

# The Engineering and Mining Journal

VOLUME 95

FEBRUARY 1, 1913

NUMBER 5

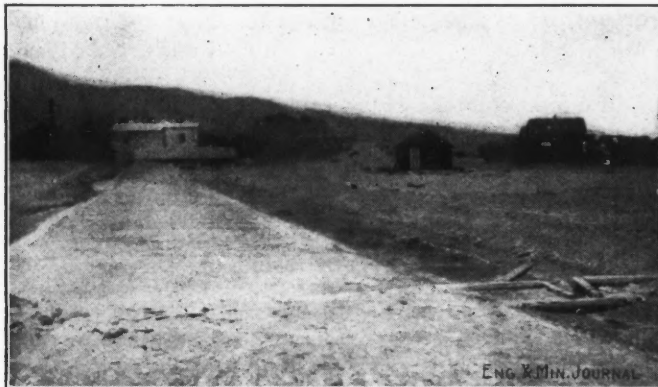
## The Searles Lake Potash Deposit

BY C. E. DOLBEAR\*

Between the Slate and Argus ranges of mountains just south of the boundary line between Inyo and San Bernardino Counties in California lies the floor of an ancient lake. This lake bottom has recently come into prominence on account of the large amount of soluble potash and other salts found there. The bottom is locally known as Searles Lake and sometimes Borax Lake. It is not a lake, however, as there is no water above the level of the bottom.

### DEPOSIT HAS BEEN MISREPRESENTED

There has been much printed in various journals and magazines concerning this deposit but I have failed to find a single article that was not chiefly characterized by "facts that are not so."



SODA WORKS FROM THE SOUTH

As I originally acquired this property over seven years ago and have spent much time and money developing it and have before me full logs and analyses of many borings over a considerable portion of the bottom, I am in a position to state "facts that are so," and believe that these facts will be of interest to a large number of people, and as there is no longer reason to suppress the facts I will endeavor to give details that will convey some idea of the true nature and extent of the deposit.

About 10 years ago I began an investigation of alkali lakes and ancient alkali-lake bottoms, having in view the possibility of finding one containing a large amount of sodium carbonate in such condition that it could be readily reduced to soda ash.

The investigation was carried on over most of the arid regions of the United States and Mexico, and a large

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amount of data was collected that is of value and interest now that potash salts are so much in demand.

### CHARACTER OF THE SEARLES LAKE DEPOSIT

The result of the search was the acquiring of Searles Lake. This deposit is on and under the floor of an ancient lake the old shore line of which is still visible for many miles along the mountain sides about 600 ft. above the bottom. The area of the bottom is about 40,000 acres. A considerable area at the southern end of the bottom is covered with detritus from the valley and mountains beyond. Other portions are composed of efflorescent crusts from a fraction of an inch to several feet thick, and still other portions are composed of clay muds. In some places these clays are firm and in others they are so soft that they are treacherous to pass over.

The muds are permeated with water containing soluble salts, which when they become thoroughly dry, are very



HAND DRILLING AT SEARLES LAKE, CALIF.

hard. This mud area is annular in shape, surrounding the central portion of the bottom. As the main portion of the mud area is approached the mud becomes softer and wetter. Presently a thin layer of crystalline salt appears on the surface. This rapidly becomes thicker and if a bar is plunged into the underlying mud, crystalline masses are encountered imbedded in the mud and presently a solid bed of underlying crystalline material is encountered. This underlying bed rises nearer and nearer the surface as one goes farther into the central portion of the "lake." Presently the overlying and underlying crystalline bodies meet and become a solid pinkish-white smooth hard salt floor extending over an area of about 12 square miles.

### RESULTS OF BORINGS

During the winter and spring of 1911, Smith Emery & Co., of San Francisco examined this solid salt

floor, by making many borings. The log given below is a fair example of all the borings within this wet-bed area.

SAMPLE BORINGS IN SEARLES LAKE							
Depth (feet)	Insol.	NaCl	Na <sub>2</sub> SO <sub>4</sub>	Na <sub>2</sub> CO <sub>3</sub>	NaHCO <sub>3</sub>	Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub>	H <sub>2</sub> O
0-18	0.2	79.7	7.6	3.2	0.0	tr	3.3
18-25	1.4	44.0	30.5	14.8	2.5	1.0	5.8
25-30	1.4	47.3	28.1	10.6	0.0	2.0	10.6
30-35	3.0	42.7	17.1	19.1	5.9	2.0	10.2
35-50	1.4	43.5	22.3	9.5	2.5	5.5	15.3
50-65	tr	82.8	10.6	3.2	0.8	tr	2.6
65-79	tr	19.0	7.3	40.3	18.5	0.5	14.4

These borings were made over the salt-bed area at intervals of from one-half mile to one mile and determined the following facts; that the average thickness of the soluble-salt bed is a little over 70 ft. That the first 23 ft. is mostly sodium chloride with a greater or less amount of impurity in the form of sodium sulphate and small amounts of sodium carbonate and borax. That the underlying 47 ft. is composed of strata of mixed sodium chloride, sulphate, carbonate, bicarbonate and borax together with potassium chloride.

It will be noted that the log above shown does not account for any potassium salts.

#### POTASSIUM NOT LOOKED FOR AT FIRST

The presence of potassium was not suspected at the time of these analyses and consequently as all chlorine was calculated as sodium chloride, potassium chloride is included in the percentages given of sodium chloride.

The ultimate average analysis made following this series of determinations revealed for the first time the presence of potassium salts. The richest layer of sodium carbonate is at the bottom of the deposit, while the whole deposit is permeated with lime that is saturated with the various salts of the deposit.

A boring made outside of the salt-bed area gave the results shown in the accompanying table. These accord

BORINGS OUTSIDE SALT-BED AREA							
Depth (feet)	Insol.	NaCl	Na <sub>2</sub> SO <sub>4</sub>	Na <sub>2</sub> CO <sub>3</sub>	NaHCO <sub>3</sub>	Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub>	H <sub>2</sub> O
0-13	Mud						
13-20	8.3	66.8	1.0	11.7	5.0	0.4	6.8
20-25	tr	98.4	0.8	1.8	0.0	0.0	0.0
25-30	1.4	15.3	4.7	38.7	24.4	tr	15.5
30-35	15.0	39.6	2.3	16.4	3.4	5.56	12.74
35-40	33.4	17.5	3.9	14.85	4.7	5.6	20.05
40-45	36.0	9.8	2.9	12.05	0.4	6.57	26.28
45-50	32.5	9.0	2.6	21.2	3.8	0.0	30.9
50-53	30.7	8.3	2.8	23.3	7.6	tr	27.8
53-55	31.0	9.0	2.8	21.2	10.9	0.0	25.1
55-60	26.9	5.8	1.9	26.5	14.3	tr	24.6
60-65	3.2	4.5	38.0	28.6	10.1	tr	10.6
65-70	6.8	5.1	6.8	43.5	21.0	tr	16.8
70-75	7.6	4.0	2.8	53.0	16.0	0.0	16.8

with results obtained by others from borings made north and northwest of the salt-bed area. Except for the first 12 ft. of the soluble salts in the boring, the carbonates of soda were present all through in decidedly greater ratio than is shown by any boring in the salt-bed area.

Another interesting revelation made by this boring is the unusual amount of borax at the depth of 30 ft. to 45 ft. The data at hand show a gradual decrease in sodium-carbonate content and a corresponding increase in sodium-chloride content as the center of the deposit is approached from the north. All of the deposit is coarsely crystalline in structure, much honeycombed, and the interstices are filled with a brine saturated with all of the salts of the deposit except sodium bicarbonate which is nearly insoluble in the solution of the other salts.

#### CALCULATION OF SALT CONTENTS

This brine has a specific gravity of 1.3. The analysis of the brine shows remarkable regularity of content throughout the whole of the underlying beds; that is,

below the first 23 ft., one hundred pounds of this brine carries, on the average, dissolved salts in the following amounts: Sodium chloride, 16.77 lb.; sodium sulphate, 5.46; sodium carbonate, 4.61; sodium baborate (anhydrous), 1.32; potassium chloride, 4.49; total, 32.65 pounds.

The salt obtained by evaporating to dryness and calcining the product to expel combined water analyzes as follows: Sodium chloride, 51.3%; sodium sulphate, 16.7; sodium carbonate, 14.1; sodium baborate, 4; potassium chloride, 13.8%. This brine constitutes approximately 18% of the total weight of the mass of the deposit.

The brine carrying the more valuable salts occurs below the sodium-chloride bed. The underlying bed averages approximately 47 ft. thick. The area of the bed explored is 12 sq.mi. The total weight of the underlying bed is then approximately 800,000,000 tons, and 18% of this is 144,000,000 tons.

#### ESTIMATED TONNAGES IN BRINE AND IN SOLID DEPOSIT

As the brine carries an average of 4.49% potassium chloride the tonnage of that salt in solution is then 4.49% of 144,000,000 or 6,465,600 tons. The brine also carries 1,900,000 tons of anhydrous borax, equivalent to 3,400,000 tons of commercial borax. Also the brine carries 6,630,000 tons of sodium carbonate.

The solids of the deposit below the sodium-chloride bed have the following average analysis: Insoluble (sand etc.), 1.44%; sodium chloride, 45.90; sodium sulphate (anhydrous), 22.80; sodium carbonate (anhydrous), 16.57; sodium bicarbonate, 6.50; sodium baborate (anhydrous), 2.32; potassium chloride, 3.64 per cent.

The total amounts of the valuable salts in solid form is then: Sodium carbonate, 108,500,000 tons; sodium bicarbonate, 42,700,000 tons; sodium baborate (anhydrous), 15,200,000 tons = 27,300,000 tons of commercial borax; potassium chloride, 23,900,000 tons.

#### BRINE FLOWS FREELY THROUGH DEPOSIT

That the brine is free to flow through the solids is shown by boring a well into the material. A 6-in. well bored through the deposit and cased through the top or sodium-chloride bed will flow brine so fast that a 3-in. centrifugal pump cannot lower the hydrostatic level of the brine in the casing more than two inches. This means that a 6-in. hole will yield not less than 3000 tons of brine per day.

The evaporative power of the air at the deposit was measured during the summer of 1910. The average for the month of July was 1.7 in. per day and for August 1.6 in. per day. The rate of evaporation of saturated brine is 63% of the rate for pure water. Consequently the rate of brine evaporation for these two months was 1.07 in. and 1.01 in. respectively.

The brine of the salt bed is encountered within a half-inch of the surface and the surface is kept constantly damp by capillary action.

Supposing the rate of evaporation to be only one-tenth of what it would be if the brine were exposed directly to the air, the evaporation over the area of the salt bed would amount to approximately 250,000 tons per day.

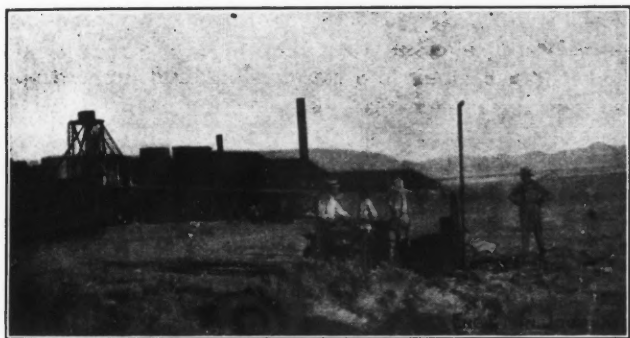
Pumping any given amount from the deposit would have the effect of lowering the level of the brine in the

bed until the evaporation is cut down by an amount equal to that removed by pumping. In other words the amount of evaporation will be cut down to a point where the sum of water evaporated plus the sum of the water pumped is equal to the inflow of water into the bed. Any fresh water running into the bed will, of course, dissolve the salts with which it comes in contact and shortly become saturated with them all so that the solid body of salts will act as a storehouse to furnish brine for a long time to come.

The brine alone contains sufficient potassium chloride to supply the United States with that salt at the present rate of consumption for 16 years, supposing there to be no renewal of the brine. With renewal as above suggested the deposit is capable of supplying potassium chloride at the present rate of consumption for at least 70 years.

#### SEARLES LAKE NOT A DEPARTMENTAL DISCOVERY

In passing I wish to state in fairness to myself that the departments of the Government which reported this deposit as a great discovery of theirs, obtained their data from me, directly and indirectly, before their representatives went near the deposit. I have had full knowledge of the existence of potash in commercial quantity at this deposit, since the middle of May, 1911, and wrote a full



CALIFORNIA TRONA CO.'S PLANT—SEARLES LAKE IN THE RIGHT BACKGROUND

report on the subject eight months before any official of the Government suspected the existence of such a deposit. In fact a copy of my report accidentally getting into outside hands was directly responsible for the knowledge of the existence of this deposit reaching these departments.

In fairness to the Geological Survey, I will say I have recently received their apology for the announcement of this discovery being made as it was. This will probably clear up some points of the controversy that took place between the department and the mining papers last spring.

The mining papers were correct. The department's workers did not make the discovery. They were wrong in their assumption that the owner did not know of its existence and also concerning the extent of the deposit. They could scarcely be otherwise for they had no data and the amounts are so enormous that nobody can be blamed for doubting such an announcement unsupported.

The illustrations accompanying this article show Searles or Borax Lake and the soda-ash works there. So far as I know, at this writing (November, 1912), no pictures hitherto published, were taken within 50 miles.

During the year 1909 the California Trona Co., the owners of this deposit, erected a plant for the manufacture of soda ash. The plant is situated at the edge of the deposit and has a daily capacity of 100 tons. This plant has never been commercially operated as the English company from which the Trona company borrowed a part of the money used in the erection of the plant, became involved in litigation with the Trona company and the matter is still being fought out in the courts.

Unless some adjustment is reached by the principals in their litigation this splendid property is unlikely to produce potash for the American farmer for many years to come. Here is ample potash for generations, unavailable while the whole country is in crying need for relief from the extortions of the Germans. The German Kali Syndicate is the only gainer by the fight. However, I have succeeded in finding another deposit of potash. It is not so large but still is capable of furnishing an amount equal to the entire supply of the United States for some years.

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### Copper Smelters and Extractors in Great Britain

The following list of copper smelters and extractors in Great Britain supplements the article given on p. 56, of the JOURNAL of Jan. 11, 1913, dealing with the world's refining capacity: Bede Metal & Chemical Co., Hebburn-on-Tyne; Black Vale Smelting Works, Swansea; Briton Ferry Copper Works (Cape Copper Co.); Broughton Copper Works, Manchester; Bedminster Smelting Works (Copper Pass & Son), Bristol; Central Metal & Smelting Co., Glasgow; Dennis, Jas. H. & Co., Liverpool; Gibb Street Works (Stephen Cox & Co.), Birmingham; Hafod Copper Works (Vivian & Sons), Swansea; Harrison Blair & Co., Farnworth, Lancashire; Kingston Metal Works, Smethwick; Liverpool Silver & Copper Co., Widnes; Llanelly Copper Works (Nevill, Druce & Co.); McKechnie Bros., Widnes; Margam Works (Vivian & Sons), Port Talbot; Mona & Parys Mines, Amlwch; Morfa Copper Works and Middle Bank Copper Works (Williams, Foster & Co., and Pascoe Grenfell & Sons), Swansea; Mersey Copper Works, Widnes; Morris & Co., Stockwith-on-Trent; Nicholson, John, & Sons, Leeds; Pembrey Copper Works (Elliott's Metal Co.), Burry Port; Rio Tinto Co., Port Talbot; Ravenhead Copper Works, St. Helens; Sheffield Smelting Co., Sheffield; Tharsis Sulphur & Copper Co., Hebburn, Cardiff, Willington Quay, Glasgow; United Alkali Co., Runcorn, Weston, St. Helens, Widnes, Irvine; Wallace Bros., Glasgow; Wiggin Street Works, Birmingham.

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### Potash from Leucite in Italy

Under the auspices of a syndicate of Berlin financiers and mining men, an extensive leucite-phonolite deposit, carrying from 16 to 20%  $K_2O$ , has been opened up in central Italy, near the coast (*Mining Journal*, Dec. 21, 1912). It has been examined by a German geologist of repute, whose opinion of it is of a favorable nature. It is stated, as the opinion of disinterested chemical laboratories, that of the total potassium contents, from 85 to 90% can be reduced to soluble potash fit for all manuring purposes.

# Reminiscences of the Nome Rush

BY G. L. SHELDON\*

*SYNOPSIS—Recollections of one of the participants in the Nome rush of 1900. Transportation was in overcrowded steamers, to a gold field already located. Placer mining fiascos on Nome beach. Prospecting in the country back of Nome described.*

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We had been fed all the winter of '99 and 1900 by fabulous stories of the richness of the Nome beach: we did not realize at the time that much of this dope was put out by the steamship companies. It was generally claimed that the beach sands were so rich that a man anywhere for a hundred miles along the Nome coast could wash out from \$10 to \$100 per hour. This, as it came so soon after the Klondike discovery of '97, which had made good, was believed. At Cripple Creek, Colo., we felt confident, as we had a man who had been there, who confirmed many of these statements. Through him, about 100 tickets were sold on the old S.S. "Centennial" at \$125 each. It afterward appeared to some of us that he made a good commission on these tickets.

## THE DIFFICULTIES BEGAN IN SEATTLE

My partner and I went to Seattle several months before sailing. It surely was a wide-open town that never slept. Many a man was knocked out and robbed of every dollar he had, even his boat transportation. We were telegraphed to procure quarters for a carload of friends from Cripple Creek. We scoured the town for two days, and finally secured rooms in first-class hotels for all the women; some of the boys thought that they were placed in the tenderloin district and left the next morning, but found that conditions were the same all over town.

We purchased two good horses, paying \$100 freight on each, and \$80 per ton freight on hay and grain for them. We procured what we have never seen elsewhere, nor seen advertised, a combination pack and riding saddle. It was similar to a McClellan tree; there were holes for heavy straps and rings in the saddle used in packing; a breast and rear heavy-canvas breeching, cinch ropes and metal hooks complete; when wanted for riding, straps with stirrups could be run through an eyelet in the saddle at the side; the saddles weighed but little, and answered the purpose nicely, when we camped at one place several days, and wished to cover a large amount of ground. The saddles fitted the horses' backs much better than the old style cross-tree pack saddle and did not make their backs sore.

We left Seattle May 30, 900 of us, on the old "Centennial," which had lain under Alaskan water two years, then been raised and refitted by Charles Lane, at a cost of \$60,000. The cabins originally were arranged for three people, but changed to accommodate five, so only one at a time could go to bed or get up. The dining room and kitchen were never meant for more than 250 persons; only those who were fortunate enough to get the first sitting, ever had anything hot, or even warm or fit to eat. We would buy from the waiters or stewards a

pie, cake or anything they could steal from the kitchen, or stand in with the cooks; even then it took hard scheming to get enough to eat. Fresh fruits were stored on the upper deck, where cool; some one would quietly manage to break or cut a hole in the box, then as one passed, he would "swipe" one or two, soon emptying the box.

Some boats had returned to Dutch Harbor, from Bering Sea, reporting that there was so much ice they could not get through. Ten thousand of us lay there eight or 10 days, unloading the horses to give them a rest, and get their land legs. We all had great times digging clams on the beach; these we baked, roasted, stewed and cooked all ways ever heard of, making one or two meals every day on the beach, with whatever we could procure from the boats. We encountered much ice in Bering Sea, coming out of the Yukon River; it appeared many times that we could not get through, but we finally, on June 18, made Nome.

Every boat had to anchor one or two miles off shore; freight and people were lightered in on large flat-bottomed scows. It was two or three days before our horses were unloaded, then they were hoisted with the donkey winch, hung in a canvas sling, and dropped over the side on a scow that had only a rope stretched at the sides.

It was claimed that there were 600,000 tons of freight and 30,000 people dumped along three miles of the beach within two weeks. Every old tub of a boat was pressed into service, loaded to the guards, with people and freight, they all passed the U. S. Government inspectors, even when generally known that they were not fit to be out of sight of land, but they all reached Nome in safety, even the old "Skookum," which was only a flat-bottomed scow, with two or three stories added on top, loaded as Noah's Ark must have been, with every conceivable thing and all classes of animals; it was towed by launches by the inside passage and around through the Aleutian Islands, finally reaching Nome in safety, with some additions in the number of live stock.

## EVERY MAN HIS OWN FREIGHT HANDLER

Nearly everyone had taken tents and provisions, and as the ships' delivery was on the beach, everyone had to "rustle" his own freight. In the conglomerate mixture this was a task; sometimes one would find tents and stove, but no provisions; or the latter and no tent or cooking outfit, but everyone was good natured, glad to get off the boats, and helped one another. Drift wood, piled high on the beach, was used for fuel. Some of these logs had the owners' marks stamped on the ends, recognized by those from Puget Sound, who were familiar with them.

Then came the disappointment to many who had expected to pick nuggets off the beach; able-bodied men cried, many returned on the same boat. There was a small area of the beach that had been rich, exceedingly so, but many miners had come in late in the autumn, others in the winter, and 5000 from Dawson, over the ice, six weeks before the boats reached there, pretty

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thoroughly cleaning it up. To show that there had been good pay dirt: I met two boys who had formerly worked for me in Idaho; they had come in during the winter and obtained a claim on the beach; they sunk down in the frozen sands, off the shore, and drift-mined on the pay streak of ruby sands, piling the sand on the bank till spring, then washing it, and obtaining an average of \$18 per man per day for four months.

There were not many wood houses, only a few stores and saloons, on the main street next the beach. Main Street was soon cut up so that even a dog team would get stuck in the muck and mud. There were no nights; the streets and saloons were always full of people. Nome soon became a city of tents; the first squatter on a lot became the owner.

For two or more miles along the beach there was the greatest collection of miscellaneous machinery or junk for placer mining that was ever seen together anywhere in the world. It is probable that every kind of patented and unpatented mining machinery ever made for the saving of gold was there; nothing missing; thousands of tons of it, and 99¾% of it worthless. After the big storm of October, 1900, there remained but little in sight; nearly everything was covered with sand; even the old "Skookum" was driven ashore and broken up by the storm.

There never was any question of the richness of Anvil, Dexter and other nearby creeks, but these had all been located early the year before. We saw one man with a rocker on the high bench, between Anvil and Dexter Creeks, wash out \$250 per hour.

We soon packed our horses and started for the interior, directly back of Nome. For several days every creek, gulch, bench; in fact the whole country was located, not only once, but three, four and six times deep, apparently without attention whatever to previous rights. We were not looking for litigation and complications and kept going until we were beyond them, probably 60 to 70 miles. Then we prospected every creek and gulch.

There were patches of snow and ice in the hollows and on some northern slopes. The water was always good. There was plenty of grass for the horses, in places many flowers. Our worst problem was wood; until one gets over in the Council City country, there is not a stick of wood in the Steward peninsula, but willows. We would "rustle" enough dry willows to make a good fire; the green ones we cut and split and put in the oven to dry; in this manner we got along. A green willow is no better than a snowball to cook with.

#### "DELIGHTS" OF ALASKAN TRAVELING

The tundra is a level plain, 10 to 20 ft. above sea level, extending back several miles to the foot hills. Traveling in the Alaskan tundra is the hardest proposition I ever ran up against; it is worse than web snowshoes in a mountainous country. The tundra was as much like a lot of wet sponges as anything, to travel over, underlaid with muck and thawed out from a few inches to a foot or more deep; there was a small wiry grass that made hard cornucopia-shaped spots in the bog, with point up, hard and stiff; you could not see them in the tundra, but when you stepped on one, you immediately knew it, as it would turn or twist your ankle, generally throwing you down.

Occasionally our horses would get mired in a soft hole;

then we would unload them in order to get them out. There was one redeeming feature, there were no nights—daylight the whole of the 24 hr.—we could travel as long as we liked; the only thing necessary for a good camping place was to find a bunch of willows.

We had a six-sided tent, 10 ft. in diameter, 3½-ft. walls, with only one pole in the center, jointed; we used ¾x12-in. iron spikes as tent pegs in the frozen tundra (in places). Our galvanized-iron stove, carried on top of the pack, was 16x16 in., 15 in. high and open at the bottom, allowing the oven, with the stovepipe telescoped, to be placed inside; it thus took up but little room and weighed 33 lb. It did not take long to make camp. As for mosquitoes, to one who has never been in Alaska, there is little use trying to tell about them; simply millions and then more millions, no let-up by night or day. We used netting hung over our hats in traveling; when we slept, over our beds, which were folding cots. I was obliged to put a large Stetson hat over my face to make it dark in order to sleep. One could get tired enough mushing in the tundra to be always willing to go to bed; couldn't wait for night.

#### A MONUMENT THAT WAS VALUABLE LATER

One day we saw a dog train packing supplies, some 20 odd dogs, each bearing his pack. A canvas sack with breching was used as a saddle and the loads hung on either side, 50 to 60 lb. on each. It was comical to see them start; until they got the swing of the load, they would stagger like drunken men and sometimes fall down. A native Alaskan dog, *malamute*, is lost when out of sight and hearing of his master, as it cannot scent him or follow his track.

When passing through a low, narrow pass in a mountain range one day, it seemed to me a good thing to make a monument of rocks so that we could recognize the place, and did so. We traveled to Mt. Bendleeben and beyond; this is the highest mountain in the peninsula, said to be over 6000 ft.; it is worn and rounded off. We rode all over it and prospected around it. We went until we could see practically nothing but low, swampy ground and water, apparently to the Arctic Ocean.

It then became necessary to get more grub; we had plenty of ham and bacon, but that was about all. We had found so many ptarmigan, that our salt meats lasted longer than anything else. The ptarmigan are somewhat similar to the Idaho "fool-hen," between a grouse and a chicken, the meat being white and juicy; they were fine eating and often one could kill them with a rock, as they were not afraid of man. Everywhere we went we found multitudes of caribou horns. It is said that about 20 odd years ago, an extra severe winter killed them all off.

By drawing lots, it fell to my partner to return to Nome for supplies. We had not seen a dozen men for the last month or more; the day after he left, three passed going out, but I did not see a soul then until his return, 10 days of 24 hr. each, the longest that I ever experienced. I ran a long ditch on bedrock, prospecting a creek that we had been unable to find a color in, just to be doing something.

Up to this time the weather had been as fine as could be desired, clear, with sun all the time. It then commenced to rain, not often hard, usually a drizzle, but it

kept up until it commenced to snow. The rain and fog for days prevented one from seeing 100 yd. It caught my partner returning; he said he would not have made it if it had not been for the monument I had insisted upon making; he was lost in the fog, not being able to see any landmarks; he knew he had been going up grade, then passed over a divide and commenced to drop down, when, thinking of the monument and similar conditions, he hunted for and found it; then by following the creeks he arrived at our camp.

We turned, prospecting farther east and back to Nome, never having found anything worth locating, as freight costs would have been over a dollar a pound. The latter part of the season there were many salmon and blueberries, which were most acceptable as a change; we used evaporated fruits and all kinds of evaporated vegetables, as economizing much in weight; also saccharine tablets in the place of sugar, a 2-oz. vial of tablets being equal to 50 lb. of sugar.

The natural difficulties, short seasons, frozen ground, heavy costs of all development, are all against easy prospecting in Alaska. Only the young, tough and hardy can attack it, and in their later years they will regret and pay for the hardships endured.

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### Dredging for Tin in Alaska

The York Dredging Co. completed the second season of placer-tin dredging on Buck Creek, Alaska, on Oct. 14, 1912. The dredge was taken out of winter quarters and put in operation on June 29, making the total running time 107 days. The cleanups for the season aggregated 175 tons of cassiterite. The total shipment was 130 tons; the remaining 45 tons ready for shipment were held at York, owing to the wrecking of a gasoline boat plying between York and Nome.

The dredge was installed in September, 1911, and made a 30-day trial run besides the time required in experimenting and adjustment, going into winter quarters on Oct. 15, 1911. The operation in the season of 1912 proved the efficiency of the dredge which was designed especially for digging stream tin. It is a California-type dredge and similar to the modern boats employed for gold-placer dredging<sup>1</sup>. The buckets are open-link, 2¾-cu.ft. capacity, nickel-steel lips. Manganese-steel lips will be substituted before the dredge begins digging in the season of 1913. At the time of building the dredge, which was completed in about six weeks, it was impossible to secure delivery of manganese steel, so it was necessary to use the nickel steel or delay the installation of the dredge until the season of 1912. The yardage capacity of the dredge is 1200 cu.yd. in 24 hr., but it was found that best results in recovery of the tin were obtained by decreasing the yardage to 950 or 1000 cu.yd. in 24 hours.

The recovery in the season of 1912 was 6½ lb. of cassiterite per cu.yd. of gravel. Higher recoveries have been obtained in the creek, but these came from the center of the stream bed by sluicing methods, while the dredge operation includes the entire width of the channel from 100 to 160 ft. The cost of placer-tin dredging is greater than for gold dredging, owing to the necessity for more frequent cleanups and the cost, in this instance, of wagon haulage and steamer freight. The product of cassi-

terite or native tin at the rate of 6½ lb. per cu.yd. requires six to eight cleanups in 24 hr., demanding the labor of three men almost constantly in each of the 12-hr. shifts.

The metal is transferred from one flume to the bins and there sacked in 50-lb. sacks, while the gravel passing through the screen is delivered to the other flume, so that the bucket line is never idle. The cleanup on a gold dredge occurs once a week or once a month, according to the value of gravel or the practice of the operator, and during the time occupied with the cleanup a gold dredge is not operating.

The haulage of the product of the tin dredge from Buck Creek to tidewater at the town of York costs approximately \$14 per ton; water transportation from York to Nome varies from \$6 to \$10 per ton, depending upon the availability of boats. The regular cost is \$6, but the shipment of the present season, owing to the wreck of the regular gasoline boat, was sent out by irregular craft that demanded the higher rate. From Nome to Seattle the rate is \$4, and from Seattle to Liverpool \$8.50 per ton; a total ordinary rate of \$32.50 per ton from the dredging field to Liverpool.

The distance from Buck Creek to York is 14 miles. The wagon freight costs about \$1 per ton per mile. A six-horse team hauls five tons, a four-horse team three tons. A traction engine was employed during part of the season of 1912, hauling seven tons per load. But this method was more expensive than horses and wagons, owing to the fact that the engine wagon could not be loaded to full capacity without cutting the roads into impassable condition. The distance from York to Nome by water is 110 miles, making the freight rate 5½c. per mile. The York Dredging Co. has its head office in the Atlas Building, San Francisco. W. W. Johnson is president.

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### The Miami District, Oklahoma

BY L. C. CHURCH\*

Generally satisfactory conditions prevailed in 1912 in the Miami district. Drilling was carried on from the Neosho River, five miles southwest of the camp, to the Kansas line, five miles northeast, and new ore deposits were reported. New mills are in process of erection for the Church-Mabon Co., the Prairie Mining Co., the Miami Lead & Zinc Co., the Cactus Mining Co. and the Grey Top Mining Co. It is expected that these will be in operation by March.

Name of Mine	Blende, Lb.	Value	Galena, lb.	Value	Total Value Zinc and Lead Sul- phides
Church-Mabon*	4,267,590	\$82,301	2,334,510	\$67,379	\$149,680
Turkey Fat	4,114,965	90,237	1,541,960	40,930	131,168
Emma Gordon	3,545,950	51,466	2,182,810	60,744	112,210
King Jack	2,328,500	53,724	515,580	14,003	67,727
Chapman-Lennan†	1,725,350	31,814	921,980	25,665	57,480
New State	1,722,650	34,308	334,420	8,987	43,296
Buckeye	1,010,960	24,206	44,260	1,204	25,410
Miscellaneous‡	1,761,190	38,927	467,340	12,130	51,057
Totals	20,477,155	\$406,986	8,342,860	\$231,045	\$638,031

\* Second mill completed in July. Third mill nearing completion.

† Mill completed in June.

‡ Includes Sullivan, Old Chief, Midas, Golden Hen and Mizpah—The latter mill completed in November.

The steady growth of the camp has been encouraging and hopes are entertained that in 1913 the production for 1912 will be doubled. The total production for the camp in 1912 is shown in detail in the accompanying table.

\*General manager, Oklahoma Lead & Zinc Mining & Milling Co., Miami, Okla.

<sup>1</sup>Eng. and Min. Journ., July 15, 1911, p. 107, and Dec. 23, 1911, p. 1226.

# Construction of No. 3 Shaft, Negaunee Mine

By S. R. ELLIOTT\*

*SYNOPSIS*—A 944-ft. shaft, constructed by enlarging raises opened for the purpose. One 738-ft. raise completed without difficulty, then enlarged and lined with concrete in sections. Stations and ore-pockets were lined with concrete.

❖

The No. 3 shaft at the Negaunee mine, Negaunee, Mich., was started by sinking a test pit to solid rock through 68 ft. of sand and hard pan. As no water or quicksand was encountered, the main drift was driven from the bottom level of the old workings, 806 ft. below the surface, to the location of the new shaft. When the drift was completed raising was commenced, the idea being to make a connection between the new drift and the bottom of the test pit.

