwall, while in rather general use, may not be known to everyone. It consists, if the angles have been read clockwise, and they should be so read, of merely adding the total readings (the single angles of course, not the double) to the azimuth of the first course and then subtracting as many sets of 360° as possible from the total. The remainder will be the azimuth of the last course, which can readily be reduced to a bearing.

The illustration shows a simple traverse and form of notes with the bearings of the courses calculated. To check: add the first column, getting 420°; subtract 360°, leaving 60°. This, added to the azimuth of the first

course, 57°, which is also a bearing, gives 117° as the azimuth of the last course, which reduces to S. 63° E. as a bearing.



### Preservation Tests on Poles

What may be termed long-time, commercial tests were made by the American Telephone & Telegraph Co., in conjunction with the U. S. Forest Service and the Bureau of Entomology, on the availability of preservative methods as applied to the members of pole lines. The most instructive results were obtained from a series of poles set in the Warren-Buffalo line in 1905, which have recently been examined, the results being reported in Forest Service Circular 198. Some of the poles were brush treated, some were impregnated by the open-tank method, and some were set without treatment, both green and seasoned. In the open-tank treatment the lower eight feet of the pole was treated. In the butt treatment the lower two feet was left untreated and the next six feet treated. As set in the ground, the treated portion extended 2 feet above the level of the ground. In the brush treatment various preservatives were used, applied sometimes in one coat and sometimes in two. Most of these were heated to a temperature of 150° to 175° F. Particular attention was paid to filling checks and knot holes and to working the preservative into the wood.

#### CONDITION OF POLES AFTER FIVE YEARS' SERVICE

Condition When Set	Preservative and Method of Application	No. of Poles	Condition of Poles at or Near Ground Line		
			Affected with Decay	Per Cent.	Average Loss of Circumference at ground line in Inches
Green.....	Untreated	194	194	100.0	1.16
Seasoned...	Untreated	357	355	99.4	1.01
Seasoned...	Coal tar, brush—1 coat	48	47	98.0	0.95
Seasoned...	Creolin, brush—1 coat	16	16	100.0	0.89
Seasoned...	Creolin, brush—2 coats	63	44	69.8	0.42
Seasoned...	Wood creosote, brush—1 coat	21	20	95.2	0.43
Seasoned...	Wood creosote, brush—2 coats	49	12	24.0	0.06
Seasoned...	S.P.F. carbolineum, brush—1 coat	10	3	30.0	0.10
Seasoned...	S.P.F. carbolineum, brush—2 coats	67	9	13.4	0.04
Seasoned...	Avenarius carbolineum, brush—1 coat	8	2	25.0	0.27
Seasoned...	Avenarius carbolineum, brush—2 coats	66	9	13.6	0.04
Seasoned...	Coal-tar creosote, brush—2 coats	83	12	14.5	0.02
Green.....	Coal-tar creosote, open tank	29	0	0.0	0.0
Seasoned...	Coal-tar creosote, open tank	153	1	0.65	Negligible

Six hundred and thirteen treated poles were placed and 551 untreated poles, both seasoned and green. A variety of soil conditions existed at the points where these poles were set, and it was attempted to maintain a certain rotation in the different types of poles, so that there might be no discrimination; but this was not entirely possible. A tabular presentation of the results obtained after five years' service is given herewith. In the examination the soil was excavated around the base of the pole and the condition of the wood noted. The circumference of the pole was measured and the decayed portion, when present, removed, then the circumference of the remaining portion measured again. An examination of the results leads to the following conclusions:

(1) The poles treated by the open-tank process were practically exempt from decay; (2) all poles treated with two coats of preservative, with the exception of creolin, were in excellent condition, although some decay was found; (3) poles treated with one coat of carbolineum, of either kind, showed only fair results; (4) one coat of wood creosote was about equivalent to two coats of

creolin; (5) one coat of creolin, or of coal tar, was practically useless; (6) the untreated poles were all decayed and little difference was noted in the seasoned and the green poles.



### Automatic Bucket Tipple

BY D. A. CAVAGNARO\*

The Channel Mining Co., of San Andreas, Calif., has installed an ingenious device which permits the hoisting engineer to dump a hoisted bucket without leaving his engine.

Referring to the illustrations, Fig. 1 shows a side view of the tippie with the bucket in place. Fig. 2 shows the

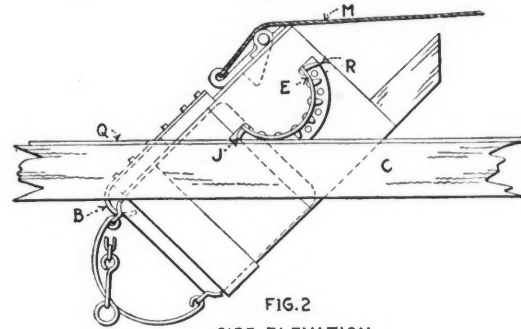


FIG. 2  
SIDE ELEVATION

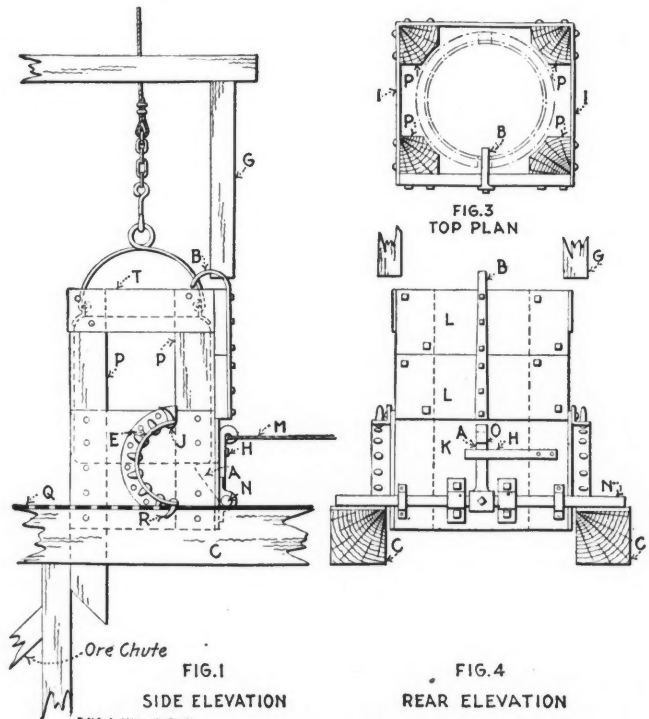


FIG. 1  
SIDE ELEVATION

FIG. 3  
TOP PLAN

FIG. 4  
REAR ELEVATION

ENGINEERING JOURNAL  
AUTOMATIC DEVICE FOR DUMPING BUCKET

dumping position. Fig. 3 is a top view which does not show, however, the catches or the rotating control. Fig. 4 is a back view of the tippie without the bucket.

The tippie itself is built around four upright pieces (Fig. 3, P), which are beveled to permit the entrance of the bucket. On the sides 1/4x6-in. iron straps I are bolted to the uprights. The top of the back is closed by two 2x12-in. planks L. The iron hook B is bolted to

\*San Andreas, Calif.



these and also any weights which may be necessary to hold the tippie upright. The bottom is closed by a  $\frac{3}{8}$  x 24x30-in. iron sheet *K*, through which the latch *A* works. The latch is held inside the tippie by the spring *H* and from its upper end *O* a rope *M* leads to the hoist. The latch *A* works on the  $1\frac{1}{4}$ -in. round iron *N*, which extends to the sides far enough to rest on the timbers *C*, and thus supports the tippie. To the sides of the tippie are bolted iron plates, which carry two half-circles *E* with a radius of 18 in., made of  $2\frac{1}{2}$ x $2\frac{1}{2}$ -in. angle iron, and in these are set a number of teeth. These teeth are spaced three inches apart and are one inch from the outer edge. The inner teeth are about one inch long, but the outer two teeth, *J* and *R*, are curved, about three inches long, and riveted in square holes to prevent turning. These teeth mesh into holes in the horizontal plates *Q*, fastened to the timbers *C*. The tippie at rest pivots on the teeth *R*, and the half circle is so set that the pivot point is about six inches behind the center, which arrangement causes the forward dumping movement. In operation the bucket is hoisted into the tippie by the engineer and forces back the latch *A*, which then springs in again and catches the bottom of the bucket. When the rope is slacked, the device tips forward by its own weight, the operation being controlled by the teeth of the half-circle *E*, meshing into the holes in *Q*, and the contents of the bucket discharge into the ore chute. The bucket is prevented from sliding out while tipped, by the hook *B*. When empty, the engineer pulls the tippie back to an upright position by means of the hoisting rope and by pulling the rope *M*, releases the latch *A* and permits the bucket to descend. As the tippie is not fastened to the timbers *C*, it could be pulled through by the bucket but for the timbers *G*, which catch the back edge.

In using this system, the underground tramming was done with trucks which held two buckets. The trammer pushed his truck under the descending empty bucket, received it on the truck, changed the rope to the full bucket and signaled to hoist.

### Double Motor Equipment for a Centrifugal Pump

After unwatering by hoisting methods two colliery shafts which were nearing completion, but had been flooded, it was decided to install an electrical pumping outfit in one to handle the water from both. This was estimated at 900 gal. per min. from each, says R. Herzfeld (paper before the Midland Inst. of Min., Civ. and Mech. Engr., abst. *Colliery Guardian*, Jan. 31, 1913).

Gallons per minute.....	375	760	920
Manometric head in feet.....	1353	1320	1323
Revolutions per minute.....	1412	1460	1519
Electric horsepower required.....	274	430	530
Pump efficiency percentage.....	570	72.1	70.8

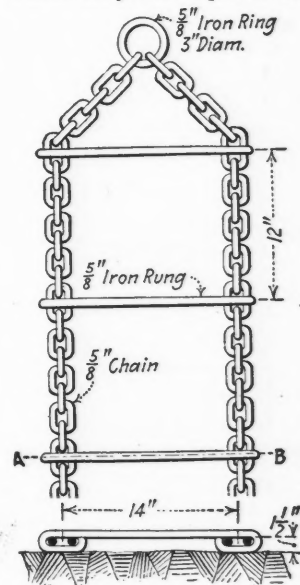
There was in existence a generating plant containing two 250-kw. sets, producing a three-phase, 50-cycle, 2500-volt current. This was sufficient to handle the 900 gal. from one shaft. It was planned to increase the capacity of the plant later. The pumps were of the centrifugal type, designed to lift 920 gal. per min. from a depth of 1275 ft. Two of these were installed and two cables, so that up to the shaft collar the plant was in duplicate, so long as the water from one shaft only was handled. Tests made on the pumps gave results shown in the table. It will be seen that by altering the periodicity

of the generators by just over 7%, a wide range of outputs with fair efficiency was obtained. But the minimum of 375 gal. was about all one of these generating sets could handle. Thus, if the principle of duplicate units was to be applied, the capacity of one surface unit was the maximum allowance for a pumping unit, which meant the use of two 300-hp. motors on each pump rather than one 600-hp. motor. In the case of one generating set being disabled, it would be necessary to use the remaining set at the highest possible efficiency to handle the minimum output of 375 gal. With one 300-hp. motor running, the motor efficiency at half-load on the pumps remained at 93%, whereas, if it had been necessary to run the 600-hp. unit from the one generating set, the efficiency would have been reduced to 89%. The difference in power factors was still greater, being 95% and 84% respectively. The combination of the two points made a difference of 11.7% in the current of the one generator, a point of highest importance. Incidentally the further duplication of units underground got by four motors instead of two, was advantageous. Two 300-hp. motors were therefore installed with each pump.



### Chain Ladder for Sinking and Raising

The use of iron ladders, especially chain ladders, is necessary in cases where they are exposed to much blasting.



SECTION A-B  
CHAIN LADDER OF  $\frac{5}{8}$ -IN. IRON

They are thus adapted to raising and sinking operations. In sinking particularly, considerations of safety should lead to the providing of a ladderway to the very bottom of the shaft, to afford a means of exit in case of failure of the hoisting apparatus. This is a precaution often inexcusably neglected. A chain ladder is well suited for use in the shaft bottom, for extending the wooden ladderway. It need be moved only occasionally, the superfluous length being allowed to coil on the shaft bottom, except during firing, when it can be drawn through itself some way up. It can be easily handled in 30-ft. sections.

A method of constructing such a ladder is shown in the illustration. The chains and rungs are both made of  $\frac{1}{2}$ - or  $\frac{5}{8}$ -in. material, and the rungs are spaced about

12 in. vertically and the chains are about 14 in. center to center. The ends of the rung pieces are heated and bent to the proper shape to fit over the links, then reheated and pounded down on the links and hooked around at the ends in their proper position, thus obtaining a snug fit. It is advisable to so hang the ladder that the doubled ends lie against the rock side, which provides a space for the hands, in climbing. The chains at the top can be caught into a 3-in. ring for suspending the ladder.



### How the Detonator Should Point

It is commonly asserted that the maximum effect of a detonator is exerted at its business end and therefore that this should point toward the bottom of the hole where it is desirable to produce the heaviest blasting effect. This point has been proven on a large scale in practical quarry work, says *Coal Age*, Mar. 22, 1913, by priming half the holes in a uniform ledge of 28 holes, as shown in Fig. 1—the detonator pointing toward the mouth of the hole. The other holes were loaded as shown in Fig. 2, with the detonator pointing toward the bulk of the charge. The ledge in which the detonator pointed outward was thrown off to within two feet of the bottom of the hole. There the rock was broken in places but was not thrown out. In the other half of the ledge, where the detonator pointed toward the bulk of the charge, the rock

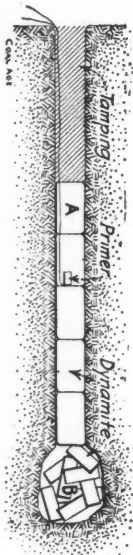


FIG. 1. DETONATOR POINTING WRONG WAY

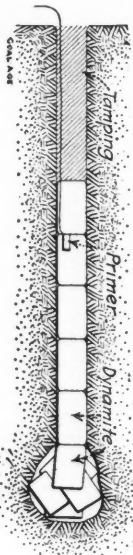


FIG. 2. DETONATOR POINTING PROPERLY

was thrown off clear and clean and nearly two feet below the bottom line of the hole, taking off about 30% more material than the same charge did with the detonator pointed the wrong way.



### Precautions in Painting Steel and Iron

A metallic surface to be painted should be dry and clean, free from rust, loose scale and grease. To be brought to this condition, according to the *Engineer*, Mar. 7, 1913, it should be treated with steel-wire brushes, steel scrapers, blocks of carborundum and chipping hammers, according to the degree of rust accumulated. Structures in service should be examined annually, all rusted parts carefully cleaned, and the paint-work patched with

two coats of red lead directly on the metal, covered with a coat of a good lead or iron-oxide paint. To dry damp metallic surfaces a coat of lime wash of fresh hot lime can be applied; this dries at once, absorbs the moisture and can then be brushed off.

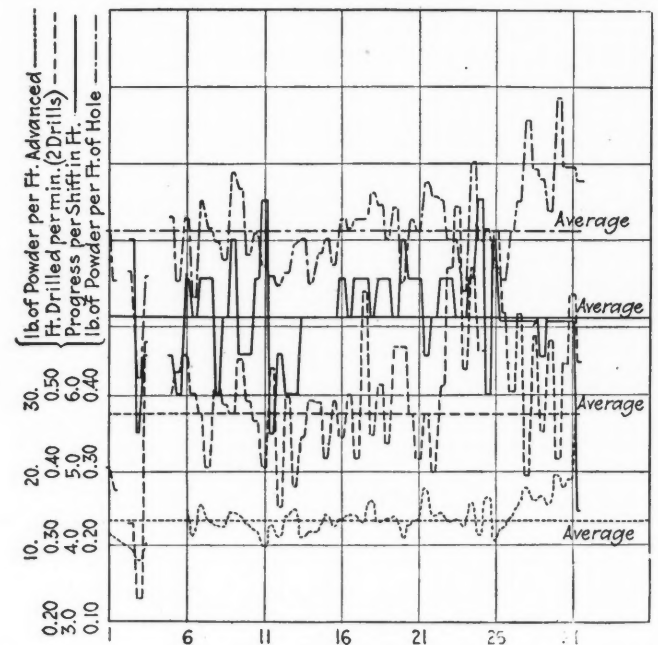
Every three years a structure should be repainted with two coats of either good white-lead, or iron-oxide paint, the latter being especially serviceable in a sulphurous atmosphere.

Lead paint especially should never be laid upon a sooty or dirty surface. A new coat of paint should not be applied when the first coat is merely skimmed over. The first coat should be allowed to dry thoroughly from the bottom. The pigment and raw linseed oil used should be the best procurable. Mixing on the job is advisable. A paint should set in 24 hr., and if necessary to use a drier to bring this about, the amount of drier should be kept at a minimum and a solid drier given the preference. Turpentine should be used sparingly and never in a finishing coat.



### Tunneling Efficiency Curves

The accompanying diagram shows a graphic method of representing the unit costs attained in tunneling opera-



MONTHLY CHART OF TUNNELING OPERATIONS

tions. The work in question was prosecuted by the Rawley Mining Co., at Bonanza, Colo., and was described by Messrs. Simonds and Burns before the February meeting of the American Institute of Mining Engineers. The abscissas represent days of the month. The ordinates have different meanings for each curve as shown. These monthly sheets were compiled from a daily log of operations and served for comparing the work, day by day. The lines marked "Average" are the average of the month's operation and offer a ready means of comparison.

The curve called "Feet Drilled per Minute," represents the tunneling character of the rock. The other three curves were made not only for study and examination, but to arouse the interest of the men in obtaining speed and powder economy.

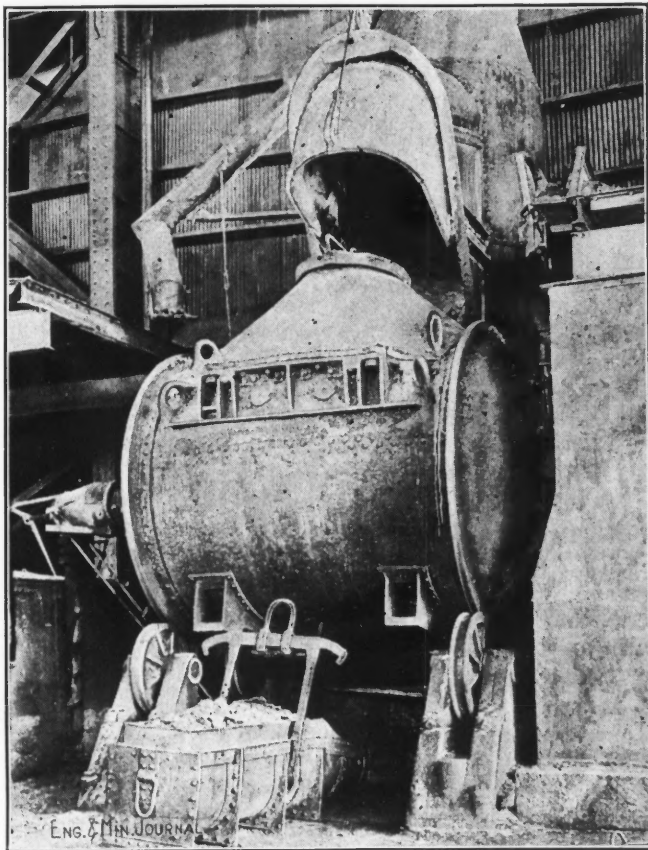


## DETAILS OF METALLURGICAL PRACTICE

### Electric Operated Copper Converters

BY G. B. ROSENBLATT\*

The use of electricity for operating copper converters is coming more and more into vogue in smelting plants throughout the West. The largest converter at present electrically operated is the one of 250 tons capacity recently constructed at the Great Falls plant of the Ana-



ELECTRICALLY OPERATED CONVERTER AT INTERNATIONAL SMELTING & REFINING CO., TOOELE, UTAH  
(Motor installed in housing at right.)

conda Copper Mining Co. The converter proper, not including bearings and gears, weighs about 65 tons, and will take approximately 50 tons of charge. This converter is to be operated by a 100-hp. Westinghouse type MC direct-current motor. The accompanying illustration shows a barrel-type converter with basic lining at the plant of the International Smelting & Refining Co., at Tooele, Utah. A totally inclosed Westinghouse motor is used, which is installed in the housing at the right of the converter.

The first converters to be electrically driven were equipped with direct-current motors, but an alternating-current motor has now been developed for this service,

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and a number of recent installations of this type have proved entirely satisfactory. With either direct- or alternating-current motors, the most approved practice is to gear the motor to a jackshaft which in turn drives the large gear on the converter proper through the worm gear. This prevents any slippage and eliminates the possibility of the converter pulling the motor past any position desired.

Motors for this work are usually totally inclosed so as to make them dustproof, but in some of the more modern installations it has been the practice to install the motor alongside the converter in a sheet-iron housing of its own, in which case a totally inclosed motor is not essential.

Motors for this service are of rugged construction and are similar in many respects to those used in steel mills. A high overload capacity is provided to take care of emergencies, and the installation is designed to withstand a high temperature, so that even a splash of molten metal from the converter mouth on the motor will not burn it out. An electric brake is usually attached to the motor, and is applied automatically whenever the current is shut off from the motor. It holds the converter dead even in case of failure of power.

The best practice is to equip the cranes for charging and handling the converter with the same type of motor equipment that is used to operate the converter proper. These motors on the cranes are subjected to much dust, fumes and high temperatures, so that rugged construction is desirable. Further, the use of identical motors on the crane and on the converter simplifies the matter of spare parts, an advantage by no means to be overlooked when the absolute necessity of keeping things moving is considered.

The chief advantage of motor operation over hydraulic is the smoothness of the motion. The converter starts gently, without halt or jar, and this is bound to increase materially the life of the lining. The smoothness and ease of motor control also obviate much of the danger from the splashing of the molten charge within the converter.

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### Stone Muller for Grinding Pans

A new muller for grinding or amalgamating pans has been invented by Gustave A. Gelien, of San Francisco, Cal., for which he has been granted U. S. pat. No. 1,057,540. The essential feature of the invention is that in an ordinary grinding pan, there is placed a stone muller or several mullers having a rim flaring at the top, composed of a body having separately formed grinding portions attached to the bottom of the slide. The side face of the muller is curved to conform to the inner periphery of the pan, and the side grinding portion is formed substantially triangular in shape and arranged to form a V-shaped groove with the flare on the rim. The muller is constructed with removable wearing

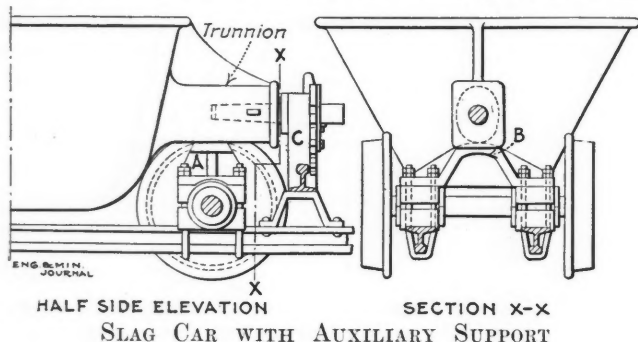
face, the stones on the wearing surface being replaceable at any time, and the body of the muller being usable indefinitely. In addition, it is expected to manufacture these faces of some artificial stone, which will have great wearing capacity. Aside from the removable wearing surface made of artificial stone, and the rather unique shape of the muller, there is little novelty in the invention.

