

Issued Weekly by the
Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROBERT MCKEAN, Sec'y.

505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance,
\$5.00 a year for 52 numbers, including
postage in the United States, Mexico,
Cuba, Porto Rico, Hawaii, or the Philip-
pines, \$6.50 in Canada.

To foreign countries, including post-
age, \$8.00 or its equivalent, 33 shillings;
33 marks; or 40 francs.

Notice to discontinue should be writ-
ten to the New York Office in every in-
stance.

Advertising copy should reach New
York Office by Thursday of week before
date of issue.

Entered at New York Post Office as
mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue, 9300 copies are printed.

None sent free regularly, no returns
from news companies, no back numbers.
Figures are live, net circulation.

Contents

	PAGE
Editorials:	
The Mystery of the Lead Market	483
The British Coal Strike.....	484
The Situation in Mexico.....	484
Changes at the Lake.....	484
Correspondence and Discussion:	
Safety Devices for Hoisting through Inclines.....	485
The Geology and Mining of Clay..	485
Osceola Report.....	486
February Dividends.....	486
Chronology of Mining for February, 1912.....	486
The Anglo-American Club of Frei- berg, Saxony.....	486
January Operations at Goldfield Consolidated.....	487
*Iron Mining in the Urals.....	487
Breitung Aid Fund.....	487
Foster's Amendment to Bureau of Mines Act.....	487
Cornish Mining Notes.....	488
Western Branch, Canadian Mining Institute.....	488
Details of Practical Mining:	
*A Wagon Oil Tank...Lower- ing the Water in a Choked Shaft... *Powder House with Concrete Roof... *Dam for Set- tling Pond... *Draining a Shaft through a Drill Hole... *Ground- ing Electric Circuits... *Patch- ing an Air Compressor Cylinder	489
A Discussion of Mining Law. H. V. Winchell	493
Byproduct Coke Ovens.....	497
*Cyaniding Tailings in Colombia. Ralph W. Perry	498
Taxation in Arizona.....	500
London Mica Market in 1911.....	500
*Ore Dressing in the Joplin District —III.....	501
Hedley Gold Mining Co.....	504
*A Method of Showing Ore Reserves. N. H. Emmons, 2d	505
Removing Rust from Steel.....	506
*The California Gold Dredge—IV. Robert E. Cranston	507
Prospecting for Alunite.....	511
Sealing Off Water in Catskill Aque- duct Shafts.....	512
Notes from Current Literature.....	513
The Determination of Platinum.....	515
The Vanadium Industry in France..	515
Elkton Consolidated Report.....	515
Personal, Obituary and Societies....	516
Editorial Correspondence.....	517
Mining News.....	519
Markets.....	525
*Illustrated.	

The Engineering and Mining Journal

Vol. 93.

MARCH 9, 1912.

No. 10.

The Mystery of the Lead Market

Ever since we ceased to have any statistics respecting the consumption and stock of lead in the United States the market for this metal has been mysterious. The perplexity was increased not long ago when the American Smelting & Refining Co. suddenly reduced its price from 4.45c. to 4c. The reason for this unexpected action has been the subject of much surmise, including the notions that it was connected with the tariff legislation pending in Washington and that it was a blow directed against the International Smelting & Refining Co. which had accumulated a large stock of lead ore at higher prices at Tooele and was about to begin converting it into bullion. The idea that the A. S. & R. Co. merely desired to sell lead was too prosaic to meet with any great favor.

It sometimes happens that a mundane calamity coincides with an eclipse of the moon, and there is no doubt respecting the substantial coincidence of the A. S. & R. Co.'s cut and the inrush of protesting lead miners into Washington, but the cause and effect are not necessarily any more closely connected in one case than in the other. The present price of lead at London is about 3.40c. per lb. Under the terms of the proposed new tariff the cost of lead on that basis imported into the United States would be about 4¼c. per lb. The London price is now rather high and doubtless there will be some advantages in entering Mexican lead refined in this country, wherefore 4c. and 4¼c. are not true comparisons, but if, as some persons imply, the smelting company has been merely giving the producers an object lesson to lead them to fight the battle in Washington we think that the news is cold comfort to the producers, because the operation is highly expensive to them.