The general arrangements at the level are shown in Fig. 2. The cribbed compartment was divided in the center by 2-in. casing planks forming two compartments, one of sufficient size for the pipes and the ladder road, and the other for a small bucket to be used in hoisting tools and cribbing. Fig. 3 shows the method of supporting the cribbing, and the arrangement of the chutes from which the rock was loaded into motor cars.

Directly below the dirt compartment a bench of solid rock was left, running back on the same angle as the lip of the chute. This served as a permanent indestructible bottom. The cribbing was accurately framed from 6- to 8-in. round tamarack timber. Each piece was faced on one side in order to maintain the same dimensions on the inside of the compartments. This greatly aided the miners in building up the cribbing plumb and made rapid hoisting practical, as there were no irregularities to strike the bucket. After the cribbing had been put in line it was necessary to wedge it firmly in order to prevent shifting.

## DRILLING AND BLASTING

The crew was composed of nine miners, three on each eight-hour shift. While drilling the cuts each miner used a Waugh No. 8 C stopper. It was found by experience that it was not advantageous to blast a deeper cut than five feet on account of the breaking or shifting of the cribbing. The best results were obtained by drilling the round as illustrated in Fig. 3. Before blasting, the cribbed compartments were covered with a 6-in. sollar, one small hole being left in the ladder-road side to allow a man to pass through after blasting. The cut, consisting of 16 holes, was blasted with fuse in three rounds as follows: (1) Holes 1 and 2; (2) 3 to 9; (3) 10 to 16. In order to make it practical to blast with fuse, at intervals of about 200 ft., small drifts about eight feet long were driven from the ladder compartment. Each drift was protected by a door. A connection was made with the air pipe to prevent the possible danger of the men being knocked out if, for any reason, the fan failed to work. It would have consumed too much time for the

men to go to the very bottom after the raise reached a great height. Before blasting the crew would enter these small drifts and suffer no discomfort even when the breast was not over 30 ft. above them.

## HOISTING

A small "puffer" was placed on the level and run by compressed air. After each cut was blasted and the loose rock in the back well trimmed, a stout pole was wedged across the raise as close to the back as possible. A 10-in. sheave was then hung from this pole so that the rope leading to the bucket was in the center of the hoisting compartment, the other end passing down one corner of the compartment to an angle sheave and then to the puffer. The signals were all given through a speaking tube, which was simply 1½-in. pipe, extending from the puffer to the top set of cribbing. An oil barrel, reinforced in the bottom with wood and on the sides with strips of steel, was used in preference to an iron bucket. On account of its depth tools and cribbing could be hoisted with little danger of their falling out. The bulge in the center lessened the possibility of the bucket catching in the cribbing. All tools, supplies and cribbing were hoisted to the breast, thus saving much time and labor.

## VENTILATION

On the level at a short distance from the raise a fan capable of exhausting 2040 cu.ft. per min. was set up. Ten-inch spiral-riveted pipe with flanged joints every 10 ft. extended from the fan up into the ladder compartment. The upper end of the pipe was kept as close to the last set of cribbing as possible. The discharge pipe, 10 in. in diameter, was made of galvanized iron, but was not perfectly tight. This fact caused a small amount of trouble. This pipe extended to an abandoned part of the mine. The foul air was discharged behind a tight door, which prevented any of it reëntering the main drift and contaminating the pure air which was needed in the breast of the raise. After blasting, the fan was started, the gases being sucked into the pipe and the pure air from the main drift flowing naturally to the breast. It was found to be a great advantage to run a piece of old hose above the sollar and discharge compressed air directly after blasting, as this hastened the removal of the gases. Before this was done there was a tendency for the air current to pass below the sollar. It was found that the gases were all removed within 15 min., but as an extra precaution the men did not return to work for 30 min. It was never found necessary to run the fan except while blasting the rounds.

## RAISE 738 FT. HIGH

On Jan. 1, 1909, the top of the raise was 20 ft. above the rail in the drift. On July 19, 1909, a hole was located in the back of the raise to strike the center of the test pit, the size of which was 2x3 ft. The first attempt was successful, showing that the raise had been brought up accurately. The total distance from the rail to the bottom of the test pit is 738 ft. From the first of January to the last of April the ground was favorable for drilling, but the upper 250 ft. was extremely hard, being sid-

NOTE—Abstract of a paper "Method of Raising, Sinking and Concreting No. 3 Shaft, Negaunee Mine," prepared for but not read at the Houghton meeting of the Lake Superior Mining Institute.

\*Superintendent, Negaunee Mine, Cleveland-Cliffs Iron Co., Negaunee, Mich.

eritic chert. The greatest amount raised in any one month was in March, the advance being 142 ft. No difficulty was experienced in completing the raise and if it had been necessary it could have been taken to a much greater height. As the raise increased in height the broken rock was allowed to accumulate, only enough being drawn out each day to keep it level with the top set of cribbing.

Ordinarily in a raise which is to be stripped to a larger size, for a shaft, the cribbing is taken out during the process of sinking. Before blasting the men go down and remove and hoist to the surface the proper number of sets in order to make sufficient room for the rock which will be broken by the stripping cut. This operation is slow, as the cribbing is difficult to remove. The miners have to stand on broken rock, which is liable to settle without warning. The cribbing is so damaged that it is useless for other work. The most serious disadvantage, however, is on account of the great danger of the raise hanging up. This almost invariably occurs. It is extremely difficult to break these jams and it is often necessary to hoist a large amount of rock to the surface. In a raise, over 700 ft. in height, a jam occurring near the bottom would cause a great loss of time and expense. In order to avoid this jam and save the cribbing for other uses, it was decided to strip the entire raise of all cribbing. If this could be done the chances of the rock hanging up would be extremely small as the outside dimensions would then be about 9x9 ft. The method of removing the cribbing was as follows:

DETAIL COST OF RAISING, NO. 3 SHAFT, NEGAUNEE MINE

	Labor	Supplies	Total	Cost per Ft.
Miners.....	\$5291.29		\$5,291.29	\$7.17
Fuse, powder, caps, etc.....		\$1238.25	1,238.25	1.68
Drilling supplies and tools.....	726.79	331.23	1,058.02	1.41
Trammers.....	424.62		424.62	0.58
Candles.....		110.27	110.27	0.15
Cribbing.....	666.71	634.12	1,300.83	1.76
Timbering.....	690.23	190.00	880.23	1.20
Nails, iron and bolts.....		41.39	41.39	0.06
Proportion electric haulage.....	199.80	50.14	249.94	0.34
Proportion of air charge.....		260.00	260.00	0.35
Shop labor and teaming.....		73.67	73.67	0.10
Puffer.....	93.05	102.70	195.75	0.27
Pipe and fittings.....	270.84	113.85	384.69	0.52
Buckets and sheaves.....	74.60		74.60	0.10
Total.....	\$8437.93	\$3145.62	\$11,583.55	
Total cost per foot.....	11.43	4.26		\$15.69
Cost of removing cribbing.....			1,067.59	1.45

A platform 7x16 ft. was made out of 8-in. round tamarack poles bolted to cross pieces as shown in Fig. 4. A wire rope was attached to each corner, the lengths being so adjusted that when the platform was suspended it would hang at an angle of 65° from the horizontal. Near the back of the raise hitches were cut and a strong timber put in place. From this timber a 10-in. sheave was hung. The platform was hoisted one piece at a time and bolted together in the raise. A 5/8-in. wire rope passed over the sheave and was attached to the ropes from the four corners of the platform. The other end passed through a slot in the corner of the platform, down one side of the hoisting compartment, to a small puffer on the level below. The angle of the platform was so steep it would be practically impossible for any piece of rock, which might fall from the sides, to break through it. As the cribbing was removed and lowered to the level, in the bucket, the platform was lowered and kept at the proper height above the heads of the men, protecting them absolutely from the fall of any ordinary mass of rock. The sheave for the bucket, which was used to lower the cribbing, was supported from the platform. In 22 work-

ing days the entire raise was stripped of all cribbing, pipe and plank. No serious accident occurred during any part of the work in the raise.

It was decided to make the shaft circular and to line the walls with 1 1/2 ft. of concrete, inside diameter to be 17 ft., which is sufficiently large to inclose a rectangular shaft of standard dimensions of 10 ft. 10 in. by 14 ft. 10 in. inside measurements. Fig. 1 shows the plan of the shaft and the general dimensions.

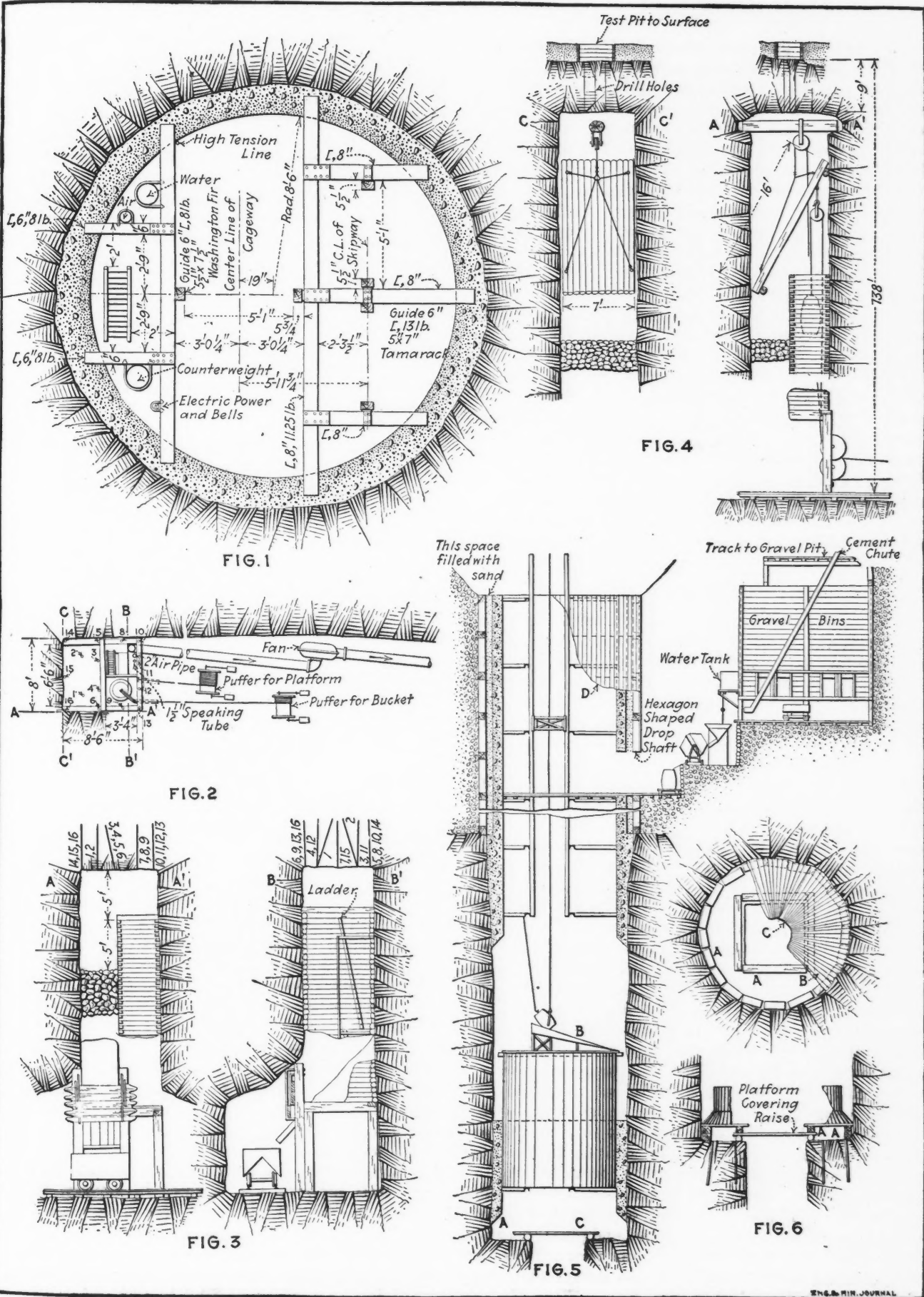
#### SINKING IN SAND

After the raise had been blasted through to the test pit, work was commenced on the surface to mill the sand into it in order to make a sufficiently large conical-shaped hole to provide head room for installing the concrete equipment. The milling of this sand would also decrease the distance which it would be necessary to sink to the ledge. In a short time this work was stopped. The sand, in falling for a distance of about 800 ft., packed so tightly in the bottom of the raise, that it prevented the water, which came through the rock, from reaching the level. When the sand became saturated it would rush out with great force. It was therefore not practical to handle it in this way. A derrick, with a 90-ft. boom, was set up on the surface and the remainder of the sand hoisted. At a point 40 ft. below the original surface a hexagonal wooden shaft, 24 ft. inside diameter, was built. The sets were placed 5 ft. apart and 3-in. planks spiked to the outside. The alternate planks were cut 5 ft. 6 in. and 11 ft. in length (Fig. 5 D). These served to tie the adjacent sets together, making the structure quite rigid and preventing it from getting out of line. This shaft was allowed to drop slowly to the ledge as the material below was excavated.

#### CONCRETE EQUIPMENT

A bed of gravel was found, at a point a short distance from the shaft, which was suitable for the making of concrete. From the conical-shaped hole around the test pit a cut 12 ft. deep was made to the gravel pit and a track put in. Four feet below this track two pockets were built, the capacity of which was 35 yd. These pockets were provided with chutes, from which the gravel could be drawn into a small car holding the exact amount for a charge. This car dumped into the hopper of a mixer, which was at a still lower elevation. Below the mixer the concrete was dumped into a kibble, which rested on a small truck. This truck could be pushed to the center of the shaft, the kibble attached to the hoisting rope and lowered, and the concrete dumped into the forms. The crew of five men on the surface could easily handle 35 yd. of concrete on an eight-hour shift, or enough to complete 10 ft. of shaft. The gravel contained a small amount of foam and for this reason the proportion of cement used, about one to five, was high. The water was heated to boiling by exhaust steam, the tank being arranged with a gage so that the proper amount was used with each charge. In the winter months the gravel was also heated by steam pipes in the bottom of the pockets. The cement house was placed close to the edge of the conical-shaped hole. A slide was built from one end of the house to the elevation of the hopper of the mixer, and the bags of cement were thrown into this slide until it was full; as one bag was removed another would slide into its place. The general plan is shown in Fig. 5.





NEGAUNEE NO. 3 RAISE AND SHAFT

## DRILLING AND BLASTING

The crew in the shaft consisted of three miners on three 8-hr. shifts. One man on each shift acted as boss and was paid \$3.25, the others receiving \$2.90 per shift. On Jan. 3, 1910, sinking in rock was started. This consisted of drilling a sufficient number of vertical holes, which depended upon the hardness of the material, and blasting them into the raise. After a careful investigation it was decided that the best progress could be obtained by using Murphy hand sinkers. These machines drill rapidly, no time is lost in setting up, and they do not get out of order easily. While the round is being drilled each man in the shaft uses a machine. The round usually consisted of 18 holes six feet deep. In iron formation, these holes could be completed in one 8-hr. shift by three men. They were blasted in one operation by electricity, delay-action fuses being used. The general plan was to strip to as great a depth as practical. The sections were made multiples of 10 ft. and varied from 20 ft. to as great as 90 ft., according to the hardness of the rock. After each blast the entire section was examined and carefully trimmed. If it could not be trimmed solid, stripping would be discontinued and preparations made to commence concreting. It is a great advantage to make the sections as long as possible, as considerable time is lost in changing from one operation to another.

## CONCRETE FORMS RESTED ON STAGING

The concrete forms consist simply of rings which are 5 ft. high and 17 ft. in diameter, made in four sections in order that they might be collapsible. They were properly braced on the inside to withstand the pressure of the concrete. When a certain section had been stripped the engineer would locate the elevation for the bottom of the first form. The procedure is to put in a number of short pieces of timber (Fig. 6 A) around the collar of the raise, and level them properly, to form a base for the floor upon which the forms will rest. The floor (Fig. 6 B) was made out of 2-in. hardwood plank, 7 ft. long, sawed on a radius of 10 ft., which is the radius of the outside diameter of the shaft. When the floor is laid on the blocking, the ends of the plank being shoved up against the irregular wall, it will completely cover the circumference. The small openings next to the rock are filled with short pieces of wood to keep the concrete from running through. The plank being only 7 ft. long, a hole about 6 ft. in diameter is left in the center. In order to make it possible to remove the floor without cutting any of the pieces, one of the planks (Fig. 6 C) is laid down with the wide end toward the center. This can be easily pulled out and the others will then come freely.

The first form lowered is a special one, intended to cut off the lower face of the concrete at an angle of 45° (Fig. 5 A). A regular 5-ft. section is then lowered and bolted together, being placed in position by dropping plumb lines from above. The special form fits snug up against this 5-ft. section, the upper circumference being 1½ ft. above the floor. The steel sets, which divide the shaft into compartments, are lowered and placed accurately in position by lines dropped from above. They are then attached to the forms by simple clamps which keep them from shifting during operations. When the sets are once in position they serve as a means of building a platform on which the men can stand. The trough

(Fig. 5 B) is next placed in position. This extends from the center of the shaft to the edge of the forms, the end next to the forms being about two feet lower than the part in the center of the shaft. This trough is light and the outer end can easily be moved around the circumference of the shaft. One-half yard of concrete is lowered in a kibble. A rope with a hook on the end is supported at a point high up in the shaft. When the kibble reaches the right point this hook is inserted in a ring in the bottom of it. The engineer continues to lower, and the kibble is inverted, the concrete running from the trough into the forms. After the first 5 ft. is concreted, 10 additional feet of forms are lowered and placed in position, a set again being put on top as already explained. In the part of the first section between the ledge and the surface special wooden forms were used as it would have required too much concrete to have filled the space between the steel forms and the hexagon-shaped shaft. These forms were simply rings of strap iron bent on a diameter of 20 ft. with 3-in. hardwood plank wired to the inside of them.

As soon as 15 ft. of shaft is completed, or at the end of 48 hr., it is possible to remove the floor upon which the first form rested. The lower set of forms is also taken out and used in the work higher up. It is then practical to continue the stripping. The morning shift would concrete 10 ft. one day and on the following place in position 10 ft. of forms. By concreting on alternate days the crew on the surface had sufficient time to fill the pockets with gravel. With only 20 ft. of forms it was not possible to average faster speed than 5 ft. of completed shaft in 24 hr., as it was necessary to give the concrete sufficient time to set. While concreting was being done on the morning shift, the afternoon and night shifts would continue to strip and prepare the next section. The size of the crew was figured so that the two operations, concreting and stripping, would proceed at about the same speed.

## RAISE COVERED DURING STRIPPING

During the process of stripping it was necessary to cover the raise to prevent accident by the men falling into it. A large, strong platform (Fig. 5 C) was made, its size being about 12x12 ft. Wire ropes extended from the four corners to a hook in the center. This hook could be attached to the ring in the bottom of the kibble and the platform lowered to rest on the solid ground, completely covering the raise. Before blasting it was hoisted and suspended from the bottom steel sets in the shaft.

The object in cutting off the lower face of the concrete of the first section on an angle of 45° was to provide a means of obtaining a tight joint between two sections. When the lower section was completed the top of the form would then be in line with the thin edge of the concrete of the upper section. A special collar was then bolted to the form, its height being 1½ ft., the upper edge being turned in toward the center of the shaft forming a lip. Rich concrete was rammed in between the ring and the old face. In the first operation the space was not completely filled. After the concrete had set, the ring was removed and all leaks between the new and the old face caulked tightly with oakum. The small triangular remaining space was next filled in with rich mortar. All joints between sections were made by this method and practically all of the water shut off. The shaft is not ab-

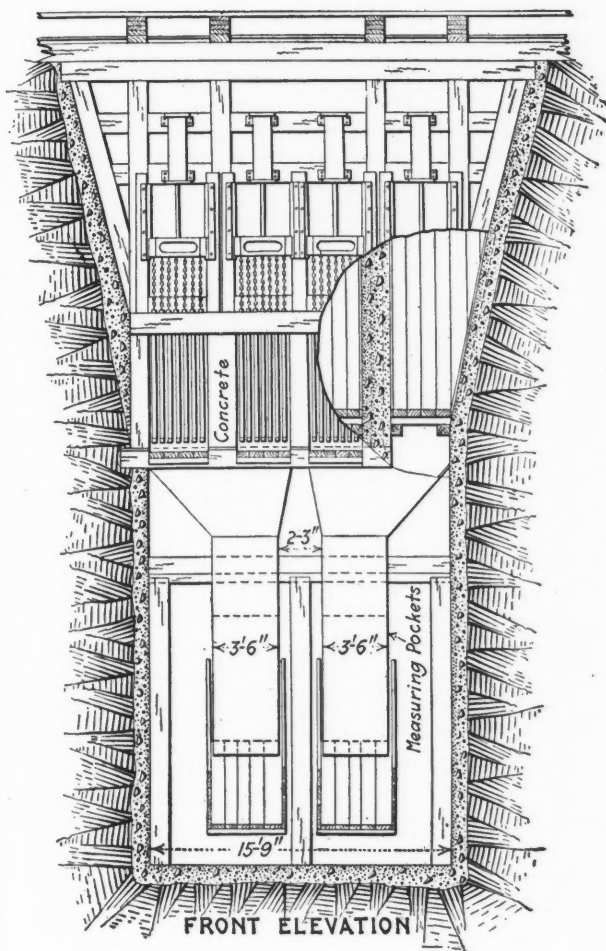


FIG. 7.

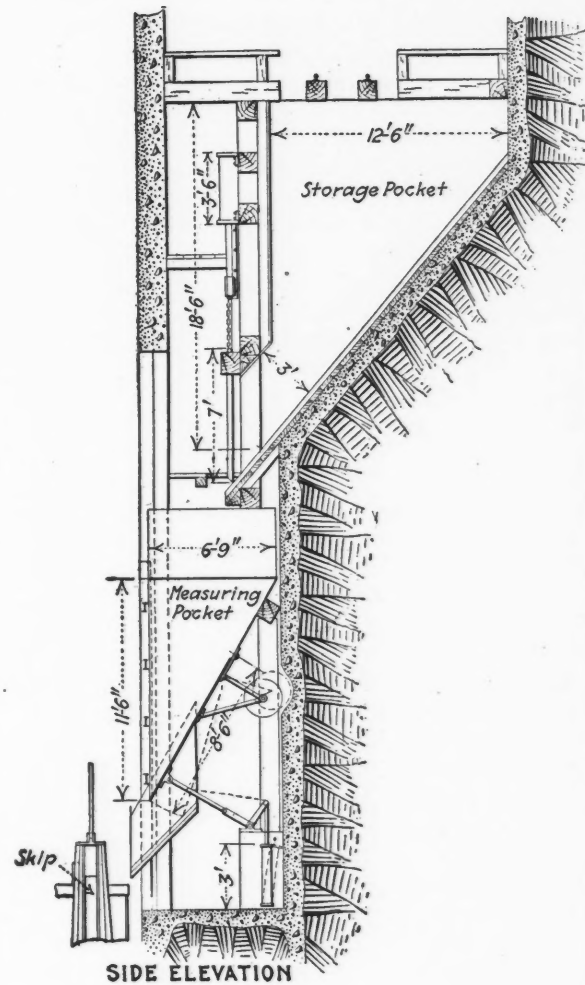


FIG. 8.

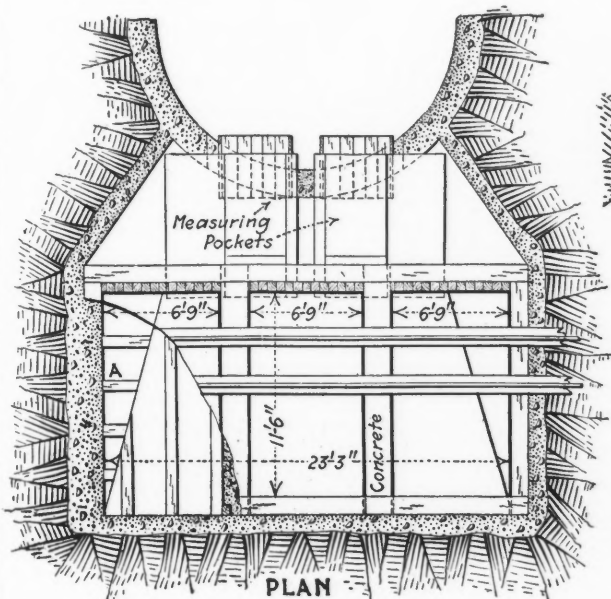


FIG. 9.

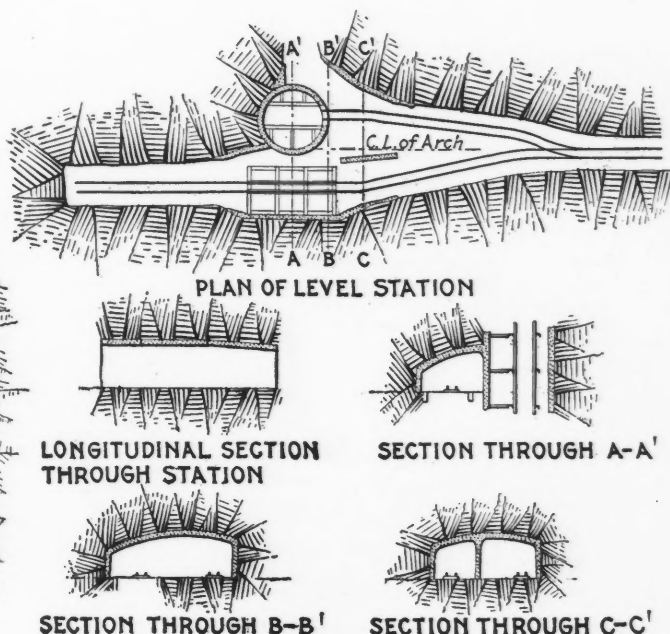


FIG. 10.

ARRANGEMENT OF STATIONS AND STORAGE POCKETS, NEGAUNEE NO. 3 SHAFT

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solutely waterproof, a certain amount continually seeping through the walls, but it is found that this seepage gradually decreases and, in time, it is thought that all of the small pores will become clogged.

It was necessary to sink the shaft to a depth of 155 ft. below the ninth level, in order to open up the tenth and to provide skip-pit room. At a point 55 ft. north of the shaft a winze 8x8 ft., inside measurements, was sunk to a depth of 160 ft. and drifts driven back to the shaft at elevations of 100 and 155 ft. From these two drifts a vertical raise was connected to the center of the shaft. The completion of this raise made it unnecessary to provide means on the surface at the new shaft for handling rock, as that which came from the part below the ninth level could be hoisted in the winze and trammed back to the old shaft.

#### SPEED OF SINKING 64 FT. PER MONTH

On Jan. 3, 1910, sinking in rock at the ledge was commenced. On Feb. 1, 1911, the total depth of completed shaft was 767 ft., or an average speed of 64 ft. per month. Below this depth the progress was slow, on account of the large amount of work on the ninth and tenth levels in cutting and concreting large stations and storage pockets. Our principal aim was to balance the crew in such a way as to complete the work at the smallest cost rather than to obtain greater speed in sinking.

After the shaft had been completed to a point 20 ft. above the rail of the ninth level, the stripping was continued to the ninth level. The excavation was then made for the station or plat, after which, work was started in cutting out the rock for the storage pockets. On account of the span and height of the back, over the pockets, this was dangerous and slow, and it was finally necessary to put in temporary timbers in order to protect the men while excavating for the pockets. On the tenth level a different plan was followed, which was safer, making it possible to finish the work in a shorter time. As soon as the excavation for the plat was completed, it was concreted before any attempt was made to make room for the pockets. This protected the men from any possible fall of ground, while excavating for the latter, and under this condition the work could be done more rapidly.

#### CONCRETING THE PLATS

In constructing the plats (Fig. 10) the side walls were first put in. The concrete was dumped at an elevation of 20 ft. above the rail into a trough which carried it from the center of the shaft to the forms. After the side walls were completed the forms for 10 ft. of arch were set up. These consisted of skeleton arches made in short sections and bolted together. On top of these arches, which were placed at intervals of 5 ft., 2-in. hardwood planks were laid. In order to prevent the concrete from running between the cracks, and to make the surface smooth, it was covered with heavy tar paper or rubberoid. The arched roof of the plats are in the form of a section of a cylinder. As the skeleton forms were made in short sections, the increase in width could be obtained by bolting together the proper number of sections. The concrete was dumped into a trough at a point 20 ft. above the rail and in the center of the shaft. This trough was supported on light timbers and carried close to the back of the excavation and extending to the forms. The arch was so planned that it sloped down from the center of the

shaft, the drop being one foot in ten. With a little shoveling concrete will run on this grade. In the highest part of the section it was necessary to ram in by hand the small amount to fill the space completely. At intervals of three feet holes were drilled in the back into which split eye-bolts were driven, and to these a network of wire rope was attached. Where the side walls joined to the arch, short pieces of scrap iron were used as extra reinforcing. To make the concrete waterproof, 2 per cent. of silicate of alumina was added to the weight of the water used. The results obtained with this material were excellent.

#### STORAGE POCKETS

In order to be able to handle rapidly two grades of ore and rock, three-compartment storage pockets were put in. The general plan and dimensions of these are shown in Fig. 7, 8 and 9. From the center compartment it is possible to load into either skip. If the grade of the larger tonnage is handled through this compartment, and a little care is used to keep a reserve in the pocket, it will never be necessary to run either skip up empty in order to continue to hoist from either of the other compartments. This may occur with a two-compartment pocket if the grades of ore hoisted are of different proportions. With the exception of the front, which is made of wood, the entire pocket is concrete. The sides are lined with plates, those in the lower part being  $\frac{1}{2}$  in. thick, while in the upper they are only  $\frac{1}{4}$  in. The long dimensions of these plates extend horizontally instead of vertically, the object being to decrease gradually the thickness from the bottom, where there is the most wear, to the top, where they would last for a great length of time. At intervals of 2 ft. 6 in. on the sides there are 5x7-in. timbers set in, and to these the plates are bolted. These plates serve as forms, behind which the concrete is dumped. As a rule, plates in pockets wear rapidly, due to the fact that they are not on a perfectly solid foundation. They buckle and in a short time ore gets behind them and they are shoved out of position. Plates in a concrete pocket are expected to last until they are completely worn out. Some way had to be provided for the replacing of the plates when worn out. As the concrete completely fills the space back of the plates, it would be impossible to reach the nuts of the bolts, so the countersunk heads of the bolts were made like the head of a screw. Before dumping in the concrete the threads were well covered with grease to keep it from sticking, and after it had set for a sufficient length of time, so that there was no chance of the nuts turning, every bolt was loosened with a large screwdriver and tightened again. When the plates wear out the bolts can be removed and other plates put in position, the same nuts being used as many times as necessary, as they were firmly imbedded in concrete. The bottoms of the pockets are made out of two thicknesses of 3-in. hardwood plank spiked to 5x7-in. timbers, placed at intervals of 2 ft. 6 in. Behind these planks concrete was also dumped. When the upper planks wear out they will be removed and replaced by others.

#### MEASURING POCKETS

Below the storage pockets there are two measuring pockets which hold a skip load. While the skips are in motion the operator has time to draw the ore from the storage pockets and fill a measuring pocket. As soon as the empty

skip is in position it can be immediately filled by simply tripping a lever. One great disadvantage in the common style of measuring pocket is that the door opens toward the skip. If, for any reason, the operator fails to close the door before giving the signal to hoist, it will be torn out by the skip, causing great delay and damage. In order to avoid this possibility, and to make the operation as near "foolproof" as possible, the pockets were designed with the doors opening away from the shaft. The ore falls on a slide from which it runs into the skips. The doors are made of two thicknesses of 1/2-in. plate strongly braced by angle iron. They are counterweighted, closed and opened by small air cylinders. These have been found to work most satisfactorily and rapid loading is possible.

**SHAFT COST \$81.56 PER FOOT**

The accompanying statement shows the detail cost of the completed shaft. The part below the ninth level is considerably more expensive than that above, due to the fact that it was necessary to transfer all of the rock, it being hoisted through the winze. The progress in this part of the shaft was slow on account of the large excavations necessary for plats and pockets on both the ninth and tenth levels.