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### Auxiliary Support for Slag Cars

At the Cananea Consolidated Copper Co., Cananea, Sonora, Mexico, the cinder or slag cars used are equipped with auxiliary supports for the trunnions at both ends of the cars. By this means, the weight of the car and contents is partially taken from the regular bearing shafts, relieving the stress on the trunnions and providing against bending of the latter.

In the accompanying illustration this supplemental support is shown at *A*. It is mounted on boxes at each end of the car and has its upper portion *B* in the form of an arch, so as normally to support the trunnions. The trunnions are substantially oval in cross-section, so that when the bowl is in a vertical position, the lower faces of the trunnions rest on the arched portion of the



supports, thereby relieving the bearings *C* of much of the weight. When the bowl is turned on its axis, the trunnions move out of contact with the auxiliary supports, permitting the contents to be poured readily.

The device is patented by Louis F. Kuhn (U. S. pat. 1,047,659). One of the advantages claimed for the invention is that it can be applied without any structural changes in the cars of the type referred to. Mr. Kuhn states that the cost of installation at Cananea is about \$9 per car, of which \$6 is for material, and \$3 for labor.

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### Crucible and Furnace Sizes

From the investigations of Jonathan Bartley (*Metal Industry*, April, 1913), it appears that there is a certain proportionate size to be observed between crucibles and furnace in order to get the maximum number of heats from a graphite crucible. When the crucible is above or below the right size it wears out quicker than the properly-sized crucible does, beside which the fuel is not used economically. It is also claimed that a square furnace does not give the same number of heats as a round one.

Mr. Bartley intimates that he is not sure with an individual furnace what the right amount of fuel space is, but apparently believes about four inches all around to be the right amount. Apparently, however, this is a matter upon which it will pay each individual crucible user to experiment.

### Treatment of Copper-Lead Mattes

The simplest way of treating copper matte containing lead would appear to be a modification of the precipitation process, if it were possible to cause the separation of metallic lead sufficiently free from copper (W. Menzel, *Metall u. Erz*, pp. 193, 219, 1913; abstr. *Journ. Soc. Chem. Ind.*, Mar. 31, 1913). The use of iron alone as a desulphurizing agent is only applicable within limits owing to the formation of lead matte. It is known that the addition of alkali or alkaline earth, or salts of these, to the desulphurizing agent increases its efficacy. The experiments described by the author with the fullest detail were carried out on Otavi matte made at Tsumeb, and containing: Cu, 40.81; Pb, 23.65; Fe, 10.45; S, 17.99; Ag, 0.04; Zn, 1.88; Mn, 0.2; As, 0.2; Sb, 0.1; SiO<sub>2</sub>, 2.57; CaO, 1.17; and Al<sub>2</sub>O<sub>3</sub>, 0.84 per cent.

In this matte the sulphur is not sufficient to form sulphides with all of the copper, lead and iron present, and in making up the charges it was assumed that all the sulphur was combined with lead. An excess of carbon was always present. Attempts to separate by producing a light copper matte and a heavy lead matte by the addition of salts of alkalis or alkaline earths to a charge of matte and carbon failed to effect any segregation. Smelting the matte with lime and carbon can only result in a partial reduction of the lead, as (according to Schenck) double sulphides of lead and calcium are formed. Tests made on these lines showed that addition of the amount of lime theoretically necessary to form sulphides of iron and calcium results in an extraction of 50% of the lead in metallic form. Increasing the amount of lime increases the extraction of lead but also its copper content, which is about 4% with 50% lead extraction.

Speiss is always formed if more than the theoretical amount of lime be present. Iron was then added, in the form of ferric oxide and carbon, in an endeavor to increase the yield of lead. When the theoretically necessary amounts of lime and iron were added, a yield of 63% of the lead was obtained, this latter containing 4.67% of copper and 92.42% of lead. Matte smelted with powdered iron oxide alone yielded 70% of the lead in the metallic form, assaying 93.62% of lead and 2.93% of copper. Charges composed of matte, barium sulphate, ferric oxide and carbon were studied, and the results were more favorable than those obtained with calcium sulphate, though these substances are both to be avoided.

After obtaining these results in gas-fired furnaces corresponding to the reverberatory in actual practice, electric smelting was studied. On smelting matte with limestone and carbon, it was found that owing to the good conductivity of the matte it was difficult to obtain a sufficiently high temperature by resistance heating, while the local overheating due to the arc caused great losses especially in the absence of a protective slag. A special form of furnace was evolved and found to give satisfactory results. Micrographic investigation tends to show that in the Otavi matte the lead sulphide is not chemically combined, crystallizing out on cooling. The author considers the methods indicated as commercially advantageous. The copper-lime matte formed is brittle and easily treated.

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A Device for Drying Blueprints is described in the "American Machinist," Mar. 27, by John Sewell. It consists of hanging the blueprints on round rods in a rack, and when full, removing the rack to a position under the outlet of a blower pipe, at the other end of which is set an ordinary electrical fan, which blows the air over a set of hot coils set in the pipe at some point.



# THE COST OF DOING THINGS

## Estimating on Cost of Power Plants

Engineers are frequently called on to estimate the cost of construction of various works before information is at hand, of anything but the principal apparatus involved, says *Engineering News*, Apr. 24, 1913, and yet the estimates may cover the expenditure of large sums, so that close approach to the actual expense is needed. F. W. Gay, chief mechanical engineer of J. G. White & Co., New York, in the *Journal of the Worcester Polytechnic Institute*, March, 1913, shows a method of checking these estimates and confining the greatest chances of error to minor parts of the installation.

He has compiled data and prepared diagrams covering power plants from 2000 to 40,000 kw. in capacity, his experience showing that engines and foundations consti-

of equipment costs, an average, say, of 10%. Using unit prices, on a square- and cubic-foot basis, as well as on a horsepower basis, checking each against the other, should keep the error within 1% or 1.5% on the total. Referring to one contract, the final figures from the cost analysis show that the estimate was in error less than 2.5 per cent.

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## Electrical Data from Some Colorado Mills

Interesting data concerning the electrical equipment of a few mills in Colorado are given by W. J. Canada (*Electrical World*, Apr. 5, 1913). As samples of highly desirable load conditions in metal reduction mills, the

TABLE I. THE COLBURN MINING & MILLING COMPANY, VICTOR, COLO.

Department	Machines Operated	Motor, Hp.	Metered Five-minute Peak, Hp.	Hours Operation	Monthly Average, Kw-hr.	Five-minute Peak, Hp. Installed Per cent.	Connected Load Per cent.	Load-factor Hours Operated Per cent.	Five-minute Peak, Per cent.
Shafthouse (Mine)	40-kw., 125-volt d.c. generator....								
	2 mine locomotives, 2 5-hp. motors, each								
	5 hp. in blacksmith								
	10 hp. on chain conveyor								
	10 hp. on aerial tram.....	1-40	40	7-9					
	Assay office, crusher.....	1-2	1	8-9	2,650	98	6.5	19.5	19.8
Machine shop.....	1-5	5	8-9						
Mine pump (emergency).....	1-10	10							
Crushing	1 Symons No. 5 crusher.....								
Grinding	1 Symons disk crusher								
	2 sets rolls	1-100	80	6-8	12,530	78.3	15.8	46.1	59.1
Elevating	2 large trommels, 12-mesh.....	1-100	80	6-8					
	Elevators and conveyors.....	2-5	6	6-8					
Tube mills	3 5-ft.x15-ft. tube mills.....			(2)-24					
	32 r.p.m. 60-ton capacity.....	3-50	155	(1)-12	60,560	103.3	56.1	67.2	65.0
Pumps	1 agitator compressor								
Agitators	1 centrifugal circ. pump.....					*	*	*	
	3 triplex solution pumps.....	1-35	50	24					
Reduction	1 tailings hoist.....	1-7½	8	24	37,010	136.5	121.0	121.0	88.8
	1 assay crusher, grinder zinc feeder	1-2	2						
	1 blower tilting furnace.....	1-1	1						
	Electrolysis	1 10-volt double G.E. generator, 1500 amp.....	1-20	20	24 (1)	7,974	100	55.3	83.0
(Twenty days' operation per mo. of period averaged).....									
Lighting mine				10-16	2,318				
Lighting mill				10-16	1,775				
Total load†	Mine and mill.....	14-383	371	Various	125,817	96.9	61.1		63.0
			Av. 3 mo.						

\*Omitting two small pumps. †24-hr. basis.

tute from 33.6% to 61% of the total equipment cost; an average of 50%; boilers, settings and foundations, from 17.25% to 31.5%; average about 25%; piping, complete, from 7% to 17%, average about 11%; condensers, complete with foundations and auxiliaries, 10% to 15%, average about 11%; circulating-water system, 4.5% to 8%, average 6.5%. This is a minimum of 72.35% of all apparatus items, leaving the remainder, 27.65%, to be divided among at least eleven groups, including "miscellaneous." Therefore, the greater part of the allowable time should be spent on these five groups.

He finds it possible to estimate as close as 3% on boilers, installed; on engines, installed, as close as 5%; on engine foundations, as close as 10%; on circulating-water systems as close as 15%; on piping systems, as close as 20%; on condensers, auxiliaries and foundations, as close as 3 per cent.

Buildings for this apparatus vary from 6% to 16%

condensed notation contained in Table I may be of interest. The mill referred to in this table has been operated under rather adverse conditions since its installation. A sample day in April, 1912, under more favorable operating conditions shows a five-minute peak of 225 kw., a minimum of 190 kw., and an average of 200 kw. for 24 hours. The readings were taken with recording instruments. The energy is supplied by the Arkansas Valley Railway, Light & Power Co., to three 100-kw., 24,000-440-volt transformers, which are placed in the reinforced-concrete substation of the Colburn company. Graphic meters are installed, which record the total load and the load of each department, and the daily readings of these meters are tabulated by the plant electrician.

In July, 1912, the mill of the Portland Gold Mining Co., at Victor, Colo., referred to in Table II, in treating 15,000 tons of ore, consumed 325,400 kw.-hr. and showed as its greatest five-minute peak 545 kw., indicating a load

factor of 83%. Energy is supplied to the steel substation of this company by the power company mentioned above. It is taken directly through the six 100-kw. transformers, which are protected by electrolytic lightning arresters to recording instruments arranged in the same fashion as those just described. The power factor at this plant averages 87 per cent.

The mill of the Primos Mining & Milling Co., at Lakewood, Colo., treated approximately 1100 tons of tungsten

ally, and about the same amount is treated in the electrically driven mills of the district, which are operated 24 hr. per day and vary not over 20% from the average load.

Formerly this load was carried by the Colorado Light & Power Co., of Cañon City, and the Suburban Traction & Lighting Co., of Pueblo, with a steam plant at Pueblo and a hydro-electric plant at Skagway. But during the last year these two companions have been taken over by

TABEL II. THE PORTLAND GOLD MINING COMPANY, VICTOR, COLO.

Department	Machines Operated	Motor, Hp.	Metered Five-minute Peak, Hp.	Hours Operation	Monthly Average, Kw-hr.	Five-minute Peak, Hp. Installed Per cent.	Connected Load Per cent.	Load-factor Hours Operated Per cent.	Hours Operated Per cent.
Crushing	Crushers, rolls, trommels.....	1-150	110	16		73.3			
Conveying	2 conveyors.....	1-20	11.5	16		47.2			
		1-10	2.7						
Sampling	Sampling crusher and grinder....	1-15	6.2	16		41.3			
Milling	4 Akron chilean mills.....	1-300	300.0	24		100.0			
Concentrating	Card and Wilfley tables.....	1-15	7.2	24		57.7			
		1-30	18.8						
Classifying	Classifiers.....	1-15	17.0	24		100.0			
		1-20	18.0						
Tube mills	2 5-ft.x16-ft. mills.....	1-60	45.0	24		37.5			
		1-60	45.0						
Lime pump	1 pump.....	1-15	5.4	2		36.1			
Agitating	Air agitators, compressors.....	1-20	23.0	5		115.0			
		1-20	25.0	5		125.0			
		1-15	8.6	24		57.3			
Filtering	Pumps and press.....	1-10	3.8	24		38.0			
Precipitation		1-15	2.1	24		14.0			
Solution pumping	Pumps.....	1-20	15.0	24		75.0			
		1-15	11.8	24		78.5			
		1-15	9.7	24		64.6			
Filter vacuum	Vacuum pump.....	1-40	23.0	24		57.4			
	Solution pump.....	1-15	11.5	24		76.5			
Air compressor		1-50	25.0	24		50.0			
Tramways	75-kw, 125-volt D.C. generator... 5 2-motor locomotives, crane type, 10-hp.....	1-100	28*	24	20,200		28.0	28.0	Load-factor
	Third-rail on ties between tracks. Ore mine to mill to dump.....								—Five-minute peak, 24 hours 80.8
Lighting	Mill and grounds.....		10 kw.	10-16					
Total load	Mill and auxiliary buildings.....	24-1050	550 kw.	Various	320,000	70.3	57.8		

\*Average for day.

TABLE III. THE PRIMOS MINING & MILLING COMPANY, LAKEWOOD, COLO.

Department	Machines Operated	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours Operation	Five-Minute Peak, Hp. Installed, Per cent.	Connected Load, Per cent.	Load Factor Hours Operated, Per cent.
Custom Sampling	1 7-in.x10-in. 30-ton crusher, belted, 280 r.p.m. ...	1-10	8	1-8	80.0		
Crushing	1 9-in.x15-in. 75-ton crusher, 240 r.p.m.....	1-15	12	5 Av.	80.0		
	1 samp. crush., grind.....	1-5	2	1-5	40.0		
Stamps	2 batteries, 5-hp. each, rated 50 tons, 90 r.p.m....	1-35	25	24	71.3		
Concentrators	2 Wilfleys, 1 Frenier, 240 r.p.m.....	1-5	4	24	80.0		
Vanners	3 6-ft. 8 4-ft. vanners, 210 r.p.m.....	1-10	10	24	100.00		
Tube mill	1 Krupp 6-ft.x8-ft. tube mill 40 r.p.m.....	1-35	22	24	62.5		
Circulating pump	3 Frenier sand pumps..... 1 300 g.p.m. No. 70 centrifugal, 1000 ft. distant on creek.....	1-15					
Lighting	160 lamps, 16-c.....		8	10-16			
Total load	Mill and auxiliary buildings	8-130	64	0-24	48.2	44.4	90.2

Monthly average load, 31,000 kw.-hr.; not metered separately for different departments. Load factor, 24-hr. average; 5-min. peak.

ore in July, 1912, with a maximum demand of 55 kw., a minimum of 37 kw., and an average of 43 kw. The chief cause for the variation was the 8-kw. crusher load, but this never occurs during the 6-kw. lighting peak. The Central Colorado Power Co. furnishes energy at 13,000 volts and 25 cycles, to the substation of the Primos company, where it is stepped down to 440 volts for motor circuits, and 110 volts for lighting purposes. (See Table III.)

The Cripple Creek mining district comprises about 18 square miles and is devoid of water power. The amount of ore now mined monthly in the district averages 80,000 tons. Approximately one-third of this is hoisted electric-

ally, and about the same amount is treated in the electrically driven mills of the district, which are operated 24 hr. per day and vary not over 20% from the average load.

Formerly this load was carried by the Colorado Light & Power Co., of Cañon City, and the Suburban Traction & Lighting Co., of Pueblo, with a steam plant at Pueblo and a hydro-electric plant at Skagway. But during the last year these two companions have been taken over by

the Arkansas Valley Railway, Light & Power Co., and all of the power stations are now interconnected, with 24,000-volt transmission lines.

These lines enter the main substation of the Arkansas Valley Co., at 24,000 volts, and there the tension is stepped down to 6600 volts for local distribution to the substations of the various mining companies. At the various companies' substations, a second transformation takes place, and the energy goes to the motors at 440 volts. The primary lighting circuit which serves the city of Victor is operated at 2300 volts, and the secondaries carry a potential of 110 volts.



# THE MINING INDEX

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## COAL AND COKE

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- 21,860—**ALASKAN COAL PROBLEMS**. Walter L. Fisher. (U. S. Bureau of Mines, Bull. 36, 1912; 35 pp., illus.)
- 21,861—**ANALYSIS**—Report of the Sub-Committee on Standardization of Methods on Determining Water in Coals and Other Fuels and in Minerals of the International Committee on Analyses. R. Lessing. (Eighth Internat. Cong. of App. Chem., Vol. XXV, 1912; 50 pp., ill.)
- 21,862—**ASH**—The Rapid Determination of Ash in Coal. H. M. Ullmann and N. W. Buch. (Eighth Internat. Cong. of App. Chem., Vol. XXV, 1912; 3 pp.)
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- 21,864—**COKE**—Mechanical Coke Quencher. W. Reubold. (Iron and Coal Tr. Rev., Feb. 28, 1913; 1½ pp., illus.) From "Journ. f. Gasbeleuchtung," 40c.
- 21,865—**COKE**—Progress in Byproduct Recovery at Coke Ovens. J. E. Christopher. (Journ. Soc. Chem. Ind., Feb. 15, 1913; 9 pp., illus.)
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- 21,867—**COMPRESSOR**—Untersuchung einer Kolbenkompressoranlage auf Zeche Dahlbusch Schacht II/V. (Glückauf, Feb. 1, 1913; 2½ pp.) Investigation of a piston compressor plant at Dahlbusch colliery, Westphalia. 40c.
- 21,868—**CONSERVATION** as Applied to Bituminous Coal Industry. Samuel A. Taylor. (Eighth Internat. Cong. of App. Chem., Vol. XXVI, 1912; 6 pp.)
- 21,869—**DUST**—Die Bekämpfung der Kohlenstaubexplosionen durch Gestelstaub und die Durchführung dieses Verfahrens im englischen Steinkohlenbergbau. F. Friedensburg. (Glückauf, Feb. 1 and 8, 1913; 12½ pp., illus.) Fighting coal-dust explosions by means of rock dust and its practical application in English collieries. 80c.
- 21,870—**ENGLAND**—The South-Eastern Coal-Field, the Associated Rocks, and the Buried Plateau. W. Boyd Dawkins. (Trans. Manchester Geol. and Min. Soc., Nov. 5, 1912; 30 pp., illus.)
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- 21,872—**FIRES**—Gob-Fires, and the Prevention of Gob-Fires in Mines. John Harger. (Trans. Manchester Geol. and Min. Soc., Vol. XXXIII, Part I, 1913; 30 pp.)
- 21,873—**GAS**—Ignition of Gas by Standard Incandescent Lamps. H. H. Clark. (U. S. Bureau of Mines, Tech. Paper 28, 1912; 6 pp.)
- 21,874—**GAS**—The Hallwood Gas-Cap Observation Machine. E. A. Hallwood. (Trans. N. Eng. Inst. Min. and Mech. Eng., January, 1913; 15 pp., illus.)
- 21,875—**MACHINE MINING**—Die Versuchsergebnisse mit der Drehstrom-"Pick Quick"-Groszschrämmaschine auf der Grube Viktoria des Königlichen Steinkohlenbergwerks Gerhard zu Lulsenthal, Saar, Welse. (Preus. Zeit. f. B. H. u. S., Part 4, 1912; 6 pp., illus.) Results of experiments made with the three-phase "Pick Quick" coal-cutting machine.
- 21,876—**MINE FILLING**—The Relation Between Subsidence and Packing, with Special Reference to the Hydraulic Stowing of Goaves. George Knox. (Trans. Manchester Geol. and Min. Soc., Dec. 10, 1912; 26 pp.)
- 21,877—**PEAT**—Investigation of the Peat Bogs and Peat Industry of Canada, 1910-11. A. Anrep. (Canadian Dept. of Mines, Mines Branch, Bull. 8, 1912; 80 pp., illus.)
- 21,878—**POWER**—Characteristics of Substation Loads at the Anthracite Collieries of the Lackawanna R.R. Co. H. M. Warren and A. S. Biesecker. (A. I. E. E., April, 1913; 7 pp., illus.)
- 21,879—**POWER**—Purchased Power in Coal Mines. H. C. Eddy. (Proc. A. I. E. E., April, 1913; 6 pp.)
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22,107—PHOSPHATE FERTILIZERS—On the Method of Producing Bicalcic Phosphate with the Help of Electrolytically Produced Acid and Alkali. W. Palmaer. (Eighth Internat. Cong. of App. Chem., Vol. XXVI, 1912; 9 pp.)



# A Five-Ton Smelting Furnace that Smelts

BY CLEMENT H. MACE\*

*SYNOPSIS—Description of the Partridge furnace, a practical furnace for small units. A continuous slot replaces the tuyeres, and the blast is preheated by passing over the molten slag.*



Several years ago, I noticed in the catalog of a prominent iron works, which makes a specialty of manufacturing smelting plants, the following statement: "Size of blast furnace—5, 10 and 15 tons—impossible;" which was unquestionably true, if the word "standard" had been inserted before "blast furnace."

In smelting, as well as cooking, the old adage holds, "the proof of the pudding is in the eating," therefore, if a furnace of the size mentioned has successfully operated for a reasonable length of time, the evidence is conclusive. Such a furnace is a five-ton Partridge hot-blast smelting furnace, erected last fall in Knoxville, Tenn., the intention being to prove the efficiency of the furnace, before installing a larger plant. There were also some mechanical problems in connection with a new arrangement for disposing of the slag, and it was thought these could be more cheaply perfected by actual practice on a small plant than on a larger one.

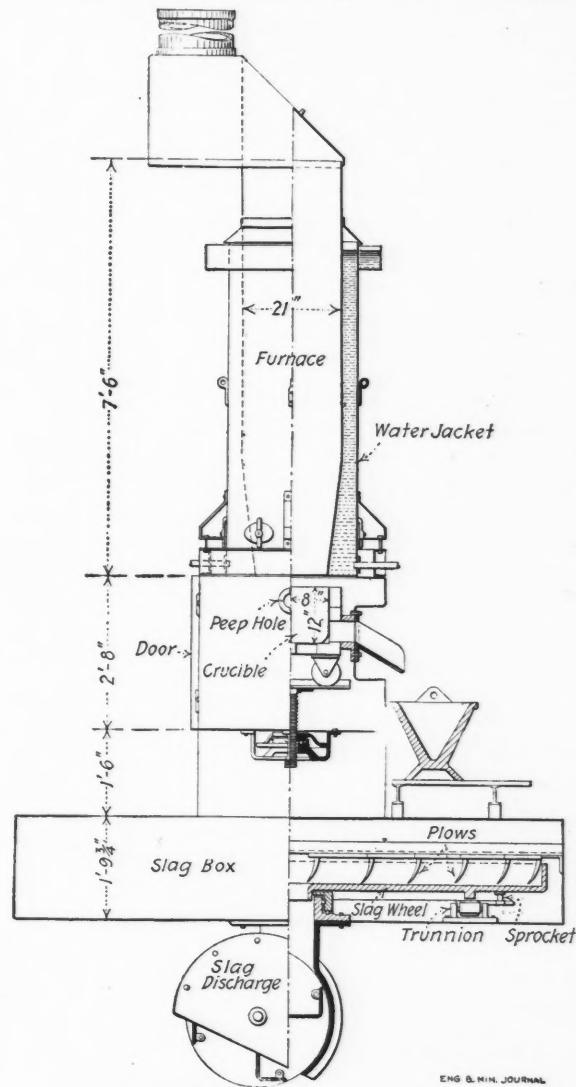
## DIFFERENCES BETWEEN PARTRIDGE AND STANDARD FURNACES

The Partridge furnace differs from the standard blast furnace in three respects, viz: (1) Elimination of the tuyeres, which are replaced by a continuous aperture; (2) preheating the blast by passing it over the molten slag; (3) removable crucibles and fore-hearths, inclosed in air-tight chambers, thus reducing the loss of heat by radiation and lessening the tendency to freeze.