It is, moreover, quite unnecessary, be-

cause the ore producer will fight tooth and nail against any reduction of the tariff anyway and does not need any object lesson; and we do not believe that anyone seriously believes that any tariff legislation will be consummated this year. In passing, we may remark that if the tariff on lead should be wholly removed our producers would not be subject to competition under the old scale of prices. It would mean rather that the New York and London prices would run more nearly together.

Nor does the idea that the A. S. & R. Co. is sticking a pin into the International appeal to good sense. The International is too strong to be driven out of business, and if it be caused to lose money the A. S. & R. Co., stands to lose also, which probably it does not want to.

The fact is that the A. S. & R. Co. ever since it made the cut has been supplying lead freely to all purchasers and its market has been *the* market, the independent producers disinclined to sell at the price standing aside and allowing the business to go to the smelting company. The sales of the latter are believed to have been very large. The inference from this is that it has been desired to make lead move.

As we have remarked many times during the last year a comparison of the recent statistics of the production of lead with the probable position of consumption by analogy with the iron and copper industries has led to the conclusion that there must have been a large accumulation of lead unsold. Although this has been emphatically denied there was nevertheless hardly any escape from the logic of the situation. Our own surmise is that the recent action of the smelting company was to relieve itself of a surplus. If at the same time there was excited opposition to the proposed tariff reduction and some annoyance to the International company those may have been satisfactory incidents.

The British Coal Strike

The most important event of the last week was the inauguration of the strike by coal miners in Great Britain, on Mar. 1, upward of one million men ceasing work and all the mines of the kingdom except two small ones being compelled to close. The effect upon general commerce and trade was instantaneous. Railway operation was curtailed, steamships were tied up and factories were closed. Coal is a fundamental necessity and because of its bulky nature and other conditions, no great supply can ever be carried in stock. When it ceases to come from the mines there is bound to be immediate trouble.

Respecting the merits of this dispute between masters and men, we are not in a position to discuss it. Whatever it be, it is insignificant in comparison with the political and economic aspects of the new system of the national strike that has been introduced in France and now in Great Britain. If the men of one industry can enforce their wishes and redress their grievances by depriving a nation of its means of existence, other groups may successively do the same thing. The system becomes an attack upon society, which does not know exactly how to move. One road leads to socialism; another to collectivism; another to militarism. Which shall it be? France solved its problem by taking the last. England is less organized and less minded to take that. America will be in an even more difficult position when the same trouble, of which we had a taste in the anthracite strike, comes fully to it. The social unrest of the times, of which these national strikes are but a manifestation, is the great problem of modern civilization.

The Situation in Mexico

The gravity with which the situation in Mexico is regarded is indicated by the proclamation of the President of the United States, on Mar. 2, notifying Americans in that country to keep their hands off and by implication, at least, advising them to leave that country. An exodus had previously been in progress and it is continuing. Unfortunately there are many thousands of Americans in Mexico who cannot leave because of their property, or that in their charge, which may not be abandoned.

We do not take any stock in the fears

that there may be a general massacre of foreigners in Mexico. The Mexicans are not savages, and both the government and the organized revolutionary party will treat persons and property as honorably as any civilized people will do, subject to the dangers of legitimate fighting, out of the way of which foreigners ought to keep. The Americans and other foreigners at such important places as Chihuahua, Torreon, Monterey, Aguascalientes, Guanajuato and Pachuca are probably safe enough. The alarm is for those who are working by twos and threes at remote and isolated places in the mountains, where they are exposed to the marauding of bandits.