**DETAIL COST OF NO. 3 SHAFT, NEGAUNEE MINE**

	Total	Cost per Ft.
<b>Surface to Ledge—48 Ft.</b>		
Sinking in sand.....	\$3,638.76	\$75.81
Steel shaft frames.....	493.56	10.28
†Steel forms.....	56.00	1.17
†Temporary surface structure and equipment.....	350.74	7.30
Cost of concrete.....	919.45	19.16
Estimated charge for compressed air.....	48.00	1.00
Temporary steam line in shaft.....	392.25	8.17
<b>Total cost per ft.....</b>	<b>\$5,898.76</b>	<b>\$122.89</b>
Less salvage.....		0.12
<b>Net total cost.....</b>		<b>\$122.77</b>
<b>Ledge to Ninth Level—738 Ft.</b>		
*Cost of raising.....	\$13,789.19	\$18.68
Cost of stripping.....	12,787.20	17.33
Steel shaft frames.....	7,420.27	10.06
†Steel forms.....	927.87	1.26
†Temporary surface structure and equipment.....	4,975.78	6.74
Cost of concrete.....	12,710.06	17.22
Estimated charge for compressed air.....	738.00	1.00
<b>Total cost per ft.....</b>	<b>\$53,348.37</b>	<b>\$72.29</b>
Less salvage.....		0.12
<b>Net total cost.....</b>		<b>\$72.17</b>
<b>Ninth Level to Skip Pit—158 Ft.</b>		
Cost of winze, drift and raise.....	\$3,861.52	\$24.44
Cost of stripping.....	5,696.16	36.04
Steel shaft frames.....	3,468.08	21.95
†Steel forms.....	189.00	1.20
†Temporary surface structure and equipment.....	1,571.73	9.95
Cost of concrete.....	2,910.34	18.42
Estimated charge for compressed air.....	158.00	1.00
<b>Total cost per ft.....</b>	<b>\$17,854.83</b>	<b>\$113.00</b>
Less salvage.....		0.12
<b>Net total cost.....</b>		<b>\$112.88</b>
<b>Grand total.....</b>	<b>\$77,101.96</b>	<b>\$81.68</b>
Less salvage.....	112.58	0.12
<b>Net grand total, 944 ft.....</b>	<b>\$76,989.38</b>	<b>\$81.56</b>
Cost per yard for concrete.....		\$7.64
Average thickness of walls.....		16.2 in.
* Cost includes ventilating plant		
† Cost pro-rated.		



**Mineral Product of New Zealand in 1911**

The mineral production of New Zealand for 1911, as officially reported, was as follows, the items being arranged in order of descending value: Gold, 455,226 oz.; coal, 2,066,073 tons; kauri gum, 7587 tons; silver, 1,311,043 oz.; scheelite, 138 tons, value, £11,853; all else (greenstone, mercury ore, pyrites, antimony, manganese ore, etc., value, £10,347.

The Taranaki Petroleum Co. on May 3, 1911, succeed-

ing in winning the bonus of £2500 offered by the Dominion government for the first 250,000 gal. of oil produced in the country. By May 16, 1912, the company had produced 461,628 gal., so that the company hoped to win the £2500 bonus for the first 500,000 gal. Statistics of dredges operating in New Zealand in 1911 show that 93 dredges recovered £296,409 in gold, and paid £45,198 in dividends. Of this 64 dredges recovered £158,586 and paid £417 in dividends, while 14 recovered £87,433, and paid £36,464.



**Minerals Separation Plants in Chile and Sweden**

In the annual report of the Minerals Separation, Ltd., the results of its operations, especially in Chile and Sweden, are given. In Chile the 240-ton test plant, erected in the mill of the Braden Copper Co., during 1912, justified all expectations, in spite of adverse circumstances, says John Ballot, managing director of the Minerals Separation, Ltd. As a result, the Braden company ordered a 3000-ton per day plant to treat its whole mill output. The first unit of 600 tons per day started work about the middle of November, under temporary disadvantageous conditions, by taking only the fine-slime product from the present type of mills. The second unit was expected to commence operating during December, while the remaining 1800-ton portion will have to wait until the Braden company has completed its full installation of secondary grinding plant. Until that is done it is obvious that the maximum recoveries will not be possible.

In this connection an interesting feature is that the whole of the 3000-ton plant is being built in the Braden company's own shops on the mine, with the exception of some special bearings which were sent from England, not because they could not have been made there, but because they can be more readily made and delivered in less time by regular makers in England. The Minerals Separation company believes that the fact that its plant can be built on any mine where there are only reasonable facilities will make it attractive to mine owners and managers. The ease with which the plant can be kept in repair is likewise emphasized.

In Sweden, the Minerals Separation company erected a plant at a well known mine, and has the assurance that the owners are satisfied that all representations have been fulfilled; they were enabled, for the first time in 30 years of the mine's history, to make a handsome profit. The successful results on this mine are important, because of the fact that other flotation methods had previously been tried without the same satisfactory result.

Negotiations are in progress with various other important mines in different parts of the world, some of which have been examined on the spot, while others have had successful tests on bulk samples of their ores carried out in London. It is expected that during 1913 the combined processes of the Minerals Separation company will be treating, in Australia and elsewhere, at the rate of between three and four million tons of ore per annum at least. By far the greater part of the increase will be derived from the treatment of copper ores.



The Sales of Nitrate Lands offered only to the south of Pena Grande have realized 5,414,102 pesos, gold (Chem. Tr. Journ., Dec. 7, 1912). The Chilean Government will shortly proclaim a fresh series of sales.

## Driving a Long Adit at Bonanza, Colo.

BY WILL C. RUSSELL\*

The Rawley Mining Co., operating at Bonanza, Saguache County, Colo., has completed its new 6235-ft. development and drainage tunnel, having cut the main lode 1200 ft. from the surface and at a point 600 ft. perpendicularly below the lowest former workings, exposing a 6-ft. vein of heavy iron-sulphide ore, carrying silver and copper, together with a small percentage of lead and zinc and a little gold.

### UNDERGROUND CONDITIONS

The work of driving this tunnel, which is 7x8 ft. in the clear, running principally through altered andesite and at about a right angle to the vein system, covered a period of 17 months and 12 days. The rock varied greatly in hardness and friability, it having been necessary to timber a total of 1618 ft. As an indication of the irregularity of the formation, it may be said that in April, 1912, only 40 ft. were driven, while in August, 1912, the adit was advanced 555 ft. in 26 days of drilling, the remainder of the month having been given up to timbering.

Considerable water was encountered at various points, a maximum flow of 1500 gal. per min. having been struck in December, 1911, which finally decreased to about 1000 gal. per min., which latter amount is now issuing from the portal. One of the chief reasons for running the tunnel was the draining of the upper workings of the company, which have a total length of 7416 ft., and about one-half of which are in commercial ore. Upon cutting the vein at the 1200-ft. level, the upper workings began to drain at once, and in 38 days thereafter they were completely unwatered.

The tapping of the vein at the tunnel level immediately put in sight an additional, large tonnage of ore, the shoot on the third level, where the greatest amount of drifting has been done, being 840 ft. in length. No ore has been stoped or shipped from the mine for seven years, it having been the policy of the company to develop a tonnage of sufficient magnitude to justify handling the property on a large scale. From the surface to the 1200-ft. level, the ore has changed considerably in character, i.e., from a silver-lead-zinc ore above, to a silver-copper ore below. Certain portions of the ore can be shipped as mined, others may be sorted and shipped, while still others should be milled. The company has on the property a 100-ton concentrating mill, which was erected for experimental purposes.

### EQUIPMENT USED

In the work of constructing the new tunnel, there were consumed 41 tons of 16-lb. rails, 38 tons 241 lb. of powder, 33,819 caps, 51 miles of fuse, and a little over 2000 cords of wood. A steam plant of 120 hp. capacity and an Imperial type 10 Rand compressor furnished the power, while the workings were ventilated by a No. 3 Roots suction blower, directly connected with a 9x9-in. high-speed, upright engine.

Slip-joint pipe, 12 and 13 in. in diameter, of No. 18 iron, riveted and dipped, was used in connection with the blower, while the compressed-air pipe ran from a maxi-

mum of 6 in. down to 3 in. in diameter at the heading. Three air receivers, 42 in. in diameter by 10 ft. in length, were placed at intervals of about 2000 ft. in the tunnel. In the blacksmith shop there were used a No. 8 Bradley coke furnace for heating the drill steel and a No. 2 Leyner pneumatic sharpener, drop hammer, etc. For the purposes of the tunnel construction alone a camp of 14 buildings was erected. A total of 40 all-steel cars of 17½ cu.ft. capacity each, and six animals were used for hauling the muck. The normal crew in the heading consisted of a shift boss, two machine men, two machine helpers, three muckers, two trammers and a pipe-and-track man.

### ROUTINE OF WORK

Two machine drills of the No. 8 water Leyner type, carrying 1¼-in. hollow steel, were used on each shift and were mounted on a 7-ft. cross-bar for the top set-up and on an 8-ft. bar for the bottom set-up. Three hangers set into hitches in the ribs at the roof, held the air and water hose in the clear. No. 44 square-pointed shovels were used to remove the muck from heavy steel plates, which covered the floor from rib to rib and extended 30 ft. from the face.

At the beginning of the operation two shifts, drilling 7- and 8-ft. rounds were maintained, but later on it was found that three shifts drilling shorter rounds produced better average results. During the operation of removing the muck, the machine men drilled the top, and in ordinary ground the muck was removed by the time the machine men were ready for the lifters. According to the requirements of the ground, 8x8-in. and 10x12-in. timbers, were installed, mud sills being laid wherever full tunnel sets became necessary. Most of the timbers were peeled and hewed, these being considered superior to sawed material.

A ditch 1 ft. in depth and 2 ft. in width, dug along the right rib and under the mud sills, carried off the water. The ventilation, compressed-air and machine-water pipes were set on cross ties over the ditch, while the track was placed on the opposite side of the tunnel. A grade of 6 in. to 100 ft. was adopted, all the timbers being lined and graded with instruments.

In the operation of driving, hangers suspended from plugs in the roof were used to give the center line, and the grade of the back. At every survey station the grade was taken and corrected, and upon completion of the 6235 ft. a check leveling showed the breast to be a little over a foot above schedule, this rise having been due to the difficulty in laying sills in flooded and running ground. After considerable experimenting it was found that 40% dynamite was the most efficient explosive day in and day out. The entire cost of the adit was \$123,920, or \$19.87 per ft. During the operation, John Allen Davis, engineer of the U. S. Bureau of Mines, spent 10 days on the property gathering data which is to be published in one of the forthcoming Government reports.

Messrs. Simonds & Burns, of New York, consulting engineers of the Rawley company, planned the work, while the local operations were in charge of Will C. Russell, manager, and Charles E. Beckwith, engineer. On account of the heavy flow of water through the newly opened vein, the company has suspended work for a short period, but will resume when the water decreases sufficiently to make rapid development possible.

\*Manager, Rawley Mining Co., Bonanza, Colo.

# A Study of Cyanide Precipitates

BY G. H. CLEVINGER\*

*SYNOPSIS*—The possible sources of the principal elements that may be found in cyanide precipitates and the effects of these impurities on precipitation and refining operations are discussed. The author urges the advantage of using especial care in precipitation to obtain a high-grade precipitate suitable for direct melting with a minimum of flux. Analyses of precipitates from several mills are given.

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The precipitates obtained in the cyanide process of gold and silver extraction vary greatly in composition. The presence or absence of certain constituents is determined by three factors: (1) The composition of the ore treated; (2) the method of precipitation; (3) the personal equation of the individual in charge of precipitation and refining.

## SOURCE OF VARIOUS METALS IN PRECIPITATES

Copper, when present, originates from the ore treated and is invariably met with in connection with the treatment of tailings which have resulted from some of the old processes of amalgamation, such as the Washoe, the patio, etc., in which a copper salt was used.

Lead may exist in the original ore as an oxidized lead mineral, which, to a certain extent, is dissolved and precipitated. In some cases lead salts are added to aid extraction; but usually when added in the proper proportion to give the best results in the extraction, most of the lead separates out as insoluble compounds in the ore pulp, little of it passing into the precipitates. Another source of lead in zinc precipitation is the lead contained as an impurity in the zinc used. Both sheet zinc and zinc dust contain lead. This is generally considered an advantage in precipitation, as the lead forms a couple with the zinc. In electrical precipitation when lead is used as anode or cathode more or less lead comes from this source. When bismuth occurs in an ore undergoing cyanide treatment, it is usually found in the precipitates.

Mercury is not a common constituent of ores treated by the cyanide process and hence it is not generally present in the precipitates, except in the case of the cyanidation of the tailing resulting from some one of the amalgamation processes. In cases where the mercury loss was high in the original amalgamation process, its recovery from the precipitates becomes of importance.

When zinc is used as a precipitant, a greater or less amount is always to be expected in the precipitates, on account of the necessity of using an excess of zinc during precipitation. However, the proportion of zinc present can, to a very great extent, be regulated by skillful manipulation so that the amount is small. The well known interference of zinc in connection with the melting operation makes its presence in any large amount highly objectionable; when present in large amount acid treatment of the precipitates, for its removal, becomes necessary before the melting can be satisfactorily done.

In those rare cases where aluminum is used as a precipitant, both metallic aluminum and aluminum oxide are present in the precipitates. In addition to the most

generally occurring metals, which have already been considered, any metal which occurs in the ore and is soluble in cyanide solution, as well as elements which occur in the zinc as impurities, are to be found in the precipitates.

Insoluble salts of calcium and magnesium separate out from the solution during precipitation. This can be prevented to a great extent by not using too high an alkalinity. These two constituents make the melting and fluxing of the precipitates more difficult. Fortunately in case of zinc precipitation the amount which separates from solution is rather small if the proper conditions are maintained.

## LIME TROUBLESOME IN ELECTRIC PRECIPITATION

When electrical precipitation is used the amount of lime separating from solution during precipitation becomes a serious matter. This tends to make the precipitates from electrical precipitation of lower grade and more difficult to refine than the precipitate from zinc precipitation. The high percentage of carbon dioxide present gives a direct clue to the high lime content of these precipitates, inasmuch as carbon dioxide precipitates lime from cyanide solutions as a carbonate. The carbon dioxide is, at least in part, due to the formation of cyanates in the cyanide solution by the electric current, due to the liberation of nascent oxygen at the anode. Carbon dioxide results as one of the products of the breaking down of the cyanates.

Silica, various silicates, alumina, iron, calcium and magnesium salts in large amount are usually the result of an attempt to precipitate turbid solutions. The importance of properly clarifying all solutions, particularly those originating from slime treatment, cannot be emphasized too strongly. In the first place, this finely divided inert material tends to coat the zinc, and thus seriously interfere with proper precipitation; and secondly, when the precipitates are converted into bullion, a larger proportion of flux and a longer period of melting are required.

At the present time the tendency is, with silver-gold ores, to do away with acid treatment of the precipitates and melt the finely divided precipitates directly after drying and mixing with the proper fluxes. In the matter of simplicity and costs this method has everything to commend it, and has become almost universal practice.

## HIGH-GRADE PRECIPITATES POSSIBLE

With proper manipulation high-grade precipitates may be obtained. In the course of my experience precipitates of over 90% total gold and silver have been obtained. This high-grade material can be melted with the addition of but little flux. Precipitates in which the total gold and silver ranges from 60 to 80% are common practice.

The real skill in carrying on precipitation is, not so much in obtaining complete precipitation of gold and silver from the solutions, although this is of great importance, but in obtaining precipitates high in metallic content, so that they can be melted direct without any preliminary treatment and with the minimum addition of flux. When this condition is fulfilled it will be found that

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the best economic results have been attained in precipitation.

The tables of analyses, given herewith, are largely the work of two of my former students, Welton J. Crook and Henry S. Lyne. They show the general range in composition of the precipitates from eight different plants, treating a variety of silver-gold ores, and situated in the United States, Mexico and Central America. In no case have the precipitates been acid treated or subjected to any other special treatment.

#### ANALYSES OF CYANIDE PRECIPITATE

	A	B	C	D	E	F	G	H
Gold.....	1.38	1.32	3.99	3.18	1.18		1.63	0.03
Silver.....	78.05	65.78	61.79	45.40	17.12		79.59	45.15
Copper.....	2.58	0.36	4.03	24.44	29.57		trace	14.58
Total zinc.....	7.84	7.23	7.89	14.30			5.30	13.91
Metallic zinc.....	0.75	0.22	0.32	0.10	0.13			0.95
Lead.....	0.46	6.15	0.92	7.48	0.51			6.66
Mercury.....	none	none	none	0.03	1.90	0.04	none	none
Ferric oxide.....	1.35	1.27	2.65	0.24	0.98		1.00	1.28
Aluminum oxide.....	2.51	4.22	0.90	1.47	18.01		8.27	1.75
Calcium oxide.....	trace	trace	0.47	trace	1.39			0.81
Magnesium oxide.....	1.68	3.05	1.74		5.66		2.24	3.49
Silica.....	0.75	trace	trace	0.40	0.53			0.03
Sodium oxide.....	0.75	0.50	1.83		0.89			3.18
Potassium oxide.....	1.41	1.80	0.70	1.44	13.40	*7.66		1.67
Carbon dioxide.....	0.57	0.98	0.20		0.57			1.58
Water.....								
Oxygen, organic matter, and not determined.....	1.42	7.28	12.89	1.62	8.29		1.97	4.38

\*Taken directly off the cathode.

Sample A: From a mine in Central America, treating a low-grade, silver-gold ore; zinc-box precipitation. Sample B: Mine in Mexico; results from treatment of rather high-grade silver-gold ore; zinc-box precipitation. Sample C: Mine in Mexico; results from treatment of silver-gold ore of moderate grade; method of precipitation, zinc boxes and Merrill zinc dust. Sample D: Mine in Mexico; results from treatment of silver-gold ore of moderate grade; zinc-box precipitation. Sample E: Mine in Mexico; results from treatment of pan-amalgamation tailing; method of precipitation, electrical, using peroxidized lead anode and tin-plate cathode. Sample F: Mine in United States; sample of precipitation taken directly from cathode and resulting from treatment of Tonopah ore; method of precipitation, electrical, identical with method used in case of sample E. Sample G: A second sample from the mine furnishing sample B. Sample H: Mine in Mexico; results from treatment of low-grade silver-gold ore containing some copper; zinc-box precipitation.

#### ANALYSES OF BULLION FROM MILLS FURNISHING PRECIPITATE SAMPLES D AND E

	D	E
Gold.....	2.92%	1.73
Silver.....	44.92	25.03
Copper.....	31.54	64.86
Lead.....	15.79	6.60
Zinc.....	4.35	none
Iron.....	0.56	0.95
Not determined.....		0.83
Total.....	105.08	100.00

Standard methods of separation and analysis were used in making all the determinations. Gold and silver were determined by corrected fire assay, made upon separate samples. Mercury was also determined by a special method upon a separate sample. No attempt was made to detect or determine the rare elements.

#### PRECIPITATES STUDIED CONTAINED LITTLE METALLIC ZINC

A most surprising thing is the apparently small proportion of zinc present as metallic zinc in the precipitates from zinc precipitation. This would seem to indicate that zinc in the extremely fine divided condition, in which it exists in these precipitates, is readily oxidized and therefore little of it remains in the metallic condition upon exposure to the air; or it may be that the combination or intimate mixture between the zinc and other metallic elements in the precipitates, as for example, gold, silver, copper, etc., is such that ordinary methods of determining metallic zinc fail to show its presence. I have already shown<sup>1</sup> that the precipitates, resulting from zinc precipitation,

are in reality alloys of zinc with the metals which have been precipitated from solution. The alloys containing a high proportion of zinc are readily acted upon by dilute acids, while those with a low proportion of zinc might be acted upon but slightly.

The method of determining the metallic zinc was based upon two assumptions: First, that the only metal present which would evolve hydrogen, when brought in contact with dilute hydrochloric acid, was zinc; second, that all the metallic zinc present would be dissolved by dilute hydrochloric acid with a corresponding evolution of hydrogen. Absorption bulbs were introduced for absorbing hydrogen sulphide, carbon dioxide, etc.; also precaution was taken to displace all the hydrogen in the flask in which the precipitates were treated. The hydrogen was converted into water by passing through a tube containing strongly heated cuprous oxide. The water was absorbed in a weighed calcium-chloride tube. From the weight of water obtained was calculated first the weight of hydrogen and from this the weight of metallic zinc. The percentage of metallic zinc in the sample is then calculated.

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#### American Mine Safety Association

A society, known as the American Mine Safety Association, with headquarters at Fortieth and Butler Sts., Pittsburgh, Penn., has been organized as a result of the conference last September, held under the auspices of the U. S. Bureau of Mines. The association, which will hold its first annual meeting in the fall of 1913, is organized to promote safety in coal and metal mines by the adoption of improved first-aid methods and of logical methods of procedure in rescue and recovery work; to recommend the adoption of approved types of first-aid and mine-rescue and recovery appliances; to obtain and to circulate information on these subjects, and to secure the coöperation of its members in establishing proper safeguards against loss of life and property by explosions, fires and from other causes.

The work of the Bureau of Mines to reduce the number of deaths in mines has led to the adoption of many different types of rescue apparatus, and also to the use of many different methods of resuscitation and first-aid-to-the-injured. Hundreds of mines within the last three or four years have been equipped with rescue apparatus, rescue corps, and first-aid corps. Many of these men who are called upon in emergencies have developed their own ways of doing things, and it is the opinion of the organizers of this association that the most efficient methods and apparatus should be found and recommended to the mining industry as a general standard.

From the merely selfish point of view, it should be recognized by operators that it is more expensive to restore wrecked mines, more costly to fight damage suits through the courts and less profitable to pay regulated liability charges or even workmen's compensation, than it is to bear the cost involved in reducing these charges by means of diminishing the number of accidents and the duration of the resulting disability by the adoption of improved safety, rescue and first-aid methods and consequently they should encourage this association, membership in which is open to any individual, firm, corporation or society interested in the reduction of the loss of life and property in mines.

<sup>1</sup>Trans. A. I. M. E., Vol. XXXIV, p. 891.

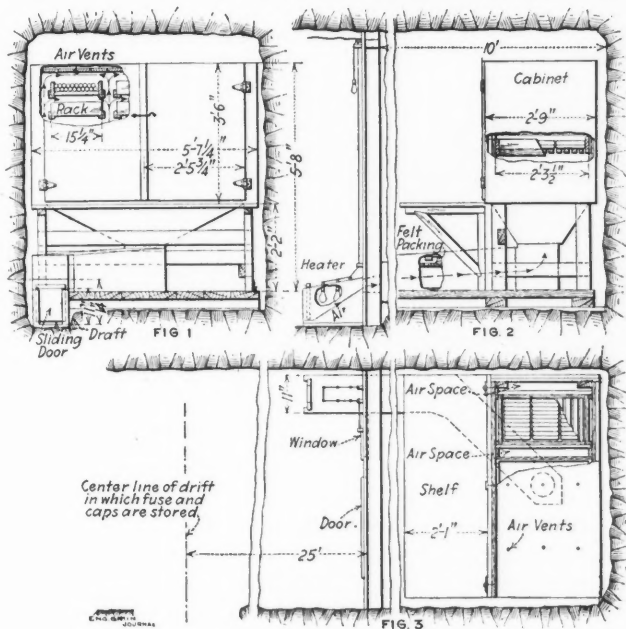


## DETAILS OF PRACTICAL MINING

### Thawing Powder Underground

By A. J. HEWITT\*

A suitable place for a powder-thawing house is often difficult to find, particularly after the prospecting stage is passed and the plant begins to extend, covering the surface with buildings, some of which are sure to be in too close proximity to the surface thawing house. This was the case at the property of the Beaver Consolidated Mines, Ltd. of Cobalt. After considerable study and careful consideration the following solution was adopted: In the underground workings of the mine, on the 200-ft. level, there was an unused drift, the heading of which was about 800 ft. from the main working shaft. In this head-



UNDERGROUND THAWING APPARATUS

ing a powder-thawing cabinet was situated and as heating with steam was out of the question, owing to condensation, a small inexpensive electric heater was installed.

The construction of the thawing cabinet is simple, as can be readily seen by the accompanying drawings. Fig. 1 shows the front elevation, Fig. 2 the side and Fig. 3 the plan.

The cabinet is composed of three tiers of racks, each rack being large enough to contain 60 sticks of dynamite. The racks are made with slat bottoms, slats being close enough together so that it would be impossible for a stick of powder to fall through, at the same time permitting the warm air to come in contact with the under layer of powder in the rack. There is also an air space left at the sides of each tier of racks to allow the heat to ascend and warm the entire interior of the cabinet.

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Warm air is conveyed to the thawing cabinet through an ordinary stovepipe which is well wrapped with 1-in. hair felt and cased with 1-in. lumber. This air duct enters the bottom of cabinet at the center, as shown in Fig. 2. Small vents are present in the top of cabinet to create a draft, drawing warm air continually from the heater.

The electric heater shown in Figs. 1, 2, and 3 is a wooden box covered with zinc, in which are placed six 32-c.p. lamps. One end of the box is made to slide, and is used to regulate the draft in a way similar to the front damper of an old-fashioned box stove. In the other end of the box near the top a hole is made in which is inserted the stovepipe, which extends about eight feet, connecting with the thawing cabinet.

The thawing cabinet is situated in the heading and about 10 ft. back there is a tight partition. Outside of this partition the electric heater and electric light are installed, all wiring being carefully insulated and none extending through the partition. The electric light is allowed to shine into the thawing room through a small glass window. Access to the thawing room is obtained through a door in the partition. Fig. 3 shows the plan of the entire apparatus.

About 25 ft. back from the thawing room in a short crosscut there is partitioned off a small room in which a daily supply of fuse and detonators is kept. In this room all orders for powder are taken care of and distribution made to the different parts of the mine.

❖

### Surveying Spads

The standard spad for underground surveying for a number of years was a horseshoe nail with the head flattened, and punched or slotted to receive the plumb-bob cord. A few years ago, a substitute was proposed consisting of a wire nail with a triangular file-cut halfway through the rim of the head, the nail being inclined when driven, so as to bring the notch on the upper edge of the head. Considerable experience with both types has brought out the following points:

- (1) The wire nail is stronger and better resists chance blows, or blasting, if set near the face.
- (2) It is cheaper and easier to make.
- (3) It makes the plumb-bob easier to hang in the first place, but slower to adjust for height.
- (4) It is more accurate. Any one size of plumb-bob cord can occupy but one position, whereas in a hole the cord can climb the side and be off-center by a small fraction of an inch.
- (5) It is not suitable when it must be set in a position difficult to reach. In such cases, it is customary, with the old-style spad, to hang a permanent loop of cord down to a point within easy reach. This is not possible with the wire nail.

In general, the wire nail is the preferable form, but care should be taken that the head is broad, so that the

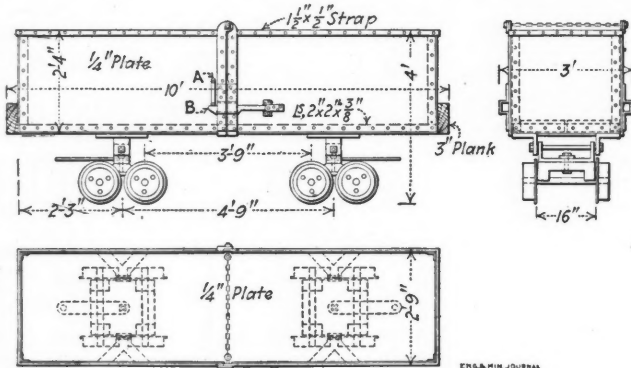
vertical cord can lie snugly in the bottom of the notch and not be forced out by the portion wound about the shank.

❖

## Middle Dump Mine Car

By W. W. SHELBY\*

The two-ton middle-dump mine car, shown in the accompanying drawing, has been in service for years at the Smuggler-Union mine. The sides and bottom are  $\frac{1}{4}$ -in. iron and are held together by  $2 \times 2 \times \frac{3}{8}$ -in. angle irons. A  $1\frac{1}{2} \times \frac{1}{2}$ -in. strap is riveted around the top of the car. The chain across the top at the middle prevents deformation and makes the pivots, about which the car dumps, more rigid. Three-inch planks are used for lining the bottom and for bumpers, the rest of the car being entirely of iron. In order to dump the car, lever *A* is knocked to one side and latch *B* forced upward by a light blow from a pick or a single jack; the car will then break in the middle, dropping the ore into pockets or bins beneath the track. The trucks are so spaced that the load between them is only a little greater than that in the ends, thus avoiding undue strain upon the latch and its safety lever. The truck,



SMUGGLER-UNION MIDDLE-DUMP CAR

with fixed wheels, is unique. There is no bottom half of the journal, the lower half of the axle being exposed. A U-bolt extending beneath the axle holds the wheels to the truck when the car is lifted from the track. Those cars that come to the surface are automatically oiled by passing over two rollers of such dimensions and so placed between the rails, that the lower parts of the axles beneath the bearings touch them in passing. The wooden rollers are free to revolve. A sack or cloth is tacked on their circumference, and being suspended in a tank of oil, they are themselves automatically oiled and furnish a good lubricating surface to the axles. The cars are coupled by chains.

❖

## Cleaning Plugged Hollow Steel

Hollow-steel drill bits, plugged with rock cuttings and sludge, require cleaning and are a source of delay and annoyance to the blacksmith. J. E. O'Rourke describes in *Mine and Quarry* an ingenious method of removing the plug as follows:

Fill the plugged bit with water; wrap a piece of wicking about a steel taper plug of proper size, and drive it hard into the shank end of the steel with a hammer.

\*Mining engineer, Smuggler, Colo.

Now make a boiler out of the drill by placing it over the forge. A small amount of heat will generate enough pressure to shoot the cuttings out of the bit, and the taper plug can be removed easily by a few blows on the anvil.

❖

## Top Set Slicing in the Chisholm District

By L. D. DAVENPORT\*

In one of the small mines of the Chisholm district, in Minnesota, it was decided to try top-set slicing. The ore in the working place in question extended about 21 to 23 ft. above the level and to take it out, the miners proceeded as follows. First an open set was put in the drift using 7-ft. caps and 12-ft. posts (sets 1 and 2 shown in the plan Fig. 1). Next, the slice was extended along the caved ground putting in  $7 \times 12$ -ft. drift sets spaced about five feet apart for about 25 ft., which was the limiting distance on that side. Then the ore above the last sets, 6 and 7, was taken out and  $7 \times 8$ -ft. sets were put on top of the  $7 \times 12$ -ft. sets already in place. This top tier was then worked back to the open set.

The caps of the bottom sets were framed on top to make a bearing for the posts of the top sets. Seven

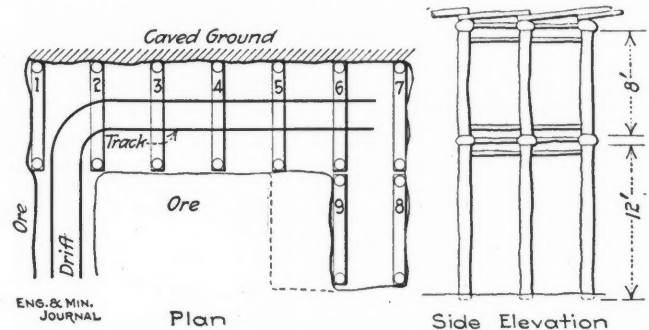


FIG. 1. UNSATISFACTORY METHOD OF TOP-SET SLICING

sprags were used in the top sets as shown in the elevation, two from post to post on each side, one at the top and one at the bottom and two between the caps, one on each side. The seventh sprag was placed between the posts of each top set on top of the cap of the bottom set.

The next step was to make room for sets designated in the plan as 8 and 9; this time, the full height of the ore was taken out and both top and bottom sets were put in. In taking out the ground adjacent to 9, for the next set, the side weight of the unsupported caved ground caused set 5 to move and although the miners tried to hold it with props, they could not stop its moving and the set "jacked-knifed," the end of the room filling with sand.

In another similar room we tried taking out the top set adjacent to set 9 first, then putting in the cap of the bottom set as a sill for the top set and then coming in under it with the 12-ft. posts. This method did not seem to help much, for as soon as the second slice was opened up the whole room started to move. As soon as the posts moved one inch or so, one end of the sprags would drop down and then a little working in the caved ground would throw down a set.

In a single slice the top sets worked well but in widen-

\*Engineer, Oliver Iron Mining Co., Mesaba, Minn.

ing out for the second slice, as soon as the ground was relieved at the side of a set, the timber started to move. It is usually difficult to blast down a single top set slice, for even when all the bottom posts are blasted the caps act as stulls and hold up the top sets.

It is claimed for this system that less timber is used and that the miners have less shoveling to do, on account of running the ore from top sets directly into the car, than in taking the same ground in two slices. I found that the amount of timber used was about the same with the exception of the boards used on the bottom of the upper slice. The miners stated that the time saved in shoveling was more than offset by tightening and replacing sprags, putting in props, etc.