The Knoxville furnace has a rectangular shaft 4 ft. in height, not boshed, and water-jacketed on its lower half. The hearth area is 13x17 in., or 1.53 sq.ft. Below the shaft is a removable crucible inclosed in a chamber connected with the slag-pan box, from which the blast comes. The space between the bottom of the shaft and the top of the crucible is 1½ in., and this opening forms the tuyere area of the Partridge furnace. It will thus be seen that a large amount of oxygen at low pressure enters the smelting zone, for the entire hearth area is utilized and the dead space between the tuyeres of the standard-type furnace is eliminated.

The slag overflows from the crucible on to the rim of a revolving cast-iron pan six feet in diameter. It here spreads out in a thin sheet and is gradually granulated and pushed to the center by plows attached to the cover of the slag box. The blast from a Connersville 1½-cu.ft. blower is admitted into the air-tight slag box and passing over the pan extracts the heat from the slag, thus entering the tuyere at a high temperature. After three trips around the pan the slags are finally discharged through the center into a pit below, whence they are removed to the dump. The lead and matte are tapped from the bottom of the crucible on the outside of the crucible chamber, as shown in the illustration.

Both lead and copper ores were smelted, though the latter class gave better results, as it was difficult to keep a cool top in lead smelting with such a short ore column. The only reason it was possible at all was due to the fact that the Partridge furnace has such a low blast pressure. This causes the smelting to take place low in the column. Another feature against lead smelting was the absence of boshes, which made the heated gases rush up the shaft without expanding. However, by cutting



THE PARTRIDGE SMELTING FURNACE

down the blast, sprinkling the ore charges with water, and using proper precautions during the blow-in, several tons of pig lead were made with not over a 10% smelting loss.

The smelting mixture consisted of: 20% of non-argentiferous galena, fluxed with 20% by weight of iron scrap; and 80% lead slags averaging 6% Pb, which had been run through a standard furnace. This gave a mixture of an average lead content of 18%, which was fed to the furnace in 100-lb. charges, separated by 10-lb. coke charges. The blower was run at 310 r.p.m., delivered 465 cu.ft. of

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air per minute, or 304 cu.ft. per sq.ft. of furnace area, as against 150 cu.ft. in standard lead practice. More air even than this would have been used had the ore column been higher. The average daily capacity on this type of ore was six to seven tons of charge. The slags averaged 1% Pb, mostly in the form of lead matte, which is a good slag, when it is taken into consideration that no forehearth was used. The low blast pressure naturally lessens the amount of flue dust appreciably, and this never assayed over 6% Pb. The matte produced, averaging 10% Pb, was piled on the dump to oxidize partially in contact with the elements, the intention being to heap roast it after a sufficient quantity had accumulated, and then re-smelt it.

The lead and matte were tapped from the crucible into conical pots every 15 min., and after cooling the lead bottoms were broken off and placed in a large refining kettle and melted. The lead was then "poled" with green saplings and molded into pigs, averaging 99.51% fine.

PARTRIDGE FURNACE AS A COPPER SMELTER

As a pyritic smelter on copper-sulphide ores, however, the furnace developed its greatest efficiency. The blower was run at 400 r.p.m., and the furnace showed a capacity of nine tons in 24 hours. With a larger blower this could easily have been increased to 12 tons. Five per cent. of coke was used for an ore containing 8% sulphur; with a like amount of sulphur in standard copper practice there is no comparison. The shaft was kept half full of charge in order to carry a hot top, thus burning out the bulk of the sulphur and oxidizing the iron. The concentration was 7:1 and a 70% copper matte was produced. After several hours' smelting the blast became so hot that it would scorch the skin. With a good matte fall the crucible kept hot and the clay plug could be pierced by a tapping bar without the use of a hammer. This is extraordinary in a furnace and crucible of such small dimensions.

It is believed this is the only smelting plant in the world that is blown out for Sundays and holidays. The crucible is mounted on wheels and rests on a plate, which raises or lowers it to position. In blowing out all that is necessary is to run the charge down, remove the crucible-chamber door at the back, take off the matte spout and run the crucible out. This is tilted to allow the residue of slag and matte to drain and is all ready to replace at the next blow-in. The total operation consumes half an hour. Blowing-in requires about the same amount of time, another half hour is consumed in warming up the crucible with barren slags, and smelting then goes along as merrily as before.

Three men on a shift operate the plant, a furnace man, helper and charge man. The helper fires the boiler, removes the slag and assists the furnace man, while tapping.

The smelting cost on copper ore for labor, fuel, oil, water and rent was \$2 per ton. All of these items, however, are cheap in the Appalachian region. Superintendence, assaying and office charges brought the total cost per ton up to \$3.

However, the same force would operate a 30-ton plant just as readily, with the addition of a roustabout on day shift, so the smelting cost per ton would be materially reduced on a larger furnace, as the overhead expenses would remain practically the same.

The results obtained on this small furnace have been so satisfactory that one 15-ton and three 30-ton furnaces are being constructed along the same lines, with the exception that the water jackets extend the full length of the shaft and the 30-ton plants have forehearths.

The accompanying cuts show two sectionalized views of the 15x20-in. 15-ton copper-matting furnace. The ground line is at the top of the slag box, which rests in a pit. Below the slag discharge is a drag conveyor in a tunnel, which automatically delivers the slag to the dump.

More complete figures on smelting costs, with various types of ore, will be published after the new plants have been in operation a sufficient length of time definitely to ascertain reliable data.



California Oil Dividends in March

California oil companies listed on the stock exchanges paid dividends for March, 1913, amounting to \$1,693,340. Of this sum the Standard Oil Co. of California disbursed \$1,125,000, which was a quarterly dividend. In addition the Mexican Petroleum paid \$240,000 on its

Company	Par.	Dividend	Amount
Amalgamated.....	\$100	\$1.00	\$50,000
American Petroleum, preferred.....	100	0.50	8,256
American Petroleum, common.....	100	0.33 1/2	39,607
Caribou.....	1	0.01	8,070
Central.....	1	0.0075	7,500
Claremont.....	1	0.01	4,500
Dome-Pinal.....	1	0.01	9,000
Home (Coalinga).....	1	0.01	1,000
Monte Cristo.....	10	0.25	2,450
Mount Diablo.....	1	0.0075	7,500
Paraffine.....	1	0.01	3,000
Record.....	2	0.05	10,000
Rice Ranch.....	1	0.01	3,000
S. F. & McKit.....	10	0.10	5,000
Sauer Dough.....	0.50	0.015	2,993
Section 25.....	1	0.50	20,000
Standard of Cal.....	100	2.25	1,125,000
State Consolidated.....	1	0.01	5,000
Sterling.....	1	0.10	25,000
Traders.....	100	0.60	9,000
Union Oil.....	10	0.60	91,403
Union Provident.....	100	0.60	91,403
United Petroleum.....	100	0.60	48,451
West Coast.....	100	1.00	10,408
Western Union.....	100	0.50	5,000
W. K.....	1	0.02	10,000
California totals.....			\$1,603,341
Mexican Petroleum Ltd., preferred.....	100		240,000
Mexican Petroleum Ltd., common.....	100		320,000
Grand total.....			\$2,253,341

quarterly dividend on the preferred stock and \$320,000 on the common, making a grand total of \$2,253,340. The above is the list in detail. Mexican Petroleum stock is largely held in California.



Output of Steel Corporation Iron Mines

The U. S. Steel Corporation in its 1912 annual report gives the following data on tonnage mined and labor employed at its iron properties:

District	Tons of Ore Mined 1912	1911
Marquette range.....	551,575	560,685
Menominee range.....	995,401	1,105,044
Gogebic range.....	1,497,950	1,264,734
Vermillion range.....	1,301,663	1,182,075
Mesabi range.....	20,001,953	14,581,530
Tenn. Coal, Iron & R. R. Co.'s mines.....	2,079,907	1,239,563
Total.....	26,428,449	19,933,631
Men employed.....	12,597	14,445
Tons per man per year.....	2098	1379

The report states that the decrease in the number of employees during 1912 was due principally to lesser stripping development operations in 1912. A list of the mines worked by the corporation and previous costs have been published in the "Cost of Doing Things."

# CORRESPONDENCE AND DISCUSSION

## Precipitation Temperatures

I have just noted the communication in the JOURNAL of Mar. 15, 1913, from Edward H. Smith on the effect of temperature on precipitation. I have never known of serious difficulty in precipitation due to low temperature, although it has been often noted that with cold solutions the amount of metal retained by the zinc is greater than with warm solutions. I have not seen any cases where the tailing, from zinc boxes assayed higher than the head, but with the use of zinc dust in a precipitating plant equipped with presses not suited to the work, I have seen marked redissolving action take place more than once. The gold in a zinc-box precipitate can be dissolved in cyanide solution even in the presence of an excess of zinc. I note herewith the results of some tests made on zinc-box products.

A fine black precipitate that settled on the frames for holding down the zinc in the last compartment, was collected. This compartment had been filled with lead-coated zinc. Analysis of this precipitate was Au, 1.92%; Ag, 2.99; Cu, 3.30; Pb, trace; Zn, 39.50; Bi, trace; As, none; Sb, none; CaO, 13.30; MgO, trace; Fe<sub>2</sub>O<sub>3</sub> plus Al<sub>2</sub>O<sub>3</sub>, 3.20; Insol., 2.88; loss in heating to 100° C., 13; loss in ignition, 21.8%. This precipitate treated for 48 hours with a 5-lb. cyanide solution gave 96.3% gold dissolved, and with a 10-lb. solution, 97.9%. Unfortunately no results on the silver extraction were determined.

Another test was made on a low-grade precipitate of light-gray color obtained from below the screen of the fifth compartment of a light-flow box. This precipitate was formed under abnormal conditions that occasionally existed in the plant. Analysis was: Au, 0.20%; Ag, 0.26; Cu, trace; Pb, none; Zn, 57.80; Bi, none; As, none; Sb, none; CaO, 19.70; Fe<sub>2</sub>O<sub>3</sub> plus Al<sub>2</sub>O<sub>3</sub>, 0.70; insol., 0.6; loss in heating to 100° C., 17; loss in ignition, 28; soluble in hot water, 5; soluble in KOH, 33.5% (of which 39.4% is zinc). This precipitate treated for 4 hours with a 5-lb. and a 10-lb. cyanide solution gave respectively 80.3% and 82.7% gold dissolved.

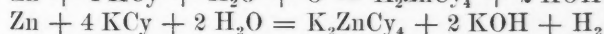
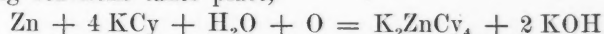
On another occasion the products from the different compartments of a zinc box were tested for the dissolution of gold. The boxes had seven compartments filled. From one of the boxes the precipitate was kept separate and was sampled and weighed. The samples were assayed and partially analyzed. A sample of the total clean-up was also taken. In Table I are given the results:

TABLE I. ZINC-BOX ANALYSIS BY COMPARTMENTS

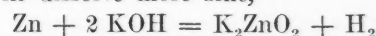
Compartment	Weight %	Analysis				
		% Au	% Ag	% Cu	% Zn	% CaO
1.....	42	5.93	7.30	8.4	21.5	4.0
2.....	28	5.76	4.43	9.1	31.5	2.1
3.....	17	3.63	1.21	4.1	44.2	9.2
4.....	5	3.48	2.81	6.3	49.2	4.2
5.....	2.5	2.61	1.54	trace	41.0	3.6
6.....	2.5	2.63	2.78	trace	46.8	4.2
7.....	3	3.11	5.34	2.5	38.5	10.2
Averages.....		5.12	4.92	7.2	31.0	4.5
General sample.....		6.71	7.88	4.5	36.5	7.3

One gram of each of the above samples was subjected to two hours' treatment in a beaker with 200 c.c. of 2-lb. cyanide solution, giving results shown in Table II:

It is not possible that the cyanide solution used could have dissolved all the zinc in the samples. The solution used contained 200 mg. of KCy. If either of the following reactions takes place,



it is seen that 200 mg. of KCy are capable of dissolving only 50 mg. of zinc, and assuming further that the KOH liberated will dissolve more zinc,



another 50 mg. of zinc will be dissolved. By the entire possible dissolving action of the solution with the production of K<sub>2</sub>ZnCy<sub>4</sub> and K<sub>2</sub>ZnO<sub>2</sub> but 100 mg. can be dis-

TABLE II. CYANIDE RETREATMENT OF PRECIPITATE

Compartment	Mgs. Gold In		Calc. Gold Value of Solution	% Gold Dissolved
	Residue	Solution		
1.....	36.26	19.42	\$56.60	34.9
2.....	36.06	18.22	53.10	33.6
3.....	22.77	11.10	32.40	32.8
4.....	20.33	11.40	33.20	35.9
5.....	16.56	9.62	28.10	36.8
6.....	14.76	12.73	37.20	46.3
7.....	13.12	15.81	46.10	54.7
Averages.....	31.39	16.75	\$48.80	34.8
General sample.....	35.03	2.703	\$78.80	43.6

solved. By referring to the table of zinc analyses, it will be seen that the samples contained from 215 mg. to 492 mg. of zinc in one gram. The amount of cyanide actually used for the dissolution of the gold amounted in one case to 18 mg., and assuming that an equal amount was utilized for the formation of silver potassium cyanide, it would have been possible to dissolve only 80 mg. of zinc. It is obvious, therefore, that a considerable portion of undissolved zinc remained in the precipitate. It is also evident that, even in the presence of metallic zinc, gold (and very likely silver) in zinc-box precipitates is soluble in cyanide solution. This may possibly be due to the mechanical condition of the zinc. Another series of tests made on another sample of precipitate showed that the weaker the cyanide solution the higher the dissolving power compared to the theoretical amount possible to dissolve.

It seems possible, therefore, that should the precipitation fall to, or approach zero, the precipitate below the screens might be attacked and the values redissolved. The tails under such a condition would carry greater values than the entering solution irrespective of temperature, although the temperature may have a slight effect on the amount dissolved. It is quite conceivable that a certain amount of dissolving action goes on under any condition below the screens on the precipitate collected there, with immediate reprecipitation as soon as the solution comes in contact with the zinc above the screens.

The redissolving action can take place in a zinc-dust press to an alarming extent under certain conditions, irrespective of temperature. I have seen solutions having a value of \$2 gold precipitated with zinc dust and pumped through a press coming out with a value of \$20 gold. This happened, not once, but several times. The trouble in this case was mechanical, and due entirely to the faulty con-



struction of the presses. After such a period of high effluent solutions the presses were opened and the bulk of the precipitate found to have settled in the bottom of the chamber. The cloths were coated with a thin coat of dirty yellow precipitate that assayed 0.34% Au, 0.45% Ag, compared with 5% Au and 4.5% Ag usually contained in the regular precipitate. The silver, as well as the gold, had been redissolved from the precipitate in this case. Is it not possible that the temperature of the solution may have little or nothing to do with the poor results in precipitation?

JOHN GROSS.

Denver, Colo., Mar. 25, 1913.

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## Silver Cyanidation at Tonopah

On reading Mr. Megraw's article on "Silver Cyanidation at Tonopah—II" in the *JOURNAL* of Mar. 1, a reference to the slime discharge of the McNamara mill will be noted, which seems to condemn that type of installation generally as a method of removal of tailings.

Quoting briefly, he says: "The mill of the McNamara . . . originally contained a number of innovations, most of which have been made for devices conforming to standard practice. . . . The filter bottom was not divided into separate hoppers, but consisted of a single V-bottom, in which was placed a spiral screw conveyor to convey the discharged slime to the point of exit. The arrangement was found to be decidedly unsatisfactory, as the slime stuck and piled up on the side of the tank and eventually the screw was tunneling under the mass of slime. In order to remedy this defect the bottom was divided up into separate hoppers by inclined partitions, and is now conforming to usual construction."

Though without first-hand knowledge of the conditions prevailing at the McNamara, I wish to state that this failure of a screw conveyor readily to clean a filter hopper is not to be considered a typical performance, nor should it be a sufficient reason to revert to the common practice.

As evidence, I would submit the results obtained at El Tigre, Sonora, where a screw conveyor is transporting heavy filter slime-cake that is dropped into a hopper that contains no water whatever. The equipment, as first set up, was a screw of ribbon type, revolving in the bottom of a horizontally set discharge hopper, the sheet-iron walls of which are inclined at an angle of 45°. The residues discharged are filter cakes from Kelly presses, which range from 25 to 30% moisture, and more often approach the former figure than the latter. Inasmuch as the cakes are stiff and sticky, the leaves are washed with water from a high-pressure hose, after having dropped the cake by internal water pressure, but the total discharge from the hopper has not exceeded a moisture ratio of 0.5 of water to 1.0 of solids, more frequently being 0.4:1, and there is no accumulation of water in the hopper at any time, to serve as a flushing medium.

When first put in use, the conveyor behaved as described by Mr. Megraw, and "tunneled" through the slime-cake, making the prompt discharge of residues impossible. After some time elapsed, the following alterations were made, which changed the screw from a source of annoyance and lost time, to a smoothly working mechanism. First, the bottom plates were taken out, and a trough, 22

in. wide, was built into the bottom, of similar gage iron. The hopper bottom was originally level, but this trough has an inclination of 12% on a 50-ft. length.

The ribbon shaft was lowered as well, but not as much, and is now a foot above the bottom of trough at discharge end, while at the other extreme it is only about 5 or 6 in. above it.

The result of the change is that all the slime slides into the trough and is at once cut up by the worm, and pushed forward before it has time to lag and hold back the succeeding fragments of cake that fall. The small amount of hose water that is used acts as a lubricant and the slime cakes shoot out of the discharge end of the hopper as though on a greased skidway.

No fall or head room was sacrificed, as the hopper is at the head of the tailings ditch. In passing, it might be said that without the aid of the screw conveyor, it is impossible to discharge the hopper save by long-continued sluicing with much water. The conveyor is driven by a small motor that takes about 3 hp. under the new arrangement, and as it is in operation about 4 hr. in all per day, the power requirements are extremely small.

Cake discharges are now made in 15 to 18 min., counting from the time that the presses are opened until the time that they are beginning to fill again with slime. In this time five presses of the "Parral" size are cleaned. Occasional discharges have been made in 10 or 12 minutes.

The above statement shows that screw conveyors will remove filter slime under the proper conditions, even though much denser than the average vacuum filter cake, and at no noticeable expense for power or repairs.

Conditions at El Tigre preclude the use of much water or water in large quantities at recurring intervals. At other plants they might be such as to offer no field for the screw conveyor for a variety of reasons, but it is certainly possible to make it work well as a means of transport for slime cake in a filter plant. Furthermore, it does not leave large masses of heavy slime in the corner of hopper, as is frequently the case when using rectangular boxes and dropping the cake in water or barren solution.

DONALD F. IRVIN.

Yzabal, Sonora, Mar. 15, 1913.

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## Driving with Machines on Tripods

I was interested in the account of a tunneling job at Mineville, N. Y., given by Theodore V. K. Swift in the *JOURNAL* of Apr. 12. The article appealed to me, however, rather as an example of how not to do it. It is hard to see how the expense of two or three drifting bars should have forced Witherbee, Sherman & Co. to the employment of the clumsy tripods, and there would seem to be only one excuse for the method of using a third machine behind the heading machines to slab off the side to full width. This is, that the rock was so hard and the speed so slow that mucking was a relatively simple problem. In high-speed tunneling, the mucking is the crux of the situation and any system which periodically covered the track with debris some distance back from the face, could not be tolerated. It seems foolish to have neglected the opportunity for an efficient, high-angled, vertical cut which the 9-ft. width of face would have given.

ROBERT OLDS.

New York, Apr. 28, 1913.

## EDITORIALS

### The Concentration of Telluride Ores

The treatment of low-grade gold-silver tellurides has caused many metallurgists to put forth their best endeavors. When the subject of the metallurgy of such ores is considered, we naturally turn to the practice at Kalgoolie and Cripple Creek.

As is well known, the standard method of treatment at present for low-grade sulphotelluride ores, where fuel costs prohibit preliminary roasting, includes table concentration followed by cyanidation and bromocyanidation. In such cases, concentration in addition to saving the heavier valuable minerals has the additional function of removing a fair proportion of the cyanicides. The treatment with bromocyanide is given in a final attempt to release the precious metals from the telluride bond, in which they defy dissolution by straight cyanide.

In the grinding of these telluride ores, fine flaky particles of telluride are formed, which float over the tables and into the tailing. If the bromocyanide solution is properly made up and has an adequate opportunity to act upon these elusive particles, the precious metals they contain can be extracted. There is always the possibility, however, that they may escape without having been sufficiently impoverished.

It is obviously of advantage to remove these floating particles at an early stage in the process. In Mr. Wood's article in this issue, the feasibility of doing this, by making use of flotation as a preliminary to table concentration, is proclaimed. The results of the tests should prove of interest to those engaged in treating this class of ore.

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### Free Assaying for the Prospector

As noted on another page of the JOURNAL, a bill has been introduced in the Colorado legislature, providing for free preliminary geological, mineralogical, and qualitative determinations by the State School of Mines on samples sent in by *bona fide* prospectors and practical miners of the state. This is a policy which seems to us detrimental to the best interests of the mining industry in many ways.

Without intending to make any criticism of the work of the Colorado School of Mines, the ordinary student's assay is not an accurate affair, and it is by the students that we understand it is intended that the bulk of the work should be done. An inaccurate assay is about as much use as a clerk who multiplies two by two and says "five." And herein is the danger to the miner.

But the student himself will, we believe, be damaged in the end. He will have plenty of practice, as a student, it is true, but unless he is taken on the faculty of his Alma Mater, he will, when he begins his business career, find that a great deal of profitable trade which should go to the commercial assayer is absorbed by the students of the State School of Mines. We should think even the mining engineers of Colorado would be aroused to the danger of this. If the School of Mines is to do assaying,

why should it not do surveying and exploring gratis, for the *bona fide* prospector?

As to determining who is a *bona fide* prospector and practical miner, there may be some difficulty. It may be, too, that some of the *bona fide* prospectors will send in 300 specimens apiece for complete analysis for all commercial and rare metals, and feel much aggrieved when a reliable assay certificate is not forthcoming in 24 hours. However, these and certain other difficulties are minor matters. The point remains that such a bill is legislating away the commercial assayer's trade into the hands of a subsidized institution, and that it is another step toward the *panem et circenses* to which the degeneracy of more than one people can be attributed.