In former years, before Diaz put things in order in Mexico, there was no sharp dividing line between the revolutionist and the bandit. The recent condition of chaos has restored that disagreeable uncertainty and conferred a quasi-respectability upon the bad men who have taken to the road for plunder. Those gentry are now roaming pretty much at will and constitute the chief danger of order for foreigners who are trying to carry on their business.

Changes at the Lake

In the last three years, some radical changes have occurred in the mining and milling practice in the Lake Superior copper country and are worthy of note. Prior to this period the rock drill in general use was the heavy, two-man air machine of the Rand type, and this was used for all operations, drifting, stoping, sinking and raising. It was standard to such an extent that experiments were seldom if ever tried with other types to determine their worth. Recently, however, conditions have made more imperative than ever before the further reduction of the cost of breaking ground. This has led to comparative tests with other machines, including electric drills, and newer types of air drills both of the one- and two-man type. Some changes have already been made along these lines, and further results will be awaited with interest.

In the stamp mills, a departure has been made in the fine-grinding department at several plants. The Chilean mill was formerly a popular machine for this work. After experiments extending over a considerable time, however, the conical pebble mill is now being used in this department at one of the largest stamp

mills at the lake, and a smaller mill recently placed in commission uses this type of machine. It should be remarked that changes of this character are not of frequent occurrence in the Lake Superior district, and are never adopted until after exhaustive tests. It is customary among the larger companies to evolve a machine gradually for any particular work, starting with some standard type and removing, adding or strengthening parts where necessary. Another factor that precludes hasty action is the size of the operation at individual properties. When it happens that something new is adopted, it means a large installation; other mines are apt to follow suit, and the total outlay involved will be no small amount. It is not surprising, therefore, that the introduction of innovations is often difficult.

We are wont to read in the financial and quasi-financial papers that dabble in mining that the so-and-so company is paying only \$2 per share in dividends but is earning \$4, the alleged earnings being computed from the production, the market price of the product, and the assumed cost of production. As the earnings go on at the rate of \$4 per share, year after year, and the dividends at only \$2, our thoughts revel in the idea of the melon that some day will be cut for the stockholders. Yet how few of those melons there are! Nor does the surplus seem to pile up in the balance sheets! Is it possible that it goes back into the properties for the maintenance of production? Of course, it is much more encouraging to stockholders to talk about producing copper for 7c. per lb. than for 10c., even if hopes and realizations are two different things.

Unrest seems to be characterizing the coal-mining industry all over the world. Besides the great British strike, trouble is impending in the important Rhenish-Westphalian district in Germany, where the miners have demanded a general increase of 15 per cent. in wages. This, they claim, will only restore the price of coal mining to the level which prevailed when a general reduction was made in 1907; and they also claim that it was then promised that the cut should be only temporary. A general strike is threatened if the advance is not granted. In France also there is trouble with the miners in the Nord and the Pas-du-Calais, the chief coal-mining districts.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Safety Devices for Hoisting Through Inclines

It has occurred to me from time to time that, whereas any number of devices have been invented or are in use to prevent the dropping of a cage in a vertical shaft, should the hoisting rope break, to my knowledge no such scheme has been offered to prevent a similar occurrence to a skip or man car in an inclined shaft. On the face of it, if I am correct in the belief that no such device has been advocated, this seems strange.

In the JOURNAL of Feb. 24, L. H. Eddy gives an interesting description of such an accident that occurred at the Bunker Hill mine at Amador City, Calif., on Feb. 7. It is noteworthy that with a skip of but $2\frac{1}{2}$ tons capacity, 14x14-in. shaft timbering was broken and loosened for a distance of 90 ft., and the shaft for that stretch was caved, due to bad ground in that vicinity. The skip-road remained intact but the roof and sides were damaged. No lives were lost, but 68 men were imprisoned underground for 24 hours, and hoisting of ore, of course, was interrupted for that space of time. I believe I am safe in saying that the company was fortunate, both in not having had greater damage done, and in not having had heavier equipment to contend with.