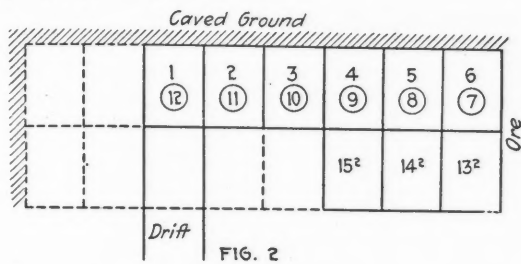


FIG. 2

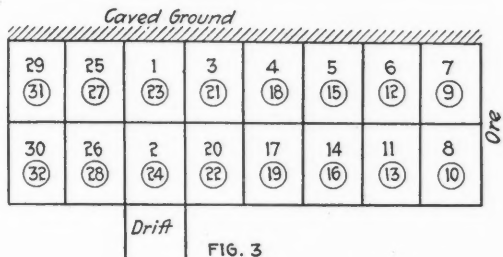
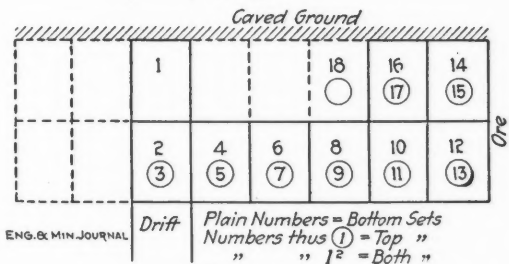


FIG. 3



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 Drift Plain Numbers = Bottom Sets  
 Numbers thus ① = Top "  
 " " 1<sup>2</sup> = Both "

FIG. 4

IMPROVED METHODS OF TOP-SET SLICING

But the most important thing is the question of the safety of the men. A regular 10-ft. slice is certainly safer to work in than a 21-ft. top-set slice. In this particular case, the miners put up two raises in the drift and took out the remainder of the pillar in two slices. They did not have to hoist the timber any higher than in the top sets and the slight additional cost per cubic foot of the top drift and the raises, as compared with the same amount of ore mined by slicing, was negligible. Also, the miners got out a few tons per day more than with the top-set slicing.

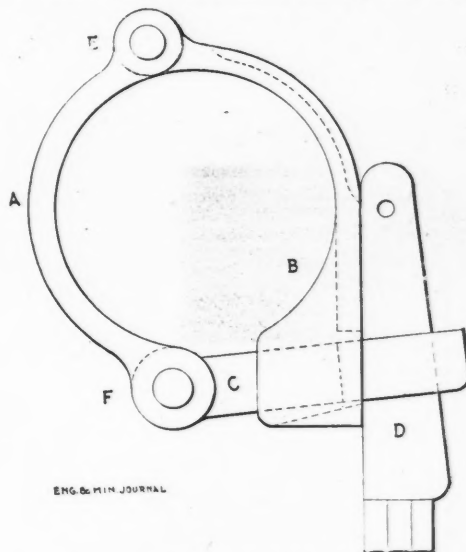
Fig. 2 is a plan showing the order in which the sets were taken out in the working place described. Fig. 3 shows a proposed method of taking out the ground with top sets which might work better, although it has not been tried here. After putting in the open sets 1 and 2, the bottom sets are taken out along the caved ground to the limiting distance, say to set 7, then, instead of raising up and taking out the top sets, we cut in

for set 8 on the bottom while we have eight or nine feet of solid ground over us to hold back the caves. Next, set 9 on top of set 7 is taken and then set 10 on top of set 8. The remaining sets are taken out in the order indicated in Fig. 3. Another proposed method, which is similar to that used in square-set work in heavy ground, is shown in Fig. 4. The open sets 1 and 2 are put in the drift and the top set 3 over 2 is taken out, then set 4 in the solid is taken and the top set above it, etc., taking the ground in vertical tiers. As soon as set 13 is finished, the solid side of the room is boarded up. Next, set 14 is taken out on the bottom while the ground above it steadies the caves, then set 15 is taken and at 16 another bottom set started.



Rule Drill Post Collar

The accompanying drawing, forwarded by R. A. Rule, of Osceola, Mich., illustrates a four-piece post collar, which dispenses with the use of bolts. The pieces B and C are hinged to the piece A at E and F, respectively. The piece C passes through a hole in the end of the piece B and is itself slotted to receive the tapered key D, which,



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RULE POST COLLAR

working on the piece B, forces it against the post. The blow of a hammer on the key D thus tightens or releases the clamp. The ease and rapidity of operation of a hinged-and-keyed collar, as compared with the usual bolted collar, results in an appreciable saving of time.



Largest Mine Hoist in the World

An order, for what is thought to be the largest mine hoist in the world, was recently placed with the Nordberg Manufacturing Co., Milwaukee, Wis., in competition with both German and English bidders.

The hoist, according to the *American Machinist*, is to be used at the Inverness Railway & Coal Co.'s mine at Inverness, Cape Breton Island, N. S., and is of the Nordberg-Corliss duplex, double-drum type. The cylinders are 34 and 34x72, and the hoist is equipped with two drums, each of which is equipped with Nordberg axial clutch and post brake, enabling independent operation of either drum.

The hoist is designed to lift the following load: A train of 12 cars, each car weighing 1150 lb. and containing one long ton of coal. It will be required to pull this load up a 10,000-ft. incline, which is  $16^\circ$  at the surface and  $35^\circ$  at the bottom. This makes the stress on the rope about 41,000 lb., and in view of this rope stress and the length of the cable, this hoist is thought to be the largest ever constructed.

Hoists with larger cylinders have been built for the copper-mining business, notably the two Nordberg hoists at the Tamarack mine in Calumet, Mich., but these are surpassed in the present case in the two particular features mentioned.



### A Motor Truck Trailer

The accompanying illustration shows a trailer designed by the International Motor Co., for the McConnell mines of Yerington, Nev., to be used with a motor truck. This trailer has a steel-lined body, which will carry five tons, or about  $2\frac{1}{2}$  cu.yd. of ore. The front wheels have a



FIVE-TON TRAILER FOR MCCONNELL MINE

diameter of 36 in., and the rear wheels 54 in., with a 6-in. face to both front and rear tires.

The tongue or pole has suitable connections for attaching to the draw-head furnished on either the Mack or Saurer truck. The trailer has its own braking system, the brakes of a substantial pattern having removable steel brake shoes, which are applied to the rear wheels.

The use of trailers in connection with motor trucks marks a new step in the development of this method of ore transportation, and is expected to show a marked reduction in costs.



### Pipeline Angle Wells

In laying a 60-in. wood-stave pipeline through Platte Cañon, the Denver Union Water Co. encountered several sharp turns, to round which, vertical tanks or angle wells were used. These, according to *Engineering Record*, Jan. 18, 1913, are tanks of  $\frac{3}{8}$ -in. steel, 8 ft. in diameter and 10 ft. high, with flat bottoms and rounded tops. About midway on the sides are riveted steel bell-end outlets set at the proper angle for the two pipeline tangents. The tanks are equipped with a manhole, and are held to a 6-ft. foundation slab by eight  $1\frac{1}{2}$ -in. bolts through angles riveted horizontally to the sides.

Besides affording a means of making a sharp turn, always difficult with wood pipe, these angle wells give a better opportunity for anchoring against horizontal outward thrust; and in addition, act as air and sand traps. The line is laid to bring them at summits for trapping the air, and to release it, Crispin air valves are bolted to special castings on the tops. There is a  $2\frac{1}{2}$ -ft. depression for the sand below the outlet pieces and a blowoff is provided for removing whatever material may settle.



### Blueprint Rack

The filing and handling of blueprints in a mine office often becomes a troublesome problem. The accompanying illustration, from *Engineering News*, Jan. 23, 1913,



BINDERS AND RACK FOR BLUEPRINTS

shows a rack that has proved useful in such cases. The prints are assembled in convenient groups, and bound together with softwood strips,  $1\frac{1}{4} \times \frac{1}{4}$  in. in section, fastened by  $\frac{3}{16} \times 1$ -in. machine screws and wing nuts.



### Cold Weather Concrete

Mining exigencies are no respecters of climate or weather. It frequently becomes necessary to cast outdoor concrete in freezing weather, as cold as  $40^\circ$  below zero. The laws for concrete setting in cold weather are only just beginning to be studied, and in the absence of exact rules for guidance, it is necessary to take every precaution both to prevent actual freezing and to guard against overloading during the setting period.

When concrete must be set under freezing conditions, it is customary to heat the sand and the rock and to use boiling water for mixing. If the freezing period is likely to be long continued, the concrete can be kept warm by steam coils applied under burlap or tarpaulins. The use of salt water to lower the freezing point is not uncommon, but its action in retarding the time of setting is not well known, so that its availability is of questionable value.

# DETAILS OF METALLURGICAL PRACTICE

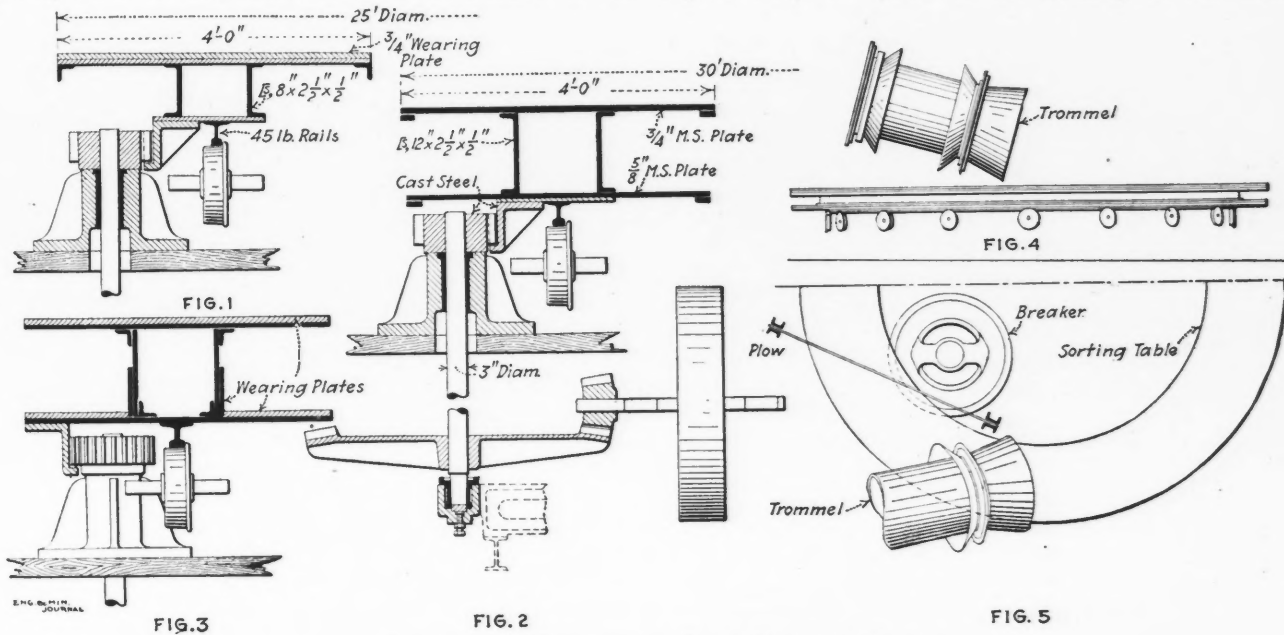
## Types of Rand Sorting Tables

Sorting is not extensively resorted to in the metallurgical works of this country as compared to those on the Rand, yet there are many mines where conditions are pointing to the advisability of rejecting as much waste as possible before the product of the mines is sent to the crushing machines in the mills. For this reason some of the sorting-house equipment which has been highly developed on the Rand is of interest not only to gold-mine operators, but to those operating lead and zinc mines, the coarse product from which it often pays well to sort by hand.

Sorting tables, while perhaps not so flexible as sorting belts, show a considerable number of good points which justify their use at present, states C. O. Schmitt in "A

provide for the space lost between the plow and point where the ore reaches the table plus any space required for washing, should this be done on the table. The space so lost varies from 8 to 12 ft., according to the arrangements made, and this must be added to the space occupied by the operators. The ore should be led to the table by a gate capable of making the distribution evenly over the whole width of the table, so as to facilitate both the washing and the subsequent picking out of the waste rock.

The waste removed from the table is generally thrown through holes in convenient places into a storage bin for removal to the waste dump. With a large table this becomes awkward, and to overcome the difficulty, sorting tables are now built with two decks, the lower deck serving to carry the waste to the opening of the waste-



STRUCTURAL DETAILS OF RAND SORTING TABLES

Textbook of Rand Metallurgical Practice, Vol. II." The use of a sorting table permits building a compact plant with only one broken-ore bin and of efficient supervision. There is no limit to the size of a sorting table beyond structural reasons, but the tables found in use on the Rand vary in diameter from 18 ft. to 30 ft., with a width of rim from 30 to 42 in. The width of the rim is limited by the reach of the sorting operators, and for that reason 42 in. should be the outside limit. The rim of the table usually moves at a peripheral speed not exceeding 30 ft. per min., so that the men have ample time to see the waste present.

The diameter of the table is determined by the number of operators required to remove the waste rock; one man can pick out from two to three tons of waste rock per shift of 10 hr. Each man requires from 2 1/2 to 3 1/2 ft., so that the total circumference required can be calculated. In doing this, however, care must be taken also to

rock bin, where it is scraped off by a plow. The gold-bearing ore is left on the table until it has almost completed a full circuit, and it is then removed by a plow so as to make room for the fresh supply. Fig. 1 shows the rim of a single-deck table, and Fig. 2 shows a table of the double-deck type. In Fig. 3 is shown a cross-section of the rim of an improved type of table having ample provision for wear in the shape of renewable plates.

A bin door with feed lip can be used for feeding the ore to the table, and is preferable to feeding directly from a washing trommel, as in that case there is a tendency to deliver the material in a narrow stream of greater depth than is desirable for good sorting. Whichever method is used, care must be taken that the direction of feeding is tangential to the rim of the table. Figs. 4 and 5 show the arrangement of washing trommel, plow, and fine breaker in relation to the sorting tables. The angle between the plow and the table should be sufficiently

acute to permit scraping off the ore with a minimum of power and the least possible wear on the face of the table. The plow must be rigidly held against the pressure arising from the accumulated ore, but it should be free to move vertically, for the reason that it should be possible to lift the plow whenever a piece of ore gets between it and the face of the table. To do this the plow is carried in suspension, and is well balanced. The wear on the plow must be taken into account by providing a wearing plate as shown in Fig. 6.

Sorting tables are generally carried on rollers by means of an ordinary steel rail fixed to the under side, and wherever a rigid foundation for these rollers cannot be obtained they should be carried in spring-borne bearings. Sorting tables of the type illustrated are driven by a circular rack and pinion from a countershaft arranged vertically, which is again driven by a set of bevel wheels from a horizontal shaft provided with a pulley. Direct driving by an electric motor is generally preferred, as the presence of line shafting and driving belts is not desirable in a sorting plant, being difficult to install, and interfering with the work. The power varies with the size of the table, but in no case should five horsepower be exceeded.

The sorting capacity depends upon the space available for operators, but the carrying capacity is a function of peripheral speed and width of rim. With a velocity of

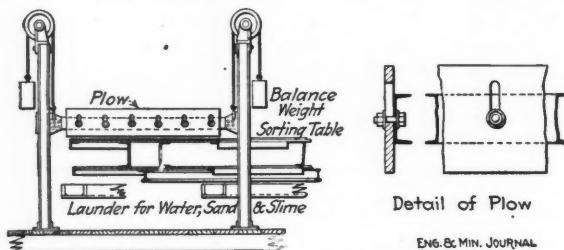


FIG. 6. DETAILS OF SORTING-TABLE PLOW

30 ft. per min. the carrying capacity of sorting tables can be taken as follows: The 30-in. table will carry 60 tons of ore per hr.; the 36-in. table, 72 tons; the 42-in., 84; the 48-in., 96 tons per hr. The cost of operating sorting tables varies considerably in the different plants, but may be taken as follows: Maintenance per ton milled 0.80c., power 0.16c., capital 0.20c., or 1.16c. total cost.

✽

## Methods of Sand Treatment Compared

At a recent meeting of the Institution of Mining & Metallurgy, H. A. White compared the systems of sand treatment in use at the Homestake in the Black Hills and the Princess Estate on the Rand. In the first place the separation of only 40% of slime against about 63% of —200-mesh material in final pulp seems extremely low, he said, when it is considered that the cost of slime treatment is lower, and the extraction higher, than on the sand plant. Again, the practice of running water to waste both in filling and after first cyanide solution has been applied has frequently been proved dangerous.

Compared with this, the method of the Princess Estate, using a Caldescott sand filter table, with the sand free from slime obtained from diaphragm cones by double washing, and a short-circuit of 0.03% cyanide solution rarely rising above 0.3 dwt. in gold value, has obvious advantages, says Mr. White. The following representative

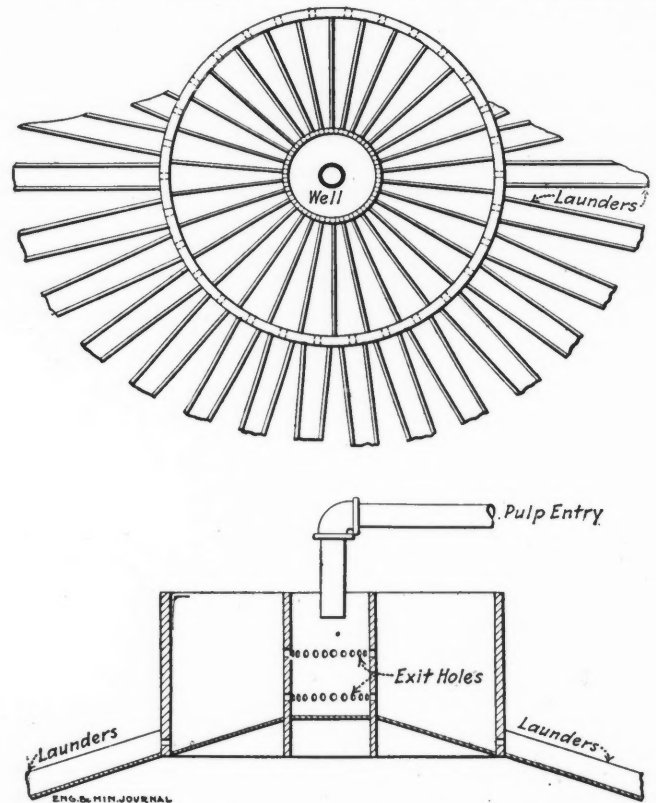
figures are given: Slime treated, 64.37%; sand treated, 35.63%; sand residue, 0.23 dwt.; slime residue, 0.149 dwt. The final drainings on this sand average less than 0.05 dwt., which figure, Mr. White thinks, would not be attained by the system of returning gold to the vats as advocated at the Homestake.

✽

## A Simple Pulp Distributor

A simple and efficient distributor for pulp, devised and in use at Stratton's Independence mill in the Cripple Creek district, is illustrated in the accompanying drawing.

There is a central well, of a size proportionate to the flow of pulp, the walls of which are perforated by a number of holes equal to the number of separate streams of



PULP DISTRIBUTOR USED AT STRATTON'S INDEPENDENCE

pulp desired. These holes are bored at exactly the same level and a little above the bottom of the well. The holes lead to an equal number of compartments surrounding the well, the outer wall being perforated also, one hole for each compartment. These outer holes lead directly to launders by means of which the pulp is carried in the desired direction.

The pulp enters the central well through a pipe, as shown, and should have sufficient momentum to avoid any settlement of heavy particles. The holes being bored at the same level, the outflow through them will be equal, especially if there is sufficient pulp flow to allow a slight head. There is a second row of holes bored a short distance above the first in order to take care of any especially heavy flow of pulp. The device works perfectly, the streams in all divisions being equal. The installation at the Independence mill divides the pulp into 24 streams for feeding concentrates and has given satisfaction ever since its use was commenced.

## NOTES FROM CURRENT LITERATURE

### Sulphuric Acid Industry U. S.

In speaking before the International Congress of Applied Chemistry (Orig. Common., vol. 2, p. 241) Utley Wedge gave the following statistics on the sulphuric-acid industry of the United States. The approximate annual consumption of sulphuric acid in the United States 50° Bé., for the manufacture of phosphatic fertilizer is 2,400,000 tons; for refining petroleum products, 300,000 tons (acid equivalent to about 500,000 tons being actually employed in this industry, taking into account its repeated use); for use in the iron and steel and coke industry, 200,000 tons; for the manufacture of nitrocellulose, nitroglycerin, celluloid, etc., 150,000 tons; and for other purposes, 200,000 tons. Of this acid, 2,665,000 tons were, in 1911, made from pyrites, 275,000 tons from copper-sulphide ores smelted in blast-furnaces, 285,000 tons from blende and 25,000 tons from brimstone. It is found most economical to erect combined sulphuric-acid and fertilizer works adjacent to the agricultural districts where the fertilizer is consumed, such works being especially numerous in the Southern States where cotton is grown. Acid works are similarly located near the oil refineries, and there is said to be a growing tendency for steel companies to manufacture their own acid. Contact processes have been installed wherever nitrocellulose and similar products are manufactured, and about 10% of the total production of acid is made by one or other of the contact processes. The practice of nodulizing cinder from pyrites burners is said to have become general in all localities where there is a market for the nodulized cinder as iron ore.

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### Influence of Blast Furnace Flue Dust on Cement

The influence of blast-furnace flue dust on the strength of portland cement was investigated by F. M. Meyer (*Tonind.-Zeit.*, p. 1883, 1912; abstr. *Journ. Soc. Chem. Ind.*, p. 1181, Dec. 31, 1912). He found both the coarse and the fine dust, which were deposited in the conduits between the furnace and the gas filters, had a weakening action when mixed with cement. These specimens of dust were rich in insoluble residue, poor in soluble silica and lime, and contained no alumina. On the other hand the very fine dust, which collected in the gas filters themselves, contained only 0.6% of insoluble residue, and 29.8, 20.1 and 22.5% of soluble silica, alumina, and lime respectively. This filter dust possessed weak setting properties of its own, and added to portland cement in quantities of 10, 20 and 30%, effected a marked increase in the tensile and crushing strengths; even 40% of added filter dust increased the seven-days' (in air) and scarcely affected the 28-days' (under water and in air) tensile and crushing strengths of 1:3 cement-sand mortars. The dust in question was so fine as to leave no residue on a 5000-mesh per sq.cm. screen, its specific

gravity was 2.37, and its volume-weight was 265 grams per liter. The latter seemed to be the only characteristic which would enable one to detect its presence as an adulterant of portland cement, for the volume-weight of portland cement averaged about 1140 grams, whereas that of a mixture containing 90 parts of cement and 10 parts of filter dust would be only 791 grams.

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### Changes at Knights Deep, South Africa

The situation at the Knights Deep mine, Witwatersrand, South Africa, is summed up in the *South African Mining Journal*, Nov. 30, 1912. The property is a low-grade deeper-level mine, and on its ability to keep a large equipment at work, crush a large tonnage and maintain working costs at a low level, depends its future. The recognition of this fact induced the management to acquire the Simmer East property and equipment, the latter a joint installation operated by the two companies; with a view to extending the policy of crushing on a still larger scale than at present, the capacity of the plant is to be increased from 100,000 to 120,000 tons per month. Two more large tube mills of standard 22 ft. 6 in. size and six vats are to be added, and when these additions are completed the Knights Deep will be in a position to mill nearly a million and a half tons per year.

A further important alteration in policy is the decision to abolish sorting altogether. The new crusher station is not yet wholly completed, but the present maximum capacity is about 5000 tons per day, which is sufficient for all requirements. The ore from the various shafts is delivered to the new crushing plant and is dumped by means of large circular tipples similar to those in use on coal mines and into which trucks are run direct from the trestle tracks.

The feature of the new crushing station is that it is designed for stage breaking. When completed there will be on each side of the plant two large Hadfield Jack crushers above, and four similar rock breakers underneath. One side of this plant is now finished, while on the other side three of the six crushers are installed and in use. The ore after sizing and preliminary breaking is run on belts to the mill ore bins. At the time of the commencement and construction of this new station, the abandonment of sorting had not been agreed on; otherwise the crushers might have been built directly over the battery bins, which are of 7000 tons capacity.

Apart from the abolition of sorting, the principal features to be observed in connection with the reorganization of metallurgical practice at the Knights Deep are: Removal of all plates from the battery to the recovery and extractor house; the addition of two new tube mills to the reduction plant; the addition of six new 70-ft. tanks to the cyanide plant.

Underground the position, both in the Knights Deep and Simmer East sections of the property, remains practically unaltered. The Simmer East now is distributing about 40,000 tons per month to the joint plant and it is believed that from this section a large tonnage will be won for some time to come. Operation on a basis of 100,400 tons milled in Knights Deep in October earned a profit, from ore yielding only 3.84 pennyweight per ton, of £20,818. Working costs were 11s. 11d. per ton.

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### Earth Dam with Core Wall

A dam of the earth-fill type, 145 ft. high above the stream bed, 400 ft. long on the base and 1050 ft. long on top is under process of construction in the Goose Creek Valley, Cassia County, Idaho. The dam will provide storage facilities for an irrigation project.

In the middle of the dam a concrete core wall extends from bedrock to the top. The lower portion of this, according to *Engineering Record*, Jan. 11, 1913, is of plain concrete 3 ft. thick. The upper portion is 1 ft. in thickness and reinforced with triangular mesh. At the upstream toe of the dam and on the sides against the ground, either cutoff trenches or cutoff walls are constructed. At the downstream toe there is a cutoff drainage trench.

The body of the dam is composed of sand, clay and rock fragments, obtained from a borrow pit about three-quarters of a mile away. It is loaded by steam shovels into steam-drawn cars and handled by a belt conveyor at the dam. This material is placed in 6-in. layers and after wetting, compacted by a steam roller.

A sluiceway is provided by a 700-ft. tunnel in the rock, having about 100 sq.ft. of section. To relieve the heavy pressure on the sluice gates during operation, a pressure tower is connected with the tunnel below the gates, through the upstream toe of the dam. This contains openings at various heights, controlled by gates, so that the pressure on the lower side of the sluice gates may be varied through wide limits and a minimum pressure corresponding to 50 ft. of head obtained on the main sluice gates during operation.

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### Extraction of Bismuth from Carbonate Ore

A process for the extraction of bismuth from carbonate ore is described by F. W. Frerichs (*Trans. Am. Inst. Chem. Eng.*, 1911, p. 90). The ore treated was a siliceous ore of yellow clayey appearance and carried about 1 oz. of gold, 15 oz. of silver, 5% of bismuth and 5% of lead in the dry ore. The ore as it came from the mine was lumpy and contained 10 to 15% of moisture. Treated with water it formed a slimy mixture which would not filter or settle. It could not even be filtered in filter presses or on suction filters. It would not give all of its bismuth to dilute hydrochloric acid unless it had been roasted in the open air.

The ore was dry enough to run through an ore crusher, in which it could be reduced to  $\frac{1}{2}$  in. It was then placed on a drying floor and afterward ground to powder, about 25% of which would pass a 100-mesh sieve. The mixture of roasted ore and dilute hydrochloric acid after boiling, settled and filtered fairly well, and in this condition the ore seemed to be well prepared for extraction

with dilute hydrochloric acid or a dilute solution of sulphuric acid and sodium chloride.

The ore was boiled in a round tank eight feet in diameter and three feet high, which allowed agitation of the ore by hand. A charge was 3000 lb. roasted ore, 1200 lb. 60° Bé. sulphuric acid, 1110 lb. sodium chloride, with enough water to make 100 cu.ft. of liquid. The charge was boiled by live steam with constant stirring. The contents of the boiling tank were separated immediately after boiling by running most of the solution, in which the slimes were suspended, into a vacuum filter of suitable size, whereupon the coarse settleings in the boiling tank were shoveled into another vacuum filter. Eighty-five cu.ft. of bismuth solution could be filtered off with a vacuum of 15 in. of mercury in 12 hr. The bismuth solution was 43° Bé. The solutions after filtering were diluted with twice their volume of water, precipitating the bismuth as basic chloride. The basic chloride was then melted in iron kettles, a charge being 40 lb. basic bismuth chloride, 6 lb. potassium chloride, 12 lb. soda ash, 58%, and 8 lb. of powdered charcoal. The solution, after having the bismuth precipitated as basic chloride from it, was treated with sulphuretted hydrogen, which precipitated the sulphides of the other heavy metals. These sulphides were then again filtered out on a vacuum filter. A sample of the sulphides produced in this way, after roasting, carried 42% of lead and bismuth, 15.2 oz. of silver, and 1.6 oz. of gold per ton. These sulphides would either be returned to the original roasting furnace or simply added to the leached residue, according to metal content. The leached residue itself was sold to the lead smelters for the lead, silver and gold contained therein.

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### New Transvaal Corundum Deposits

A new discovery of corundum was made toward the end of 1911 on the upper ridges of the watershed, seven or eight miles from the Oliphants River, and west of the Mashishimali Ranges. The deposits, according to J. Broad-Roberts (*Journal of the South African Institution of Engineers*), are associated with a mica belt and occur in a variety of forms. One is an irregular vein of feldspar and quartz, about four feet wide, in which sapphires also are found. The footwall is a calcareous tuff, the hanging a talcose and micaceous decomposed schist.

At two other points lenses of ruby granular corundum were discovered. Associated kyanite and fushite occur here and translucent rubies from the size of pinheads up to over one inch in diameter and four inches long. Nearby are small veins of Alexander garnet. At another point a lens of some size contains gray crystals in a matrix of clear, micaceous rocks and a schistose sediment. Other deposits of granular corundum ore are also known.

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### Irving Leaching Process

In a leaching process devised by Joseph Irving, of Salt Lake City, Utah (U. S. pat. 1,048,541), sulphuric acid and ferric-sulphate solution are used for leaching copper ore. The copper is then precipitated out on either iron or zinc scrap. A novelty in this process seems to be the use of a filter composed of pyrite and sand, through which the solutions are passed before precipitation. It is claimed that the pyrite will completely reduce any ferric salts present in the solution, thereby greatly diminishing the consumption of iron or zinc scrap.



# Electrolytic vs. Iodide Assay for Copper

BY P. S. HARRISON\*

**SYNOPSIS**—A series of experiments was made by the author to determine whether, on impure Mexican mattes, the electrolytic or the iodide method would give superior results, his conclusion being that the iodide was best suited to the conditions under which he worked.

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Two grades of impure matte which were being worked on daily were chosen by me as material on which to make a comparison between the electrolytic and iodide methods of copper assay. Their general analysis was as given below:

	Ins %	Fe %	Zn %	S %	As %	Sb %	Ag %
Metallurgica Nacional....	0.6	23.6	2.7	24.5	0.31	0.12	0.923
Hidalgo.....	.....	.....	.....	5.0	7.90	24.12	.....

On these two mattes three methods for the electroanalysis were used, of which details are as follows:

## DETAILS OF ANALYTICAL METHODS EMPLOYED

**First method:** To 1 gram of matte in a 250-c.c. beaker, add a little water, 10 c.c. concentrated nitric acid, 1 c.c. sulphuric acid, and heat to dryness on hot plate. Cool, add 8 c.c. concentrated nitric acid, 30 c.c. water, and enough salt solution to precipitate all the silver; boil, filter through a 11-cm. filter paper into a tall electrolysis beaker, washing with hot water and electrolyze with *N. D.* 100 = 0.2 amp., 1.9 to 2.1 volts, for 14 hr., washing cathode twice with warm water and once with alcohol, dry at 100° C. and weigh.

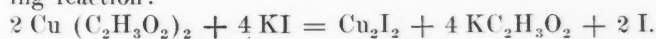
Difference between original weight of cathode and cathode plus deposit equals metallic copper plus such impurities as have been deposited, which are shown in the table below, under "Direct Method."

**Second method:** To 1 gram of matte in a 250-c.c. beaker, add 10 c.c. pure bromine, heat gently until dry, bake for one hour, cool, add 10 c.c. concentrated nitric acid, 10 c.c. hydrochloric and digest until all is in solution, then add 5 c.c. concentrated sulphuric acid and boil to abundant fumes, not boiling off much of the sulphuric acid, cool, add 30 c.c. water, boil 10 min., then allow it to stand hot till any anhydrous ferric sulphate has entirely dissolved, then filter through an 11-cm. filter, receiving the filtrate in a tall electrolysis beaker, washing with hot water; to the filtrate add enough salt solution to precipitate all silver present, and electrolyze as in the first method, treating the cathode the same way after completion of determination. The results appear in the table below, under "Bromine Method."

**Third Method:** To 1 gram of matte in a 250-c.c. beaker add 10 c.c. concentrated nitric acid and 10 c.c. hydrochloric acid, boil until decomposition is complete and then add 5 c.c. concentrated sulphuric acid, and boil to abundant fumes, not boiling off much of the sulphuric acid. After cooling, boil with 30 c.c. of water for 10 min., and then allow to stand hot until any anhydrous ferric sulphate has entirely dissolved, then filter through an 11-cm. filter to remove the lead sulphate, recovering the filtrate in a 400-c.c. beaker, washing the filter and residue at least six times with hot water. Now add to the filtrate 25 c.c. of a saturated solution of commer-

cial sodium thiosulphate and boil for 20 min., filter through a 12½-cm. filter, washing twice with hot water and once with grain alcohol, dry paper and precipitate in a porcelain crucible carefully and ignite at a low temperature, which will leave the copper sulphide ready to be treated; brush the contents of crucible into an electrolysis beaker and add 8 c.c. concentrated nitric acid, heat to dissolve the copper and silver, adding salt solution to precipitate the silver, filter, wash with hot water, add 2 c.c. concentrated sulphuric acid and electrolyze as in first method, treating cathode in the same way after completion of determination. (See table below "Hypo Method.")