It may be added to this, as a matter of history, that the University of Nevada undertook this business several years ago, and created quite a local scandal thereby. Certain cut-rate assayers in various camps turned over their assaying to the University, thereby making a handsome profit.

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### Duties on Ferroalloys

Although its amount and importance are relatively small, the paragraph assessing duties at an advanced rate on ferromanganese and other ferroalloys in the new tariff bill, has caused a large amount of discussion. One reason, perhaps, is that it runs counter to all the other provisions of the tariff bill, which are intended to reduce the duties and to do away as far as possible with protection. It is claimed by those opposed to the new duties that they impose a burden upon the steel manufacturers which is not in accordance with the principle of the bill or with the lower prices which reduced duties on finished material are supposed to promote.

The framers of the bill, on the other hand, claim that the duty on these alloys produces and will produce an item of revenue which is not to be neglected, while at the same time, they will not constitute any appreciable burden upon the trade. The facts in the case seem to be that the total consumption of ferromanganese and spiegel-eisen in the manufacture of steel has, in recent years, been not far one way or the other from 240,000 tons, about one-half of which is imported. The tendency of recent years has been to a considerable decrease in the use of spiegeleisen and an increase in that of ferromanganese, showing that the steel manufacturers prefer to use in the converter and the steel furnace the alloy with a high percentage of manganese. The market price in this country depends entirely on the imported alloys, since those companies which manufacture them here consume their own product in their own works and have practically none for sale. The price has varied a good deal with the demand, but a rough calculation shows that at the highest point the cost of the manganese alloy is not far from 4 to 5c. per ton of finished steel. It may be added that practically all of the manganese alloys made here are from imported ores, the quantity mined in this country being very small.



From this brief statement it will be seen that the duty, at whatever point it may be fixed, is not a matter of very great importance. The only point perhaps to be regretted, is that the framers of the bill should have seen fit to impose an *ad valorem* instead of a specific duty. The former leaves open certain difficulties in calculation and certain opportunities of fraud, which are not present when the duty is specific. However, it seems to us that the discussion over this item is really quite out of proportion to its real importance.

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### Rapid Estimation of Silver in Cyanide Solution

One of the most annoying inconveniences accompanying the use of zinc dust for precipitating gold and silver from cyanide solutions, has been the impossibility of estimating the metal content of the solution quickly. In consequence, the amount of zinc dust required to precipitate the metal cannot be definitely known and its use has to be more or less at random, the average content of the solution governing the addition. Clearly this is not entirely satisfactory, for the content of the solution will vary widely from the average, and highest economy will be rarely attained. This condition is more particularly true with silver than with gold, for the obvious reason that the quantity of gold is much less than silver and its variations less marked. Moreover, methods for quickly estimating gold have been proposed and used. It is with much pleasure, then, that we publish in this issue an article by G. H. Clevenger, in which is described a method which he has devised for the immediate estimation of silver in cyanide solutions. By using this system, the operator is enabled to know in a few minutes the quantity of silver he has to precipitate and can add zinc in the exact proportion required. The method ought to result in a substantial saving of zinc and the production of a cleaner bullion. It is well worth adopting in any cyanide plant treating silver ores in which interfering elements do not appear.

It will be noted that the prevention of interference by nickel, cobalt and mercury is not yet worked out, which militates against the process where amalgamation tailings are being treated, and in the Cobalt district. Whether a factorial correction can be applied, or whether the interfering elements can be chemically eliminated will afford some interesting experiments, and, we hope, articles also.

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### One Way of Selling Steel

Americans have been credited with being exceptionally pushing salesmen and most enterprising in their methods of disposing of material. It is to be doubted, however, if any one corporation in the steel trade has adopted the tactics used by the large German manufacturers, the discussion of which is now causing a good deal of excitement abroad. At any rate, if any work of that kind has been done here, it has been most carefully concealed, and there has been no open suspicion of such practices. The two or three important German concerns manufacturing armor-plate, guns and other war material are charged with expending considerable sums for promoting and stirring up the war feeling in Germany and other countries, and thereby inducing governments to ex-

pend large sums in buying such material. It has been charged in the German Reichstag and elsewhere that these firms have not only spent large sums in subsidizing the press, but also that they have bribed ordnance officers and public officials on rather an extensive scale. Apparently a good deal of this work has been done with very little attempt at concealment. The same or similar tactics have been charged in France and England, although in those countries there is not any such proof presented that has been brought forward in Germany.

In this country, there is not the same opportunity of promoting a war feeling that there is among the European nations, although the Japanese war scare which some newspapers here seem to be trying to promote, is an indication that the same tactics might be used. It is to be hoped, however, that our larger steel companies will not be tempted to follow the example of their European brethren, but will be satisfied with more peaceful and more useful opportunities for trade.

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### Shipping to South America

Americans are well used to being scolded for the careless methods employed in packing goods consigned to our southern neighbors. That the scoldings are probably deserved is revealed by recent conversation with a man in charge of forwarding mining machinery and supplies to a company operating in the province of Antioquia, Colombia. Carelessness in packing was not the only difficulty encountered. Written and printed instructions covering the details of addressing as well as packing were followed grudgingly by the firms from whom goods were purchased, or were totally ignored.

The route followed by the shipments in question was a difficult one, involving an ocean trip to Barranquilla, trans-shipment to a river steamer, a railroad transportation overland, another river-steamer trip and finally packing on mules. Evidently freight should be well packed and carefully directed to get through to its destination. A request to one firm to put their small packages in boxes of 125 lb. each for mule packing, resulted in the delivery of a box weighing 1300 lb. Fancy that on a mule! Iron bands specified on the boxes were omitted and cases of fragile assay goods arrived with side and bottom missing.

As JOURNAL readers know, shipments to a foreign, non-English-speaking country, where business usages are different and where custom barriers must be passed, need to be consigned exactly right. In this case instructions to measure and weigh each package, and put on the outside the weight, dimensions and value, were often neglected, and the goods were consequently detained in the custom house. The address as stipulated, *in care of* a certain customs broker for the company manager, was changed in one instance so as to read *to the broker in care of* the manager, and the manager who was 13 days by mail from the port, had to be communicated with to get his order to release the goods.

Manufacturers cannot be expected to know the details of transportation in all parts of the world, but where ignorance exists, common sense would seem to dictate an exact adherence to instructions. It would cost our manufacturers little or nothing to pay attention to these details and remove a source of irritation that must be diverting a large amount of trade to other countries.



## BY THE WAY

The Anaconda Copper Mining Co. has offered a first prize of \$750, and a second prize of \$250 to its mine foremen who annually make the best and next best records in reducing the number of accidents to persons in the mines under their charge.

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There have lately appeared items in the newspapers to the effect that the Guggenheims are going to build a zinc-smelting works at El Paso, Texas. We understand, however, that there are no plans on foot which would substantiate those rumors.

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A hint to the wise is contained in the following story from Sapulpa, Okla.: The son of Judge W. E. Root threw a cannon cracker into the casing of an abandoned and plugged oil well. The cracker went off, so did the well, and likewise all the windows in the judge's house. It is wise to find out whether a well is loaded before making it the repository for lighted cannon crackers.

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The Rio Tinto Co., so well known as a producer of copper, may become an iron miner also. At the recent annual meeting in London, the chairman, C. W. Fielding, said: "I may remind you that you own also fairly large quantities of strictly iron ore, in which there is no sulphur or copper. Up to the present, we have not been handling this product in large quantities, but in a year or two, as a result of improvements which are contemplated and which may include the introduction of electric railway traction, we may be able to carry out a line of policy in regard to marketing this material. Trial shipments have proved it to be of a good salable quality."

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Several years ago a syndicate in which the General Development Co. was interested gave some attention to a plan for consolidating the mines of the Comstock Lode. Mr. Channing made a reconnaissance of the mines, but either was not favorably impressed or else something else turned up to interfere with the plan, which anyway was abandoned. About that time Herman Zadig, the San Francisco broker, wrote a letter, in which he said: "I had quite a talk with Mr. Channing on the way down, and in a very polite way gave him to understand that a man not familiar with the Comstocks is not capable of giving an opinion as to the future of this great Lode." The humor in this remark will appear to many persons who know Messrs. Channing and Zadig.

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The JOURNAL has sometimes criticized the Western Federation of Miners, but we are not vindictive and can only commiserate with the Black Hills unions in the fate which seems about to befall them. A. C. McHugh, "Brother McHugh," appeals to the unions for support in floating the stock of the Deadwood Homestake Mining Co. This company has holdings and options in the Deadwood district, and, like most companies, needs money. Mr. McHugh asks the union men of the Black Hills to buy his million shares of stock, of which the proceeds shall be de-

voted, one-half to development, one-quarter to purchases, and one-quarter to McHugh. In return he promises to develop the only union mine in the Black Hills. The plan is enthusiastically endorsed by the Deadwood union, the Galena union, and the Lead City union of miners, by the local union of electrical workers, by the typographical union, and, it need not be said, by the bartenders' union. The unions in the Black Hills have had hard sledding since the Homestake won its fight, and we can sympathize with their attempts to establish a rival to that great concern. But we incline to the opinion that this venture is likely to leave their individual pockets more depleted than any strike the Western Federation ever called.

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The Second National Investment Co. of Georgetown, Colo., is advertising in a New York paper, "An investment for men of modest means," which is described as being "the first time the soundest of all semi-speculative securities is offered to Eastern investors," the title of this investment being "First Lien Ore Certificates." It is explained that a "First Lien Certificate calls for the return of the principal and a large actual additional profit, after which the certificate is retired and a 7% preferred stock issued without further payment. Every dollar received from these certificates goes into property improvements, and until the entire principal and the agreed upon profit are returned to the holder the issuing company cannot pay a dividend. . . . This issue is based upon the present actual commercial operation of a world-famed mining estate that has over 25 miles of work upon it and is today self-sustaining, with a past estimated production of \$30,000,000." All of this has a familiar ring except the name of the security, which would not be so alluring if called "debenture bond." A "First Lien Certificate" may call for the return of the principal, there's no doubt about that, but the principal may not come when it is called. We don't think that "first lien ore certificates" ought to escape any less careful scrutiny respecting the value behind them than would be given to debenture bonds.

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A remarkable tribute to the Minerals Separation process of ore concentration by flotation was paid by Lord Kintore in his address to shareholders of the Sulfide Corporation, says the *South African Mining Journal*. In referring to the improved grade of the concentrates produced in the Corporation's main mill, he remarked: "The fact is—and I think it is only fair that I should draw attention to it—that the Minerals Separation process which we use in our zinc mill has attained a remarkable pitch of efficiency. For the last year the recovery of zinc by this process averaged 90%, against 85½% in the previous year, while for the first five months of the current year it has further risen to an average of nearly 94%, and I do not think that anywhere else in the world, or by any other process could these figures be equaled." Besides New South Wales the Minerals Separation process is now in use on mines in Queensland, South Australia, Chile, Sweden, Finland, dealing with lead, zinc or copper ores. Altogether these plants are treating about 3,000,000 tons of material per annum. The last two plants to be started up are those at the Braden Copper mine in Chile and at the Great Cobar mine in Queensland.

## American Institute of Mining Engineers

The following Iron and Steel Committee has been appointed by the American Institute of Mining Engineers to serve until the next annual meeting; Charles Kirchoff, chairman; Albert Sauveur, vice-chairman; Herbert M. Boylston, secretary, Abbott Building, Harvard Square, Cambridge, Mass. The other members are: John Birkinbine, William H. Blauvelt, James Gayley, Henry D. Hibbard, Henry M. Howe, Robert W. Hunt, Esrey Johnson, Jr., William Kelly, Richard Moldenke, Joseph W. Richards, A. A. Stevenson, Felix A. Vogel, Leonard Waldo, William R. Walker, William R. Webster and Frederick W. Wood.

It will be noted that the various interests of the iron and steel industry are authoritatively represented on this committee by producers of raw materials (iron ore, coke and other fuels, refractories, etc.), and of finished materials, by consumers, consulting metallurgists and educators.

The primary duties of the committee are to secure important papers on iron and steel, to promote their discussion, to organize lively and fruitful meetings and otherwise to foster the interests of the large number of members of the Institute connected with the iron and steel industry in its many phases. Its success during the past year has been noteworthy. Through its instrumentality many valuable papers were presented at the Cleveland and New York meetings, followed by animated and productive discussions, while the attendance of iron and steel men at both meetings was remarkably large and representative.

Since the next meeting of the Institute is to be held in a Western mining district far remote from iron and steel centers, plans are now being made for a meeting in a more accessible place in the latter part of October under the auspices of the Iron and Steel Committee, to be devoted to the presentation and discussion of papers relating to iron and steel. Arrangements are under way and the indications point to a successful meeting. Efforts will be made to secure important papers covering the four divisions into which the industry may be classified, namely: (1) Mining and preparation of ores, including concentration, nodulizing, sintering, briquetting, etc.; manufacture of coke and other fuels and refractory materials. (2) Manufacture of pig iron, including blast-furnace construction and appliances. (3) Manufacture of wrought iron and steel, including mill construction and appliances. (4) Manufacture of finished products of cast iron, steel and wrought iron, including testing, heat treatment and metallography.

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### Method of Zinc-Dust Precipitation

A variation of the zinc-dust method of precipitation has been devised by Whitman Symmes and Walter E. Trent, who have been granted U. S. pat. No. 1,048,373 covering it. The method is essentially the use of a vacuum filter upon which a bed of zinc dust is placed, and through which pregnant solution is drawn.

The filtering unit is a rectangular pan, having a wire screen a short distance above its bottom, the screen supporting a filtering medium. The zinc dust is distributed over the surface of the filtering medium. A number of

these pans are placed in a tank, each connected with a central suction pipe from the bottom of the pan, and the tank, after being filed with valuable solution, is pumped out through zinc-dust filters in the pans. Each pan has a valve connection between it and the suction pump. When the tank is emptied, the pans are supposed to be taken out and the precipitate removed.

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### Chino Copper Co.

The report of the Chino Copper Co. for the year ended Dec. 31, 1912, shows that since the last annual report, patents have been received on 36 additional claims, bringing the total number patented to 131 claims with an area of 2412.38 acres, and leaving 13 claims, comprising 231.14 acres yet to be patented. In addition to the above, the company owns 160 acres of agricultural land adjacent to its mining properties and has acquired such additional surface rights as are necessary for use in the disposition of overburden stripped from the orebodies. The total area owned and controlled, in connection with the mill location, at Hurley, and the various water rights belonging to the company, contains 7996 acres. Of this total, 6600 acres are owned outright, the remainder being leased from the state and individuals.

During the year a limited amount of development drilling was performed, with the object of determining the exterior limits and boundaries of the orebodies, in order to demonstrate where it would be safe to deposit the overburden stripped from them. This drilling resulted in substantial extension of the proven ore-bearing area. The total amount of drilling completed since the beginning of development by this method to the close of the year was 195,659 feet.

The last annual report showed 54,970,646 tons of ore containing an average of 2.24% copper developed. Of this tonnage, about 60% was stated to be available for steam-shovel mining. Calculated upon the basis heretofore used of excluding lower-grade material, the ore reserves shown by this report would be something over 58,000,000 tons. By the application of a modified basis of calculation, this being the one upon which the engineers agree that the total developed tonnage can be most economically and profitably mined, the ore reserves amount to over 90,000,000 tons, containing an average slightly above 1.8% copper. Neither the tonnage nor the grade of it is stated in specific terms, because it is impossible, pending further experience, to determine exactly what angle of slopes will be necessary and safe in mining to greater depth. It is estimated that of the tonnage stated, about 80,000,000 tons of average grade, or nearly 90% of the total reserves, will be available for steam-shovel mining.

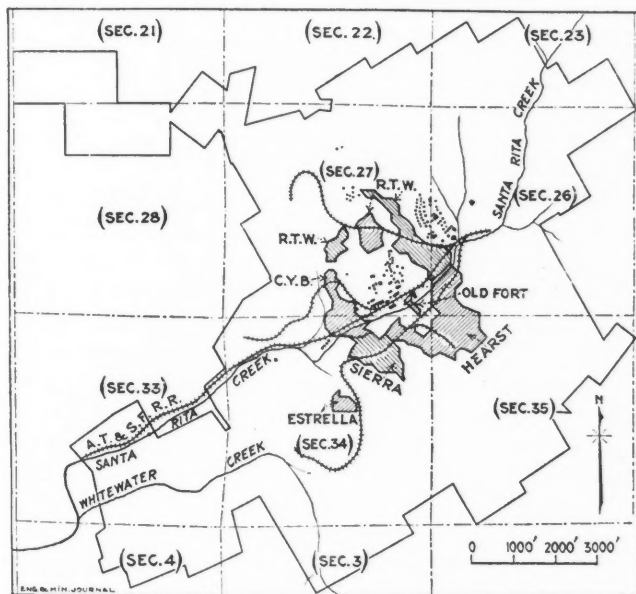
The total amount of material of all classes moved by steam shovel during the year was 2,850,464 cu.yd. Of this quantity, 2,223,678 cu.yd. was waste, the difference, which was equivalent to 1,301,463 tons, being ore. Of this amount, approximately 200,000 tons were added to stock-piles at the mine, the remainder being sent to the mill.

The average cost of steam shoveling for the year was 29.14c. per cu.yd. in place, equivalent to 14.03c. per ton. The cost of handling waste alone was somewhat lower than the average cost of all the yardage, being 27.61c. per yd., equivalent to 13.29c. per ton; while the cost of ore production alone was 16.52c. per ton.



The total amount of deferred charges for the year, due to stripping operations, amounted to almost exactly 1c. per lb. of copper produced in concentrate, notwithstanding the fact that the amount of stripping removed was equivalent to uncovering between three and four times the amount of ore actually mined. Since the beginning of the second quarter of the year, a charge of 30c. per ton of ore produced has been made against operations, to cover stripping expense, and it is estimated that this rate of charge as applied to the increased tonnage handled, when the mill is in full operation, will be sufficient nearly, if not quite, to cover all current stripping expense and avoid any substantial additions to suspense charges on this account. Practically all the ore sent to the mill during the year was mined by steam shovel, and no underground mining will be necessary for many years.

During the latter part of the year, 2291 tons of ore produced from the Hearst section and containing a little over 12% copper, was shipped direct to the smeltery at El Paso. All of the orebodies, especially those in the Hearst section, contain large tonnages of ore which can be



MAP OF THE CHINO PROPERTIES

better shipped direct to smelters, but the extraction of this ore will be intermittent, due to the necessity of extracting these orebodies as they are encountered in the ordinary course of mining the normal-grade deposits with which they are associated.

Additional steam-shovel and accessory equipment, purchased during the year, brought the total up to seven shovels, 15 locomotives, fifty 6-yd. dump cars and forty-five 12-yd. dump cars. The total amount of trackage in use about the mines at the end of the year was 14.39 miles. Additional trackage is being constructed and it is estimated that the increase during 1913 will bring the total up to about 18½ miles.

On Apr. 1, the third and last section of the original three-section mill was put in operation. The present mill consists of five sections. During the first three months of the year, two sections of the mill were in operation; for the next five months, three sections were operated, and for the last four months, four sections were in commission, the average for the year being equivalent to approximately three sections in continuous operation.

The total tonnage treated for the year was 1,120,375 tons, equivalent to approximately 1000 tons per section per day. The plant has demonstrated a capacity of 1200 tons or more per section, attained during certain months when the regular operations were not seriously disturbed, and the entire plant of five sections has therefore an economical capacity of about 6000 tons per day on normal-grade ore.

The average copper content of the ore treated during the year was 2.077%, and the average recovery of copper in concentrate was 61.63%, equivalent to 25.61 lb. of copper per ton of ore treated. For the first six months of the year, when a large percentage of the ore was derived from near the surface where the copper minerals were highly oxidized, the percentage of recovery was only a little over 54%. During the latter half of the year, when a better class of concentrating ore was available, about 65% was recovered.

During the month of July, when clean ores were available for practically the entire month, the recovery was a fraction under 75%; and at the time of this report, and for about two months previous, the recovery was maintained at over 70%. The average milling cost for the year was 58.57c. per ton, but as this includes all of the extraordinary expense incident to starting up the plant operation on comparatively small tonnages, it cannot be taken as indicating what the cost will be with the full plant in operation. The regular milling cost has now been reduced to below 50c. per ton.

The total production for the year of copper contained in concentrate was 28,684,208 lb., the average grade of concentrate produced being 21.2% copper, and the ratio of concentration 16.56 tons into 1. This grade of concentrate is lower than it will be normally, because of the extensive amount of carbonates in the ore treated. When we are able to operate entirely on ores fairly free from carbonates, the concentrate will average, as has been found, about 25% copper. This factor has an important bearing on the cost per pound of producing copper, as affected by transportation and smelting charges on concentrate. The production of copper contained in concentrate for the year, by quarters, was for the first, 3,271,980 lb.; second, 4,289,644 lb.; third, 10,340,963 lb., and fourth quarter, 10,781,621 lb. In addition to this, there was a production from crude ore shipped direct to the smelter, as previously stated, of 553,758 lb. of copper, making the total gross production for the year from all sources 29,237,566 lb. of copper.

The average cost of copper produced from concentrate after deduction for smelter allowances, was 7.69c. per lb., and the cost of production from crude-ore shipments was 6.98c. per lb. These costs include all expenses of every nature. Operations at full tonnage capacity and on the cleaner character of ore, which will be available, permitting higher extraction, will result in materially decreased cost of production.

The income for copper produced was \$4,344,261, being the income on 27,776,088 lb., at an average selling price of 15.64c. per lb. The operating expenses were, for mining and milling, \$858,108.77; for treatment, refining and freight, \$942,231.63; for selling commissions, \$43,759.74; for stripping, \$287,992.50, making a total operating expense of \$2,132,092, and a net operating profit of \$2,212,169 is shown, to which is to be added the miscel-

laneous income, which includes dividends, rentals, royalties, etc., amounting to \$125,133, making a total income of \$2,337,302. Deducting from this the interest on bonds and notes, amounting to \$160,397, the total net income for the year is shown to be \$2,176,904. The summary shows the balance to credit of profit and loss on Dec. 1, 1911, to have been \$284,445, to which is added the net income for the year ended Dec. 31, 1912, as mentioned above, \$2,176,904, making a balance on Dec. 31, 1912, \$2,461,360.

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## Rail Production in the United States

The figures collected by the Bureau of Statistics of the American Iron & Steel Institute give the total production of rails in the United States for two years past as follows, in long tons, division being made according to material used:

Rolled from:	1911		1912		Changes Tons
	Tons	Perct.	Tons	Perct.	
Bessemer ingots.....	1,053,420	37.3	1,099,926	33.0	I. 46,506
Openhearth ingots.....	1,676,923	59.4	2,105,144	63.3	I. 428,221
Electric steel.....	462	.....	3,455	0.1	I. 2,993
Old steel rails.....	91,751	3.3	119,390	3.6	I. 27,639
Iron.....	234	.....	.....	.....	D. 234
Total.....	2,822,790	100.0	3,327,975	100.0	I. 505,125

The notable point is the rapid increase in the use of openhearth steel for rails. Two years ago only a few thousand tons were made from that material; in 1907 the proportion of openhearth rails was only about 7% of the total, but in 1910 the amounts were nearly equal, and in 1912 openhearth rails were nearly double the quantity of bessemer.