The fourth method, the iodide, is the same as the third up to the point where the copper residue is transferred from the crucible. In this method brush the residue into a copper flask, add 100 mg. of potassium chlorate and 10 c.c. concentrated nitric acid, heat to dryness, cool, add 50 c.c. water, then ammonia water in excess, boil off the excess, add 10 c.c. acetic acid, boil until all copper is in solution, cool to room temperature, and add six grams potassium iodide, which gives the following reaction:



The iodine set free is titrated with a standard solution of potassium thiosulphate, using starch as indicator, which gives the following reaction:



The advantage of the iodide method is that such impurities as As, Sb, Zn, Bi and Ag do not interfere with the determination, and in the hands of a good man it is extremely accurate and checks should compare within 0.03% of copper. (See under "Iodide Method" in table.)

## RESULTS ON METALURGICA NACIONAL MATTE

Determination	% Cu. No. 1	% Cu. No. 2	% Cu. No. 3	% Cu. Average	Amp.	Volts.	Time Hr.
Direct method....	43.28 (a)	43.26 (a)	43.32 (a)	43.27	0.2	2.0	14
Bromine.....	43.00 (a)	43.06 (a)	43.02 (a)	43.02	0.2	2.0	14
Hypo.....	42.89 (b)	42.96 (a)	42.94 (a)	42.93	0.2	2.0	14
Iodide.....	42.96	42.92	42.94	42.94	.....	.....	.....

(a) Cathodes dark; not a good deposit; shows impurities. (b) Cathodes bright; good deposit; no impurities.

## IMPURITIES COME DOWN WITH COPPER IN ELECTROLYSIS

From the table it is readily seen that the direct method gives 0.33% higher copper results on Metallurgica Nacional matte than the iodide. The reason for this is that all the impurities are still in solution, and a part of them are precipitated with the copper, which is shown by the dark color of the cathode, although theoretically, the arsenic and antimony should not precipitate with the current density and voltage used, but due to the combination they precipitate partially with the copper and give high results, which can be better seen on the determination of Hidalgo matte in the table below. Since the bromine and hypo methods check the iodide, and as practically the same procedure has to be gone through, there seems to be no advantage in using electroanalysis instead of the iodide method on Metallurgica Nacional matte. As the iodide method is better known by chemists here in Mexico, I would recommend it, as conditions such as acid strength, current density, voltage, and personal equation play a large part in the accuracy of the electroanalysis.

\*Chemist, American Smelting & Refining Co., Aguascalientes, Mexico.

If the sample is not a high-grade sulphide the bromine method will not be of any use, as only the sulphides of arsenic and antimony are volatilized by bromine, so in that case if the sample contained impurities to any great extent the hypo method would have to be used or the method described by Ledoux & Co., in which the copper is precipitated as cuprous sulphocyanate, after which proceed as in the hypo method, above. Ledoux & Co. further states that all mattes and ores of unknown composition are run by this method, as it eliminates such impurities as bismuth, arsenic, antimony and other elements which might possibly contaminate the copper.

## RESULTS OBTAINED ON HIDALGO MATTE

Determination	% Cu. No. 1	% Cu. No. 2	% Cu. No. 3	% Cu. Average	Amp.	Volts	Time Hr.
Direct method...	23.80 (a)	23.54 (a)	23.88 (a)	23.74	0.2	2.0	14
Bromine.....	19.68 (a)	20.42 (a)	20.48 (a)	20.26	0.2	2.0	14
Hypo.....	18.64 (b)	18.62 (b)	18.62 (b)	18.62	0.2	2.0	14
Iodide.....	18.70	18.68	18.66	18.68	...	...	...

Remarks: (a) Cathodes black and not a good deposit. (b) Cathodes bright; good deposit.

The above table shows that neither the direct nor bromine methods can be used on this class of material, as the arsenic and antimony are not quantitatively driven off by the bromine as they are not present in the form of sulphides, although some is driven off, as there is a difference of 3.48% between the bromine and direct methods.

## DETERMINATION OF IMPURITIES IN ELECTROLYTIC FOILS

To prove that this was arsenic and antimony, the six cathodes from the direct and bromine methods were placed in an electrolysis beaker and 20 c.c. nitric acid and 60 c.c. water added, and boiled until all precipitate was dissolved off the cathode. Three grams of tartaric acid were added and the solution evaporated to about 5 c.c. volume. Five cubic centimeters of concentrated sulphuric acid were added and boiled to fumes, cooled, water added, the solution made neutral with ammonia water and ammonium sulphide added, which precipitated the copper, leaving the arsenic and antimony in solution. The solution was filtered, receiving the filtrate in a large beaker, made acid with hydrochloric acid and the arsenic and antimony precipitated as sulphides. The precipitate of copper sulphide was then treated as follows:

Filter paper and contents were placed in a beaker and 8 c.c. concentrated nitric acid added with 10 c.c. water and heated gently, the filtrate received in an electrolysis beaker, 2 c.c. concentrated sulphuric acid added and electrolyzed as before, giving the following results:

Determination	% Cu No. 1	% Cu No. 2	% Cu No. 3	% Cu Average	Amp.	Volts	Time Hr.
Direct method.....	18.74	18.69	18.72	18.71	0.5	2.0	6
Bromine.....	18.70	18.77	18.75	18.74	0.5	2.0	6

Remarks: Cathode bright; good deposit; no impurities.

The conclusions that can be drawn from the above results are as follows: That on all unknown ores and mattes there should be a separation made of the copper and impurities, and that the direct and bromine methods at best are satisfactory in few cases, so that for the electroanalysis there is left only one method, the hypo, with which results in both of the mattes used, check with the iodide method, and as the latter is much easier to handle and can be applied to every kind of ore and matte with perfect assurance that results will be correct.

Iodimetry is the most accurate method known to volumetric chemistry, and by using potassium thiosulphate the standardized solution does not change from one day

to another, although I would recommend running standards at least twice a week or oftener. The time required to make an iodide copper determination is much shorter than the electrolytic and takes less of one's time from other work; then, too, when electrolytic work is done in a laboratory, there has to be a large expenditure for expensive apparatus, balances, etc., which also favors the iodide method, as when acids are used with discretion the cost per determination is small. So summing up all the data, I would say that under all circumstances the iodide is as good or better, as in the way it is handled there are no interfering elements, while silver always has to be separated in the electrolytic method.

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## Glass Sand

Since glass sand constitutes the base of practically all commercial glass, where freedom from color, transparency, and brilliance are essential in the product, the importance of the quality and purity of the sand cannot be overestimated. Good glass sand should be perfectly white in color. The grains should be uniform, even and angular, rather than rounded, and should not be very fine.

The chief impurities present are usually iron and alumina, the latter generally present in the form of clay or loam, or associated with organic matter, a part of which can be, and in the better grades is, removed by burning and washing. Iron is, however, the most dreaded of impurities, as it destroys the color of glass by giving it a greenish tint which is exceedingly difficult to neutralize perfectly. Hence the iron should not exceed 1/2% in the sand used for the manufacture of any kind of flint or white glass, while for the finest grades there should be not over a trace present.

Sand containing not over 99% of pure silica is abundant in the United States. In the Eastern States it exists in almost inexhaustible quantities in Juniata County, Penn.; Hancock County, W. Va.; Fox River, Ill.; Berkshire County, Mass.; also at Crystal City, Mo.; near Minneapolis and St. Paul, Minn.; while Ohio, Indiana, New Jersey, New York, Maryland, Georgia and Alabama all possess vast deposits of pure sand. The greatest output at present is from Pennsylvania, about 30% of the country's total, which may be estimated at about 1,600,000 tons for 1912.

Glass manufacturers generally make yearly contracts for their supply of sand, for which the prices usually range from \$1.05 to \$1.25 per ton, f.o.b. mines, according to quality. In the last five or six years there has been practically no change in the prices quoted, but prior to that time fine mountain sands often sold at from \$1.50 to \$1.75 per ton.

While common sand for cheap green glass can sometimes be bought f.o.b. works (under favorable water-transportation conditions), at as low as \$1 per ton, the economy in using this grade is doubtful.

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**The Petroleum Market**—The Standard Oil Co. thus explains the situation: "The year 1912 developed new conditions. The worldwide increase in the demand for petroleum products, conspicuously gasoline, the steadily diminishing production of the qualities of crude oil from which illuminating oil and gasoline are commercially derivable; and the steady encroachment upon surplus stocks on hand. As the inevitable outcome of the foregoing conditions there has been a marked advance in the price of the higher qualities of crude oil. While it is hoped that the higher prices being paid for crude oil will stimulate the discovery of new fields of the requisite quality no decline in the price of gasoline can be foreshadowed unless in the event either of a larger supply or a lessened demand."

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## COPPER

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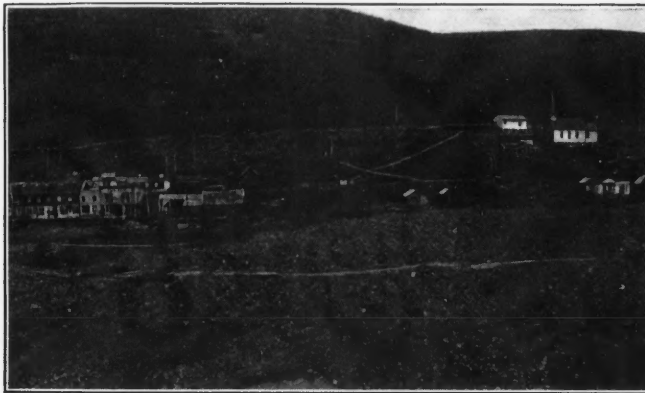
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21,275—**DRILLS**—Possibilities of Further Increase in the Efficiency of Modern Air Drills. Gust G. Bring. (Jernkontorets Annaler, 1912; 100 pp., illus.)

21,276—**FIRE**—Ueber den Brand der Hauptschaltanlage in Heinitz und ihren Neubau. A. Peucker. (Preuss. Zeit. f. B., H. u. S., 1912; Part 3, 4½ pp.) On the conflagration of the main electric machinery building at Heinitz and the arrangement of the rebuilt works.

- 21,277—HAULAGE—The Margin of Safety Required for an Haulage at Great Depths. R. B. Greer. (Journ. So. African Inst. of Engrs., Nov., 1912; 2½ pp.) Discussion on paper previously indexed. 60c.
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- 21,312—AUSTRIA—Die Bergwerks- und Hütten-Industrie Oesterreichs im Jahre 1911. (Glückauf, Nov. 9, 1912; 3½ pp.) Austria's mining and metallurgical industry in 1911.
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- 21,325—NICKEL—Reagens zum Nachweis geringer Mengen Nickel. Fortini. (Chem. Ztg., Dec. 14, 1912; ½ p.) Reagent for detecting minute quantities of nickel. 40c.
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- 21,327—PHOSPHORUS IN ACETYLENE—The Determination of Phosphorus in Commercial Acetylene. L. M. Dennis and W. J. O'Brien. (Journ. Ind. and Eng. Chem., Nov., 1912; 2½ pp., illus.)
- 21,328—SAMPLING MILL—Murray Mill of the Utah Ore Sampling Co. L. O. Howard. (Salt Lake Min. Rev., Oct. 30, 1912; 3 pp., illus.)
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- 21,334—TAR OIL—Verwendung des Teeröls für Kraftmaschinenwerke und industrielle Feuerungsanlagen. Schömburg. (B. u. H. Rundschau, Dec. 20, 1912; 4¼ pp.) Application of tar oil for power purposes and industrial heating apparatus. 40c.
- 21,335—WHITE LEAD—The Manufacture and Properties of Sublimed White Lead. John A. Schaeffer. (Paper before Eighth Internat. Congress of App. Chem., 1912; 8 pp., illus.)
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- 21,337—CEMENT—Tufa Cement as Manufactured and Used on the Los Angeles Aqueduct. J. B. Lippincott. (Proc. A. S. C. E., Oct., 1912; 26 pp., illus.)
- 21,338—PORTLAND CEMENT—The Raw Materials of the Portland Cement Industry. No. 1. Percy S. Barber. (Engineer, Nov. 8, 1912; 1¼ pp.) 40c.
- MISCELLANEOUS**
- 21,340—ACCIDENTS—Trade Accidents and Diseases. Frederick L. Hoffman, Wilhelm Lindemann, Thomas Oliver, J. D. McGowan, Friedrich Roepke, Wm. C. Hanson, H. Linenthal, C. R. Henderson and J. B. Andrews. (Eng. News, Oct. 24, 1912; 3 pp.) Abstracts of paper before the Internat. Congress of Health and Demography. 20c.

# PHOTOGRAPHS FROM THE FIELD



SOME KLONDIKE SCENES, INCLUDING A VIEW OF THE TOWN OF GRAND FORKS WHERE GOLD WAS DISCOVERED, STARTING THE KLONDIKE RUSH

## CORRESPONDENCE AND DISCUSSION

### The Purity of Metals

My attention has been called to a leader on "The Purity of Metals" in the *JOURNAL* of Nov. 23, 1912. I do not doubt that the first part of a charge of electrolytic recast copper may occasionally turn out 99.93%; if this is so, it is quite different from my experience of this kind of American copper in this country. It is, of course, probable that it is now made more pure than a few years ago. The whole point of my contention, and it is supported by overwhelming facts obtained in practice, is that such copper is not the best for use in the engineering and shipbuilding trades. I am pleased to see that you confirm my contention by pointing out that a copper-wire drawer has had to reduce his speed, which is a serious loss. I know that this is the experience of many mills, not only in wire drawing, but in brass and copper mills, owing to the excessive purity of the metals used.

If copper tubes were supplied to engineers or shipbuilders in England, which passed the American specifications, they would be rejected as a source of danger in any engine room in which they were used. It has been known for years over here that so called impurities are absolutely as essential in copper as carbon is in steel; the whole basis of casting copper depends on the presence of oxygen, arsenic or phosphorus. Any specification which does not take this into account is valueless.

I inclose herewith the standard specifications which are adopted in this country and you will see it is quite a different style of specification to that which the American Society for Testing Materials has drawn up.

ERNEST A. LEWIS.

Birmingham, England, Dec. 24, 1912.

[The specifications inclosed cover: Copper plates for locomotive fire boxes, which must carry not less than 99% Cu, and from 0.25 to 0.45, or 0.35 to 0.55% As, according to class; rods for locomotive stay-bolts, carrying not under 99.25% Cu, and 0.15 to 0.35 As; tubes for locomotive boilers, carrying not less than 99% Cu, and 0.35 to 0.55% As; and copper conductors, the only copper strictly comparable with that on which the committee of the Association for Testing Materials, has reported. These specifications are given below. The above use of copper or brass in locomotive building in the United States is confined to engines for export, and consequently this use is not a matter of great import to the American consumer.—EDITOR.]

For copper conductors, the Standard for hard-drawn high-conductivity commercial copper is a wire 1.0 m. long weighing 1.0 gram, and having a resistance of 0.1539 standard ohms, at 60° F. (15.6° C.). For the purposes of this definition the term hard-drawn copper is defined as that which will not elongate more than 4% on a gage length of 10 in. when broken by tension. The standard for annealed high-conductivity commercial copper is a wire 1.0 m. long, weighing 10 grams and having a resistance of 0.1508 standard ohms at 60° F. An average temperature coefficient of 0.00238 per deg. F. (0.00428 per deg. C.) is adopted.

The weight of copper is taken as 555 lb. per cu.ft. (8.89 grams per cu.cm.) at 60° F., which gives a specific gravity of 8.90. A variation of 2% from the adopted standard of resistance is allowed in all conductors. An allowance of 1% increased resistance, as calculated from the diameter, is allowed on all tinned copper conductors between diameters 0.118 in. and 0.028 in. inclusive. For the purpose of calculation of tables, a lay, involving an increase of 2% in each wire, except the center wire, for the total length of the cable, is taken as the standard.

### Stamp Milling in 1912

I wish to call attention to an incorrect statement in the article on "Stamp Milling in 1912," by Louis D. Huntoon (*ENG. AND MIN. JOURN.*, Jan. 11, 1913). The statement referred to is as follows:

H. F. Marriott is responsible for the introduction on the Rand of a preliminary discarding of waste rock from the mine ore by hand. The first mine to adopt this was the Village Main Reef.

J. Harry Johns adopted sorting at the Ferreira in the year 1893, and "a preliminary discarding of waste rock from the mine ore by hand," or sorting, was adopted by the majority of the Rand companies a comparatively short time thereafter, and has been a conspicuous feature of the Rand practice ever since.

I am sure that Mr. Marriott would be the last person who would want to claim credit for the pioneer work of other men.

SIDNEY J. JENNINGS.

Los Angeles, Calif., Jan. 20, 1913.

[Mr. Marriott has made no such claim, so far as we are aware. Mr. Jennings corrects an error of Mr. Huntoon—EDITOR.]

### Who is a Mining Engineer?

The first edition of "Lamb's Diagram"<sup>1</sup> has already been exhausted. Please make this public so that the delay in replying to some correspondents will be understood.

S. P. G.<sup>2</sup> has not complied with the conditions laid down in the original article, as he does not say that he has not determined his own relative position. His suggestions will be given a hearing, however, if he will publish his factors.

MARK R. LAMB.

Santiago, Chile, Dec. 28, 1912.

### The Metallurgy of Copper in 1912

In my article, the "Metallurgy of Copper in 1912," in the *JOURNAL* of Jan. 11, 1913, I stated that the roasting furnaces at the new Calumet & Arizona company's smeltery will be 12 ft. in diameter. This was an error, as these furnaces will be 21 ft. in diameter. In some way the figures became transposed in my notes.

ARTHUR L. WALKER.

New York, Jan. 22, 1912.

<sup>1</sup>Eng. and Min. Journ., Nov. 16, 1912.

<sup>2</sup>Ibid., Nov. 30, 1912.



## EDITORIALS

### Silicosis in the Joplin District

The mines of the Joplin district, especially those known as "sheet ground" mines, are opened in a bed of chert mineralized with blende and galena. The mines are generally dry and the drilling in them is to a large extent done by upwardly slanting holes. The chert is very brittle, breaking into myriads of sharp angular particles. Under these conditions it might be imagined that silicosis, leading to serious pulmonary troubles, would be prevalent. Long ago we expressed the opinion that it was prevalent, although the character of the local mining population and the absence of reliable statistics, in fact of any medical statistics at all, prevented the early recognition of the trouble. This situation has, however, changed with time, and the existence of the danger is now recognized by several of the more important mining companies, which have started to combat it.

We are informed that in almost every instance the companies find it extremely difficult to make their miners observe even the more simple of the necessary precautions. This is a common experience. In all kinds of work men willingly court known and certain hazards rather than to take a little trouble to guard against them. In the crusade against lead poisoning and all other occupational diseases, it has not been the callous employer alone who has had to be reformed, but also the careless workman. Of the two, the employer has generally been the more amenable to reason.

At the mines of the American Zinc & Lead Smelting Co., the largest in the Joplin district, all the rock drills have been equipped with automatic sprayers. However, the drill-men are obstinate in using this device, and it is only by the threat of discharging disobedient employees that the company is enabled to enforce its use. In connection with this device a rubber tube runs from a bucket of water to the drill, and a fine spray is kept going continuously at a point about 8 in. inside of the collar of the hole. The drillers are put to the extra trouble of providing buckets of water at intervals, wherefore their objection.

The same company, which is under an enlightened management, has also tried the experiment in one of its mines, of providing each miner with an individual canteen for drinking water. It is hoped that the spread of contagious diseases may be reduced in this way. All of this is in line with the most modern thought and practice in sanitation.

### Pipe Corrosion in Mines

The corrosion of the water lines of mines by the acid water that often has to be pumped is a vexatious problem always. In such districts as Butte, Mont., and Joplin, Mo., where the ore is sulphide and all the water has to be pumped, it is especially a matter of great concern. It is commonly overlooked in such mines that the air lines need attention just as much as those employed for

the conveyance of water, with the difference that in one case the protection must be on the inside, and in the other case on the outside. Drips of water from the roof upon a pipe will quickly cut a hole through the latter and permit the whistling escape of air that is so often to be heard. In these cases it is not merely the wasting of pipe that is to be prevented, but also the wasting of air. A good many mine managers are careless about this, but in the large and best operated mines its importance is well recognized. We know of one great group of mines in which a corps of engineers is detailed to keep an eye on the air lines all the time. The saving of power effected in this way is found to be highly economical. When the whistle of escaping air is heard in a mine, the conclusion may safely be drawn that there is something wrong in the running of that mine.

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### An Unusual Transaction in Silver

Perhaps the most remarkable feature in the London silver market last year was the conduct of the heaviest transaction of the year in such a way that it had practically no effect upon the market. Even early in the year it was apparent to the Indian government that it would be necessary to buy a large quantity of silver later in the year to keep up its coinage reserve. Contrary to the usual custom it was decided to make the purchases, if possible, in such a way that they would not be suspected and would not disturb the market. Accordingly they were distributed over several months—April to August—and were kept in London until shipments became absolutely necessary.

Of course, others had expected that coinage purchases would be made, especially the Indian speculators who had bought and held silver for two years past in anticipation of such a contingency. But so adroitly was the operation carried through that they do not seem to have suspected anything until September, when it became necessary to make heavy shipments from London on government account. They excited general surprise, but had little or no effect on the market. The silver had been bought and was out of the way and no more purchases could be expected, for a time at least. The credit of carrying out the plan and preserving the requisite secrecy seems to belong to the house of Samuel Montagu & Co., which conducted the buying for the government.

Much fault has been found in the market and even in Parliament with the nature of the transaction. It is claimed that concealment deprived the market and the sellers of silver of the benefit which they ought to have received. The Indian speculators were especially bitter. On the other hand, it is claimed that a large sum was saved by the Indian government which would otherwise have been added to the money to be raised by taxation; while steadiness of the silver market is in itself a benefit to Indian trade.

Whatever opinion may be held on these points, the whole transaction was certainly well managed from a

business point of view, and was almost entirely unprecedented in its nature; though it would be difficult to repeat it for some time to come.



### The Aqueduct Accidents

An article in the present issue of the *JOURNAL* gives the figures for accidents and deaths on the new Catskill aqueduct, and explains the working conditions. The large total number of accidents occurring in this work has been the object of severe criticism by the daily press and we are glad to publish facts which largely extenuate the Board of Water Supply. Nevertheless, with all the evidence in, the figures as compared with those recently published by the *JOURNAL* for Arizona and Montana mines, are strikingly bad. We have, as the death rate for the aqueduct tunnel work for 1912, 8.4 per 1000, as against 6.6 for Arizona, and 3.21 for Montana, and a general average of about four in Western mining.

We think the Board of Water Supply might have done much better in this matter. With such capital as never falls to the lot of a mining company to expend, and with the highest engineering intelligence to draw upon, it might have taken a long step forward by investigating the whole matter of underground accidents, and so ordering things as to reach the irreducible minimum of deaths; but the opportunity was not seized and it appears now that it is safer to work in a well managed metal mine than on this broadly planned and conspicuous public undertaking.

We are aware that the source of the difficulty is the poor quality of labor available, unintelligent generally, and specifically unacquainted with underground work, as it is, but in all other respects the advantage of favorable conditions is with the aqueduct. Its shafts are comparatively shallow; there are no open stopes and no reason for the frequent falls of ground that are the most prolific source of fatalities in metal mining; no such speed is required or obtained as would excuse carelessness; funds are abundant and no pressure toward immediate dividends exists. In this case surely the rather superior attitude often adopted by our civil-engineering friends toward the mining profession would be hardly becoming.



### Publicity in Mining Matters

As the readers of the *JOURNAL* know, we have constantly urged greater publicity in mining matters. Unlike most manufacturing business, mining is almost a noncompetitive business. In fact, in gold mining, it is entirely so, as the price of the product is absolutely fixed. Consequently, publication of information is not going to cut the mine's profits; interchange of information will probably increase them. The superintendents who have nothing more to learn are all dead; those who can learn nothing more ought to be.

Apart from the general check on honesty of directors and efficiency of managers, gained by the policy of publicity, stockholders may some day see that there is another way in which publicity may help them. In the case of mines run on the Star Chamber plan, it can be seen by anyone that if a stockholder desires to sell his stock, he will get just what some insider chooses to give him for it; the public knows nothing, and can learn nothing

of the true worth of the mine. Let the minority stockholders work for publicity. Get a protest on the minutes, even if you cannot get the information.



The latest recrudescence of the green gold myth comes from Chicago. A letter written from there to the manager of an important gold mine has been brought to our attention. This letter reads thuswise: "I write to inform you that I have discovered a treatment for the development of gold in the ore. By this treatment the growth of the mineral can be discerned in from eight to 10 weeks. Six months of the treatment gives a gain of 100%, and a year's treatment gives all the way from 100 to 1000%. The importance of the discovery to the mining world, indeed to the world at large, can be established only by test of the treatment. The treatment costs \$1 per ton or less. I will sell the discovery to those who wish to buy on the following conditions." It is unnecessary for us to quote the conditions, which are succinctly stated, but we may say that they seem to us to be reasonable and entirely devoid of hoggish spirit. At first sight we were struck by the irony of writing to the manager of a gold mine to tell him how to make gold grow in his ore, but upon second thought the fine logic of the writer appealed to us. A proposal to make gold grow in a brickyard would probably be dismissed promptly as unworthy of consideration, but there are many desperate mine managers who would like to make gold grow in their ore.



Heavy advances in price have been noted in several of the minor metals of the platinum group recently. For iridium, for instance, there has been an increased demand, due chiefly to the automobile trade, while supplies have not increased. The price of an ounce of the metal is now nearly four times that of an ounce of gold. Palladium has also been scarce and high in price; but the demand for this metal is small and variable. The supply of iridium is not likely to increase, for our Russian correspondent reports the production in the Urals very small.



The fire which imprisoned 35 men in the Nelson tunnel of the Happy Thought mine at Creede, Colo., in December, draws attention once more to the importance of the requirement that every mine have two separate outlets. In this last case, as in the fire at Copperhill, Tenn., several years ago, the men were able to make their escape through connecting workings. Otherwise there might have been catastrophes. The latest incident also emphasizes once more the great danger of fires in metal mines that commonly exists.



The copper market has not yet settled. Once or twice there has been signs that it was coming into equilibrium, but some new uncertainty in Europe has interfered. Vigorous European buying is not to be expected until the war cloud has been dispersed and industry is freed from alarm on account of it.



The index for Vol. 94 of the *ENGINEERING AND MINING JOURNAL*, for the period from July to December, 1912, is mailed with this issue. Subscribers who fail to receive this index should notify the subscription department promptly.

## BY THE WAY

Colima has been in eruption again. Is this also a revolt against Madero?

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Six million packages were handled by the parcels post during the first week of its operation. Doubtless a goodly proportion of these went from the mail-order houses to remote mining camps.

❖

The Treasury Department at Washington has issued a notice to the public that it is no wise connected with "The United States Treasury Gold Mining Co.," which is said to be sending out "literature" from Chicago.

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A well known copper magnate was once asked for a definition of a good copper mine. "A good copper mine," he replied, "is one that will not only pay dividends, but also will withstand mismanagement and rascality and still pay dividends."

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Prof. Alexander Agassiz, who was for years president of the Calumet & Hecla Mining Co., left an estate which has been valued by the appraisers at \$2,136,252. The estate consisted mainly of securities which totaled \$1,902,265. Professor Agassiz held a block of 1059 shares of Calumet & Hecla stock, which was appraised at \$555,975, but strange to say the appraisers found that he held 5000 shares of Hawthorne Silver & Iron Mines, Ltd., and 5000 shares of Temagami-Cobalt, which are classed as worthless. It was for the sale of such stocks that Julian Hawthorne and his associates are now on trial in the Federal court. There were other worthless stocks, listed by the appraisers, such as: Simmons Rolling Machine Co., 155 shares; Dexter Woolen Mills Co., 100 shares; which would indicate that even those who become wealthy and are generally regarded as "insiders," do not always succeed with their stock purchases; and, on the other hand, one really successful mining stock paved the way for a fortune.

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The U. S. Geological Survey has been troubled lately by men fraudulently claiming certain connections with the Survey. Recent advertisements of a South African oil company, prominently displayed in London and other papers throughout the British Islands, contain a flattering recommendation of the holdings of this company by an engineer, W. W. Van Ness, who is stated to be "late of the United States Geological Survey." Mr. Van Ness is unknown to the geologists of the United States Geological Survey and so far as can be determined from the records has never held any scientific or other appointment with that organization, says the Survey's press bulletin. The statement that he has been a member of this scientific bureau of the United States Government is obviously intended to delude persons into purchasing stock on the strength of the recommendation conveyed by this connection, and without doubt it may have been successful in misleading some. Such a statement amounts to no more nor less than fraud, whether authorized by Mr. Van Ness or not. Another case is

that of a man in the Central States who is quoted as having been a field man of the Survey and as having resigned his position to take leases on some of the mineral deposits discovered by him in the course of his work for the Government. The facts are that he was employed by one of the Survey geologists for 14 days as a guide.

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Four miners were arrested at the Grand Central station in New York as they stepped off the Western Express, on Jan. 21. The arrests were made as the result of a telegram from Sheriff Harry Schraeder, of Leadville, Colo. The men are Romain Noldine, Eugenio Bortorlato, John Pearzzeni and John B. Zadra—at least, that is the way the reporter spelled their names. On being searched it was found that each man wore under his shirt a close-fitting money bag containing, besides a quantity of coin and greenbacks, a goodly store of gold dust and nuggets. The baggage checks of the party called for small iron-bound chests that were extremely heavy. According to a local dispatch, the stolen gold is supposed to have come from the Little Jonny, or from the London mine. superintendent of the New Monarch Mining Co., appears superintended of the New Monarch Mining Co., appears in the papers as complainant against the four miners. The thefts were discovered through the exhibition of a 24-lb. nugget sold to a saloonkeeper in Leadville by the men under arrest. The discovery of this piece of gold led to an investigation, and the cabin in which Noldine and his two brothers lived, was searched. A quantity of high-grade ore and gold dust was found there, and the two brothers were placed under arrest. Just before this, Romain Noldine and his three companions had started for New York. The men were held awaiting the arrival of an officer from Colorado. "The crime with which the men are charged is called high-grading in the mining country," explains the *New York American*, "and is accomplished by slowly accumulating minute specks of gold ore day by day until a fortune has been accumulated."

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## The Nipper

(Written for the "Engineering and Mining Journal")

BY BERTON BRALEY

The Nipper is the bell-hop of the mine,  
 And the wise guy's always pretty good to him,  
 For though he's fresh and flip he has got you in his grip  
 And your chance to wiggle out of it is slim.  
 He's the wisest little devil that you know,  
 As he scampers like a monkey here and there,  
 Though he's often known to tarry with the tools he has to  
 carry,  
 He is better when you smile than when you swear.  
 When you're in an awful hurry for your tools,  
 He will linger, he will loiter on his way,  
 He will amble and he'll "mope," wander round from stope  
 to stope,  
 While you're sweating at the waiting and delay;  
 But when you want a good excuse to loaf  
 And you hope he never, never will appear,  
 He will get his errand done and come back upon the run  
 With the cheery salutation, "Well, I'm here."  
 He is made of mingled pepper-plant and lye,  
 He's the latest thing in repartee and slang,  
 Underground he raises Cain to the miners' grief and pain,  
 And on top he's often leader of a gang!  
 His amusements they are various and vain,  
 He's the owner of a most amazing gall,  
 He's no model kid, it's true, he will smoke and drink and  
 chew,  
 But we've got to have the Nipper, after all.

## Federal Mining and Smelting Co.

Stockholders owning preferred shares in this company have served notice upon the management to discontinue delivering ore to the American Smelting & Refining Co., and have communicated similar notification to the latter company, announcing their intention of inaugurating legal proceedings for the annulment of the ore contract between the two companies. This is to be done on the ground that the terms of the contract are unfairly in favor of the smelting company, that the latter controls the Federal company through its ownership of the majority of the common stock of the latter, that the contract is, consequently, made in effect by the smelting company with itself, and to the loss of the preferred stockholders of the mining company. Sydney Norman, of Spokane, is leading the fight in behalf of the preferred stockholders. He is represented by G. J. and S. N. Carr, of New York.

Some years ago the American Smelters Securities Co. bought of John D. Rockefeller 30,700 shares of the common stock of the Federal Mining & Smelting Co., which was carried on the books of the Securities company in "Investment Account." With the depreciation in Federal shares this investment account has repeatedly been written down, and at the end of 1911 it stood at \$1,585,670, this including Federal stock and all other securities of companies in which a controlling interest was not held.

The Federal Mining & Smelting Co. has about 120,000 shares of preferred stock and 60,000 of common stock outstanding. The preferred stock (7%, cumulative) is preferred both as to principal and accrued dividends in event of liquidation. The preferred stockholders have no vote whatever, except they may vote jointly with the common stock on any proposal to increase the outstanding preferred stock. The 7% dividends were paid until and including December, 1911. From and including March, 1912, preferred dividends have been paid at the rate of 6%. The last common dividend was 1½%, paid in January, 1909, although 1908 operations had resulted in a deficit after payment of dividends and a portion had to be paid out of surplus. According to the *Boston News Bureau*, the largest stockholders at present are as follows:

Am. Smelt. Securities Co. ....	29,952	Jesop & Lamont.....	1000
Harry Bamberger.....	600	L. Levy & Co.....	700
Rogers & Gould.....	390	Alex Milne.....	650
Schuyler, Chadwick & Burnham	1,200	J. A. Moffett.....	500
Charles Sweeney.....	100	Albert Plaut.....	300
Van Schaick & Co.....	877	D. B. Ryan.....	330
C. W. Wilhelm.....	800	G. W. Street.....	400
Harris, Winthrop & Co.....	485	W. N. Welch.....	320
Levi Holbrook.....	300	Wolff Bros.....	405

Many of the above are New York brokerage houses.

The smelting contract between the Federal and the Smelting company provides for payment for 90% of the lead at 90% of the New York price up to 4.10c. for the latter; when the New York price is higher than 4.10c. the mining company benefits by half of the excess. Silver is paid for at 95% of the New York price and gold at \$19 per ounce when the content of the ore is 0.05 oz. or more. Zinc is penalized at 50c. per unit in excess of 10 units. The returning charge is \$8 per ton for smelting, plus the freight to smeltery where consigned. The freight rate is said to average \$7@7.25 per ton.

American Smelting interests assert that the threatened suit will amount to nothing, inasmuch as the contract between the two companies, which it is alleged is unfair to the Federal, was made by able mining and

smelting men of both companies and was at that time considered equitable. They say the present contract is merely a 21-year extension of contract made by the Smelting company and Standard Oil interests when the latter controlled the Federal, and is similar to many contracts made about that time with other companies.

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## British Iron Trade in 1912

The foreign iron trade of Great Britain in 1912 showed considerable gains over the preceding year. The total tonnage of iron and steel exported and imported for the full year was as follows:

	Exports		Imports	
	1911	1912	1911	1912
Pig iron.....	1,203,109	1,263,835	175,911	220,810
Other iron and steel.....	3,312,796	3,554,170	1,586,047	1,778,634

This trade, with that in machinery and other finished products, is valued by the Board of Trade returns for the year as follows:

	Exports		Imports	
	1911	1912	1911	1912
Iron and steel.....	£43,730,292	£48,628,978	£11,133,854	£12,970,862
Machinery.....	30,900,678	33,161,772	5,768,662	6,820,744
Cutlery and hardware.....	10,214,458	12,492,079	6,708,535	9,694,572
New ships.....	5,663,115	7,031,899	.....	.....
Total.....	£90,568,543	£101,314,668	£23,611,051	£29,486,178

In 1912, the increase in the total value of exports was £10,746,125, or 11.8%; in the value of imports, £5,875,127, or 24.7%, as compared with the previous year.

## IRON AND STEEL PRODUCTION

The report of the British Iron Trade Association, just issued, gives the following figures of production for the first half of 1912, comparisons being made with both halves of 1911:

	1911		1912
	First Half	Second Half	First Half
Pig iron made.....	5,110,823	4,607,815	3,606,147
Bessemer steel ingots.....	765,229	695,911	674,251
Open hearth ingots.....	2,477,982	2,522,490	2,327,731
Total steel ingots.....	3,243,211	3,218,401	3,001,982
Wrought or puddled iron.....	552,566	638,933	467,260

The first half of 1912 showed considerable decreases from 1911, but in the second half of the year there was a great gain in production, so that it is believed that the totals for 1912 were equal to those of the preceding year. There was a large increase in the imports of pig iron and crude steel, for conversion into finished material.

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## Agricultural Entry of Oil Lands

### WASHINGTON CORRESPONDENCE

Senator Clark, of Wyoming, has reported from the Senate committee on public lands a bill affecting the lands in Wyoming now withdrawn from entry as oil lands. The provisions are substantially those already in force governing homestead entry on the public lands in Utah, which provide that homestead entry can be made on any such land and full patent secured, except for reservation to the United States of all oil and gas in the lands, together with the right to prospect for, mine, and remove the oil and gas upon payment for the actual damage suffered by the settler.

A bill has also been offered by Senator Borah, permitting the State of Idaho to select from withdrawn lands in Idaho, any tracts desired, the phosphate and oil rights remaining with the Federal government. Otherwise complete title passes to the state and may be passed by it.

## Edison Electric Mining Lamp

The accompanying illustration shows the general features and the manner of carrying a new safety electric lamp. The lamp is operated by the Edison storage battery, for the development of which Mr. Edison was recently awarded the Rathenau medal by the American Museum of Safety.

The battery itself is inclosed in a nickeled steel container, from which the electrolyte cannot escape. The battery cannot be so over-charged, it is claimed, as to cause injury, and charging in the reverse direction, or leaving in any state of charge or discharge does no harm. The only attention demanded is charging, replenishing the electrolyte with distilled water and changing the electrolyte every nine or ten months. The battery is connected by a flexible cord, through the locked case, to the lamp. The cord cannot be disconnected, and is covered



EDISON STORAGE-BATTERY CAP LAMP

by a flexible steel armor for part of its length at both ends. Danger of sparking by breaking connection is thus avoided.

The lamp itself consists of a tungsten lamp with a parabolic reflector protected by a heavy glass lens, cushioned on gaskets. There is a hook for cap attachment. The miner cannot get at the lamp without breaking a seal on the reflector. The use of such lamps in coal mines should be of great benefit as a safety precaution, and their use in metal mines offers a method of obtaining improved illumination.

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**A Petroleum Engineer for the U. S. Bureau of Mines** is being advertised for by the United States Civil Service Commission. The position is to have a salary ranging from \$2000 to \$3600 per year, and the duties will be to investigate the equipment, and methods of drilling and operating oil and gas wells, with special reference to the prevention of waste. Applicants who desire to take the examination should apply for form No. 304, and must file such papers on or before Feb. 24, with the U. S. Civil Service Commission, Washington, D. C., or the secretary of the board of examiners at various principal post offices. Applicants must have had at least two years' practical experience, and educational training equivalent to graduation from a university of recognized standing. In the examination the rating will be 40 points for general education and scientific training, 30 points for practical experience in the oil-well industry, and 30 points for publications or discussion of engineering problems.

## Accidents in the Catskill Aqueduct

For the year 1912 in all departments of work for the new aqueduct which is to bring Catskill water to New York, there were 3250 accidents, of which 79 were fatal. According to figures furnished by the New York Board of Water Supply, there were employed 12,500 men as a daily average, this representing, not the payroll, but those men actually at work. This gives a yearly death rate of 6.3 per 1000. The average rate for the five years, from 1908 to 1912, was 4.7. At first glance it would appear that the rate should have decreased in 1912, due to improved discipline and increasing familiarity with the work. The opposite result is explained by the increase in tunneling operations, which are more hazardous. Of the 79 deaths during 1912, 59 were on tunneling work. The number of men employed was probably about 7000, giving a death rate of 8.4. The causes of death are not classified, but in the tunnels, explosions and rock falls are the most important.

It appears that the present New York labor law is very strict in its interpretation of the term "accident," and the most trivial injuries must be reported as such. Many precautions, however, are taken to promote safety. Inspectors are furnished to superintend all the handling of explosives and enforce the strict rules provided. Each city magazine is in the charge of a man, licensed by the Municipal Explosives Commission, who carries the key to the switch box and does all the shot-firing. Electric firing is used exclusively. The tunnels are run with top heading and bench, which was found safer than a bottom heading and stoping method. Men are provided especially for signaling at both the bottoms and the collars of the shafts. While all the work is done by contractors, the incentive for them to use precautions is strong, as they carry no industrial insurance, and are liable for heavy damages. The class of labor is not at all high and almost all accidents are traceable to the carelessness of the men themselves. Nevertheless the death rate is much lower than that on the Panama Canal, in spite of the fact that the canal rate is based on the total number of men on the payroll, and it is also lower than the rate of 10 per 1000, which was that obtained on the Croton aqueduct.

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## Pearson in Sudbury Nickel Field

SPECIAL CORRESPONDENCE

An important purchase has been negotiated in the Sudbury nickel field during the last two weeks. Dr. F. S. Pearson, who has been closely identified with Sir William MacKenzie in his hydro-electric power enterprises in Canada and Mexico, has taken over the holdings of the Dominion Nickel-Copper Co. It is believed, however, that Doctor Pearson and his former associates will not be called upon to do the financing, rumor having it that the money will be put up by the Rothschilds. The Dominion Nickel-Copper Co., controlled by J. R. Booth and M. J. O'Brien, has large and important holdings in the Sudbury range. No details have as yet been made public, but it is known that a large first payment has been made.

It is generally considered that the Dominion company had developed between four and five million tons of ore. The orebody at the Murray mine ranges from 40 to 80 ft. in thickness and carries about 3½% of combined nickel and copper.

## PERSONALS

Jesse Scobey, of Denver, Colo., is in Nicaragua.

Franklin W. Smith, of Bisbee, Ariz., is in New York.

J. V. N. Dorr, of Denver, is taking a vacation in Panama.

R. C. Canby has gone to the Globe district, Arizona, on professional work.

Rush T. Sill, of the firm of Sill & Sill, Los Angeles, Calif., is in Sonora, Mexico making mine examinations.

Harry J. Wolf is delivering a series of lectures on mining engineering at the Colorado School of Mines.

Richard A. Parker has been appointed consulting engineer by the El Paso Gold Mining Co., of Cripple Creek, Colo.

Will C. Russell, manager of the Rawley Mining Co., Bonanza, Colo., is visiting in New York for a few weeks.

James MacNaughton, general manager of the Calumet & Hecla and allied companies, is in Boston attending the annual meetings.

Captain S. J. Goodney, formerly in charge of the Armenia mine near Crystal Falls, Mich., has resigned to take charge of a mine at Iron River.

J. R. Finlay has gone to Southeastern Missouri to value the St. Joseph Lead Co.'s and Doe Run Lead Co.'s properties and will be engaged there until the end of April.

A. L. Gerry, superintendent of the Longyear mine for the Inter-State Iron Co., has returned from a month's vacation spent in New York, Boston and other eastern points.

C. V. Watson, recently chief engineer for the Rogers Brown Iron Co. on the Mesabi range, has resigned to take up special work in geology at the Michigan College of Mines at Houghton.

Sanford B. Belden has been elected vice-president of the Jeffrey Manufacturing Co., with headquarters at Columbus, O. He was formerly in charge of the Pittsburgh office of the company.

J. H. Jowett, general sales manager of the Ingersoll-Rand company, sailed for South Africa, by way of London, on Jan. 30, to make an extended visit to its mining districts in the interest of his company.

George J. Siedler has been appointed sales manager of the Taylor-Wharton Iron & Steel Co., succeeding J. M. Sherrerd, resigned. His office is at High Bridge, N. J. W. S. Stothoff has been named assistant sales manager.

Robert E. Brooke, of the E. & C. Brooke Iron Co., Birdsboro, Penn., has been elected president of the Eastern Pig Iron Association, for the ensuing year. W. S. Pilling, of Pilling & Crane, Philadelphia, has been re-elected secretary.

Frank J. Probert, of Los Angeles, Calif., is engaged in professional work in the Moctezuma district, Sonora, Mexico. From there he visits the Three R. mine, near Patagonia, Ariz., for a few days, returning to Los Angeles about the end of the month.

F. Lynwood Garrison has been retained as chief engineer in charge of exploration of placer lands controlled by the Breitung Mines Corporation in Colombia. Mr. Garrison sails for Colombia on Feb. 1, accompanied by a corps of four assistant engineers.

John M. Bush, who was superintendent of the Ashland mine at Ironwood, Mich., during the last few years of its operation by the Cleveland-Cliffs Iron Co., is to be transferred to Iron River as general superintendent of the company's properties in that district. Captain Perkins, the underground captain at the Ashland for a number of years, is to go with Mr. Bush.

Fletcher M. Hamilton, who has succeeded W. H. Storms as state mineralogist of California, is 31 years old and is a graduate of the mining college of the University of California, class of 1904. His first practical knowledge of mining was gained in the Mother Lode region. He also had experience at Jardine, Mont., in mining gold, silver and tungsten ores. He spent two years in Mexico as superintendent of La Bufa mine in Durango. Since his return from Mexico he has been doing examination work in California, Nevada and Montana and development of gravel property in Sierra and Plumas counties, Calif. He has announced no change in conduct of the mining bureau, and for the present will retain the employees appointed by Mr. Storms. Since Mr. Storms has announced that he has no intention of contesting the

action of Governor Johnson in removing him summarily from office without other cause than that he was not in harmony with the administration, Mr. Hamilton will be able to carry on the work of the bureau without delay.

## OBITUARY

W. H. Mitchell died at Bishop, Inyo County, Calif., on Jan. 8. He was 71 years old, born in England. He began mining at Virginia City, Nev., in 1869, and mined there and at Bodie, Calif., for 20 years.

Ole Nelson, aged 78 years, died at Oakland, Calif., on Jan. 12. He was born in Norway, and went to California in 1855. He was one of the pioneer miners in Alpine and Calaveras counties. He was a soldier in the Civil War.

Thomas J. Furbee died at Red Bluff, Calif., on Jan. 6 aged 82 years. He crossed the plains with an ox-team in 1854 and engaged in mining in Inyo and Nevada Counties. He held many responsible positions, the last being with the Pittsburg Consolidated at Nevada City. He retired from active work about 10 years ago.

Samuel N. Knight, a native of Maine and 74 years old, died at Sutter Creek, Calif., Jan. 14. He went to California in 1863 and to Sutter Creek in 1874, starting a foundry which grew to an important establishment in the manufacture of stamp mills, hoists, pumps and engines. He was the inventor of the Knight water wheel.

C. H. Thomas, 74 years old, died at Tuolumne, Calif., on Jan. 8. He was born in England and while a young man went to South America and Nicaragua for English syndicates. He mined in Amador and Placer counties, Calif., in the early history of the Mother Lode, and for 20 years was manager of the Dead Horse mine, in Tuolumne County, when the mine was a large gold producer. He retired from active mining work about 10 years ago.

J. Parker Whitney, aged 78, died at Monterey, Calif., Jan. 17. He was born at Gardner, Mass., and went to California around the Horn in 1851 and to Colorado in 1865, where he engaged in mining. He was U. S. commissioner to the Paris Exposition in 1867. He built the Silver City R.R. connecting the town of that name with the Santa Fé at Deming, N. M. Returning to California Mr. Whitney engaged in fruit growing and sheep raising.

Edward Treadwell, superintendent of the Trinity Bonanza mine in Trinity County, Calif., was killed in a snowslide at the mine on Jan. 14. The body was recovered on Jan 22 by miners who sunk a shaft into the snow a depth of 40 ft. It was found in a barn in which he had evidently sought refuge from the slide. He was the son of James Treadwell of the Alaska Treadwell mine. David Williams, a miner, was also caught in the slide and killed. The 40-stamp mill was destroyed, the whole structure being torn down except 20 of the stamps that remained standing.

## SOCIETIES

**American Electrochemical Society**—The twenty-third general meeting of the society will be held in Atlantic City, N. J., Apr. 3, 4 and 5, 1913. The headquarters of the society will be at the Hotel Traymore, which grants the use of the solarium as a meeting hall.

**Colorado Scientific Society**—George E. Collins was re-elected president of the society at the annual meeting in Denver recently. The new vice-presidents are E. N. Hawkins and Richard A. Parker. Frank E. Shepard and Thomas B. Stearns were elected to the vacancies on the executive committee.

## BUSINESS NOTES

The Hess Flume Co., Denver, Colo., announces the purchase of the Maginnis flume patents, together with the business of P. Maginnis of Kimball, Neb. The Hess company will continue the manufacture of both the Maginnis flume and the Hess flume at both its Denver and Canton, Ohio, factories. The infringement suit begun by P. Maginnis against the Hinman Hydraulic Manufacturing Co. of Denver, will be continued.

## EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Jan 22

**Governor Johnson has Removed W. H. Storms** from the position of state mineralogist without naming cause, and has appointed Fletcher M. Hamilton, a graduate of the University of California, Class of 1904, who has had practical experience as a miner and superintendent of mines in California, Montana and Mexico. The governor is reported to have acted upon an opinion of Attorney General Webb that the state mineralogist is removable at the pleasure of the governor. The position is statutory and the term is for four years. Mr. Storms' incumbency began Dec. 1, 1911. When Mr. Storms accepted the position he agreed to employ two men named by Governor Johnson, believing that they were competent to fill some position in the mining bureau. One desired the position of librarian, the other aspired to the position of curator. Neither was in any way fitted for such work; one was made assistant to the statistician, the other a messenger. When E. C. Hutchinson, president and general manager of the Kennedy Mining Co., was appointed a member of the board of trustees of the mining bureau by Governor Johnson he began an inquiry into the affairs of the bureau and concluded that the services of these two employees were of no value; to this the board agreed and requested Mr. Storms to take the matter up with the governor and ask for relief from the expenditure of \$225 per month for the salaries of the two useless employees. Governor Johnson resented this interference with his plans for satisfying the demands of patronage and sent his secretary to investigate, and this investigation was augmented by the activity of the two objectionable employees who provided the governor with extensive reports on what they termed the misconduct of the bureau. Mr. Storms dismissed them. Then followed an investigation by the state board of control which made a mountain of a molehill by reciting some of the so called irregularities that had been corrected by the board of trustees. The trustees replied to the attack of the board of control by a report to the governor showing that the conduct of the mining bureau had not been unlawful or improper. Mr. Storms also replied in an open letter to the press which was answered through the press by the chairman of the board of control in violent, undignified and coarse language. The governor replied by stating that he expected Mr. Storms would immediately resign, as he was not in harmony with the administration. The open letter of Mr. Storms was a plain, candid and dignified statement of the facts of his appointment and the employment of the two useless employees. It was evidently expected by Governor Johnson that Mr. Storms could be removed by the legislature. A bill to create a state mining department and provide for the appointment by the governor of a mine inspector who should be ex-officio state mineralogist, was introduced in the legislature by a senator of avowed friendship for the governor and for one of the discharged employees. The enactment of this bill into a law would abolish the state mining bureau and remove Mr. Storms. If the charges made by the board of control regarding the conduct of the bureau were true there would be no occasion for the enactment of a law to provide for the removal of the state mineralogist, nor for the governor to summarily remove him without cause. The trustees of the bureau, the mining engineers who recommended Mr. Storms for the position and the California Miners Association would not have hesitated to demand his removal. Mr. Storms will not contest the action of the governor, as the result would likely be merely the indorsement of his vindication by the board of trustees, and would require costly litigation.

DENVER—Jan 24

**To Provide Milling and Smelting Facilities** and other industrial plants that pertain to Colorado industries, representative W. T. Smith, of Jefferson County, has introduced a bill into the Colorado legislature, to create a commission to be known as "The Industrial Commission of Colorado," and which is to consist of the governor, attorney-general, secretary of state, state auditor and chief justice of the supreme court. This commission is to be organized to protect and develop the industries of the state. It is proposed to build a smeltery which should be as near the state school of mines

as possible. The commission may add to the smelting plant other means for the reduction of ores and make such improvements in all plants as may make them more efficient and enable them to utilize byproducts. It also is authorized to fix the rates to be charged and these rates shall be such as to cover all costs and expenses of operations and maintenance, with a fair compensation and profit to the state for services rendered, and so as to give to the producer as large a part of the value of his product as possible; all railroad and other transportation companies operating in this state shall charge and receive no more than a reasonable compensation upon all interstate business. The intent is to relieve the miners, as far as possible, from what they consider extortionate charges by railroads and smelteries and to provide a better market for their products.

**In the El Paso Annual Report** to the stockholders, President Burris states that the company has produced \$8,000,000 in gold bullion and has paid 50 dividends totaling \$1,600,000. In addition it has expended large sums in the operation of the mine and in securing mining territory, together with the installation of high-class mining equipment, buildings, etc. From Dec. 31, 1911, to Dec. 21, 1912, the company paid 6½% in dividends. The estate contains 73 acres, and the apex of the vein is controlled for more than 3000 ft. within its lines. The mine has today more than 27 miles of underground drifts and crosscuts.

**The Formation of a \$25,000,000 Merger** has been announced, according to press dispatches, with El Paso as a nucleus. The names of the other companies to be included in the merger are not stated, but it is believed that they are the Vindicator, Elkton, C. K. & N. Isabella, and probably others. The announcement was made by Joseph Walker, Jr., of New York, after a visit of inspection to the mines. Guides are now being placed in the Nichols shaft. Allen L. Burris, president of the company, will be in the district within a few days, and at that time the new shaft may be opened officially. Production is 3500 tons per month. The company has 175 men on its pay roll, while lessées are working 75 men.

**Acceptance of 18% Zinc Ore** from the mines at Leadville has been announced by the zinc plants in Kansas and Oklahoma. This means that many bodies of zinc ore, in particular, the zinc-carbonate ore, too low-grade to be handled in the past, will now be placed on the market. In a large number of the mines there are bodies of this grade of ore, and active work will doubtless be taken up at most of these before many weeks have passed. The effect on the output of zinc should soon be apparent.

**Construction of a New Drainage Tunnel** in the Cripple Creek mining district, 700 ft. below the Roosevelt tunnel level, will be begun early this year, according to a statement made by Allen L. Burris, president of the El Paso company; \$100,000 has been subscribed for the new tunnel. The railroads have given \$50,000 and the Cresson Consolidated company has given \$50,000. The cost of the tunnel is estimated at \$450,000. It will require nine years to complete. The financing of the tunnel has been temporarily halted on account of the attitude of the Portland company, which is that there should be further delay until the oreshoots are proved to depth.

BUTTE—Jan. 22

**Fire Broke out in the Coal Breakers** of the Cottonwood Coal Co. at Stockett on the night of Jan. 18, resulting in the killing of one man, injuring three, and a property loss of nearly \$100,000. The mine, which is owned by the Great Northern R.R., will be closed down until temporary chutes for loading coal can be built, which will result in throwing 400 men out of work. The breaker, which had been in use for 14 years, was of timber, three stories high, and was highly inflammable. The cause of the fire has not been ascertained, but was probably due to locomotive sparks or to spontaneous combustion.

SALT LAKE CITY—Jan. 23

**The Silver Tenor of Utah Ores** is given in statistics compiled by the U. S. Geological Survey for 1911. These show the following averages of silver in ounces per ton of lead ores: 11.93 at Frisco in Beaver County; 21.01 at Tintic; 7.38

at Bingham; 10.18 at Rush Valley; 20.32 at Park City. The silver in copper ores amounted to 0.247 oz. per ton at Bingham, and to 12.619 oz. at Tintic. The silver in dry or siliceous ores was 12.838 oz. per ton at Tintic, 8.611 at Bingham, 0.001 at Mercur, and 21.454 at Park City. The relatively high tenor of silver in lead ores and dry siliceous ores from Tintic and Park City is noteworthy as compared with those from other camps of the country.

**Copies of the Brief on Lead Tariff Schedule**, submitted to Congress by George W. Riter in behalf of Utah lead producers, have been received. This is opposed to an ad valorem duty on lead as compared to a specific duty, which is regarded as the most logical and business-like.

**Dividends Paid by Tintic Mines** during 1912 amounted to \$1,018,939, beside which a surplus approximating \$750,000 was accumulated by various properties. Among new dividend payers were the Gold Chain and Ophongo, while the Chief Consolidated, Eagle & Blue Bell, and May Day made earnings which placed them on a dividend paying basis. The Iron Blossom increased its surplus to over \$300,000; the Chief Consolidated started with a surplus of \$22,000 on Jan. 1, 1912, and in its first profitable year of shipping accumulated \$305,000. The Victoria Consolidated operated profitably, paid for the Snowflake ground, and installed new electrical equipment. The most active and largest producers were: the Iron Blossom, Centennial Eureka, Chief Consolidated, Gemini, Eagle & Blue Bell, Victoria, Grand Central, Gold Chain, Ophongo and Mammoth.

#### NEGAUNEE—Jan. 24

**The First Rescue Car** to be stationed in a metal-mining region, has been definitely assigned to the Lake Superior mining districts of Michigan, Minnesota and Wisconsin, with headquarters at Ironwood, Mich. The car is being started on a tour of the Michigan iron ranges and will be in Iron River and vicinity for a period of six weeks beginning Feb. 2. The crew consists of an engineer, a foreman miner, a first-aid miner and a cook. Edwin Higgins, in charge of the car, has made the following announcement: "We are not coming here to teach the operators how to mine ore nor how to do anything else. But we hope that by studying conditions regarding rescue and first-aid work, learning something here and there, and finally by combining what we learn here with what the U. S. Bureau of Mines has learned in various other districts, eventually to make conditions better." It is stated that during 1912 fatalities in coal mining in the United States were reduced nearly 50% as compared with 1911, a condition largely due to the combined efforts of the Bureau of Mines, Red Cross Association and individual companies.

**Representing Fee or Royalty Owners** is becoming a more or less regular occupation among engineers on the Lake Superior iron ranges and there are some who make a specialty of this at a certain price per 40-acre tract. In the past, fee-owners merely accepted the statement of the railroad company which transported the ore as to the number of tons moved, and received payment on that amount. The statements of the railroad were rarely questioned and the system seemed to give general satisfaction. However, in late years on the Mesabi and Cuyuna ranges and in the Iron River district the fee owners have exhibited a desire to force mining companies to take out every ton of ore regardless of the difficulty of mining it, and have in many instances hired representatives to check the car numbers and approximate weights during the shipping season. On the Marquette, Gogebic and Old Menominee ranges little supervision or checking of any kind is done by the fee owners, and there very seldom results any trouble of any kind. Under ordinary conditions there is probably no need of representation for the fee owner at the mine; the iron mining companies are honest, well managed organizations that want to get all the ore possible out of the ground. If there is 1000 tons more or less of ore in a corner of a stope where the cost of mining is twice what the ore is worth, but which the fee owner forces the company to extract, it is doubtful whether the fee owner will be much ahead in the end by antagonizing the company's officials. However, in some cases, it is likely that for a fee owner to hire a representative is much like taking a receipt when paying a bill; it is an added precaution and is good business policy.

#### CALUMET—Jan. 25

**A Tax on Copper** shipped out of the state for smelting, and amounting to 1/4 c. per lb. has been proposed in a bill introduced into the house of representatives of the Michigan legislature. Should this bill become effective it would have little effect on the Lake Superior mines, for practically

all of the copper is smelted locally, with the exception of some of the Calumet & Hecla ore, which is shipped to the company's electrolytic plant near Buffalo. Plans have been completed and work started on an electrolytic plant to be erected at the site of the company's smelting plant at Hubbell and will go into commission during the year. Mohawkite, which was discovered in the Mohawk and Ahmeek mines, had previously been shipped to New Jersey for treatment but can now be handled at the plant of the Lake Superior Smelting Co. at Dollar Bay.

#### PORTLAND, ORE.—Jan. 21

**The Output of Clay in Oregon** is approximately \$1,000,000 and about \$5,000,000 worth of clay is imported annually, is a statement credited to Doctor Withycombe, of the Oregon Agricultural College, in the report of the Bureau of Mines. The report says that the state is paying an exorbitant price for structural materials. As an instance pressed brick cost \$16 per 1000 in the Middle States and \$27 in Oregon. The cement situation is even more appalling, says the report. While accurate figures are not available, it is said 1,500,000 bbl. of portland cement were shipped into Portland alone, while not a barrel is manufactured in the state. It is pointed out that Oregon must have resources which would produce good portland cement. The report also states that Oregon should produce all the lime used in the state. Suggestions are made that the Bureau of Mines, if properly equipped for investigation, could save great sums to the state. The following suggestions are made in the way of appropriations for the work of investigation: Investigating clay, \$4750; cement, \$3250; coal, oil, gas and the extent of phosphates, \$3500; salary of a mining geologist and assistant for both eastern and western Oregon, \$10,000, and cost of other aids in investigation bring the total desired up to \$34,800.

#### MURRAY, IDAHO—Jan. 22

**Mines are Closed on Account of Snows** and in general the whole of the Coeur d'Alene district is more or less handicapped by the unusually heavy snowfall. The chief difficulty is in the operation of tramways and other means of delivering ore or supplies. The snow lies on the level between four and five feet and in places as deep as twelve feet.

#### COBALT—Jan. 25

**Two Men Were Convicted of Highgrading** and were sentenced to two and three months imprisonment at hard labor, at the North Bay court.

**Greater Interest in Cobalt Stocks** has been manifest during the last few weeks; the mining exchanges having demonstrated the greater interest which the public is now exhibiting. This interest is widespread, a great deal of it emanating from English buyers. As a result, prices are higher.

**Men Closely Associated with the Beaver Mine** have taken a lease on two properties known as the Prince and Michigan Cobalt. The Prince property adjoins the Beaver and lies between it and the Timiskaming. Little work has been done to date, but judging from the location, the prospects for underground development are considered encouraging. The Michigan Cobalt lies to the north of the Silver Leaf, and nothing, except a small amount of surface work has as yet been attempted.

#### PORCUPINE—Jan. 25

**An Interesting Outcome of the Porcupine Strike** is the action taken by the Hollinger Mines under the Lemieux Act. Under this act, the miners were required to give 30 days notice before going out on strike, but they disregarded this provision and as a consequence, the Hollinger took action against the men. Over 100 summons were issued and the cases came up for a trial a few days ago. Two of the leaders were fined \$500, or three months in jail, while one of the men was fined \$50 or two months in jail. The last was a sort of test case, the rest of the cases having been postponed for a week, largely, it is believed, to give the men a chance to get out of the district, as the government does not wish to have all these men in jail. The three men who were convicted elected to go to jail instead of paying the fine, partly as a protest against what they considered an unjust law and largely because they have no money. The local union has exhausted all its funds and appeals to headquarters have been fruitless. It is believed that under these conditions the strike will shortly be called off. The vice-president of the union is now on his way to Porcupine from Denver, but it is not known what action he will take. Everything throughout the district is quiet and the mines appear to have plenty of men.



# THE MINING NEWS

## ARIZONA

### Gila County

**INSPIRATION CONSOLIDATED**—In the mine 270 men are employed by the company, and about 40 men on surface work. These men are employed in the preparatory mining work, the hundreds of men engaged in the mill construction and railroad grading being employees of contractors. According to the last measurement the inclined shaft has reached the 3480-ft. level, the upper tram level. It has been decided to continue the shaft 100 ft. below this level so as to be able to raise from that depth to the level where a 180-ton waste pocket will be cut. Because of the similarity of ores the Inspiration mill will be modeled to a great extent upon the plan of the Miami concentrator.

**OLD DOMINION**—The date of completion of the new 500-ton unit of the concentrator depends largely upon when the shipments of steel arrive from the East, but if there should be no delay the concentrator should be running late in autumn. The excavation for the crusher plant is completed and the forms are in place for the concrete. Excavation work is proceeding at the site of the sampling mill and concrete ore bins. The foundation for the new Nordberg compound-gear hoist at the "A" shaft was completed early in January and is ready for the hoist, which has been delayed in shipment.

### Maricopa County

**RED ROVER**—Sinking continues at this mine north of Phoenix, at the shaft which is now 380 ft. deep. Much water has been encountered at this depth. Drifting in both directions on the vein will soon be started. Nearly all of the ore found is of shipping grade. R. M. De Gex is superintendent.

**BLUE BIRD**—This mine 50 miles north of Phoenix, owned by W. E. Thomas and P. T. Hurley, of Phoenix, is being unwatered preparatory to examination. The property is an old one and considerable development has been done. A shaft of copper-sulphide ore has been opened up.

**SLOCUM**—Copper sulphide containing much free gold has recently been found in this mine north of Phoenix. The property is owned by J. G. Hardin & Sons. Active development is now under way.

**GHOST**—The streak of high-grade gold ore, opened in this mine near Hot Springs Junction some time ago, is being developed, and the streak continues high grade. H. J. Bennett, of Phoenix, is owner.

### Mohave County

**RAINBOW MOUNTAIN MINING CO.**—With the completion of the railroad spur to the ore bins, this company commenced shipment of its ore to the Needles smelter and will probably ship about a carload daily. The ore is carried from the mine to the bins by an aerial tram about two miles long; H. S. McCann, manager.