The rails made are classified according to section as below:

	Under 45 Lb.		45 to 85 Lb.		85 Lb. and Over	
	Tons	Perct.	Tons	Perct.	Tons	Perct.
Openhearth.....	75,203	2.3	488,695	14.7	1,541,246	46.3
Bessemer.....	103,826	3.1	591,744	17.8	404,356	12.2
Other.....	69,643	2.0	38,153	1.1	15,049	0.5
Total.....	248,672	7.4	1,118,592	33.6	1,960,651	59.0
Total, 1911.....	218,758	7.8	1,067,696	37.8	1,536,336	54.4

Openhearth steel was used chiefly for the heaviest class of rails, and bessemer steel for the medium sections. The rerolled rails are chiefly light sections. The proportion of light rails, under 45 lb., has not varied much for several years, but that of rails over 85 lb. has increased steadily.

There were 24 rail mills in operation in 1912, against 25 in the preceding year.

### PRODUCTION AND CONSUMPTION

The rail production and consumption for 10 years past has been as follows:

	Production	Imports	Exports	Consumption
1903.....	2,992,477	95,555	30,837	3,057,795
1904.....	2,284,711	37,776	416,250	1,906,237
1905.....	3,375,929	17,278	295,023	3,098,184
1906.....	3,977,887	4,943	328,036	3,654,794
1907.....	3,633,654	3,752	338,906	3,298,500
1908.....	1,921,015	1,719	196,510	1,726,224
1909.....	3,023,845	1,542	299,540	2,725,847
1910.....	3,636,031	7,861	353,180	3,290,712
1911.....	2,822,790	3,414	420,874	2,405,330
1912.....	3,327,915	3,780	446,473	2,885,222

The maximum production was reached in 1906 and that was also the year of maximum consumption. The year 1912 was fifth of the 10 years given in its approximate consumption, but the exports were the largest on record. The imports of recent years have been very small, and made chiefly on the Pacific Coast.

### ALLOY STEEL RAILS

Included in the 3,327,915 tons of steel rails rolled in 1912 are 149,267 tons of alloy rails, against 153,989 tons in 1911. The following table gives the production of titanium, manganese, and other alloy steel rails by processes from 1909 to 1912.

Alloy Rails	Openhearth and Electric		Total
	Bessemer		
Titanium steel rails.....	103,941	37,832	141,773
Manganese, copper, and nickel.....	4,933	2,561	7,494
Total, 1912.....	108,874	40,393	149,267
Total, 1911.....	115,450	38,539	153,989
Total, 1910.....	229,935	27,389	257,324
Total, 1909.....	35,699	13,696	49,395

The alloy steel rails are of heavy section, almost without exception. The total last year was very much less than in 1910; in both years titanium was the alloy chiefly used.

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## Reported in New York

It is reported that 100 carloads of Miami concentrates are stalled between Miami and Cananea. On Apr. 22, the Miami company began shipping to Tooele.

The Chile Copper Co. has been organized with a capital of \$110,000,000. Apparently the property is to go into the company at \$95,000,000, against \$15,000,000 cash for plant and equipment.

The Copper Extraction Co., exploiting the Bradley process at Anaconda, is said to have quit work, temporarily at least. T. W. Lawson and A. C. Burrage have put a great deal of money into this operation.

The New York Curb Market has admitted to quotation as a prospect the 550,000 common shares of the New Utah-Bingham Mining Co., par value \$2.50. The amount of stock outstanding is 397,432 shares.

Preferred stockholders of the Vulcan Detinning Co. have been formally notified of the decision of the directors to pay 21% accumulated dividend on the preferred stock, as soon as the money from the judgment against the American Can Co. is collected.

It is reported that Inspiration has signed a contract with Minerals Separation and will abandon its plan for an ordinary concentrating mill and will erect a flotation plant of 8000 tons daily capacity. It is estimated from the experimental work that has been done that the new process will give a copper extraction of at least 85% and will save about \$1,500,000 in construction of plant.

Unless the Goldfield Consolidated Mines Co. complies with the transfer rules of the New York Stock Exchange before June 16, its stock will be stricken from the list of securities sold on the floor, is the announcement of the governing committee. The requirements for listing recite "a trust company or other agencies or other individuals shall not at one time and the same time act as transfer agents and registrar of a corporation," while the Goldfield Consolidated Mines Co. advised that, commencing Mar. 17, the transfer and registration of its stock will thereafter be performed "by a singular agency, both as transfer agent and registrar." Notice is given this far ahead to enable the Goldfield Con. stockholders a chance to act on the matter. The stock will probably go back on the New York Curb.



## PERSONALS

Kirby Thomas, of New York, is in Quebec on examination work.

D. P. Shuler has returned to Fredericktown, Mo., from California.

Edgar L. Newhouse and Judd Stewart, of the Guggenheim interests, have returned from South America.

C. R. Corning has gone to South America on professional business that will engage him for several months.

E. G. Spillsbury has returned from Texas, where he was engaged in professional work for several months.

F. Lynwood Garrison has returned to Philadelphia from Colombia. He is no longer connected with the Breitung interests.

Dr. L. D. Ricketts, president of the Cananea Consolidated Copper Co., was at Globe, Arizona, last week on professional business.

H. C. Hoover arrived from London last week and proceeded immediately to San Francisco where he will remain for several months.

J. H. Susmann has retired from his position with the Lewisohn companies, but will remain on the boards of directors. He will practice as consulting engineer.

Percy E. Barbour, manager of the Uwarra Mining Co., Candor, N. C., visited New York last week and contracted for the equipment of a 50-ton cyanide mill at his property.

Forbes Rickard, Denver, Colo., formerly general manager and consulting engineer for the Valdez Creek Placer Mines in Alaska, has severed his connection with that company.

Arthur Haug has assumed the position of chief chemist and engineer of tests of the American Steel Foundries at Thurlow, Penn. He was formerly chief chemist of the Rock Island arsenal.

G. W. Beidler, manager of the Alexandra mine, Cobalt, Ont., now operated by the Canadian Gold & Silver Co., has gone to Pittsburgh to report to the directorate regarding recent discoveries.

As a result of the change of control of the Drummond mine, Cobalt, Ont., R. W. Brigstocke, who has been in charge for eight years, will remove to Long Lake, near Sudbury. E. V. Neelands has been appointed as his successor.

Arthur Keith and F. B. Laney, of the U. S. Geological Survey, were recently in the Ducktown district in Tennessee, making final observations preparatory to the publication, with W. H. Emmons, of a detailed report of the geology of the Ducktown district.

Robert E. Cranston has been appointed by the Breitung Mines Corporation to act as chief engineer in charge of mining exploration now being undertaken in Colombia, succeeding F. L. Garrison. Mr. Cranston sailed, May 2, from New York for Barranquilla.

Prof. Albert Sauveur, Cambridge, Mass., who has been made vice-chairman of the Iron and Steel Committee of the American Institute of Mining Engineers, will be in charge of the committee's work in the absence of the chairman, Charles Kirchhoff, in Europe.

A. M. Hunt, a prominent consulting engineer, has been appointed chief of the department of machinery of the Panama-Pacific International Exposition, San Francisco. He has been in business in that city since 1894. G. W. Danforth, also a local engineer, will be assistant chief of the department. He has been connected for 10 years with the Union Iron Works.

The Cambria Steel Co. has elected the following officers: W. H. Donner, president, Pittsburgh; J. L. Replogle, vice-president and general manager of sales, Johnstown; E. E. Slick, vice-president and general manager in charge of operations, Johnstown; W. S. Robinson, vice-president and in charge of treasury department and stock transfers, headquarters in Philadelphia.

Prof. Dr. M. Belonsky, custodian of the Mineralogical and Petrographical Institute and Museum of the University of Berlin, has come to this country on a visit of six months to study mineral associations and establish connections, etc., for the University of Berlin. We bespeak for him courtesy and assistance in such places as he may visit.

## OBITUARY

Emanuel Penrod died at Vallejo, Calif., Apr. 16, at an advanced age. He was one of the party of prospectors who discovered the Comstock Lode in 1858, but he did not realize the importance of the find, and realized little or nothing from it. He had been retired from active work for some years.

## SOCIETIES

**University of Illinois**—The formal dedication of the new Transportation Building and of the Locomotive and Mining laboratories will be held at Urbana, Ill., May 8 and 9. On May 9 and 10 a special mining conference will be held, at which a number of papers on coal mining will be presented and discussed.

**American Institute of Mining Engineers**—At the annual meeting of the New York section held May 2, after the business meeting Albert H. Fay, of the U. S. Bureau of Mines discussed the Bureau publication, "Technical Paper No. 40," on "Metal Mine Accidents in the U. S. During 1911." Other members joined in the discussion.

**American Chemical Society**—A regular meeting of the Pittsburgh section was held last week in Thaw Hall of the University of Pittsburgh. D. M. Buck, chief chemist of the American Sheet & Tin Plate Co., spoke on "The Resistance to Corrosion of Mild Steel Containing Copper." Prof. Alexander Silberman, of the University of Pittsburgh, read a paper on "Notes on Recent Developments in Glass Technology," and G. D. Chamberlain, of the Carnegie Steel Co., talked on "Some Examples of the Use of the 'Hydra' Plate in Steel Works Photography."

**Association of American Steel Manufacturers**—A. A. Stevenson was reelected president at the annual meeting held in Pittsburgh recently. Mr. Stevenson is vice-president of the Standard Steel Works Co. P. E. Carhart, inspecting engineer of the Illinois Steel Co., Chicago, was reelected vice-president. Frank A. Robbins Jr., of the Pennsylvania Steel Co., Steelton, Penn., was elected secretary. There are now 34 important companies associated with the society, recent additions being the Phoenix Iron Co., and the Youngstown Sheet & Tube Co.

**Utah Society of Engineers**—The annual meeting and banquet were held on the evening of Apr. 18 at the Hotel Utah. Officers for the coming year were elected. On the following evening there was a lecture on fireproof construction and fireproofing materials by H. B. McMaster, of Youngstown, Ohio, representing the metal-lath industry. This was illustrated by lantern slides. The students and faculty of the University of Utah, Salt Lake High School, the Fire Department, members of architect and builders associations, etc., were invited to attend.

**Colorado School of Mines**—The senior class, composed of 70 students who will graduate from the institution this year, left Denver Apr. 21 on a special train for their annual tour of inspection of the more important mines, mills and smelters of the West. They will visit the coal mines near Portland and Cañon City and the metal mines of the Leadville district. After inspecting the hydro-electric power plants at Shoshone and Glenwood they will go to Castle Gate, Salt Lake City, Park City, Bingham, Garfield and Ogden, Utah and proceed thence to Butte, Anaconda and Silver Bow, Montana. The class is accompanied by Professors G. W. Schneider and C. A. Allen of the mining department, Dr. F. W. Traphagen and E. E. Dittus of the metallurgical department, Professor G. M. Butler of the mineralogical department and Professors Hazard and Hawley of the electrical and mechanical engineering departments. Dr. H. B. Patton of the geological department will join the party at Salt Lake. The class will return to Denver May 21, two days before the annual commencement at Golden.

**University of Washington**—The annual spring inspection trip of the College of Mines was this year held in the western part of the State of Washington during the week April 5-14; 16 members made up the party, including Dean Roberts, Professors Daniels and Corey. Camp No. 2 of the city water supply at Cedar Falls was first visited. Here rock tunneling, diamond and chilled-shot drilling, gravel washing, concrete masonry work, aerial tram- and cable-way operation were studied. The party next visited the new Milwaukee tunnel at the summit of the Cascades. Various

methods employed in driving the headings, benches, stopes and timbering, methods of disposal of rock and the power plant and shops were all visited. From this point the party traveled to Cle-Elum, Wash., for a four days' stay, visiting the various coal mines of the Northwestern Improvement Co. the Roslyn-Cascade Coal Co., and the Roslyn Fuel Co. Time was divided between underground and surface work. The various systems of mining and drawing coal, transportation methods, ventilation and pumping, as well as the surface equipment and power arrangements were thoroughly gone over. Leaving Cle-Elum the party drove to Liberty, a former prosperous placer camp 20 miles to the east. Here the various methods of drift mining were studied in detail. Recent lode development in the camp came in for a share of attention in the study of the prospects and deposits opened up by tunnel and shaft. A small stamp mill recently installed gave opportunity for study of the milling processes. On the trip Dean Roberts gave several illustrated lectures on the different camps on the subject of "Gold Dredging" and Professor Daniels on "Recent Coal Mining Machinery and Appliances."

## INDUSTRIAL NEWS

The Stearns-Roger Manufacturing Co. is introducing the McKesson-Rice screenless sizer, and has a working machine on exhibition at 47 West St., New York, where it will be until about May 10.

The Bunker Hill & Sullivan Mining & Concentrating Co. has ordered two more 6-ft. Hardinge mills. The Copper Range company has just completed the installation of two 8-ft. and one 6-ft. Hardinge mills in its Trimountain plant, and four 8-ft. and two 6-ft. mills in its Champion plant. These mills are used for regrinding jig tailings.

The Samson Manufacturing Co., 1738 Broadway, Denver, Colo., placed the Samson crusher on the market about five years ago. Since then 500 of these machines have been sold. The company is planning to increase the weight and strength of the rigid frame of the crusher and provide for an increase in its capacity by widening the aperture of the jaws. Manufacturing and selling agencies are being established throughout the United States and Canada.

In the latest edition of the "Textbook on Corrosion," issued by the Stark Rolling & Milling Co., Canton, Ohio, information concerning the anticorrosive, rust-resisting qualities of "Toncan" sheet metal is given. The various uses of the product are illustrated by prominent installations. Tables giving standard weights, gages and other specifications for roofing, siding, etc., add to the usefulness of the book to consumers of sheet-metal products.

The National Tube Company, Pittsburgh, Penn., has just issued Bulletin 12 relative to the characteristics of "National" steel pipe. The bulletin contains concise information concerning the chemical composition, physical properties, and specifications of steel pipe. The observations of various authorities on the relative corrosion of iron and steel pipes are given. These references give steel pipe favorable mention. The pamphlet also contains a classified list of the publications of the company concerning tubular products and fittings.

The report of the Western Electric Co. shows that the sales for 1912 amounted to \$71,729,329, an increase of \$5,500,000 over 1911. It is stated in the report that the company has 24,000 customers other than telephone companies. This signifies wide activities in fields other than the telephone industry. The line of equipment handled embraces everything electrical, from the largest generating plant to the simplest of electric household devices. The number of employees on the company's roll was 24,564, an increase of about 1000 over the previous year. The company now has 57 pensioners, an increase of eight during 1912, on its list at an average annual pension of \$634. The report reflects a generally satisfactory condition of telephone and allied electrical industries.

The Sullivan Machinery Co., Chicago, Ill., in its new catalog, 65 A on diamond prospecting core drills describes, among other things, a new type known as the "Rambler" diamond drill. The drill is direct connected to a gasoline engine and mounted on a steel truck for convenient transportation. This outfit was especially designed to meet the requirements for a drill of moderate capacity to be used in inaccessible districts where transportation of boilers, heavy machinery, and fuel is impracticable and costly. The necessary speed variations are secured by means of a friction-disk drive, the range of speed of the drill spindle being 100

to 500 r.p.m. The Rambler drill has a capacity of about 500 ft., removing a  $\frac{1}{2}$ -in. core. The swivel head is of the screw-feed pattern with three feeds which may be altered by a lever without stopping the drill. The length of feed is 24 in. A hoist of the internal-gear type is used. The gasoline engine is of an improved two-cylinder opposed type with magneto ignition. The entire drill and engine are covered with a sheet-metal case to keep out dust and moisture. The outfit as thus mounted weighs about 3500 pounds.

## TRADE CATALOGS

Scott Drill Co., St. Louis, Mo. Bull. No. 6. Gasoline rock drills. Illustrated, 8x10 $\frac{1}{2}$  inches.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Duntley portable electric drills, grinder and spike drivers. Illustrated, 8 pages, 6x9 inches.

The Lagonda Manufacturing Co., Springfield, Ohio. Bull. G-1. Lagonda reseating machine. Illustrated, 8 pages, 6x9 in. This pamphlet describes the construction and use of the portable carborundum wheel for removing soot and scale from the faces of caps and tube ends, to aid in making a tight joint when replacing caps on boilers after having been removed for tube-cleaning purposes.

Mussens, Ltd., 318 St. James St., Montreal, Que. Catalog No. 51. Illustrated, 55 pages, 6x9 in. In this catalog are described the general design and special features of Holman rock drills and accessories. One of the new devices manufactured by Holman Bros., Ltd., is the Holman stretcher-bar hoist. This is a compact hoist, made in single- and double-cylinder types, capable of raising 500 to 1000 lb. and sufficiently light, to be readily moved about underground. It is mounted by fastening to a regular drill column and is operated with either air or steam. Over 500 of these hoists are in operation in Australia, where they are used in raising and lowering steel, hauling dirt from winzes and similar work.

## NEW PATENTS

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

**FILTER**—Rotary Filter. Randall P. Akins, Denver, Colo., assignor to Colorado Iron Works Co., Denver, Colo. (U. S. No. 1,059,327; Apr. 15, 1913.)

**LEACHING TANK OR FILTER**. Harry E. Kier, Colorado Springs, Colo. (U. S. No. 1,058,869; Apr. 15, 1913.)

**ORE FEEDERS**—Improvements in Ore Feeders. H. E. Waters and J. L. Cawthorne, Boksburg, Transvaal. (Brit. No. 21,110 of 1912.)

**FERRO-CHROME**—Process for Increasing the Yield of Chromium in the Aluminio-Thermic Production of Carbon-free Ferro-Chromium from Chrome Iron Ore. Th. Goldschmidt A. G., Essen-Ruhr, Germany. (Brit. No. 18,671 of 1912.)

**ZINC**—Apparatus for the Manufacture of Metallic Zinc. Robert Denis Lance, La Garenne-Colombes, France, assignor to Pierre Ferrière, Paris, France. (U. S. No. 1,059,307; Apr. 15, 1913.)

**ZINC**—Electrodeposition and Refining of Zinc. Uryln Clifton Tainton, Manchester, and John Norman Pring, Sandbach, England. (U. S. No. 1,059,233; Apr. 15, 1913.)

**ASBESTOS**—Ore Breaker. John Franklin Pharo, Thetford Mines, Que. (U. S. No. 1,058,789; Apr. 15, 1913.)

**CAGES**—Car-Feeding Device for Cages. Charles E. Brooks and Clarence Gates, Bowerstown, Ohio. (U. S. No. 1,058,405; Apr. 8, 1913.)

**DRILLING**—Valve Mechanism for Rock-Drilling Engines. John George Leyner, Denver, Colo. (U. S. No. 1,058,074; Apr. 8, 1913.)

**SHAFT SINKING**—Improvements in and Relating to Pit and Shaft Sinking. C. W. Alker, Gresford, Eng., and J. W. Liddell, Keresley, Eng. (Brit. No. 5423 of 1912.)

**CLASSIFIER**—Ore Classifier. Albert E. Wigglin and Archer E. Wheeler, Great Falls, Mont., assignors of one-third to Robert H. Richards, Boston, Mass. (U. S. No. 1,058,828; Apr. 15, 1913.)

**CRUSHING**—Ore Mill. George R. Thurber, Kenora, Ont. (U. S. No. 1,059,089; Apr. 15, 1913.)

**SEPARATION**—Improvements in and Relating to Electrostatic Separating Devices for Sorting Heterogeneous Materials, more especially Minerals, Metallic and others, Sulphur, Phosphates of Lime and Like Materials. A. M. F. Blanchard, Asnières, France. (Brit. No. 6772 of 1912.)

**ORE TREATMENT**—Method of Treating Ores and the Like. Niels C. Christensen, Jr., Salt Lake City, Utah. (U. S. No. 1,058,034; Apr. 8, 1913.)

**LABORATORY CRUSHER**. David McIntosh, Denver, Colo. (U. S. No. 1,058,774; Apr. 15, 1913.)



## EDITORIAL CORRESPONDENCE

### SAN FRANCISCO—Apr. 22

**Grand Jury Reported Mammoth Smeltery to Be a Nuisance.** Apr. 28, declaring that serious damage was being done at Kennett by the fumes from the plant, states a press dispatch from Redding. In view of the fact that in Colano County the supervisors selected three experts to decide complaints against the Selby smeltery, further details regarding the report against the Mammoth will be awaited with interest, especially in regard to the qualifications of the members of the grand jury to decide the question in hand.

**The Partial Overturning of the Pato Dredge,** a 9-cu.ft. all-steel bucket-elevator dredge operated by the Patos Mines Ltd., in Colombia, South America, recently reported to the Hammon Engineering Co., of San Francisco, was not a serious or costly mishap. The dredge is now being operated satisfactorily in good ground. The assembling of this dredge was done at the most economical place for the delivery of the machinery and structural parts, but some distance from the main dredging field. The completed dredge then dug its way to the field, and by this unusual practice in dredge operation made an extraordinary test of strength. This is one of the all-steel dredges now in operation that were designed and built by the Yuba Construction Co. Two steel dredges with wooden hulls, of 9-cu.ft. bucket capacity, were built for companies operating in southeastern Oregon and Idaho. Two others, all-steel, of 15-cu.ft. bucket capacity were put in commission in California in 1912 by the Natomas Consolidated. Two more are in course of construction; one, a 7-cu.ft. dredge will be put in commission in the Natoma field in May; the other, of 15-cu.ft. bucket capacity, for the Yuba Consolidated Goldfields, is now in course of construction. All these dredges were especially designed for hard digging, and the performance of the five now in operation has proved satisfactorily in every instance. Besides the advantages of strength and durability the all-steel dredge has an economic advantage over the wooden-hull boat equipped with wooden gantries, in the transportation of materials, especially when the dredges are to be built and operated far distant from the source of supply of materials.

**Gold Dredging in Calaveras County Has Been Increased Recently** by putting in commission two new dredges, one on Calaveras River, the other on Mokelumne River. That on the Calaveras, near the town of Valley Spring, is a one-bucket boat of small dimensions which has not been operated continuously, so that an estimate of the commercial value of its operation cannot at present be fairly made. The boat was built and operated by the Western Dredge Mine & Construction Co., of San Andreas. The dredge on Mokelumne River is a 7-cu.ft. bucket elevator type, built and operated by the Oro Water, Light & Power Co., of Oroville. This boat is situated near the town of Camanche. It began the initial digging about the middle of February and was put in commission Mar. 1. It has been digging in easy ground and at shallow depth, but even with this advantage has proved satisfactorily the value of the machinery built by the New York machine shops operated by the owning company at Oroville. This company operates a 4-cu.ft. dredge at Jenny Lind, which was put in commission about one year ago, and initially was equipped with smaller buckets. It was reconstructed from a dredge formerly operated in the Oroville field, and when the old bucket line was worn out the new one was put on. The Isabella dredge in the Jenny Lind field has, within the present year, been equipped with a new bucket line and a new steel bow-gantry. There are 77 new buckets in the line; 20 made entirely of manganese steel and the remainder equipped with manganese steel lips and high-carbon steel base and hood. The Calaveras dredge in the same field has been undergoing some essential repairs and improvements. Ten new buckets have been installed. This field is on Calaveras River in a flat that was subject to damaging effects of flood water. The small area of the land that was adapted to agriculture was rendered practically valueless by the floods. The assessed value of these lands prior to the dredging operations was \$5 per acre. This was raised to \$100 per acre as dredging lands. The dredges have produced tailing available for levees and retaining walls that can be constructed to the permanent benefit of the lands adjoining.

### DENVER—Apr. 21

**The James Peak Tunnel Bill Is Repealed** by Senate bill No. 73, which was filed June 5, 1911, and entitled: "An act to promote and increase the general prosperity of the state by constructing a tunnel under and through the base of James Peak, a spur of the Rocky Mountains, to be used for public or semi-public purposes."

**An Appropriation for the School of Mines,** at Golden, is covered by Senate bill No. 71, and provides for the extension, equipment, operation, and maintenance of the experimental ore dressing and metallurgical plant, provided that the School of Mines shall make free of charge preliminary geological, mineralogical and qualitative determinations of all ores sent to it by bona fide prospectors and practical miners of the state. The bill contains an emergency clause making the appropriation, amounting to \$40,000, available at once.

**The Lady Belle Mine Has Been Leased for Two Years** to the New York & London Mining Co., Ltd. The terms of the lease are withheld by the owners, Kemp, Wolverton & Glenn, but are known to call for immediate work. The Lady Belle claim was staked on the site of the original discovery in the Eagle district. The first work will be to grade the roads from the Lady Belle to the Brush Creek county road, a distance of two miles, preparing a way to get in heavy machinery as well as to ship ore. Captain Hassel, of New York is at the head of the leasing company.

**A Hearing in the Case of Stratton's Independence, vs F. W. Howbert,** internal revenue collector, in a suit to determine whether ore shipped from a mine is profit or merely the sale of real estate, has been set for Oct. 14, by the supreme court. The collector is attempting to collect the corporation tax on the amount of business done, represented in ore shipped from the mine. The Independence company contends that it is unfair to tax ore because it is only real estate and that its removal and shipment from the mine depreciates the value of the property, as it only converts what was formerly part of the mine into cash, and is not profit.

**A Bill Pertaining to the Width of Lode Claims** recently passed the General Assembly. House bill No. 588 amends Sec. 4193 of the statutes and hereafter the width of lode claims in Gilpin, Clear Creek, Boulder and Summit Counties shall be 150 ft. each side of the center of the lode, and in all other counties in the state the width shall be 300 ft. each side of the center. This change has the effect of doubling the width of new lode claims in the state. Old locators may take advantage of the new law by filing additional certificates taking in the additional widths allowed. The bill further states that counties may agree upon a greater or less width, but that the maximum width shall not exceed 300 ft. each side of the lode.

### BUTTE—Apr. 24

**The Company Which Has Been Drilling for Gas at Hardin,** near Billings, recently discontinued work temporarily after about 1000 ft. depth had been attained. The reason given for the cessation of operations was that the company was unable to secure a sufficient number of signed leases to the land being prospected, to obtain a large enough acreage to insure the commercial success of the venture. This company has 13,000 acres under lease at Silesia, a short distance west of Billings, and has decided to transfer operations to that place and do nothing further at Hardin until the demands are acceded to.

**The Progress of Electrification of the Butte, Anaconda & Pacific R.R.** is indicated by the fact that the first of two electric motor locomotives arrived in Butte, Apr. 21, from Schenectady, N. Y.. Nineteen locomotives have been ordered, of which 17 will be used in freighting, and two in passenger service. The newly arrived motors are for freight service. They are built of steel, are double trucked and geared, and weigh 75 tons each. Each of the four pairs of wheels on each locomotive is operated by a motor, giving a tractive force of 3000 tons. One operator will be sufficient for one of these locomotives, and the engineers now employed on the steam locomotives will be instructed in their operation. The electrification of the Anaconda end of the line, including

the yards and the hill lines to the smeltery, is nearly completed, and within a few days the two motors will be put in commission there switching, to familiarize the crews with the change to electric power. The locomotives ordered are expected to arrive at the rate of four per month.

**An Accident to the Hoisting Engine at the Leonard Mine** of the Anaconda company resulted in five men being killed and nine injured at the No. 1 shaft on the morning of Apr. 23. Shortly after 8 a.m. while the shift was being lowered, the engineer lost control of the engine, which went wild, allowing both cages to fall to the bulkhead at the 2200-ft. level. The cage in the east compartment was being lowered with four men to the 60-ft. level, when the accident occurred, and the cage dropped, the men being instantly killed. The cage in the other compartment was at the 1400-ft. level, where four men had just stepped off, and with seven men on the upper deck and three on the lower, the signal had just been given to hoist to the 1300-ft. level when the east cage dropped past the other. Two men on the lower deck succeeded in leaping to the station just as their cage began to fall carrying with it eight men to the bulkhead 800 ft. below. All of these were more or less seriously injured, and that they were not killed is variously accounted for, but was probably due to the squeezing of the timbers inward in this compartment by the descent of the east cage and its trailing cable. Under the strain caused by the great speed the engine went to pieces, parts of the castings flying in all directions, causing the death of one man on the surface near the shaft, and the serious injury of another. The east cage was being lowered by brake, and it is thought, that the rod, connecting the steam-operated braking device with the operating lever, broke after the brake had been released; the bursting of the east reel released the brake on the west reel, letting the west cage drop.

#### SALT LAKE CITY—Apr. 24

**The Establishment of Four Fellowships in Mining and Metallurgy**, open to college graduates, who have studied in these courses or in inorganic or physical chemistry is announced by the University of Utah. The fellowships have an annual value of \$675 each. Notices to this effect have been sent out by Joseph F. Merrill of the State School of Mines, a part of the University, and applications are invited from young men, who desire to become assistants in the metallurgical research department now being organized.

**Data of Western Land Withdrawals** by the Government to conserve oil, gas, phosphate, and other deposits, is given in a recently issued bulletin of the U. S. Geological Survey. The phosphate lands withdrawn are in Utah, Idaho, Wyoming, Montana, also Florida. In the Western states mentioned the known phosphate area is 220 miles from east to west, and 420 miles from north to south. Only a limited part of this area, however, is underlaid by commercially valuable deposits. The high-grade rock contains from 70% to 73% or a little more of tricalcium phosphate.

#### MIAMI—Apr. 23

**As a Sequel of the Recent Cave-In**, at the Miami Copper Co. property, three of the six units of the mill were closed Apr. 21. Some time ago the raise through which the ore from the stockpile is handled, caved, necessitating immediate repair and this temporary tonnage loss combined with the temporary loss following the cave-in on the 245 level are the direct causes of the partially suspended mill operations. N. O. Lawton, mine superintendent, stated that the repairs are rapidly nearing completion and that the mill will be running at its normal capacity within seven days. The negotiations for the shipment of the concentrates to the International smeltery at Tooele, Utah, were completed and shipments were begun Apr. 22. Since the cessation of operations at Cananea, the railroad officials have been furnishing all the cars necessary to have the concentrates and there are now more than 100 cars of the company's concentrates stalled between Miami and Cananea. While at work in the mill, Apr. 23, an American workman was electrocuted.

**The Strike at the El Paso Smeltery** is accountable for holding up shipments from other mines near Miami.

#### PORCUPINE—Apr. 26

**Rapid Melting of the Snow Has Caused Severe Floods** around Porcupine Lake and the town of South Porcupine has been partially flooded. While no great damage has been done to the town, about ½ mile of the railroad track west of South Porcupine has been washed out so that it is impossible to get coal and supplies through to the Dome and Timmins over the railway. While this has had no serious effect to

date, unless it is remedied shortly, it will in all probability, result in several of the mines being obliged to close down. On account of the breakdown of the Wawaitin power plant, some of the mines are very short of power and are having to rely on the steam plants. It is, practically impossible to haul coal over the roads and if the railroad is not repaired in a short time, it is probable that several of the smaller properties will have to shut down altogether. The Pearl Lake Mining Co., has already taken this step. On account of the sudden break-up, grave fears have been expressed as to the possibility of the dam at Sandy Falls being washed out. This dam has already been regarded with suspicion and as Sandy Falls is supplying all the electric power for the Porcupine camp at present, a break-down there would mean cessation of operations throughout practically the whole district.

#### CHIHUAHUA—Apr. 18

**Mining Interests of Northern Mexico Are in a Precarious Condition**, more so than at any period since the inception of revolutionary disturbances three years ago, and immediate relief is not in sight. While this condition is more or less common to all mining and industrial districts of the republic, the states of Chihuahua, Sonora, Durango and Coahuila are probably suffering the most. Heretofore, foreign interests in particular have been comparatively immune from molestation, but recent happenings would indicate that this may not be the case henceforth. During the last few weeks foreign, and especially American mining interests in this state have suffered severely. Bandit gangs first molested the Naica camp and compelled the Italian-French owned company to contribute to the cause in the way of ransom for its superintendent. A visit was made to Boquilla, where an English-Canadian company is building a dam for the development of electrical energy, and the bandits escaped with thousands of dollars in ransom money and store goods. Still another and bolder band under Pancho Villa held up a train on the Mexico Northwestern line, west of Chihuahua and secured on "receipts" bullion to the value of 180,000 pesos. This bullion was the property of the Yoquivo, Batopilas, Santo Domingo, Tres Hermanos and Seiffert companies, the first two named being American companies, the third English, the fourth Mexican and the last German. None of these have as yet discontinued operations but it is likely that several will do so shortly unless greater safety is assured both in mine operations and in marketing of product. Other camps in the western part of this state as well as in Durango have been visited while operations generally throughout the states of Coahuila and Durango are practically at a standstill.

**The Chihuahua Smeltery Is Now Operating** and is the only one of the large plants in the northern states that is in commission. With the tie-up in railroad traffic south of Torreon and between Jimenez and Chihuahua it has been impossible to bring in fuel and as a result, the Torreon, Valardeña, Aguascalientes, Mapimi and Monterrey plants are shut down. At last accounts, the San Luis Potosi plant was operating at small capacity. The Rio Tinto copper smeltery at Terrazas is also in commission. As long as the railroad communication from Chihuahua to El Paso is kept open the local smeltery can continue operating and thus permit the Santa Eulalia and tributary mines maintaining a regular output. It is possible, too that smelteries to the south as far as Aguascalientes can and will arrange for securing a supply of fuel from the north as soon as communication is established south of Chihuahua, which will undoubtedly be earlier than a supply can be obtained from the southern Coahuila fields or from United States points via Eagle Pass or Laredo. [Later dispatches state that all American Smelting & Refining Co. smelteries except that at Valardeña, are in blast.—Editor.]

**At Parral the Mining Industry Is Demoralized.** Only three or four companies are operating, and these under stress on account of the intermittent railroad service. At Guanacevi and Indé in the adjoining state of Durango, a few of the larger companies are doing some work with little attempt at production. The Cusihiuiriachic camp in the western part of Chihuahua, has been comparatively free from visitations since the placing there of a sufficiently strong Federal garrison. The productive mines are also less handicapped since the long period of car shortage ended about five weeks ago. The suspension of operations on the part of the Madera Co., Ltd., with large lumber mills at Pearson and Madera along the line of the Mexico Northwestern Ry., has also aided in the general demoralization. Most of the mines are dependent on this company for timber, and many of the peons employed as laborers have been turned adrift without a saved-up fund, to become rebels or bandits.



# THE MINING NEWS

## ALASKA

### Dome Creek District

**SPALDING**—The result of a four-days' run of the stamp mill was \$4300. The mill will be kept in steady operation.

### Juneau District

**ALASKA-TREADWELL**—In March, 69,944 tons of ore crushed yielded \$165,187, or \$2.38 per ton in bullion and concentrate; \$73,165 being the estimated net profit.

### Valdez District

**CAMERON-JOHNSON GOLD MINING CO.**—Extensive operations will be carried on this season, and an 8-hp. Fogs gasoline engine and hoist have been ordered and will be installed at once.

## ARIZONA

### Cochise County

**UNITED ARIZONA**—This mine in the Johnson-Dragoon district has been examined and the sale of an interest in the mine has been reported, but Pesident Alfred S. Miller, of Philadelphia, denies a definite negotiation or option for the mine and says that plans have been made to complete the development from funds now provided for the company. The Republic mine of this company shipped to Bisbee last year 1400 tons of 5% copper ore. Shipments are now being made from development. The company's report shows that the ore developed during last year was valued at \$670,000 and that recent extension of the deep levels has added \$300,000 to this as partially proved ore. Exploration is being continued and it is proposed to add a compressor and hoists to enable increase in output. The company, last year secured by purchase and exchange of stock the adjoining Gleeson, Magazine and Mackay groups of claims. Negotiations for the purchase of the branch railroad from Dragoon to the mine are now under way.

### Graham County

**KEATING**—A transaction was recently concluded in Clifton, whereby the Keating group of seven claims passed into the hands of an English company.

### Maricopa County

**ROWLEY**—Development, which has been extended 80 ft. below the water level, has disclosed three strong veins of copper-gold ore. The company is shipping the ore being taken from the drifts.

### Mohave County

**TOM REED**—The bullion from the March cleanup is valued at \$93,000.

**AMERICAN METAL MINES**—It is reported that plans are about perfected to enable the company to secure the machinery to continue the development of the property at Deluge Wash.

**GOLD REED**—This property is near the Tom Reed mine. The main shaft has reached a depth of 225 ft. on the Jupiter claim and a contract has been let to sink it to a depth of 300 ft. Another shaft is to be sunk on the Mayflower Claim.

**RAINBOW**—About 1000 tons of ore from this property has just been treated at the mill, at Needles, and it is reported that extraction was high. This mine is shipping regularly to Needles and has a large tonnage of ore broken and in sight.

**UNION BASIN MINING CO.**—The crosscut on the 300-ft. level of the Golconda mine has cut the Tub vein at a depth of about 175 ft. Some of the ore assays 30% zinc. It is reported that a Saurer truck will be used to haul the ore and concentrate to the railroad.

**GOLD ROAD**—Two bars of bullion were recently shipped, one valued at about \$25,000 and the other at \$28,000. These were part of the April production. It is stated that most of the low-grade ore, which was in the stopes at the time the company took over the property, has been removed and milled, and that a better grade of ore will hereafter be milled.

**KLONDIKE GOLD MINES CO.**—By a recent decision of Judge Duffy, in the suit of Joseph Wharton vs. the Klondike Gold Mines Co. and Charles Gracev, the Klondike Gold Mines Co. has gained clear title to the Klondike mines, which are in the Weaver district, about 30 miles west of Chloride. It is expected that the company will now commence active development work.

### Plima County

**CHESTERFIELD COPPER CO.**—Development work on the 700-ft. level has opened a shoot of ore, of which 14 in. next to the hanging wall assays \$50 per ton.

**GOLD BULLION**—The mine force has been increased and extensive development has been planned for the new strike on Last Chance Hill. Regular shipments are now being made to the Douglas smelter via Tucson, the ore returning \$40 per ton above the freight and smelting charges.

### Santa Cruz County

**ARIZONA-EUROPEAN**—This prospect near the R.R. is being opened by Schuckman, Fleishman, and other Nogales men. The showing is said to be excellent.

**ELEPHANT'S HEAD**—A force of 25 men is kept busy at work on this copper-lead property near Mt. Hopkins, and there is a report current that fine ore has been struck in the long tunnel.

**TIA JUANA**—This mine, owned by Balcom, Kane and the estate of Professor Blake, is being examined by the representatives of English copper interests. The mine lies on the south slope of the Santa Ritas at 7000 ft. elevation, and the vein carrying copper and silver is wide.

## CALIFORNIA

### Amador County

**LITTLE ILLINOIS**—It is reported that a stamp mill is contemplated, and that an assessment of 1c. per share on the stock will be levied, to raise funds for its erection.

**BUNKER HILL**—The monthly dividend of 2½c. per share was paid Apr. 15. This makes a total of 82 dividends, ranging from 2½c. to 7½c. or an aggregate of about \$750,000 in less than seven years.

**KENNEDY EXTENSION vs. ARGONAUT**—The apex suit has been again postponed owing to the continued illness of Curtis H. Lindley, attorney for the defendant. It is agreed by counsel that the suit may go to trial in September.

**CENTRAL EUREKA**—While clearing the lower levels of water accumulated following the caving of the shaft, the shaft and main levels are being retimbered or repaired. The extraction and crushing of ore will proceed more rapidly after this work is done and less time will be required to put the mine in working order.

**ONEIDA**—The former owning corporation, the Oneida Gold Mining & Milling Co., incorporated under the laws of West Virginia, is being dissolved. The present owner, the South Eureka Mining Co., recently disclosed good ore on the 1800-ft. level in a vein extending south from the South Eureka. The company contemplates putting 20 stamps of the old 60-stamp mill in commission for crushing this ore. The Oneida and South Eureka are so situated that they are economically operated jointly; but the milling is done separately as the hoisting shafts are some distance apart and both properties are equipped with stamp mills. Peter Richards, a foreman, was killed, Apr. 18, by falling from the headframe to the ground, a distance of 60 ft. His neck was broken. He was splicing a cable at the time of the accident.

### Butte County

**FORBESTOWN CONSOLIDATED**—The 20-stamp mill and 75-ton cyanide plant are in operation at the Gold Bank-Golden Queen mine.

### Eldorado County

**BIG CANYON**—This old mine, near Shingle Springs, is being unwatered and will be examined by engineers representing Englishmen.

**NOBLE**—This prospect, near Georgetown, has been bonded by J. B. Farnsworth and Fraser Bros. A 5-ft. vein of low-grade ore has been disclosed.

**BEEBE**—This mine, at Georgetown, is being unwatered. It has been idle for three months. The shaft is down 200 ft. and about 100 ft. of crosscutting has been done.

### Stanislaus County

**LA GRANGE DREDGE**—This 5-cu.ft. dredge operating on Tuolumne River was overturned Mar. 21, from a leak in the hull, and is being righted. It was expected that digging would be resumed by the end of April. A new steel spud, which weighs 19 tons, will be installed. The old spud was not worn out, but was found to be too light for the hard ground recently encountered. It weighs 16 tons, and at the time of going into commission the boat began digging in ground to which the spud was adapted. As near as could be ascertained at the time of the overturning of the dredge the leak was caused by the hull striking against a hard point of ground on the starboard bow. The boat listed rapidly and settled down, starboard side against the bank of the pond, resting at an angle of 40°. The time was less than 4½ hr. from the discovery of the leak till the boat was permanently settled. It had been digging 32 ft. below the water line and settled in 30 ft. of water. The flotation pond was lowered to 28 ft. before beginning to right the dredge. The hold is being pumped out by electric pumps, and the pulling on the righting cables will be done with an oil-fuel donkey engine.

### Trinity County

**GUGGENHEIM EXPLORATION CO.**—This company has taken options on the Alta Bert dredge and a large area of land, including lands that have been and are being prospected with Keystone drills, embracing a total of about 2000 acres on Trinity River. Of this area it is probable that about 500 acres of pay ground will be developed. The Alta Bert dredge is owned and operated by a subsidiary company of the Union Construction Co., of San Francisco. A part of the land has been drilled by the owners of the Headlight mine. The Guggenheim interests have three drills now in operation. The Alta Bert dredge has been digging in good pay gravel from the start, and is known to be a profitable investment, but the price to be obtained, if the present negotiations are completed, is sufficient inducement for the owners to withdraw from the Trinity River field and devote the capital to other fields. The options will expire July 1.

**COLORADO**  
**Boulder County**

**WHITE EAGLE MINING & MILLING CO.**—This company operates the Nil Desperandum group of mines near Sunshine, and ore is shipped to the Chamberlain-Dillingham Ore Co., at Boulder. A car of 23 tons returned Apr. 11, \$427. The mines are operated through tunnels, and at present all work is done by hand, but the installation of a compressor and machine drills at an early date for use in all development work, is contemplated. The lower tunnel, or third level, is being driven through the mountain to the Sunshine side, which will cut off about  $\frac{3}{4}$  mile of wagon haul and eliminate a rise of 154 ft. in 500. This tunnel is being driven on the vein and some excellent oreshoots are being opened for stopping. A stope is being timbered on one shoot where the ore is more than 4 ft. wide. On the second level a new stope is being timbered about 100 ft. east of the shaft. This stope will again open the oreshoot which in the upper tunnel produced more than \$50,000. On the third level east, a stope is being carried up about 125 ft. which is now coming into the junction of the north vertical and south sloping veins. The ore is at present more than 12 ft. wide. A sack of 74 lb. of high grade shipped recently from the west third level gave 185 oz. gold, and 210 oz. silver per ton, and a net return of \$121. A group of three claims, adjoining the Nil Desperandum group to the north was recently acquired by lease and bond. These were taken over not only for the ore, but because they are much lower down the mountain, so that lower tunnels can be driven. As soon as machine drills are installed it is more than likely that driving the lower tunnel east to the end of the claims, a distance of over 1900 ft. from the present workings, will be started. This will open the St. George claim for the entire length and afford over 400 ft. of stopping ground above this level. A body of low-grade ore has been exposed in the lower tunnel. This is the Maxwell Dike. It crosses the properties and is more than 83 ft. in width, and the ore assays from \$6 to \$14 per ton gold. At present no work is being done on this ore as a large mill would be required to enable it to be mined at a profit.

**Clear Creek County**

**SYNDICATE**—This mine near Dumont has been leased to Charles Lerchen who has commenced operations.

**DEER TRAIL MINING CO.**—Operations at Bard Creek will be started about May 1. Extensive development is contemplated.

**WALDORF CONSOLIDATED MINING CO.**—The property of this company in the Argentine district, was sold Apr. 15 to satisfy a judgment amounting to \$95,000, in favor of the Central Savings Bank & Trust Co., of Denver, as trustee for the bondholders.

**NEWHOUSE TUNNEL**—The charges for transportation and compressed air for power have been reduced. The haulage charge is now 1c. per cu.ft. and the charge for compressed air used in development work is \$30 per month. It is estimated that the new scale of charges will encourage development, increase the number of lessees working through the tunnel and result in more extensive operations.

**Lake County—Leadville**

**EMMET**—The 140 ft. of retimbering in the shaft on Yankee Hill, has been completed.

**PYRENEES**—Arrangements have been completed for unwatering the shaft on Carbonate Hill. Work will be started at once and when the water is out the shaft will be sunk 150 ft. deeper, making the total depth 1300 ft., and it will then be the deepest in the district.

**GREAT WESTERN**—Work has been resumed on this Prospect Mountain property, below Lake Isabel. Sinking will be continued for 100 ft. at least before drifting is started to the east and west. The bottom of the shaft is now at a contact, parts of the walls being mineralized.

**San Juan Region**

**BROWN MOUNTAIN SMELTERY**—Repairs to this smeltery are nearing completion, and the sampler is now in shape so that ore can be received.