**TOM REED**—The December production of this mine was approximately \$125,000. For the year 1912, the total production was \$1,111,067.64. Of this amount \$984,807.37 was the mill production from the 43,994 tons of ore treated and \$126,260 was recovered from the treatment of 10,162 tons of tailings. Dividends were paid to the amount of \$536,637 exclusive of the December dividend of \$60,000 which is not yet paid. In addition to this amount, \$250,000 was set aside for improvements and depreciation and over \$100,000 to take care of dividends. Shaft No. 4, for which the contract was let in November, is down to a depth of 80 feet. It is about 100 ft. north of the vein which it is expected to intersect at a depth of between 500 and 600 ft.

**JOSEPH M. QUALEY CO.**—This company is operating the Pinkham mine under the management of L. A. Dockery. Two, double-compartment shafts are being sunk on the vein. Shaft No. 1 has been sunk 60 ft. in 29 days with two shifts, including timbering and the hoisting of about 40 buckets of water daily. This shaft cut an oreshoot at a depth of about 100 ft. John Angle is the superintendent.

**MIDNIGHT**—It is expected that the mill on this property will be ready for operation by the first week in February. Harold Hawks will be in charge.

**TENNESSEE**—This mine has commenced shipment of its ore to the Needles smeltery; the first five 50-ton ore cars arrived recently at Chloride. It is understood that all the old mill tailings will be shipped to Needles for treatment in the concentrator. These tailings carry gold, silver and lead but are of most value for the zinc contained.

**GOLD ROAD**—The regular weekly shipment of bullion from this mine averages about \$20,000. It is estimated that the production for 1912 was about \$800,000, the exact figures not yet having been made public.

## CALIFORNIA

### Amador County

**SOUTH EUREKA**—The work of clearing the caved-in portion shaft is progressing slowly. The eleventh set of timbers had been reached at last report, and at that point the timbers were new sets, which were as badly broken as the old sets adjoining. The caving extended as the work of clearing the shaft proceeded. It is not possible yet to state the precise extent of the damage, nor how much time will be required to put the shaft in working order. The first report of the accident stated that both skips were below the caved part of the shaft at the time; but the fact is that after the men had been sent down a skipload of rock had been hoisted,

so that one skip was below and one above. The ore bins are now empty and the mill is idle.

**ONEIDA**—A good body of medium-grade ore has been encountered on the 1800-ft. level. The mine is operated in connection with the South Eureka and is owned by the South Eureka Mining Co. H. Schmal, of Sutter Creek, is superintendent.

**ONANDAGA**—New development is in progress at this mine north of Plymouth. Improved equipment will be installed should the developments warrant.

### Calaveras County

**WATERMAN**—The orebody has been reached by the 5-in. drill at a depth of 260 ft. The bore will be deepened to 460 ft.

**DOLLING**—The winze from the 400-ft. level is down 160 ft.; high-grade ore was cut at the bottom. Preparations are being made to resume milling. The mine is equipped with a modern 40-stamp mill that has been idle for several months.

**REINER**—The wreckage of the fire that recently destroyed the 20-stamp mill and headframe is being removed and the site cleared for installing a new plant. Work in the mine will be resumed as soon as the hoist and pumps are in place. John C. Benson, Altaville, is superintendent.

### Inyo County

**SKIDOO**—The mill and mine are closed, owing to the damage done to the pipe line by the recent cold weather. The pipe line is 29 miles long carrying the water from Jail cañon at the foot of Telescope peak across the desert under high pressure. It was installed in 1907. The mine which is equipped with a 20-stamp mill has been a large producer. Recently the production has decreased. Only a few lessees now remain at the mine.

### Kern County

**GOOD HOPE**—The heavy timbers for the new stamp mill are in place and the machinery is on the ground. The gas-line hoist will be removed to the Twin Brothers mine to be replaced with an electric hoist. The installation of electrical machinery and the mill will largely increase the output; Mr. Kirkpatrick, superintendent.

**WHITE FLOWER**—A strong vein of tungsten ore was recently disclosed in this mine northwest of Atolia. The vein increases in width and quality with depth. Andrew Nixon is owner.

**SANTA ANA**—About 20 tons of screenings recently milled at the Red Dog mill averaged \$18 per ton. The mine has been operated under lease by C. G. Illingworth and others in the last year. The lease has not been renewed.

**SUNSHINE**—The pipe line that delivers water to the mill burst in several places during the cold weather recently and is being repaired. The water is hauled by the Santa Fé to Johannesburg where it is delivered to the pipe line.

**RED DOG MILL**—Lack of water caused by the breaking of the pumps at the station of the Randsburg Water Co. caused the temporary closing down of the mill at Johannesburg. The milling of ore from Teagle-Lamberson lease on the King Solomon was interrupted.

### Nevada County

**CHAMPION**—It is reported that a strike of high-grade ore was recently made in a drift on the 2400-ft. level, the deepest working in the mine. The property is being developed by the North Star Mines Co. in an extensive and systematic manner.

**NORTH STAR MINES CO.**—Notice has been received from the office of the fish and game commission of the state that the waste solutions, etc., from the cyanide plant are killing fish, and that the tailings must be prevented from flowing into the creek.

### Placer County

**RAWHIDE**—Crushing ore has begun at this mine near Towle. There is a good supply of water and a large body of ore is reported to have been developed. Hellester Gold Mining Co. is owner. Frank Oliver, formerly of Goldfield, Nev., is superintendent.

### Sacramento County

**NATOMAS CONSOLIDATED**—The reconstructed No. 8 dredge was put in commission Jan. 16. This is the second all-steel dredge to be built and operated in California. The original dredge was a wooden-hull boat, constructed in 1910, and was burned in October, 1911. The present dredge was launched Sept. 13, 1912. It is one of three 15-cu.ft. bucket dredges in this field. L. L. Lepetit was superintendent of construction.

### San Bernardino County

**GRAND VIEW DEVELOPMENT CO.**—This company has been recently organized to develop quartz claims between Kramer and Jingrey near the Santa Fé railroad. Griffith, Cronenwet and others of Kramer and Los Angeles and San Pedro men are members of the company.

### Yuba County

**TARR MINING CO.**—The delinquent stock of this mining property was sold at Smartsville on Jan. 6. Since E. W. Tarr resigned as manager the work has not progressed satisfactorily and a large indebtedness for assessments is reported. The company built a dry-land dredge and other unusual parts of a mining plant, which has not proved successful.

**COLORADO****Clear Creek County**

**SILVER HORN**—A 5-in. streak of high-grade gold-silver ore has been encountered.

**JOSEPHINE**—This company recently made a shipment of high-grade lead ore. This ore was produced from development work which has been very encouraging. A vein of galena 10 to 16 in. wide has been opened for several hundred feet.

**SANTIAGO**—Encouraging progress has been made during December in the development of this property. A 2-ft. streak of cerussite has just been struck in No. 2 level. During the last year several rich pockets of copper and lead ore were developed and the property is now shipping regularly.

**ONONDAGA**—This is the name of a new company in which Dr. Charles A. Rowland, of Syracuse, N. Y., is interested, and which has recently purchased the Ruler properties on Griffith Mountain formerly owned by H. N. Williams. The development of this property is planned through the Capital Prize tunnel.

**Gilpin County**

**POZO**—Development of this Nevadaville property will be resumed in the near future. A new shaft house will be built and the installation of a new hoist and compressor is under consideration. The shaft is to be sunk 600 ft. H. Lindsley is manager.

**Lake County—Leadville**

**JOLLY**—Lessees are keeping the teams busy hauling iron and zinc-carbonate ore. More than a car of ore per day is being shipped.

**RESURRECTION**—Lessees are taking out a good tonnage of zinc-carbonate ore, said to contain more than 30% zinc.

**COLONEL SELLERS**—The new hoist which will be installed at the bottom of the upper shaft, is on the ground and will be placed at once. When this is completed sinking will be started.

**NEWHOUSE TUNNEL**—Work has been started at Belden and the tunnel is being driven into Battle Mountain to cut the ground recently purchased by the Empire Zinc Co.

**R. A. M.**—On account of a lack of cars R. A. Kent was forced into idleness for a short period, but is now working the dump with a full force.

**SIXTH STREET DUMP**—George Daly and partner are working over this old shaft dump for the lead-silver ore it contains. One lot has been sent to the smelter as a test and the returns will indicate whether or not the dump can be profitably worked.

**ROBT. E. LEE**—A new lift of 26 ft. has just been completed in this shaft on Fryer Hill, and which was sunk to get at the zinc-carbonate ore in order to handle it more expeditiously. From this part of the property the lessees are getting out a car daily of zinc and in addition are sending out the same amount of iron.

**IBEX**—After many drawbacks and other obstacles connections have been made between the St. Louis winze and the Ibez workings. From the tunnel level the winze was sunk 450 ft., and from the bottom of the winze to the surface is 300 ft. This places the property in good shape to prospect for known ore in this part of Breece Hill. Manager Stewart states that after stations are cut and some repair work done three drifts will be started, one to run north to cut under St. Louis shaft No. 3, one to the south and one to the west. When this work is under way it will thoroughly prospect the area owned by the company.

**Teller County—Cripple Creek**

**GOLD DOLLAR**—The amount of development work in 1912 exceeded all such work ever done before by the company, and the last year was one of the best in its history.

**MABLE M.**—Production for December was said to have exceeded 1000 tons of medium-grade ore, half of which was shipped by the lessees. The development of the bottom level continues satisfactory to the company.

**DR. JACK POT**—Production amounts to 500 tons of ore per month, shipped by lessees. Two machines are now on development work, driving drifts north, and south from the shaft on the ninth level, which is 1000 ft. deep. This is the deepest level of the Davenport shaft.

**IDAHO****Idaho County**

**McKINLEY**—This mine near Lucile has been leased by William Simpson. The small mill is being overhauled and supplies are being brought in.

**MINERAL ZONE**—Now that the road to the mill is in condition stoping has been resumed and the mill is being operated at its full capacity. While the mill was idle the entire mine crew was at work developing new ground.

**AMERICAN EAGLE**—Satisfactory progress is reported with the sinking of the new shaft. Some difficulty has been experienced in the getting of supplies, but the company has not been obliged to suspend operations so far.

**SOUTH FORK**—Large bodies of milling ore are being developed in the old Espy workings and in the new vein recently discovered higher up the mountain.

**ELK GOLD MINING & MILLING CO.**—This company is considering the building of a mill. The mine has been developed steadily for the last six years and large reserves are blocked out.

**Latah County**

**MIZPAH COPPER**—Equipment for the new combined compressor and electric lighting plants has begun to arrive. The plant will be operated by an 80-hp. gas engine. Pending the completion of the plant development work is being done by hand.

**Shoshone County**

**IDORA HILL**—Work is being pushed on the Idora siding on the Murray branch of the railroad and as soon as it is

completed lumber and machinery for the new concentrator will begin to arrive. Heavy snows have somewhat hindered the work of excavating which is about half completed.

**RAY-JEFFERSON**—Work has been begun on the new intermediate tunnel with an additional force.

**TUSCUMBIA**—The company has commenced work on the raise from the lower level, working through the No. 3 tunnel of the Idora property.

**SNOWSTORM**—The new unit of the mill has been placed in commission and is now treating 150 tons daily. The mill has a capacity of 200 tons, but the present crushing capacity is only 150 tons. New crushers are on the way and soon the plant will be operating at full capacity.

**WONDER**—A strike of 18 in. of clean lead-silver ore has been made in a 6-ft. vein. The company will soon install a compressor plant and machine drills.

**AMAZON**—A bunk house and other buildings are being built on this property recently acquired by the Interstate-Callihan company. The air pipe from the Interstate Compressor has been brought to the Amazon tunnel and development work will be commenced as soon as the camp is finished.

**MAHER-O'HEARN**—Half interest in this group of mines adjoining the Tiger-Poorman has been purchased by Harry L. Day and associates.

**H. E. M.**—At the annual meeting it was voted to increase the capitalization to \$1,500,000 to supply funds for additional development work and equipment. The company proposes to build a concentrator in the spring and is already putting in a compressor plant.

**NABOB**—The 75-hp. motor for the mine has arrived and is being set in place in the station. The Washington Water Power Co. line is not quite completed, but was expected to be ready for the delivery of power by Feb. 1.

**TEDDY**—Contracts for 1500 ft. of development work have been given to Grenfell Bros.

**STEWART**—Heavy snows which interfered with the operation of the tramway have forced the mine to suspend operations recently for a day at a time.

**BOULDER CREEK**—Work has been resumed on this property and encouraging results are reported. A small shoot of high-grade ore was uncovered recently.

**ALMA**—Plans are being made for resumption of work at an early date. The recent strikes in the National and Copper King are more or less responsible for the revival of interest in this property.

**COPPER KING**—The latest reports state that the copper ore has a width of more than 2 ft., and assays about \$23 per ton. In addition is a 2-ft. streak of lead-silver ore.

**SNOWSHOE**—The developments of the recently found copper ores show a steady increase in copper.

**MICHIGAN****Copper**

**ONECO**—Operations are centered in drifting south on the 11th and 12th levels, but no material change has been noted lately in the character of the ground. Drifting north from the third level has recently been resumed.

**NEW ARCADIAN**—Shaft sinking is continuing at this company's shaft at the rate of about 75 ft. per month, and the shaft is now down about 350 ft. At a depth of 500 ft., lateral openings will be started to develop the lodes which lie on either side of the shaft.

**WOLVERINE**—No. 5 shaft, being sunk on the Osceola lode, is down to the fifth level.

**SUPERIOR**—Railroad connections have been completed which will afford shipping facilities to the mills of the Lake Milling, Smelting & Refining Co. plant, and shipments will be started at an early date. Developments on the west lode at No. 1 shaft continue satisfactory. No. 2 shaft is sinking near the 17th level, at which a drift will be driven to connect with No. 1 shaft.

**WYANDOT**—This company is sinking a winze in the east drift about 1100 ft. from the shaft. A depth of about 75 ft. has been reached and the ground thus far passed through has carried copper in commercial quantities. This latest development is the most encouraging experienced at the property in some time. It is planned to sink to a depth of about 125 ft. and then drift.

**ISLE ROYALE**—This company has experienced considerable difficulty in getting its new No. 7 shaft established in the vein owing to quicksand, and operations at this point have been temporarily suspended.

**SOUTH LAKE**—This company's shaft is down about 200 ft., and so far has cut three copper-bearing formations. The last was encountered at a depth of about 170 ft., and was heavily charged with copper. At a depth of 300 ft. a station will be established and the formation opened.

**HANCOCK**—Drifting on the lode that was cut by the 18th level crosscut is showing the formation to be widening out, the copper tenor remaining the same. Stations have been cut and the crosscuts started at the 2770-ft. level and the 3320-ft. level and work is going forward in cutting the stations at the 3650-ft. level and the 8900-ft. level.

**OJIBWAY**—The crosscut from the 1700-ft. level of No. 1 shaft has reached the Kearsarge lode and preparations have been completed to start a winze on the formation. The raise from the 1900-ft. level of No. 2 has been temporarily stopped while timbering is being done. This raise is in about 125 ft., and has encountered considerable water.

**Iron**

**DULUTH DIAMOND DRILL CO.**—Diamond drilling is being done on the McDonald "forty" in the Iron River district just south of the Baker mine of Corrigan, McKinney & Co. The location is northwest quarter of northwest quarter of Sec. 6, 42-34. It is thought that the iron formation may be found to cross the northwest corner of the tract.

**GREENHOOT**—On this property in the Iron River district southeast of the Zimmerman mines, diamond-drill exploration is being carried on, and an exploratory shaft has been sunk 120 ft. J. T. Spencer, of Iron Mountain, is interested.

**HOLLISTER MINING CO.**—This company, of Crystal Falls, will install a 625-kv-a. Curtis turbo-generator in its power plant. In the installation are included a 50-kw. generator, 150-hp. motor, Tirrill regulator, three 20-kv-a. transformers and switchboard; also two 4-ton electric mining locomotives; all from the General Electric Co.

**CLEVELAND CLIFFS IRON CO.**—This company will install a 100-kw. General Electric motor-generator set in the Lloyd mine at Morris, and three 6-ton electric mine locomotives in the Ishpeming mines.

**MINNESOTA**

**Mesabi Range**

**OLIVER IRON MINING CO.**—A new approach is being cut at the Monroe pit, at Chisholm. All the mines in this district are busy, with large accumulations of stockpiles from last season at most of the underground mines. This is true at most of the Hibbing underground mines, and it is the general opinion that the open pits can supply all the ore needed by the company to fulfill its minimums under the Hill lease. For the next two years, after which time it will not be able to take care of the minimums and the accumulated stockpiles will be used.

**MISSOURI**

**Flat River District**

**A MERGER IS BEING PLANNED** by stockholders of the Doe Run Lead Co. and St. Joseph Lead Co. for an amalgamation of the two corporations with the Mississippi River & Bonne Terre R.R. Co. The stockholders have employed J. R. Finlay, to examine and appraise the properties, after which a plan will be formulated, to be presented at the annual meetings in April.

**Joplin District**

**IN THE KLONDIKE CAMP**, prospectors drilling on a 40-acre lease of the Rothschild land report finding rich ore from 154 to 166 ft., the clippings indicate a continuation of the run being mined at the Yellow Pup and Yellow Jacket mines.

**LEONARD LAND**—Mining operations are being resumed on the S. M. Leonard land in the Chitwood district. Due to recent prospecting virgin deposits of ore have been discovered and development work has been started.

**DETROIT MINING CO.**—This company operating the old Cumberland ground has a 200-ton mill in operation.

**M. & M. MINING CO.**—This company operating on the Superior ground has opened some good deposits and is producing steadily.

**INDIANA MINING & DEVELOPMENT CO.**—This company has taken over the old Brooklyn Mining Co. lease and is operating a mill. Drill strikes have been made at depths ranging from 70 to 200 ft. Three shafts are in ore and are connected by a tramway with the mill. A fourth shaft is in ore but is not yet connected with the mill.

**LITTLE HOOSIER MINING CO.**—This company has been reorganized and the mill overhauled and adapted to custom work to accommodate smaller operators on adjoining tracts.

**MATTES MINING CO.**—Bids are being received by this company for the sinking of a 5x7-ft. shaft 240 ft. deep on its lease on the Burgner land near Knights Station. Rich drill strikes have recently been made on this land.

**FRANCIS T.**—This is a new producing mine and is being opened on a 35-acre lease of the Phillips land in the Thoms Station district. The production at present comes from a hand-jig plant and from free jack culled directly into the ore bin. A pile of crushing rock is accumulating pending the building of a concentrating plant. A 23-ft. face of ore is being developed at a depth of 173 ft. with little or no water to contend with.

**MONTANA**

**Butte District**

**ANACONDA**—Shaft sinking from the 1800-ft. level has been resumed in the main shaft of the Badger State mine. Sinking one compartment wide is now going on in the chippy compartment, the plan being to leave a 40- or 50-ft. pentice between sinking operations and the shaft above. The shaft will be sunk to the 2400-ft. level at least before a stop is made, stations to be cut at the 2000-, 2200- and 2400-ft. levels as these depths are reached. The chippy, or auxiliary cage, which was placed in commission sometime ago, is being used with a bucket for sinking purposes. The waste is hoisted to the 1600-ft. level where it is dumped into a chute especially built for the purpose, and thence transported in cars to be used for stope filling. Sinking in the Emily shaft, two compartments wide, was stopped some time ago, after the shaft had reached a point a few feet below the 1000-ft. level, and at present the shaft is being raised from the 1300-ft. level to connect with the upper part at this point. This raise is now about 50 ft. above the 1300-ft. level. On the 1600-ft. level a drift has been driven to a point below the Emily shaft and a station is being cut preparatory to raising the shaft in the same manner as above. Electric motors have been installed on the 1600- and 1800-ft. levels and all ore is being hauled in this manner. The working force in the mine and on the surface has been gradually increased until there is now a total of over 400 men on the pay roll, and an average of more than 700 tons of ore is being hoisted and shipped daily. The work of preparing for the installation of the new Nordberg hoist, one of the most powerful in the camp, and which is now on the ground, is being pushed with all speed. Excavation has been completed and the concrete foundations are nearly all in place. Owing to the fact that this mine is somewhat isolated from the rest of the company's properties, it being fully a half mile from the nearest mine, the Diamond, it has been decided to operate the new hoist with steam, for some time at least.

**Cascade County**

**BROADWATER**—Charles D. McClure, of Phillipsburg, recently inspected the Broadwater and Diamond R. mines near Nelhart. He is the owner of these mines which have not been operated since 1897. Prior to this they were worked for two years. The owner intends to begin operations again in a short time. The ores contain silver, lead and zinc.

**Granite County**

**ROYAL MOUNTAIN MINING CO.**—This company was recently organized by Eastern men who have acquired the Sunday mine adjoining the Royal gold mine, from the estate of the late A. V. Corry, of Butte. Much development work was done years ago, and about \$70,000 in gold produced. There are seven claims in the group and work will be started at once in extending the main tunnel to the contact with a porphyry dike traversing the property, and in prospecting other parts of the ground. J. L. Maxwell, of Butte, will have charge of operations.

**Jefferson County**

**BOSTON & CORBIN**—The new concentrator being built at this property in the Corbin district, is fast nearing completion, and it is believed it will be in readiness for operation about the middle of February.

**BRONX MINING CORPORATION**—This company has been organized for the purpose of developing a group of gold claims, comprising 124 acres situated three miles northwest of Pipestone Springs. Barton Mitchell, of Butte, is president and general manager.

**NEVADA**

**Comstock Lode**

**OPHIR**—On the Sutro tunnel level, a drift to the northeast has been started 600 ft. north from the connecting drift with the C. & C. shaft, and is following the vein. It will open ground above the old stopes. On the 2400-ft. level, understopping will be resumed, where ore was discovered some time ago. It was planned to stope from the 2500-ft. level, but the ore did not extend to that depth, and what remains below the sill floor of the southwest drift, on the 2400-ft. level, will be taken out.

**CONSOLIDATED VIRGINIA**—The large and well equipped station at the 1000-ft. level of the C. & C. shaft has been completed, and a so called "lightning" drift has been started to the northwest to cut the east vein. This drift will be driven with all possible speed, and an average of 80 ft. per week will be maintained, including timbering, the ground being heavy.

**UNION CONSOLIDATED**—The winze being operated jointly with the Mexican has been unwatered to the 2670-ft. level, and is being equipped with pump column, air pipes, etc. It is planned to drive west from the 2700 into Union ground.

**Elko County**

**AMERICAN DIATOM MINING CO.**—This company will reopen its property seven miles from Carlin on a larger scale, additional funds for this purpose having been secured in the East, by Manager M. Sholl. The company produces diatomaceous earth.

**Nye County**

Shipments in tons from Tonopah mines for the year to date and for the week ended Jan. 18, are as follows:

Mines	Week	Year	Mines	Week	Year
		to Date			to Date
Tonopah Mining	3200	9750	North Star	45	90
Tonopah Belmont	3145	9680	Mizpah Extension		
Montana-Tonopah	1012	2710	Jim Butler	300	900
Tonopah Extension	1050	2900	Tonopah Merger		323
West End	1045	2955			
Midway	45	90	Totals	10,247	30,304
MacNamara	405	906	Estimated value	\$215,280	\$648,102

**MACNAMARA**—Drifting on the 600-ft. level is in progress on a vein of milling ore. Two new freshshots of excellent grade are being developed on the 300-ft. level.

**MONTANA-TONOPAH**—A new vein, 4 ft. wide has been opened on 665-ft. level and 7 ft. of low-grade ore has been cut on the 700-ft. level.

**TONOPAH MERGER**—Sinking of the shaft from the 1070-ft. level a further 100 ft. has been resumed.

**White Pine County**

**NEVADA CONSOLIDATED**—There is a shortage of coal for use at the mines. Most of the drills and three of the steam shovels have been laid off. Severe weather conditions have again prevailed causing much difficulty in handling the ore.

**GIROUX**—The Morris shaft is being deepened in order that skips may be installed. Shipments to the Steptoe smelter of 1000 tons per day are being maintained in spite of shortage of ore cars.

**NEW JERSEY**

**BALBACH SMELTING & REFINING CO.**—This company has installed a 4½-ft. Hardinge ball mill to replace a battery of 10 stamps. The company is now engaged in building a new lead refinery on its Newark Bay property.

**NEW YORK**

**Essex County**

**A STRIKE WAS CALLED** at Mineville, Jan. 23, at the iron mines of Witherbee, Sherman & Co., recognition of the union and readjustment of the working hours being demanded. The sheriff took charge of the situation to protect those men who cared to continue work. The men have since been returning to work at the rate of 50 to 100 per day; 800 or 1200 are now working. Joseph D. Cannon, of the Western Federation of Miners, complained to Governor Sulzer that the men were violently forced to return to work, which is denied by the company. It is officially stated that the strike was called because of the company's refusal to reinstate two men who had been discharged for making libelous statements about the company and untrue remarks about the conditions underground.

**OREGON****Josephine County**

A PUBLIC UTILITIES COMMISSION has been named by Mayor Robert G. Smith, of Grants Pass, who will act as chairman. This commission will have charge of the building of the municipally owned railroad from Grants Pass to the coast at Crescent City, Calif. This road will open mineral and timber lands at present not accessible. The calling of bids for the \$200,000 bond issue recently voted is authorized by the city, to run for 20 years.

VANGUARD—C. E. Phillips, one of the owners of this mine on Josephine Creek, states that extensive development work is being done and that the outlook is promising. The ore is rich in gold and copper.

BLUE LEDGE—H. C. Russel, of Marquette, Mich., is looking over this copper mine, for Lake Superior men; R. S. Towne, of New York, owner.

**UTAH****Juab County**

THE SHORTAGE OF CARS at TINTIC—This is felt by many of the companies which have zinc ore ready for the market, and desire to ship these at the present prices of spelter.

IRON BLOSSOM—A dividend of 10c. per share has been declared, payable Jan. 25. The new electrical equipment is working satisfactorily.

**Salt Lake County**

UTAH COPPER—The mills are treating about 18,000 tons of ore daily. By Feb. 1, some of the trouble caused by frozen ore will be eliminated through minor changes which are now being made.

COLUMBUS CONSOLIDATED—The boarding house was recently destroyed by fire, and work has been discontinued, pending arrangements for the accommodation of the employees.

UTAH-APEX—This company recently ordered a 3-ton General Electric mine locomotive.

**Summit County**

PARK CITY SHIPMENTS for the week ended Jan. 11 amounted to 3,041,810 lb.; those for the week ended Jan. 18, to 3,895,200 lb. Shippers for the latter week include the Silver King Coalition, Daly West, Daly-Judge, Silver King Consolidated, Ontario and American Flag.

SILVER KING COALITION—This company's output for the week ended Jan. 18, amounted to 1047 tons. The ore came chiefly from the 500-, 900- and 1300-ft. levels. About 400 men are employed. It is reported that a new shaft will be sunk from the Alliance tunnel level.

THOMPSON-QUINCY—Raising from the 900 level of the Daly West has been started. This raise is at present in quartzite, and is being put up to reach the limestone contact where ore is expected.

DALY—It is rumored that this company has purchased the hoisting equipment of the Nail Driver, and will remove it to the No. 2 shaft. Work was started here the first of the month. The shaft is approximately 800 ft. deep.

SILVER KING CONSOLIDATED—Ore is being hauled to the railroad. This is high-grade silver-lead ore from the 110-ft. winze below the 1550-ft. level. Preparations are being made for sinking the main shaft from the 1300- to the 1800-ft. level. Snow is from two to six feet deep.

**Tooele County**

OPHIR HILL—From two to four cars of ore daily are being shipped over the St. John & Ophir R.R. by this company and the Cliff, including shipments from time to time by the Lion Hill Consolidated. The extreme cold weather put a stop to outside operations for several days, but the camp is again back to normal production.

CLIFF—The shaft has been driven on the vein to the 700-ft. level below the tunnel. Development from the bottom will be started at once. The vein here is strong, and carries ore. There is a good showing on the other levels below the tunnel. Regular shipments are being made.

CONSOLIDATED MERCUR—Operations were suspended for several days on account of the cold weather. The solutions were frozen.

**WASHINGTON****Ferry County**

OLD REPUBLIC—The Rathfon Reduction Co., lessee, is shipping at the rate of one carload per week. The company has recently made arrangements with the Anaconda company for air for its drills.

VALLEY DEW—Work has been resumed on this property owned by the Titanic Mining Co.

**Stevens County**

UNITED COPPER CO—This and the Aurora company have made a joint contract with the West Kootenai Power & Light Co. for 1000 hp. to be used in the mines and plants of the two companies. The delivery of 250 hp. will begin May 1 from the Meyers Falls plant, the remainder to come from the Bonnington Falls plant, beginning within the next two years. The contract is for a period of 10 years at the rate of \$40 per horsepower-year.

**CANADA****Ontario**

CANADIAN EXPLORATION CO.—This company has resumed operations on the Long Lake gold mine near Sudbury, which has been idle for nearly a year waiting for the installation of electric-power connections from the Wahnapitae power plant. The mill now has 20 stamps and a daily capacity of 120 tons. Tube mills and agitators are used, crushing

in solution. The arsenical sulphide ore assays from \$8 to \$12 in gold. About 300,000 tons is developed and a depth of 200 ft. has been reached in the shaft. The treatment of the ore has been studied by George G. Thomas, metallurgist, and direct cyanidation without roasting has been adopted. R. W. Brigstocke is manager.

**Ontario Cobalt**

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Jan. 25, were as follows:

Bailey.....	32.93	Kerr Lake.....	32.75
Beaver.....	32.00	La Rose.....	31.21
Buffalo.....	30.50	Lost and Found.....	
Casey Cobalt.....		McKinley-Darragh.....	33.46
Chambers-Ferland.....		Nipissing.....	
City of Cobalt.....	32.93	O'Brien.....	22.80
Cobalt Lake.....	32.00	Penn.-Canadian.....	
Cobalt Townsite.....	30.50	Provincial.....	
Colonial.....		Right of Way.....	
Coniagas.....	43.50	Seneca Superior.....	
Crown Reserve.....		Silver Queen.....	
Dominion Reduction Co.....		Timiskaming.....	
Drummond.....	42.60	Trethewey.....	25.09
General Mines.....		Wettlauffer.....	
Hargraves.....			
Hudson Bay.....		Total.....	326.84

RIGHT OF WAY—The royalty, payable to the Timiskaming & Northern Ontario Ry. Commission has been reduced to 15% of the net profits.

McKINLEY-DARRAGH-SAVAGE—Press dispatches state that the application will be made to the Ontario legislature by the company for an act to pay dividends out of the funds and also to repay on account of capital such amounts as it may determine, notwithstanding that the value of the net assets may be less than the par value of the issued capital stock.

WETTLAUFER—Buffalo shareholders who are asking for proxies with a view to unseating the directors, claim to have voting power for over 400,000 shares.

NORTHERN CUSTOMS CONCENTRATOR—An additional 10 stamps have been installed to replace four Nissen stamps. The mill now has a total of 120 stamps, and is one of the largest concentrators in Canada.

CROWN RESERVE—The annual report states that up to Jan. 1, 1913, this mine produced 15,227,143 oz. of silver, worth \$8,273,908. The production for 1912 was 2,714,766 oz. valued at \$1,692,060. The net profits for 1912 were \$1,136,010, which was \$143,729 less than during 1911. The total dividends paid to date amount to \$4,775,797. The general manager states that the McEnaney mine in Porcupine, which is controlled by the Crown Reserve, had ore in sight sufficient to yield a profit of \$650,000.

**Ontario-Porcupine**

DANE COPPER CO.—An 8-ft. vein of high-grade copper ore has been cut on the 100-ft. level.

DOMELAKE—A reorganization has been completed and the shareholders are now exchanging their stock on the basis of three new shares for 21 sent in.

DOCTOR REDDICK—An action has been brought against this Larder Lake property for unpaid wages amounting to about \$5000.

PEARL LAKE—The final payment on this property has been made by the Hargraves Engineering Co. All the debts of the company have been paid.

**MEXICO****Conhulla**

GUADALUPE—Francisco Zambrano and brothers have purchased a controlling interest in these mines from Ismael Winfield for \$51,000.

**Durango**

AMERICAN SMELTERS SECURITIES CO.—A new sintering plant is being built at the company's Velardena smeltery. Three lead and three copper furnaces are in operation, smelting about 1600 tons daily.

**Hidalgo**

REAL DEL MONTE—In December this company milled approximately 41,000 tons of ore. The total for November was 39,200 tons. The company starts the year without any deferred charges, 1,000,000 pesos having been charged off in 1912, and with the mines in better condition physically and with regard to ore reserves than at any previous time. The net earnings in 1912 were double those of any preceding year. The Rosario mine, the reopening of which was started in 1911 after 20 years of idleness, is now considered one of the company's most important properties, and has been completely equipped for operation on a scale of 300 tons a day. The U. S. Smelting, Refining & Mining Co., controlling Real del Monte is anxious to acquire other properties in Mexico, and so far 150 visits of examination have been made. These have resulted in only four formal examinations, and no purchases have been made.