**Teller County—Cripple Creek**

**EL PASO**—Advance reports state that the April production will exceed that of any previous month. The opening of the new shaft permits shipping one or two extra cars each day.

**WORK**—Deputy U. S. Marshall Clark, of Denver, has taken formal possession of the property on Raven Hill under a judgment of \$400,000 in favor of the Doctor-Jack Pot Mining Co.

**MICHIGAN**

**Copper**

**MASS CONSOLIDATED**—This mine was forced to close down, Apr. 26, a result of labor troubles.

**LAKE**—Shipments of about 550 tons daily are being made to the Baltic mill, yielding about 25 lb. of mineral per ton, but the refined copper yield is about 15 lb. per ton.

**KEWEENAW**—Diamond drilling is being done at this property, testing the Ashbed lode at various places. Two holes are being sunk, designated as No. 41 and 42 and should reach the lode at a depth of approximately 425 ft. Results so far have been inconclusive.

**OSCEOLA CONSOLIDATED**—The reconstruction work at the No. 1 shaft of the North Kearsarge branch is progressing satisfactorily and the shaft will probably be ready to resume operations in the early summer, which will add materially to the production. At No. 6 shaft of the main mine a series of underground electrically driven pumps is being installed and it is also planned to resume sinking at both this shaft and No. 5 of the main mine.

**NEW ARCADIAN**—The shaft at this property is being sunk deeper in the lode at a depth of about 500 ft. and the formation is heavily charged with copper. The results are

so encouraging that it has been decided to continue sinking until the formation has passed out of the shaft again and then to crosscut to the other two formations that parallel this lode, instead of starting the crosscut at a depth of 500 ft. as was first the plan.

**WYANDOT**—Development on the No. 8 lode continue satisfactory. Drifting is in progress in each direction from the bottom of the winze, which is down about 115 ft. below the crosscut which intersected the formation. This formation is soft amygdaloid charged throughout with copper that will readily be recovered by stamp-mill treatment. Considerable work has been done on this lode and its continuity has been so thoroughly established that it is likely that definite steps will be taken to open the lode on a more extensive scale. The shaft through which the lode is being opened is an exploratory shaft and the formation was reached at a depth of about 1100 ft. from the shaft by a crosscut driven at the 700-ft. level.

**MISSOURI**  
**Joplin District**

**GOBLER**—Operations are to be resumed at this mine after several months of idleness. The 150-ton mill is being overhauled.

**KATY LOU**—This lease in Chitwood Hollow, purchased by the Cripple River Hydraulic Mining Co., of New York about one year ago and operated by J. B. Shale as manager, has been sold.

**KELLER**—Double shifts are being worked in sinking a new shaft on an 80-acre lease of this land southeast of Joplin. Good lead and zinc ore has been encountered in seven drill holes at depths of 94 to 115 feet.

**QUICK SEVEN MINING CO.**—A new shaft has been sunk and a derrick erected northeast of the mill, near Neck City. The ore will be sent from the derrick to the mill over a wire-rope tramway similar to one already in use from the northwest shaft.

**GWINN LAND**—Drill prospecting which was continued on this land during the autumn and winter has been suspended. The land is north of Joplin along both banks of Spring River and while no bonanza ore was discovered, the results are said to be satisfactory.

**WANETA PEARL**—On account of this lease being on a hillside, the owners have leased a portion of the Clark & Ward land to provide a site for the sludge pond. It is a soft-ground mine between Thoms Station and Carl Junction.

**UNITED-LEHIGH MINING CO.**—After a year of active operation the mill at Carl Junction will be removed as the deposit has been worked out. It has not been definitely decided where the mill will be relocated. All tracking and underground equipment will be removed except the pumps which will be operated by the Chicago-Lehigh Co. operating on the same tract.

**WALLOWER & CO.**—The owners and lessors of the Luscombe, North and South Carterville, Homestead, Aylor, Coinfield & Burch mining lands and leases have signed contracts whereby they agree to pay to Frank Wallower and associates 5% of all mineral mined on the lands mentioned, for several years. In return Wallower agrees to install pumps with capacity sufficient to drain the mines and to keep them drained so that mining may be carried on continuously. The mines are expected to be in operation within six or seven months and about 400 men will be employed.

**MONTANA**  
**Butte District**

**PILOT-BUTTE**—The shaft has reached the 2000-ft. level and a station is being cut. Within a week or 10 days the work of crosscutting on this level, both north and south from the shaft will be commenced. A vein containing 4 ft. of good ore was cut in the shaft a short distance below the 1500-ft. level, and it is believed that a crosscut on the 2000-ft. level will intersect this ore within 75 ft. of the shaft.

**DAVIS-DALY**—In order to determine more rapidly the extent of the oreshoot recently cut on the 1400- and 1500-ft. levels of the Hesperus claim, a third shift of men has been put on. The vein has been drifted on for a distance of 100 ft. on the 1400-ft. level, the ore assaying from 4% to 10% copper and several ounces silver. Crosscutting has also been started, to cut the vein in several other places. About 100 tons of ore is being shipped daily.

**Deer Lodge County**

**OLD BONANZA**—Timothy C. Calnan has sold his interest in a group of seven claims near Silver Lake, to John Lawlor for the sum of \$2000. The claims consist of the Old Bonanza, Fourth of July, Big Fir, Mattie Mack, Monitor, Peerless and Ole.

**BIELLENBERG & HIGGINS**—The work of hauling the machinery for the mill at the head of Bear Gulch, is progressing rapidly. Two earloads have been moved as far as the mouth of the gulch, and are now being moved up a steep slide to the mine by block and tackle. It is expected to have the mill in readiness by July or August.

**Granite County**

**ROYAL BASIN MINING & MILLING CO.**—An order for \$65,000 worth of new equipment and machinery has been given. There is a wide vein of copper-carbonate ore, assaying about 4% copper in the mine. The ore is being successfully treated by leaching at a small mill and with the completion of the power line, now in course of construction from Philipsburg, the plant will be enlarged.

**Lewis & Clark County**

**ARGO**—A lease and bond has been secured on this property in the Scratch Gravel Hills by Peter Latsch, of Helena. The property was developed some time ago by Martin and Connolle, who opened some promising copper ore and erected a roll mill and concentrator.



**NEVADA**

**Comstock Lode**

COMSTOCK-PHOENIX—The tramway has been completed from the surface to Sixmile cañon.

C. & C. SHAFT—Repairs have been completed upon the 2500 station, preliminary to reopening the east drift that connects with the north drift leading to the old Ophir-Mexican winze.

CALEDONIA—By a recent court decision this company is denied the privilege of using the Overman shaft to make surveys in its property. The company will now seek to prove its right to use the shaft.

SIERRA NEVADA—In the raise about 56 ft. above the 2500-ft. level, a south drift has encountered the vein at the southerly extremity of the fault that abruptly cut off the high-grade ore on the south side of the raise. The vein where again cut is 45 ft. south of the raise, is 3 ft. wide and contains much quartz of milling grade. A raise has been started to prospect the vein above, in the belief that the continuation of the rich ore will be developed.

**Lincoln County**

HIGHLAND-MARY—This claim is shipping about one carload per month.

HOME RUN—About one carload per month of copper ore is being shipped.

MENDHA—Having secured the necessary water, this company is now installing jiggging machinery, and will commence shipments about June 1.

PROVIDENCE MINES & COMMERCIAL CO.—A small force was put to work on the Yuba East shaft about Dec. 1, and the company is now shipping about one carload monthly of silver-lead ore averaging about \$50 per ton.

NEVADA-UTAH—Although the affairs of this company have been practically untangled by Trippe & Co., at none of its properties have operations been resumed. It is probable, however, that lessees will soon commence work on the old Yuba mine, and possibly on the Half Moon.

PRINCE EXTENSION—In the wash below the Prince mine, this company is using a diamond drill in an effort to make a valid location against adverse locators. The management feels confident that it will strike the Prince bed at depth, but nothing can be exposed until the wash is penetrated.

VIRGINIA-LOUISE—A contract has been let to sink the shaft to the 500 or water level, after which a connection will probably be made with the adjoining Prince shaft for ventilation and safety. The shaft has been in ore for the last 200 ft., but no shipments will be made until the mine is properly developed, as the company is well financed.

**Lyon County**

McDONALD-BOULTER—This property in Mason Pass has recently been turned over to a syndicate represented by H. S. Brady, of Tonopah. A two-compartment shaft will be sunk to a depth of 500 ft. before drifting is started.

BURLINGTON NEVADA CO.—Ore is again to be shipped to the Thompson smeltery. It is coming from the tunnel from which several carloads have been produced in development. The shaft will not be put in commission until the hoist is installed, when, it is expected, the production will be increased.

COPPER BELT MINING & DEVELOPMENT CO.—This company has taken over the Baird property of six claims in the Mason Pass district. A working shaft is being sunk, and hoisting machinery is to be installed at once. The surface showing is prominent, and from the early development, aggregating about 1000 ft. of shallow workings, several shipments of commercial ore were made.

MONTANA-YERINGTON—The lease and option, and also the controlling interest in this property, have recently passed to C. W. Geddes. Considerable development has been done disclosing ore of good grade, several carload lots of which have been shipped with satisfactory results. A gasoline hoist of 500-ft. capacity, is now being installed, and the shaft will be sunk to this depth. Levels will be opened at 100-ft. intervals. George Wingfield and H. S. Brady, of Tonopah, are interested.

**Nye County**

SHIPMENTS in tons from Tonopah mines for the week ended Apr. 26, were as follows:

Tonopah Mining.....	3350	North Star.....	50
Tonopah Belmont.....	3956	Mizpah Extension.....	....
Montana-Tonopah.....	1092	Jim Butler.....	450
Tonopah Extension.....	1070	Tonopah Merger.....	....
West End.....	930		
Midway.....	50	Total.....	11,508
MacNamara.....	560	Estimated value.....	\$248,847

**NEW JERSEY**

**Middlesex County**

AMERICAN SMELTING & REFINING CO.—The blast-furnace forces went out on strike Apr. 27, causing that department of the Perth Amboy plant to close down.

**Morris County**

EMPIRE STEEL & IRON CO.—The strike of miners at the Mt. Hope iron mines is still unsettled. At a conference, Apr. 18, the men's requests were submitted. The company in its answer to the men declined to recognize the union. No advance in wages is possible, it was stated, at this time, since a voluntary increase was made Jan. 15. Assurance was given, however, that after the extensive improvements now under way are completed, the question of further increase in wages would be taken up. The company was willing to grant a fortnightly pay day, and to give proper notice for vacation of houses, and stated that trading at the company's stores had always been optional, and that credit had been regularly extended. It refused to discharge the men then in its employ. The answer of the company was not satisfactory to the strikers and the strike will go on. About 275 men are out, while from 70 to 80 are at work.

**NEW MEXICO**

**Colfax County**

CORA BELL—This property is just outside the Maxwell Land Grant Co. property, at a small camp called Red River City. A 10-stamp mill with tube mill and Pachuca tanks treats a petzite ore. The shaft is 100 ft. deep, and a drift has been driven 40 ft. Of two samples taken one gave \$34 over 30-in. width, the other \$22 over 60-in. width, in gold and silver.

**Socorro County**

MANY LESSEES ARE WORKING AT KELLY; the output of zinc-carbonate ores is about 1000 tons per month.

**NORTH CAROLINA**

**Randolph County**

HANNA'S CREEK GOLD MINING CO.—This company has been organized with a capital of \$60,000, to operate a gold mine near Ashboro. O. W. Williams, of Philadelphia, is president of the company, and H. H. Green, of Ashboro, is manager.

**Jackson County**

INVESTIGATIONS OF THE SILICEOUS NICKEL DEPOSITS AT WEBSTER have been made recently to determine the practicability of using these low-grade nickel-silicate ores as a flux for some copper-sulphide ores in the vicinity for the production of nickel-copper matte.

**OREGON**

**Josephine County**

RED CUB—This copper mine near Agness will be developed.

SUCKER CREEK—This placer mine has received a large shipment of hydraulic pipe and a No. 2 giant.

AJAX—In driving a crosscut from the main drift, ore was encountered averaging 10 ft. in width, and carrying gold and silver.

CALIFORNIA—Work was commenced recently on the wagon road to this property and upon its completion a mill will be built. Charles Cline is manager.

BLACK BEAR—A contract has been let for 750 ft. of tunnel on this property. The vein was encountered at a depth of 500 ft. and is 20 ft. wide. S. Buckner is superintendent.

BENTON—This company is preparing to erect a 5-stamp mill. Good ore has been encountered in the lower level. This property was worked with an arrastre for several years, but was recently taken over by Portland men.

**Lane County**

McKENZIE RIVER GOLD MINING CO.—This company has been incorporated to take over the Treasure mine in the Blue River district. There is said to be \$75,000 worth of machinery on the property, and that it is all in good condition. This mine was operated by English people for a short time and then shut down.

**Malheur County**

RED, WHITE & BLUE—A half interest in this quartz mine, which has been operated by Taylor & Worsham since last autumn, has been sold. Six stamps have been operated.

HUMBOLDT—At this mine, six miles east of Malheur, a shoot of ore on the 400-ft. level has been uncovered, which assays \$1200 per ton in gold. The mill is running night and day and more than \$60,000 is being cleaned up monthly from treating low-grade ores.

**UTAH**

**Juab County**

TINTIC SHIPMENTS for the week ended Apr. 18 amounted to 153 cars.

BECK TUNNEL—This company is now out of debt.

KNIGHT MILL—Excavating has been started for the new 100-ton mill at Silver City.

COLORADO—This property is not producing at present, but a fissure is being followed in limestone on the 500-ft. level.

MAY DAY—This company is arranging to develop below the 1100-ft. level, either by sinking the shaft, or through an adjoining property.

CARISA—Prows & Jarman, lessees on this property, are mining copper ore in the old Spy section between the 100-ft. level and the surface.

IRON BLOSSOM—A raise has been lifted 80 ft. in ore from the 500-ft. level, and 600 ft. south of this ore running well in silver and gold has been opened.

DRAGON CONSOLIDATED—This property controlled by the Knights, is being developed from the 500-ft. level of the Iron Blossom No. 1 workings, and from the 300-ft. level of the Black Jack. Steady shipments of iron ore are being made.

CENTENNIAL-EUREKA—A dividend of \$1.50 per share has just been paid. There are 100,000 shares, of which the U. S. Smelting, Refining & Mining Co. owns 99,864. Including the present distribution, dividends have amounted to \$37.50 per share since 1906.

**Salt Lake County**

SNOW IS DELAYING SHIPMENTS at several Alta mines, which are producing. Teams are now able to reach Tanner's Flat, but it will be some time before they will be able to get into the camp. Most of the snowslides of the season are over, there having been some large ones, but no damage to property was done. The roads have been buried in places. Work is being done at the Michigan-Utah, Alta Consolidated, South Hecla and Columbus Extension.

**MICHIGAN-UTAH**—During the last year, this company has been doing a limited amount of prospecting, but proposes to begin more active development.

**UTAH POWER & LIGHT CO.**—D. C. Jackling has been elected president, and W. S. McCormick, vice-president of this company, a large electric service corporation.

**COLUMBUS CONSOLIDATED**—This company has sold and transferred its property to the Wasatch Mines Co., receiving in exchange 160,000 shares of capital stock in that company. This stock will be distributed among Columbus Consolidated shareholders, there being 283,538 share outstanding.

**MONTANA BINGHAM**—A small force of men has been put to work cleaning up the tunnel, and putting things in condition for operation on a larger scale. The tunnel is in 1500 ft., and it is proposed to extend it to 4000, to prospect and drain 730 acres of mineral land in Bingham, including the Fortuna, Starless, Bingham Amalgamated, and Congor, in addition to the company's own ground.

#### Summit County

**DALY-JUDGE**—It is reported that light rails at this property are to be replaced by heavier 40-lb. rails.

**SILVER KING CONSOLIDATED**—The main shaft now being sunk is down 105 ft. from the 1300 level, a station has been cut, and sinking resumed.

**THOMPSON-QUINCY**—A fissure has been followed for 63 ft. in a raise from the 900 level, and the limestone-quartzite contact is expected shortly. The fissure is 2 ft. between walls, and is mineralized.

**GRASSELLI CHEMICAL CO.**—A lease on this company's zinc mill at Park City is reported to have been taken by Julius Frankel, to treat zinc-lead tailings from the Daly West, Daly-Judge, and Silver King Coalition mills.

**C. C. CONSOLIDATED**—Electrical connections have been completed, furnishing power for the pumps and compressor. A contract has been given to sink the shaft from the 450-ft. level. There is a possibility of cutting the ore zone of the old Crescent mine on its dip to the northwest.

#### WASHINGTON

##### Ferry County

**HARPER CONSOLIDATED**—A stamp mill is to be built this summer. Work will be started May 1. J. L. Harper, of Republic, is general manager.

**SURPRISE CONSOLIDATED MINING & MILLING CO.**—This company, capitalized for \$1,500,000, in \$1 shares, has been organized, and by a practically unanimous vote of the shareholders of the Republic Mines Corporation, at a meeting held Mar. 31, the taking over by this company of the assets of both the Republic Mines Corporation and the North Washington Power & Reduction Co., assuming the indebtedness of both, was approved, effecting virtual consolidation. The stockholders of the Republic Mines Corporation are to receive 1,000,000 shares of Surprise Consolidated stock for their holdings, and the North Washington Power & Reduction Co. investors are to receive 300,000 shares, the remaining 200,000 shares to be held in the treasury as a reserve fund. The combined liabilities of the two companies aggregate \$306,000, of which \$71,000 is charged to the Republic Mines and \$235,000 to the Power & Reduction Co. The only obstacle now in the way of consolidation is the possible refusal of the chief creditors to grant an extension of time, and a committee has been appointed to secure the consent of the creditors, to transfer the liabilities to the new company. The holdings of the Republic Mines Corporation consist of the Lone Pine, Pearl and Surprise mines at Republic, and the principal indebtedness was incurred in developing the Surprise. The North Washington Power & Reduction Co. owns the reduction works at Republic, and was organized primarily to provide treatment facilities for the Republic Mines property. If the new company is launched, it will dispose of the power franchises held by the power company, for which it is said an offer of \$75,000 has been made already, and will increase the capacity of the mill from 250 to 300 tons per day, and build a trolley line from the mines to the mill, eliminating the necessity of rehandling the ore.

##### Snohomish County

**MONTE CRISTO**—It is reported that this mine, near Monte Cristo, is to be reopened in the near future.

##### Stevens County

**COPPER HOARD MINING CO.**—This company has been incorporated and has taken over the Lookout lode claim, which will be developed this season. F. M. Jarvis, Chewelah, will have charge of the work.

#### WEST VIRGINIA

##### Harrison County

**GRASSELLI CHEMICAL CO.**—On Apr. 17, 500 employees of this company at Meadowbrook, went on strike, protesting against a sentence of six months in jail, imposed upon two of their number for carrying revolvers. The majority of the strikers are foreigners, the men in jail being Spaniards.

#### WISCONSIN

##### Platteville District

**WAGES HAVE BEEN CUT AT THE FRONTIER** and other mines, in view of the shrinkage in ore prices and the proposed tariff reductions.

**MUDDY ROADS ARE PREVENTING ORE SHIPMENTS**, except from the few mines on the railroads. The ore has been sold or contracted for, but the conditions of the roads prevent it being hauled.

**SCRABBLE CREEK**—This mine, at Hazel Green, is now shipping ore.

**LAWRENCE**—At this new mine, the shaft is being sunk, water being raised by an electric pump.

**HIRD**—Water troubles are being experienced in sinking the shaft at this mine of the Frontier Ore Co. The pumps have to raise 3000 gal. per minute.

#### CANADA

##### British Columbia

**CRAWFORD BAY**—It is reported that platinum has been found in samples of ore from this property, of which Bruce White, of Spokane, is owner.

##### Ontario Cobalt

**COBALT ALADDIN**—This company has leased the mill in the Nipissing Reduction camp in order to treat Chambers-Ferland ore.

**BURNSIDE**—It is stated that these claims, adjoining the Foster property at Kirkland Lake, have been taken over by the Cobalt Aladdin Mining Co.

**BUFFALO**—The mill report for February, shows that the mill treated 4468 tons of ore of an average assay of 47 oz. silver. A total of 185,333 oz. was recovered.

**SILVER QUEEN**—The debt of \$3000 of this company has been wiped out during the last year. The property is leased on a 25% net royalty basis to the Aladdin Cobalt Mining Co.

**BEAVER**—The company has decided not to pay the regular quarterly dividend as the money is needed for the development of the Elk Lake property in which it is interested. The annual report shows \$172,511 carried over.

**McKINLEY-DARRAGH-SAVAGE**—The production for the first quarter of 1912 was 430,923 oz. This is below the output for the corresponding period of the previous year, but as soon as the additions to the mill are completed, the output will be materially increased.

**CONIAGAS SMELTING CO.**—John W. Shriner, a farmer whose property is near Thorold, has brought an action against the company on the ground that refuse from the plant draining into a stream poisoned his cattle and that the fumes ruined vegetation. He asks an injunction against the operation of the plant and \$1000 damages.

**SHIPMENTS** of ore and concentrates in tons, from Cobalt for the week ended Apr. 26 were as follows:

Bailey.....		Kerr Lake.....	
Beaver.....	36.23	La Rose.....	160.33
Buffalo.....		Lost and Found.....	
Casey Cobalt.....		McKinley-Darragh.....	62.78
Chambers-Ferland.....		Nipissing.....	128.43
City of Cobalt.....		Nipissing Reduction.....	
Cobalt Lake.....		O'Brien.....	
Cobalt Townsite.....	75.85	Penn.-Canadian.....	
Colonial.....		Provincial.....	
Coniagas.....		Right of Way.....	
Crown Reserve.....		Seneca Superior.....	31.98
Dominion Reduction Co.....	43.97	Silver Bar.....	
Drummond.....		Silver Queen.....	
General Mines.....		Timiskaming.....	41.86
Green Meehan.....		Trethewey.....	
Hargraves.....		Wettlaufer.....	
Hudson Bay.....		Total.....	581.43

##### Ontario—Porcupine

**DIAMOND DRILLING AND OTHER OPERATIONS HAVE BEEN SUSPENDED** at Schumacker, owing to shortage of power.

**DOMELAKE**—It is expected that the new mill will soon be in operation.

**McINTYRE**—A new 12-drill compressor will be installed to enable the mine to supply the new mill.

**THREE NATIONS**—A new 5-stamp mill is being erected and should commence operations in about two months.

##### Yukon Territory

**CANADIAN KLONDIKE CO.**—The No. 2 dredge started operations at the mouth of Bear Creek, Mar. 30, which is said to be the earliest starting of dredging on record in the Yukon valley.

#### MEXICO

##### Baja California

**WEST MEXICO MINES CO.**—This Denver company announces that the building of a mill at the gold mines in the San Antonio district is under way. Development work has been going on since one year ago.

##### Sonora

**LUCKY TIGER**—In March, 2457 tons of ore was crushed at the old mill. In the stamp mill 3281 tons of ore was crushed. In the cyanide plant 5527 tons of current and 1808 tons of dump tailings were treated. The yield for the month was \$119,883, the net estimated profit being \$44,386. A refund of zinc duty, amounting to \$10,643, which had recently been paid under protest, was made, Apr. 1. Since the battle of Sept. 13, 1912, little trouble arising from revolutions has been experienced.

#### CENTRAL AMERICA

##### Honduras

**AN OPTION ON THE EXTENSIVE IRON DEPOSITS** in the Tegucigalpa district has been given to an American syndicate on a royalty basis and in connection with an arrangement to extend the government railroad to the district and to purchase the existing railroad from Puerto Cortez on the Caribbean.

#### SOUTH AMERICA

##### Colombia

**A SUIT INVOLVING THE TITLE TO PLACER LANDS** has been brought against the Breitung company, which is developing a large area of ground.

##### GERMANY

**MINERS IN THE UPPER SILESIAN COAL MINES WENT ON STRIKE**, Apr. 19, and it is said that about 50,000 men have quit work.



# THE MARKET REPORT

## METAL MARKETS

NEW YORK—Apr. 30

The metal markets have not been eventful during the week past. Prices have held fairly well, with only moderate fluctuations.

### Copper, Tin Lead and Zinc

**Copper**—The disturbed political situation abroad has brought about some liquidation in the standard market, and quotations for standard copper are now again considerably below the parity of the refined copper. In consequence there is a considerable amount of arbitrage trading on part of European dealers, who are thus in a position to offer electrolytic copper at a price rather lower than the quotations which have been ruling recently. American interests desiring to move copper have been obliged, of course, to make concessions. Some moderate sales for export were made, but on the whole the market ruled extremely dull throughout the week. Domestic consumption continues good, but buyers are well supplied, and, under present conditions, not interested in entering into further contracts. Some of the agencies continue to ask 15½c., delivered, usual terms, but others offer at 15½c. and have accepted 15.45c. The close is more or less nominal at 15½@15¾c., cash, New York, for Lake copper, and 15.20@15.30c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 15.10@15.15c. as an average for the week.

There has been considerable bear speculation throughout the week, but as long as electrolytic copper is holding at its present level, there is not much room for a further decline in prices for standard, which close steady at £67 2s. 6d. for spot, and £67 2s. 6d. for three months.

Base price of copper sheets is 21@22c. per lb. Full extras are charged, and higher prices for small quantities. Copper wire is 16½c. carload lots at mill.

Copper exports from New York for the week were 9107 long tons. Our special correspondent gives the exports from Baltimore at 3657 tons for the week.

**Tin**—The London market displayed a good deal of firmness throughout the week. Especially was the strength pronounced in spot tin, while less interest was shown in futures. In consequence thereof, the backardation amounts now to over £10 per ton, no doubt brought about by the buying of spot tin in order to cover the shorts falling due at this time. The domestic market shows remarkable apathy, and there is hardly any demand so far as consumers' business is concerned. Sellers continue to be anxious to dispose of their holdings and are offering it at from ¾@½c. below the import price. The market abroad closes firm at £230 10s. for spot, and £220 5s. for three months, and easy here at about 49¾c. for May.

Tin output of the Federated Malay States for the three months ended Mar. 31 was 11,536 long tons in 1912, and 10,844 in 1913; decrease, 692 tons.

**Lead**—The market has quieted down considerably. The close is steady at 4.50 New York, and 4.32½@4.37½ St. Louis.

The London market has fluctuated within narrow limits and the close is undecided at £17 12s. 6d. for Spanish lead, and 7s. 6d. higher for English.

**Spelter**—The heavy output is still pressing on the market, as consumers are disinclined to take hold on a liberal scale even at the very attractive prices which are now being quoted by various sellers. The close is easy at 5.30@5.40c. St. Louis, and 5.45@5.55c. New York.

The London market is unchanged at £25 10s. for good ordinaries and £25 17s. 6d. for specials.

The strike at the Meadowbrook works of the Grasselli Chemical Co. is still on.

Base price of zinc sheets is now \$7.75 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

The Altoona Zinc Smelting Co. has been incorporated by the American Metal Co. as the operating company for the smelting works at Altoona, Kan.

Imports at Baltimore for the week ended Apr. 26 included 701 tons of zinc ore from Rotterdam.

### Other Metals

**Aluminum**—The market is still inclined to be quiet, and sales are only moderate, largely of small lots. The quotation is a shade easier, 26¾@27c. per lb. being asked for No. 1 ingots. The foreign market is steady.

**Antimony**—Without any marked change the market is steadier, with a firmer tone. Stocks are being reduced and better business is expected. Current quotations are 9@9¼c. per lb. for Cookson's; 8¾@8¾c. for Hallett's; 7¾@8c. for Chinese, Hungarian and other outside brands.

**Quicksilver**—The market is still rather quiet with prices inclined to be easy. New York price is \$39 per flask of 75 lb., with 58c. per lb. for small lots. San Francisco, \$38.50 for domestic orders and \$36 for export. The London price is £7 10s. per flask, with £7 2s. 6d. named from second hands.

**Magnesium**—The price of pure metal is \$1.50 per lb. for 100-lb. lots, f.o.b. New York.

### DAILY PRICES OF METALS

#### NEW YORK

Apr.	Sterling Exchange	Silver	Copper		Tin Cts. per lb.	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.		New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
24	4.8665	60½	15½ @15½	15.25 @15.35	49	4.50	4.35 @4.37½	5.50 @5.55	5.35 @5.40
25	4.8665	60½	15½ @15½	15.20 @15.30	49½	4.50	4.35 @4.37½	5.50 @5.55	5.35 @5.40
26	4.8655	60½	15½ @15½	15.20 @15.30	49½	4.50	4.35 @4.37½	5.50 @5.55	5.35 @5.40
28	4.8665	60½	15½ @15½	15.20 @15.30	49½	4.50	4.35 @4.37½	5.55 @5.55	5.30 @5.40
29	4.8670	60½	15½ @15½	15.20 @15.30	49½	4.50	4.35 @4.37½	5.45 @5.55	5.30 @5.40
30	4.8670	60½	15½ @15½	15.20 @15.30	49½	4.50	4.35 @4.37½	5.45 @5.55	5.30 @5.40

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

#### LONDON

Apr.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
24	27½	67	67½	73½	226	221½	18½	25½
25	27½	67½	67½	74	228	222½	18	25½
26	27½	.....	.....	.....	.....	.....	.....	.....
28	28¼	67½	67½	73½	227½	221½	17½	25½
29	27½	67½	67½	73½	229	220	17½	25½
30	27½	67½	67½	73½	230½	220½	17½	25½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, pot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¼c.

**Nickel**—Shot, block and plaquettes are quoted at 40@45c. per lb., according to quality and size of order. Electrolytic nickel is 5c. per lb. higher.

**Imports and Exports in Great Britain** of metals other than iron and steel, are reported for the three months ended Mar. 31, as follows, in long tons, except quicksilver, which is in pounds:

	Imports		Exports	
	1912	1913	1912	1913
Copper.....	35,537	32,560	15,207	18,303
Tin.....	12,874	12,248	14,543	17,508
Lead.....	52,925	52,878	11,544	14,179
Zinc.....	33,972	34,235	2,135	2,148
Quicksilver, lb.....	1,471,960	980,303	667,625	744,753
Minor metals.....	1,813	2,162	6,649	7,484
Ores, etc.:				
Tin ore.....	7,562	8,163		
Pyrites.....	251,329	247,438		

Exports include reexports of foreign material. Copper figures include metallic contents of ore and matte.

**Exports of metals and minerals from Spain in January**, reported by the "Revista Minera," in metric tons:

	Metals		Ores	
	1912	1913	1912	1913
Copper.....	9,030	1,430	709,926	843,452
Copper precipitate.....	1,345	1,896	15,581	15,747
Lead.....	934	372		
Zinc.....	10,892	15,478	179	189
Quicksilver.....	495	7	11,482	12,687
Manganese.....	209	2		
Pyrites.....			2,708	2,291
			205,072	294,066

Pyritic ores carrying 2.5% or over in copper are classed as copper ore; below that point they are classed as pyrites. Exports of salt were 34,560 tons in 1912, and 37,150 tons this year.

### Gold, Silver and Platinum

**Gold**—The price of gold on the open market in London continued at the Bank level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. In New York a total of \$1,300,000 gold was taken this week for shipment to Canada.

**Platinum**—Business is good and the market is steady and unchanged. Dealers ask \$45@46 per oz. for refined platinum, according to size of order. Hard metal—platinum-iridium alloy—is \$49@53 per oz., according to proportion of iridium. The foreign market is strong and there is some talk of higher prices.

**Silver**—The market received an impulse owing to the prospect and final negotiation of the Chinese loan; but owing to the "Senate" having refused acceptance of the loan negotiations and settlement, the whole matter is again in an unsettled state, and silver is quiet at 27½d. in London.

Exports of silver from London to the East, Jan. 1 to Apr. 17, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India.....	£2,213,300	£2,501,300	I. £288,000
China.....	520,000	166,000	D. 354,000
Total.....	£2,733,300	£2,667,300	D. £ 66,000

Exports of silver from New York week ended Apr. 26 were \$1,053,214, to London and Paris. Imports were \$219,912, from Mexico and South America.

Imports of gold in Great Britain, two months ended Feb. 28, were £7,349,019; exports, £8,338,426; excess of exports, £989,407, which compares with an excess of imports of £930,222 last year.

Imports of silver in Great Britain two months ended Feb. 28 were £3,620,505; exports, £3,049,951; excess of imports, £570,554, which compares with an excess of exports of £124,448 last year.

### Zinc and Lead or Ore Markets

#### JOPLIN, MO.—Apr. 26

The high price of zinc blende is \$47, the base per ton of 60% zinc ranging from \$42@44. Calamine sold at \$19@22 per ton of 40% zinc. The average all grades is \$40.16. Lead prices advanced 50c. to \$1, placing the base per ton of 80% metal contents at \$53@53.50. The average all grades is \$52.40 per ton.

#### SHIPMENTS WEEK ENDED APRIL 26

	Blende	Calamine	Lead ore	Value
Totals this week.....	12,455,660	1,207,210	1,412,370	311,385
Four months.....	182,145,860	12,417,330	31,686,150	5,292,018
Blende value, the week, \$260,276; four months, \$4,284,611.				
Calamine value, the week, 14,106; four months, 170,788.				
Lead value, the week, 37,003; four months, 836,619.				

#### PLATTEVILLE, WIS.—Apr. 26

The base price paid this week for 60% zinc ore was \$40@44 per ton. The base price paid for 80% lead ore was \$52@54 per ton.

#### SHIPMENTS WEEK ENDED APRIL 26

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week.....	2,943,150	366,660	1,511,420
Year to date.....	45,703,220	2,055,900	20,499,570

Shipped during week to separating plants, 3,389,680 lb. zinc ore.

## IRON TRADE REVIEW

#### NEW YORK—Apr. 30

The iron and steel trades continue in very much the same condition as last reported. Specifications on contracts come in freely. Some works in eastern territory complain of the lack of new orders, but in the Central West makers are not finding any fault with the bulk of business coming to them.

An important transaction announced is the purchase by the Bethlehem Steel Corporation of the Fore River Shipbuilding Works in Massachusetts. With the plants which the Bethlehem Co. already owns at Wilmington, Elizabethport, and San Francisco, this purchase will make it about the largest shipbuilding concern in the country. The Fore River plant has a number of contracts on hand and has a well equipped yard, and it will furnish an outlet for a large quantity of the plates, shapes, and other material manufactured at Bethlehem.

#### PITTSBURGH—Apr. 29

There is no material change from last week in the actual flow of business to the steel mills, but the tone of the market is somewhat improved, by way of there being more confidence in the mills being able to run at substantially the full gait for several months. The sudden decrease in the volume of business coming out two or three weeks ago administered a mild shock to confidence, perhaps merely because the flow of business had been so uniformly full for months. It is now recognized that the let-up is of small proportions, as the total volume of specifications averages fully 75% of the current shipments, and with so large an accumulation of business on books it would require a period of months of this reduced rate before the mills would be forced to slow down much in the rate of production. Naturally there is no definite assurance that the next change will be toward a greater volume of business, but the chances are at least even. It is pointed out that as in most lines the mills are practically filled with specifications to run them into the fall, for buyers to specify freely at this time would mean that they were anxious to cover for deliveries late in the year, and this would be unnatural at this season.

Prices are held with remarkable firmness in the circumstances, there being practically no shading in the fundamental finished lines, outside of that in galvanized sheets mentioned a week ago, and which bears promise of filling up the few mills which are now insufficiently provided with tonnage. There has been a loosening up in billets and sheet bars, particularly for forward delivery, which is very welcome to buyers and has not even yet brought such material down to its proper relation with finished material prices.

**Pig Iron**—The market continues practically stagnant, but the hopes of furnaces are increased that there will be an early buying movement, as buyers are very indifferently covered, and steel-mill consumption is certain to be heavy for months. Already the price decline has been sufficient to shake out practically all profit for the less well positioned furnaces, in view of the much higher prices for coke and ore, with slightly higher labor costs, than prevailed at the last low point for pig iron, and any further decline would result in decreased production, whereas the decline in stocks to the lowest point for a long time indicates that production and consumption are even now well balanced. Foundry iron has declined on offerings, without there being any transactions of moment, while other prices are unchanged, and we quote: Bessemer, \$17; basic, \$15.75; malleable, \$15.50; foundry, \$15; forge, \$14.50, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

**Ferromanganese**—The market continues stagnant. Consumers are well provided for their immediate wants, and will not consider forward purchases until there is time to develop whether the foreigners will stand any part of the contemplated increase in the tariff, since contracts are always written with a duty clause, putting advances on the purchase. We quote prompt and forward at \$61, Baltimore.



**Steel**—While deliveries of billets and sheet bars on contract are practically as unsatisfactory as ever, there is a definite loosening up in market offerings, particularly for forward delivery. This establishes a definite forward market, which has been lacking for several months. During this period the only quotable market has been for prompt shipment, which would naturally command a premium. We have been quoting billets at \$29 and sheet bars at \$30, this being for prompt shipments, and the resumption of quotations for forward delivery makes the decline look more pronounced than is really the case. We quote prompt billets at \$28.50 and prompt sheet bars at \$29, at maker's mill, Pittsburgh or Youngstown, this being based on a late sale of 300 tons of sheet bars at \$29, and representing an actual decline of \$1 a ton, while the prices quoted may possibly be shaded shortly. For forward delivery, beginning July, we quote billets at \$27@27.50 and sheet bars at \$27.50@28, there having been sales at the lower figure, and offerings at present at least at the higher figure. It should be mentioned, however, that information has just developed of a recent sale of April sheet bars at about \$26.50, maker's mill, which suggests that the quoted prices might be shaded materially.

**Sheets**—Mills which contracted freely some time ago are receiving specifications very freely, practically equal to their current shipments, this being the case both with the leading interest and with several large independents. There are, however, a few mills not so provided, which are eager for business, and these are freely offering galvanized sheets at 3.40c., a concession of \$2 a ton, as mentioned last week. Occasionally black sheets are offered at \$1 a ton concession, but this appears to be relatively infrequent. The mills, which are well filled, report turning away considerable tonnage offered at cut prices, and the prediction is that the weak mills will shortly become comfortably filled. Blue annealed sheets are firm, with some mills filled up solidly for more than three months. We quote: Blue annealed, 10-gage, 1.75c.; black, 28-gage, 2.35c.; galvanized, 28-gage, 3.40@3.50c.; painted corrugated, 2.55c.; galvanized corrugated, 3.50@3.55c. per pound.

**The United States Steel Corporation** reports for the quarter ended Mar. 31 the net earnings over working expenses and renewals as below, comparisons being made with the first quarter of 1912:

	1912	1913
January.....	\$5,243,406	\$11,342,533
February.....	5,427,320	10,830,051
March.....	7,156,247	12,254,217
Quarter.....	\$17,826,973	\$34,426,801
Sinking funds, special renewals, etc.....		\$8,730,292
Interest on bonds.....		5,668,209
Total charges.....		\$14,398,501
Surplus for the quarter.....		\$20,028,300
Dividends—1½% on pref. and 1¼% on common.....		12,658,700
Undivided balance.....		\$7,369,600

No special appropriations are reported made. The net earnings show an increase of \$16,599,828 over the first quarter of last year, but were \$758,756 less than in the December quarter.

**IRON ORE**

It is reported that Philadelphia parties who own iron-ore deposits in El Pluton and Las Truchas in Guerrero, Mexico, are making arrangements to explore and open them, so that they may be in condition to ship ore to the Eastern markets, as soon as the Panama Canal is opened, and shipments to Eastern ports direct are possible.

An important merger of Lake transportation interests was completed in Cleveland this week. The new concern is known as the Inter-Lake Steamship Co., and includes the Lackawanna, Acme, Mesaba, Provident and Standard Steamship companies, the Huron Barge Co. and the 17 vessels recently sold by the receiver of the Gilchrist Co. The consolidated company owns 39 vessels, with a total freight capacity of 295,000 tons. It will issue \$6,500,000 stock and \$3,000,000 bonds. Pickands, Mather & Co., of Cleveland, are the controlling interest, and the vessels will be used in the iron-ore and coal trades.

**CHEMICALS**

NEW YORK—Apr. 30

The general trade continues steady with a fair amount of business forward.

**Arsenic**—The market remains very dull; manufacturers of insecticides are through with their purchases for the season,

and there is little doing. Quotations are \$3.90@4.12½ per 100 lb., and are rather nominal at those figures.

**Copper Sulphate**—Business is steady with sales at a fair rate. Questions are unchanged at \$5.25 per 100 lb. for carload lots and \$5.50 per 100 lb. for smaller parcels.

**Nitrate of Soda**—Business has been quiet, with comparatively little doing, since the spring trade is pretty well over. Quotations are rather easier at 2.60c. per lb. for spot, 2.57½c. for May, 2.55c. for June, 2.50c. for July and August and 2.47½c. for later deliveries.

**PETROLEUM**

Oil production in California in March was 8,184,809 bbl. For the three months ended Mar. 31, the total production was 23,069,906 bbl.; deliveries, 22,871,771 bbl.; stocks reported, 46,996,189 bbl. at close of March.

**COPPER SMELTERS' REPORTS**

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

	Dec.	Jan.	Feb.	March
Alaska shipments.....	3,766,029	1,668,328	660,250	472,293
Anaconda.....	23,400,000	21,000,000	21,250,000	22,900,000
Arizona, Ltd.....	3,100,000	3,100,000	3,000,000	3,200,000
Copper Queen.....	8,805,568	7,554,966	6,855,796	7,558,709
Calumet & Arizona.....	5,840,000	4,750,000	4,500,000	4,250,000
Chino.....	3,368,850	2,903,030	3,133,638	4,449,884
Detroit.....	2,389,875	1,769,071	1,39,377	1,640,671
East Butte.....	1,314,021	1,469,000	1,500,000	1,400,000
Mammoth.....	1,850,000	1,957,804	1,41,150	1,641,091
Giroux.....	625,000	650,000		
Mason Valley.....	1,550,000	1,575,103		
Nevada Con.....	3,975,631	4,169,705	4,798,531	
Ohio.....	566,816	492,760	379,849	596,651
Old Dominion.....	2,727,000	2,727,000	2,381,000	2,853,000
Ray.....	3,638,500	3,610,000	3,610,000	4,287,400
Shannon.....	1,361,420	1,232,000	1,152,000	1,260,000
South Utah.....	nil	nil	nil	
United Verde*.....	3,000,000	2,900,000	2,750,000	
Utah Copper Co.....	5,676,484	7,182,495	7,585,303	9,248,880
Lake Superior*.....	18,300,000	17,500,000	19,000,000	19,000,000
Non-rep. mines*.....	7,750,000	7,500,000	7,000,000	8,000,000
Total production.....	103,005,194	95,711,259		
Imports, bars, etc.....	28,761,087	34,026,236	21,372,292	
Total blister.....	131,766,281	129,737,495		
Imp. in ore and matte.....	10,385,662	7,563,758	9,459,432	
Total American.....	142,151,943	137,301,253		
Miami†.....	2,913,840	2,932,369	2,817,200	3,102,200
Shattuck-Arizona.....		1,381,422	1,136,480	1,234,450
Brit. Col. Cos.:				
British Col. Copper.....			1,740,000	1,967,962
Granby.....		1,792,245		
Mexican Cos.:				
Boleo†.....	2,480,240	2,658,880	2,535,680	2,204,720
Cananea.....	5,592,000		4,880,000	4,772,000
Moctezuma.....	2,793,781	2,913,294	2,730,514	3,062,159
Other Foreign:				
Braden, Chile.....	910,000	1,484,000	1,178,000	1,472,000
Cape Cop., S. Africa.....	750,560	770,540		732,480
Kyshtim, Russia.....	1,489,600	1,644,160	1,352,960	
Spassky, Russia.....	974,400	974,400	1,003,520	
Exports from:				
Chile.....	7,392,000	6,752,000	5,824,000	7,840,000
Australia.....	9,856,000	9,744,000	5,512,000	6,944,000
Arrivals in Europe†.....	16,363,200	17,689,280	8,509,760	15,585,920

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

**STATISTICS OF COPPER**

Month	United States			Visible Stocks.		
	U.S. Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
III, '12	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV.....	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V.....	126,737,836	72,702,277	69,485,945	69,066,021	134,170,000	199,242,029
VI.....	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII.....	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII.....	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX.....	140,089,819	63,460,810	60,264,796	46,771,374	113,568,000	160,269,374
X.....	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI.....	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII.....	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452			
I, 1913.	143,479,625	65,210,030	60,383,845	105,212,582	78,491,840	183,904,422
II.....	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III.....	136,251,849	76,585,471	77,699,306	122,302,800	81,244,800	203,547,600
IV.....				104,269,270	87,180,800	191,450,070

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Table with columns: Company, Delinq, Sale, Amt. Lists various companies and their assessment details.

Monthly Average Prices of Metals

SILVER

Table showing monthly average prices for silver in New York and London from 1911 to 1913.

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

COPPER

Table showing monthly average prices for copper in New York (Electrolytic and Lake) and London (Standard) from 1912 to 1913.

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

TIN

Table showing monthly average prices for tin in New York and London from 1912 to 1913.

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

LEAD

Table showing monthly average prices for lead in New York, St. Louis, and London from 1912 to 1913.

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

SPELTER

Table showing monthly average prices for spelter in New York, St. Louis, and London from 1912 to 1913.

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

PIG IRON IN PITTSBURG

Table showing monthly average prices for pig iron in Pittsburgh (Bessemer, Basic, No. 2 Foundry) from 1912 to 1913.

STOCK QUOTATIONS

Table of stock quotations for Colorado Springs and Salt Lake, listing company names and bid prices.

TORONTO

Table of stock quotations for Toronto, listing company names and bid prices.

SAN FRANCISCO

Apr. 29

Table of stock quotations for San Francisco, listing company names, bid prices, and other details.

N. Y. EXCH.

Table of stock quotations for New York Exchange, listing company names and bid prices.

N. Y. CURB

Table of stock quotations for New York Curb, listing company names and bid prices.

BOSTON CURB

Table of stock quotations for Boston Curb, listing company names and bid prices.