**Jalisco**

AMPARO—Two additional Krupp tube mills are being installed, making four in all. The plant is treating 7000 tons monthly, and the additional tubes are expected to make the treatment of at least 7600 tons per month possible. In 1912 the company earned a big surplus over its dividend disbursements of \$240,000.

**Zacatecas**

NORIA—This Sombrerete district property of the Noria Development Co. is now under option to Camp Bird, which controls the Santa Gertrudis mine in the Pachuca district of Hidalgo. New development resulted in the opening of rich silver ore in 1911. The completion of the Durango-Canitas line of the National Rys., now under construction, will greatly benefit this property.

# THE MARKET REPORT

## METAL MARKETS

NEW YORK—Jan. 29

The Metal Markets for the week have been rather quiet and steady, with the important exception of copper, which is still irregular and unsettled, with a lower range of prices.

Gold and Silver Movement in the United States, year ended Dec. 31, as reported by the Department of Commerce and Labor:

	Gold		Silver	
	1911	1912	1911	1912
Exports.....	\$37,183,074	\$47,424,842	\$65,064,646	\$71,961,755
Imports.....	57,445,184	66,548,772	43,746,571	48,401,086
Excess..... I.	\$20,262,110	\$19,123,930	E.\$21,918,075	E. \$23,560,669

The apparent increase in silver was due to the advance in prices, not to the quantity. At the average values of the year, the total exports were approximately 123,189,000 oz.; the net exports, 41,100,000 oz.; for 1912 the approximate quantities were 118,290,000 oz., and 38,729,000 oz., respectively.

### Gold, Silver and Platinum

**Gold**—The price of gold on the open market in London remained at the bank value, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. With the exception of moderate amounts for India and Germany, most of the supplies went to the Bank of England. In New York a total of \$5,050,000 was shipped to Argentina, on English account.

**Iridium**—Supplies of this metal are still small and prices high, \$70@75 per oz. being asked.

**Platinum**—The market is quiet, but steady. Dealers ask \$45@46 for refined platinum and \$49@51 per oz. for hard metal. The foreign market is reported firm.

Our Russian correspondent writes, under date of Jan. 16, that the market has been a little slow, owing to the holidays. At Ekaterinburg the price has been lower, owing to a pressure to sell by the small dealers, who need money for the holidays. Buyers have taken all that was offered at 9.60 rubles per zolotnik—\$36.10 per oz.—for crude metal, 83% platinum. At St. Petersburg the same grade is quoted at 37,700 rubles per pood—\$36.95 per oz.—and the market is firm.

**Silver**—Owing to China sales, a result of delays in connection with the six-power loan silver has sold down to 28 1/2 d.; the price in India having receded to same figure. It is thought some reaction upon this figure is intended, particularly when special orders come on the market, which is likely to occur next month.

Exports of Silver from London to the East Jan. 1 to Jan. 16, reported by Messrs. Pixley & Abell:

	1912		1913		Changes
	£	\$	£	\$	
India.....	£315,300		£756,500	I. £441,200	
China.....	110,000		10,000	D. 100,000	
Total.....	£425,300		£766,500	D. £341,200	

Gold exports to India were £140,000 for the week.

### Copper, Tin, Lead and Zinc

**Copper**—On Jan. 23 there was an encouraging volume of business transacted in the morning at prices averaging about 16.20c., net cash, but offers to domestic consumers at 16 3/4 c., delivered, usual terms, failed to consummate business. In the afternoon a large sale was negotiated on terms corresponding to 16c. cash. It has been characteristic of the market throughout the week that sharp concessions could be obtained privately on business considered worth while. A slump in the London market on Jan. 27 weakened the general tone here and gave increased opportunities to arbitrageurs, of which advantage was taken. In some quarters first-hands have shown a pronounced desire to place future copper and since Jan. 25, March-April deliveries have been offered at 15 3/4 c. cash. The situation is much mixed, reflecting the uncertainty existing on all hands, and there

are wide variations in the prices asked by the several agencies; also between what they have asked and what they have done. Buyers, both here and abroad, are holding back. Consumption continues excellent, but in Europe the political situation is deterring buyers from taking hold, and in this country they are indisposed to place orders, except in a hand-to-mouth way, until market conditions become more settled. It is thought that stocks in the hands of manufacturers are low and that large orders must soon be placed by them. The business done during the week, Jan. 23-29, attained considerable proportions although it was much less than an average week. The bulk of the business reported was with domestic manufacturers. In the early part of the week some moderate sales of Lake copper were made at about 16 3/4 c., but during the latter half of the week quotations for this kind of metal had been only nominal. At the close we quote Lake at 16 1/4 @ 16 3/4 c.; electrolytic in cakes, ingots and wirebars at 15.80@15.90c. Casting copper is quoted nominally at 15.75@15.85c. as an average for the week.

The London market has been weak, due both to liquidation of stale bull accounts and some speculation. On Thursday, Jan. 23, spot was £70 10s. and three months £70 15s.; on Jan. 24 spot was £69 5s. and three months £69 10s.

### DAILY PRICES OF METALS

#### NEW YORK

Jan.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
23	4.8765	62 1/2 @ 16 1/4	16.00	49 1/2 @ 4.30	4.15	6.75	6.65	6.75	
24	4.8765	62 1/2 @ 16 1/4	16.00	49 1/2 @ 4.35	4.20	6.85	6.75	6.55	
25	4.8755	62 1/2 @ 16 1/4	15.90	49 1/2 @ 4.30	4.15	6.60	6.50	6.70	
27	4.8745	62 1/2 @ 16 1/4	15.80	49 1/2 @ 4.35	4.20	6.80	6.60	6.50	
28	4.8750	61 1/2 @ 16 1/4	15.80	49 1/2 @ 4.30	4.15	6.60	6.50	6.60	
29	4.8755	61 1/2 @ 16 1/4	15.90	51 @ 4.35	4.20	6.70	6.60	6.60	

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. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; 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

Jan.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
23	28 1/2	70 1/2	70 1/2	76 1/2	226 1/2	225	17 1/2	26 1/2
24	28 1/2	69 1/2	69 1/2	76	225 1/2	223 1/2	16 1/2	26 1/2
25	28 1/2	68 1/2	68 1/2	75	226 1/2	224	16 1/2	26 1/2
27	28 1/2	68 1/2	69	75	227	224	16 1/2	26 1/2
29	28 1/2	68 1/2	68 1/2	75	232	225 1/2	16 1/2	26 1/2

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.174c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 2 1/4 c.

On Jan. 27 and 28, spot ruled around £68 12s. 6d. and three months around £69, and at the close on Jan. 29, spot was £68 10s., and three months £68 17s. 6d. per ton.

Base price of copper sheets is 23@24c. per lb. Full extras are charged, and higher prices for small quantities. Base price of copper wire is 19c. per lb., carload lots at mill.

Copper exports from New York for the week were 4567 long tons. Our special correspondent gives the exports from Baltimore at 1735 tons for the week.

**Brass Prices**—The American Brass Co. announces the following base prices, taking effect Jan. 27: Sheets, high brass, 17½c. net per lb.; low brass, 19¾c. Wire, high brass, 17¼c.; low brass, 19¾c. Rods, high brass, 17¼c.; low brass, 20½c. Brass tubing, brazed, 22c.; open seam, 20¾c. Brass angles and channels, 21¼c. Scrap allowances are 12c. net per lb. for high brass; 13¾c. for low brass.

**Tin**—The spot market in London developed ever-increasing strength. Available stocks in London warehouse are abnormally small, and any increased demand is bound to bring

about a famine in the metal. Future tin is but slightly affected by the strong tone of the spot market, and is now selling at a backwardation of over £6. This large discount in the price of three months tin has somewhat disturbed the confidence of home consumers in the stability of the market and made them reluctant to cover their future requirements. They seem to be well supplied for their immediate wants, so that the London squeeze does not affect them. The market closes strong at about £232 for spot and £225 10s. for three months, and about 51c. for February tin here.

Cornwall production in 1912 is estimated at 6492 long tons of black tin; an increase of 341 tons over the previous year.

Messrs. Robertson & Bense report the receipts of tin ore and concentrates at Hamburg, Germany, in December at 1754 tons, all from Bolivia.

**Lead**—The market is quiet, with a fair business doing from day to day. Prices are slightly firmer, St. Louis 4.15@4.20c.; New York 4.30@4.35 cents.

The London market for Spanish lead has declined to £16 12s. 6d. and at the lower figures, consumers show some interest. English lead is quoted at £17 per ton.

**Spelter**—The demand continues slack and there has been considerable pressure to sell, in consequence of which the market has this week witnessed a decided decline, and at the close the metal is obtainable at 6.50@6.60c. St. Louis according to time of delivery. New York is quoted 6.60@6.70 cents.

The London market is quiet, and good ordinaries are quoted £26 2s. 6d.; specials £26 15s. with futures offered thereunder.

Base price of zinc sheets is \$9 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Other Metals

**Aluminum**—The market has been rather more quiet and prices are a little easier. Current quotations are 26@26½c. per lb. for No. 1 ingots, New York, according to deliveries. No change is reported in the foreign markets.

**Antimony**—The market has been inclined to be quiet, with business on a moderate scale. Cookson's is still quoted at 9¼@10c. per lb. and Hallett's at 9¼@9½c. Chinese, Hungarian and the outside brands are easier, 8¼@9c. per lb. being asked.

**Quicksilver**—Business has been rather quiet and prices are unchanged. New York quotation is \$40 per flask of 75 lb., with 59c. per lb. asked for retail lots. San Francisco, \$40 for domestic orders and \$37.50 for export. London price is £7 15s. per flask, with £7 10s. quoted by jobbers.

**Bismuth**—The syndicate which controls the European production quotes 7s. 6d.—equal to \$1.80—per lb. in London. In New York a quotation of \$1.72 per lb. is made for metal produced from American ores.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 25

The high offering for zinc sulphide ore was \$57.50, the base per ton of 60% zinc \$50@54.50 per ton. Zinc silicate brought a base price of \$28@32 per ton of 40% zinc. The average of all grades of zinc is \$53.02. Lead is unchanged from the previous weeks of the month, the general offerings being \$53 per ton of 80% metal content. The average of all grades of lead is \$52.88 per ton.

SHIPMENTS, WEEK ENDED JAN. 25

	Blende	Calamine	Lead Ore	Value
Total for week	11,216,470	739,430	2,047,380	\$361,022
January total	44,690,470	2,067,840	7,559,380	\$1,430,176
Zinc blende, the week	\$294,447;	the month,	\$1,198,487.	
Zinc calamine, the week	12,539;	the month,	33,404.	
Lead value, the week	54,036;	the month,	198,285.	

PLATTEVILLE, WIS.—Jan. 25

The base price paid this week for 60% zinc ore was \$54@55 per ton. The base price for 80% lead ore was \$51 per ton.

SHIPMENTS WEEK ENDED JAN. 25

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Total for week	2,831,490	127,160	1,469,150
Year to date	12,732,360	241,260	4,501,350

Shipped during week to separating plants, 1,955,090 lb. zinc ore.

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 95%. In computing the total American supply duplications are excluded.

Company	Sept.	Oct.	Nov.	Dec.
Alaska shipments	1,726,715	1,435,235	1,671,367	3,766,029
Anaconda	24,500,000	25,250,000	24,250,000	23,400,000
Arizona, Ltd.	3,340,000	3,200,000	3,000,000	3,100,000
Copper Queen	9,103,861	8,184,575	8,807,940	8,805,568
Calumet & Ariz.	4,462,000	4,404,000	4,918,000	5,840,000
Chino	3,217,369	3,638,500	3,911,169	3,368,850
Detroit	1,881,668	1,934,828	1,968,620	2,389,875
East Butte	1,416,830	1,398,177	1,245,504	1,314,021
Mammoth	1,834,937	1,883,283	1,805,869	
Giroux	1,005,208			
Mason Valley	1,200,000	1,563,700		
Nevada Con.	5,607,578	850,741	4,160,533	3,975,631
Ohio	635,000	187,141	573,644	566,816
Old Dominion	2,204,000	2,523,000	2,758,000	2,262,000
Ray	2,978,404	3,403,755	3,191,926	
Shannon	1,142,000	1,210,000	1,436,000	1,360,000
South Utah	225,568	nil	nil	nil
United Verde*	2,750,000	2,750,000		
Utah Copper Co.	6,616,887	2,022,352	4,562,417	5,676,484
Lake Superior*	19,250,000	21,500,000	20,400,000	
Non-rep. mines*	8,094,792	8,250,000	8,250,000	
Total production	103,025,987			
Imports, bars, etc.	25,149,329	28,205,270	22,797,099	
Total blister	128,175,316			
Imp. in ore and matte	7,142,232	11,224,879	8,149,728	
Total American	135,317,548			
Miami†	2,949,150	2,577,750	2,972,000	2,913,840
Brit. Col. Cos.:				
British Col. Copper		1,022,904	881,582	
Granby	2,083,118	2,018,424	1,852,896	
Mexican Cos.:				
Boleo†		2,612,400	2,315,040	2,480,240
Cananea	3,500,000	4,428,000	5,064,000	4,592,000
Moctezuma	771,844	3,045,667	2,112,377	2,793,781
Other Foreign:				
Cape Cop., S. Africa	678,720	757,120	907,200	770,560
Kyshtim, Russia	1,750,000			
Spassky, Russia	981,120	974,000	974,400	
Tilt Cove, Newf'd.		86,785		
Exports from				
Chile	6,048,000	8,512,000	4,816,000	7,392,000
Australia	7,616,000	9,520,000	10,752,000	9,856,000
Arrivals in Europe§	8,518,720	13,771,520	12,976,320	16,363,200

† 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
I, 1912.	119,337,753	62,343,901	80,167,904	89,454,695	158,323,200	247,777,895
II.	116,035,809	56,228,368	63,148,096	66,280,643	154,851,200	221,131,843
III.	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	65,066,029	134,176,000	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	71,094,351	60,121,331	44,335,064	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	46,701,374	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.	1,581,920,287	819,665,948	746,396,452			
I, 1913.				105,312,582	96,857,600	202,170,182
II.						

IRON TRADE REVIEW

NEW YORK—Jan. 29

The Iron and Steel Trades show no material changes from last week's report. Deliveries on specifications, and work at mills continue active and strong. The weather has generally been good, permitting full working. New business has been moderate only, chiefly for the reason that mills cannot take much new work except for rather distant deliveries.

There seems to be little concern about the future, for the reason that there is a very large tonnage in sight which is not actually placed yet, but is sure to come in good time. On the whole the trade is in strong position and seems likely to continue so for some time to come.

Pig-iron orders are more scattered, but still in good volume. Prices are not quite so strong, apparently not because of any lack of demand, but because the advance had been carried a little too far, and it was not possible to hold fancy figures.

The testimony taken in the Steel Trust dissolution suit this week, while it brought out nothing that was not fairly well known before, has revealed something of the cross-currents in the management of the Steel Corporation which made rather interesting reading, if not of permanent value.

The United States Steel Corporation statement for the December quarter shows net earnings over operating expenses and renewals as follows:

	1911	1912
October.....	\$9,159,338	\$12,485,412
November.....	6,946,717	11,120,749
December.....	6,999,060	11,579,396
Total for quarter.....	\$23,105,115	\$35,185,557
Sinking and replacement funds.....		\$9,420,631
Interest, etc.....		5,695,045
Total charges.....		\$15,115,876
Surplus for the quarter.....		\$20,069,681
Dividends, 1 1/2% on pfd. 1 1/2% on common.....		12,658,702
Balance, surplus.....		\$7,410,979

Deducting deficits of previous quarter, the total surplus for the year 1912 was \$3,610,129. The total net earnings for the year were \$108,178,307, an increase of \$3,822,744 over the previous year.

Foreign Trade of the United States in iron and steel, including machinery, for the 11 months ended Nov. 30 is valued by the Bureau of Statistics of the Department of Commerce and Labor as below:

	1910	1911	1912
Exports.....	\$176,461,644	\$220,432,092	\$265,377,556
Imports.....	36,267,671	26,690,333	26,679,224
Excess exports.....	\$140,193,973	\$193,741,759	\$238,698,332

In 1912, as compared with 1911, there was an increase of \$44,945,464, or 20.4% in exports; and a decrease of \$11,109, or 0.04%, in the imports.

PITTSBURGH—Jan. 28

The Steel Corporation's earnings of \$35,185,557 in the fourth quarter bore out the more conservative of the estimates which had been made. The year's earnings are approximately \$108,178,307, or less than \$4,000,000 better than those of 1911, although the tonnage of shipments increased about 35% and prices rose \$5 to \$7 a ton. This illustrates how long it requires for the steel industry to work up to a more profitable basis, on an advance, on account of heavy selling for forward delivery. The present quarter's earnings will show an increase of \$5,000,000 or more.

New business has unquestionably made a relatively poor showing for January. The first half business had already been done, and the reserve of buyers, as regards second half, is if anything increased. Specifications have been heavy, despite the fact that the contracts now in force are at higher prices than those which expired Dec. 31. Premiums for early delivery continue large in plates, bars and sheets.

Pig Iron—The market has continued very dull, with not enough doing to test prices thoroughly. Sentimentally the market is somewhat weaker, though allowance must be made for the fact that January is normally a dull month. Of importance to the pig-iron market is the break in Connells-ville furnace coke. The sharpest decline was last Saturday, when prompt furnace coke sold down to \$3.50 and this week it is possible lower figures could be done, there being

not enough demand to test the situation. On contract lower prices can be done, but buyers are holding aloof. If they can see their way clear to selling their product some of the idle furnaces will come in, but meanwhile they are not interested in coke. We quote: Bessemer, \$17.25; basic, \$16.50; No. 2 foundry, \$17.50; forge, \$17; malleable, \$17@17.25, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—Freight rates on imported ferromanganese are likely to be raised to the regular domestic rates, a start having been made by which on Feb. 1 the rate from New Orleans to Chicago goes up from \$3.05 to \$3.80. Material is rather plentiful, some dealers having imported more than needed. The contract market remains at \$65, f.o.b. Baltimore, with \$1.95 freight to Pittsburgh, while the prompt market is quotable at about the same figure.

Steel—The famine in billets and sheet bars continues. The Carnegie Steel Co. has picked up all the steel it could find, amounting to less than 5000 tons in the past week, all billets, which brought \$29 at maker's mill. No other transactions are reported. No bessemer has been offered, but it is believed it would bring as good a price as openhearth. We quote billets at \$29 and sheet bars at \$30, maker's mill, Pittsburgh or Youngstown, with rods at \$30, Pittsburgh.

Sheets—The sheet market is extremely strong. Mills that can make early deliveries have no difficulty in selling their product at fancy premiums, and special finish sheets can be sold even for second half at \$1 to \$3 above the regular base price, with full extras for finish besides. We quote: Blue annealed, 10 gage, 1.75@1.80c.; black, 2.35@2.40c.; galvanized, 3.50@3.60c.; painted corrugated, 2.55c.; galvanized corrugated, 3.55c. per pound.

IRON ORE TRADE

It is reported that some Lake ore has been sold to furnaces in the East at a discount from the regular price.

Imports of Iron Ore into the United States 11 months ended Nov. 30 were 1,662,830 long tons in 1911, and 1,904,594 in 1912; increase, 241,764 tons. Of the imports in 1912, Cuba supplied 1,259,813 tons; Sweden, 315,796; Newfoundland and Labrador, 124,585; Canada, 95,714, and Spain 83,631 tons. Exports of iron ore for the 11 months were 752,931 tons in 1911, and 1,186,831 in 1912; increase 433,900 tons.

Imports of manganese ores were 176,486 tons in 1911, and 257,743 in 1912; increase, 81,257 tons.

COAL TRADE REVIEW

NEW YORK—Jan. 29

The Coal Trade in the West has settled down into a pretty regular condition. Supplies and delivery are easy and prices more regular than they were. The domestic demand has been small, owing to the continued mild weather.

Conditions are very similar in the seaboard bituminous trade. The anthracite trade is also quiet and steady. Steam coal demand is good; outside of that it will be a weather market for the next month or two.

CHEMICALS

NEW YORK—Jan. 29

The General Markets continue steady and rather firm, with a good business forward in most lines.

Arsenic—Demand is rather slow and supplies are good. The makers of insecticides have not yet started heavy buying. Quotations are a little weaker at \$4.50@4.62 1/2 per 100 lb. for both spot and futures.

Copper Sulphate—The market is steady with fair business. Prices are unchanged at \$5.50 per 100 lb. for carload lots and \$5.75 for smaller parcels.

Nitrate of Soda—Business has been rather quiet and prices are unchanged. Quotations are steady at last figures. 2.60c. per lb. for spot and February, 2.57 1/2c. for March and April; 2.55c. for May and June; 2.50c. for later deliveries.

Petroleum

Exports of mineral oils from the United States for the year ended Dec. 31 were 1,736,230,014 gal. in 1911, and 1,844,530,045 gal. in 1912; increase, 108,300,031 gal., or 6.2%. Exports in 1912 included 173,522,223 gal. crude; 1,023,681,414 gal. illuminating oils; 213,559,784 gal. lubricating and paraffin; 175,089,771 gal. naphthas and gasoline; 259,276,853 gal. residuum.

Assessments

Company	Delinq	Sale	Amt.
Andes, Nev.	Feb. 4	Feb. 25	\$0.03
Belcher, Nev.	Feb. 7	Feb. 28	0.10
Confidence, Nev.	Feb. 7	Feb. 26	0.20
Consolidated Virginia, Nev.	Feb. 11	Mar. 4	0.15
Copper Hill, Ida.	Jan. 5	Feb. 5	0.002
Corbin Copper, Mont.	Feb. 11	0.50	
Corbin Copper, Mont.	Apr. 22	0.50	
Dry Cañon Con., Utah.	Jan. 14	Feb. 12	0.001
Gould & Curry, Nev.	Feb. 8	Feb. 28	0.03
Great Western, Nev.	Jan. 13	Feb. 3	0.01
High Grade, Mont.	Jan. 18	Feb. 18	0.01
Melcher, Utah.	Feb. 11	Mar. 3	0.02
North Star, Nev.	Jan. 13	0.02	
O.K. Silver M. & M. Co., Utah	Jan. 30	Feb. 20	0.01
Ophir, Nev.	Jan. 23	Feb. 14	0.15
Pioche Metals, Nev.	Feb. 10	Mar. 17	0.01
Rescue Eula, Nev.	Feb. 5	Mar. 5	0.01
Sandstorm-Kendall, Nev.	Jan. 6	Feb. 10	0.01
Sierra Nevada, Nev.	Jan. 30	Feb. 20	0.10
Spider, Utah.	Feb. 5	Feb. 25	0.01
Superior & Boston, Mont.	Jan. 4	1.00	
Tonopah North Star, Nev.	Jan. 13	Feb. 17	0.02
Umatilla Tonopah, Nev.	Jan. 20	Feb. 24	0.01
Wabash, Utah.	Jan. 24	Feb. 15	0.05

Monthly Average Prices of Metals SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	24.865	25.887		
February	52.222	59.043	24.081	27.190		
March	52.745	58.375	24.324	26.875		
April	53.325	59.207	24.595	27.284		
May	53.308	60.880	21.583	28.038		
June	53.043	61.290	24.486	28.215		
July	52.630	60.654	24.286	27.919		
August	52.171	61.606	24.082	28.375		
September	52.440	63.078	24.209	29.088		
October	53.340	63.471	24.594	29.299		
November	55.719	62.792	25.649	29.012		
December	54.905	63.365	25.349	29.320		
Year	53.304	60.835	24.592	28.042		

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

COPPER

Month	NEW YORK				London, Standard	
	Electrolytic		Lake		1912	1913
	1912	1913	1912	1913		
January	14.094	14.337	14.337	62.760		
February	14.084	14.329	14.329	62.893		
March	14.698	14.868	14.868	65.884		
April	15.741	15.930	15.930	70.294		
May	16.031	16.245	16.245	72.352		
June	17.234	17.443	17.443	78.259		
July	17.190	17.353	17.353	76.636		
August	17.498	17.644	17.644	78.670		
September	17.508	17.698	17.698	78.762		
October	17.314	17.661	17.661	76.389		
November	17.326	17.617	17.617	76.890		
December	17.376	17.600	17.600	75.516		
Year	16.341	16.560	16.560	72.942		

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

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	191.519		
February	12.962	195.036		
March	12.577	192.619		
April	43.923	200.513		
May	16.063	208.830		
June	45.815	205.863		
July	44.519	202.446		
August	45.857	208.351		
September	49.135	223.762		
October	50.077	228.353		
November	49.891	227.619		
December	49.815	226.875		
Av. year	46.096	209.322		

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

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.327	4.327	15.597		
February	4.026	3.946	3.946	15.738		
March	4.073	4.046	4.046	15.997		
April	4.200	4.118	4.118	16.331		
May	4.194	4.072	4.072	16.509		
June	4.392	4.321	4.321	17.588		
July	4.720	4.603	4.603	18.544		
August	4.569	4.432	4.432	19.655		
September	5.048	4.924	4.924	22.292		
October	5.071	4.894	4.894	20.630		
November	4.615	4.463	4.463	18.193		
December	4.303	4.152	4.152	18.069		
Year	4.471	4.360	4.360	17.929		

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

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.292	6.292	26.642		
February	6.499	6.349	6.349	26.661		
March	6.626	6.476	6.476	26.048		
April	6.633	6.483	6.483	25.644		
May	6.679	6.529	6.529	25.790		
June	6.877	6.727	6.727	25.763		
July	7.116	6.966	6.966	26.174		
August	7.028	6.878	6.878	26.443		
September	7.454	7.313	7.313	27.948		
October	7.426	7.276	7.276	27.543		
November	7.371	7.221	7.221	26.804		
December	7.162	7.081	7.081	26.494		
Year	6.943	6.799	6.799	26.421		

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

PIG IRON IN PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	\$15.12	\$13.32	\$13.32	\$14.00		
February	15.03	13.28	13.28	14.01		
March	14.95	13.66	13.66	14.10		
April	15.13	13.90	13.90	14.15		
May	15.14	13.90	13.90	14.12		
June	15.15	14.11	14.11	14.22		
July	15.15	14.38	14.38	14.38		
August	15.43	14.90	14.90	14.85		
September	16.86	16.03	16.03	15.63		
October	17.90	17.18	17.18	17.22		
November	18.07	17.09	17.09	18.00		
December	18.15	17.45	17.45	18.73		
Year	\$16.01	\$14.93	\$14.93	\$15.28		

STOCK QUOTATIONS

COLO. SPRINGS Jan. 28		SALT LAKE Jan. 28	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.01	Beck Tunnel	.08
Cripple Cr'k Con.	.01	Black Jack	10
C. K. & N.	.16	Cedar Talisman	.01
Doctor Jack Pot.	.07	Colorado Mining	.16
Elkton Con.	.61	Columbus Con.	.10
El Paso	6.16	Crown Point	.02
Findlay	.96	Daly-Judge	6.00
Gold Dollar	.15	Grand Central	.72
Gold Sovereign	.02	Iron Blossom	1.25
Isabella	.12	Little Bell	1.10
Jack Pot.	.05	Lower Mammoth	.04
Jennie Sample	.05	Mason Valley	18.00
Lexington	.004	May Day	.22
Moon Anchor	.005	Nevada Hills	1.42
Old Gold	.03	New York	1.00
Mary McKinney	.67	Prince Con	.89
Pharmacist	.01	Silver King Coal'n	3.00
Portland	.96	Sioux Con	.02
Vindicator	.89	Uncle Sam	.11
Work	1.004	Yankee	.15

TORONTO Jan. 24

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.09	Foley O'Brien	13
Coniagas	9.00	Hollinger	15.00
T. & Hudson Bay	63.00	Imperial	.02
Timiskaming	.34	Jupiter	.35
Wettlaufer-Lor.	.15	Pearl Lake	.29
Apex	.01	Porcu. Gold.	.18
Crown Chartered	.00	Preston E. D.	.03
Doble	.20	Rea	.20
Dome	18.25	Swastika	.09
Dome Exten.	.06	West Dome	.10

SAN FRANCISCO Jan. 28

Name of Comp.	Cig.	Name of Comp.	Bid
Alta	.04	Belmont	8.00
Belcher	.18	Jim Butler	.71
Best & Belcher	.08	MacNamara	.22
Caledonia	.69	Midway	.74
Challenge Con.	.05	Mont. Tonopah	1.75
Chollar	.01	North Star	1.40
Confidence	.12	West End Con.	1.40
Con. Virginia	.14	Atlanta	.16
Crown Point	.20	Booth	.02
Gould & Curry	.01	C.O.D. Con.	.07
Hale & Norcross	.05	Comb. Frac.	.36
Mexican	.79	Jumbo Extension	.93
Occidental	.70	Pitts-Silver Peak	.05
Ophir	.27	Silver Pick.	.45
Overman	.35	St. Ives	.30
Potosi	.02	Tramp Con.	.01
Savage	.04	Argonaut	11.75
Sierra Nevada	.17	Bunker Hill	14.50
Union Con.	.15	Central Eureka	.27
Yellow Jacket	.19	So. Eureka	.75

N. Y. EXCH. Jan. 28

Name of Comp.	Cig.	Name of Comp.	Cig.
Amalgamated	72 1/2	Adventure	4 1/2
Am. Agri. Chem.	53 1/2	Ahmeek	310
Am. Sm. & Ref. com	73 1/2	Algomah	1 1/2
Am. Sm. & Ref. pf.	105 1/2	Allouez	30 1/2
Am. Sm. Sec. pf. B	84	Am. Zinc	30 1/2
Anaconda	37 1/2	Ariz. Com. cts.	9 1/2
Batopilas Min.	1 1/2	Bonanza	.33
Bethlehem Steel pf	69 1/2	Boston & Corbin	.6
Chino	42 1/2	Butte & Galak	.3
Federal M. & S. pf.	39	Calumet & Ariz.	66 1/2
Goldfield Con.	2 1/2	Calumet & Hecla	500
Great Nor. ore. ctf.	40	Centennial	15 1/2
Guggen. Exp.	49 1/2	Cliff	.3
Homestake	116	Copper Range	48 1/2
Inspiration Con.	17 1/2	Daly West	.4
Miami Copper	23 1/2	East Butte	.14
Nat'l Lead, com.	50 1/2	Franklin	7 1/2
National Lead, pf.	106 1/2	Granby	.69
Nev. Consol.	18 1/2	Hancock	21 1/2
Phelps Dodge	210	Hedley Gold	.29
Pittsburg Coal, pf.	90 1/2	Helvetia	1 1/2
Ray Con.	19 1/2	Indiana	.15
Republic I & S. com.	24 1/2	Island Cr'k, com.	.55
Republic I & S. pf.	85 1/2	Island Cr'k, pf.	84 1/2
Sloss Sheff'd. com.	45 1/2	Isle Royale	29 1/2
Sloss Sheff'd. pf.	93 1/2	Keweenaw	.24
Tennessee Copper	33 1/2	Lake	.21
Utah Copper	54 1/2	La Salle	.4 1/2
U. S. Steel, com.	64 1/2	Mass	.45
U. S. Steel, pf.	110	Michigan	.15
Va. Car. Chem. pf.	108	Mohawk	54 1/2

N. Y. CURB Jan. 28

Name of Comp.	Cig.	Name of Comp.	Last
Barnes King	86	Alaska Gold M.	13 1/2
Beaver Con.	42	Bingham Mines	4
Braden Copper	9 1/2	Boston Ely	80
B. C. Copper	4 1/2	Boswycolo	1
Buffalo Mines	2 1/2	Butte Central	7 1/2
Caledonia	40	Cactus	.06
Con. Ariz. Sm.	1 1/2	Calaveras	1 1/2
Davis-Daly	1 1/2	Chief Cons	3 1/2
Diam' field-Daisy	4 1/2	Corbin	.35
Ely Con.	12	Cortez	.40
Florence	43	Crown Reserve	3 1/2
Giroux	3 1/2	First Nat. Ccp.	2 1/2
Gold Hill Con.	1 1/2	Majestic	.42
Greene Cananea	9 1/2	Mexican Metals	2 1/2
Greenwater	105	Moneta Porc.	10
Internat. S. & R.	124	Nevada-Douglas	2 1/2
Kerr Lake	3 1/2	New Baltic	.95
Keystone	12	Oneco	1 1/2
La Rose	3 1/2	Raven Copper	.21
McKinley-Dar-Sa.	2	Rhode Island Coal	.05
Min. Co. of A. new	3 1/2	San Antonio	13 1/2
Motherlode Gold	10	Smokey Dev.	2 1/2
Nev. Utah M. & S.	10	S. W. Miami	.3
Nipissing Mines	9	South Lake	.6 1/2
Ohio Copper	1 1/2	Tratheway	.34
Pacific Sm. & M.	1 1/2	United Verde Ext.	.34
Puebla S. & R.	2 1/2		
South Live Oak	1 1/2		
South Utah M. & S.	1 1/2		
Standard Oil (Old)	1110		
Stand'd Oil of N.J.	435		
Stewart	1 1/2		
Tonopah			