In the Lake Superior copper country, while such accidents are not of daily, weekly, or even monthly occurrence, still they are not uncommon. There, however, conditions are much more severe, the chief difference in this respect being, that the skips and, therefore, the loads are of much greater weight. Skips of from 7- to 10-ton capacity are in common use, and hoisting is done at a speed of about 3500 ft. per min., and from depths of over 4000 ft. The angle of the incline varies from under 30° to over 70° from the horizontal, but the greatest speed is reached in shafts having a dip of about 37° . Under these conditions, when a skip containing say seven tons of rock, breaks away at a point a few hundred feet from surface and leaves the skip road at any point after a descent of several lifts, the resulting damage is apt to be and often is great. In many cases, of some of which I have personal knowledge, not only are the dividers and wall plates torn out and destroyed for several hundred feet, in one and sometimes two compartments, but the skiproad itself is as much demolished as would be

the road bed in case of a bad railroad accident. Often the plat timbering is also damaged at one or more levels.

Such accidents are expensive in many ways, although no lives may have been lost. The battered skip, and its contents must be removed and any hoisting cable that may have stayed with the skip. New timbers must be cut and placed not only for support, but for stringers, if concrete is not used. The time consumed in these repairs is not the least important factor in the expense, as hoisting of rock must cease while repairs are in progress. This may cause inconvenience at the mill and will certainly disarrange underground work as far as the trammers are concerned and perhaps may cause cessation of mining for a shift or two. That the possibility of such accidents always exists where inclined hoisting is done, is shown by the schemes employed at the Lake to alleviate the damages. These include as perfect a skiproad as possible, well greased skips and rope and frequent inspection of both; at some of the mines the skips have been equipped with skids and guides, both made of iron and constituting an integral part of the skip. The skids are designed to slide on the rails should one or more wheels come off either in hoisting or any other way; the guides are to cause the skip to stay on the skiproad should anything happen in ordinary hoisting or in case of accidental descent. As a final precaution, a rock pentice is generally left below the bottom loading level to stop the skip in an accidental descent, thus protecting workmen in the bottom of the shaft.

It will be noticed, however, that these schemes aim simply to minimize the damage caused by a runaway skip; none of them go to the root of the evil and attempt to prevent the skip from falling, unless the inspection of the hoisting cable can be called such. The devices in use on cages in vertical shafts are designed to prevent the fall of the cage should the rope break. Why is not a similar object attainable in inclined shafts? If such a device is in use anywhere, I am not aware of it and would welcome information regarding it. I am quite certain, however, that nothing of the sort is in use in Michigan, and am of the opinion that it has never been attempted there.

Without attempting to evolve any such scheme here, it is apparent that a device of this sort, to be effective, would have to provide for stopping the skip almost

simultaneously with the breaking of the rope and for securely holding it there, wherever it may be. Once any appreciable momentum is attained, the task would be doubly difficult if not impossible. This fact, together with the inconvenience that would be caused in ordinary hoisting, precludes probably the use of any apparatus that would aim to stop the skip at the level next below the point at which the accident occurred. A dog-and-tooth device would be equally objectionable if it interfered with the lowering of the skip; particularly that necessary when bringing the skip on the landing chair for loading at levels. It would seem as though some plan would have to be employed that involved the same principle as is used in vertical shafts, an action which is idle when everything is right, but which operates automatically and instantly upon the breaking of the rope. To provide for catching the skip at any point in the shaft, it would probably be necessary to place one or more notched guides parallel to the stringers, these guides to engage whatever mechanism was placed on the skip. For this reason the cost of installation would probably be less if done while the shaft was being sunk than if installed in an old shaft. In either case, however, the cost could only be measured by the amount of damage done by such an accident as it is designed to prevent.

In conclusion it may not be amiss to say that the advantages of such a safety device are so apparent as to warrant the belief that it must have occurred to others and to have been discarded for cause. As to this, however, I will reiterate that I am unaware of any such scheme having been suggested or tried out either experimentally or practically. Therefore, is it not feasible, and if not, why not? L. E. IVES.

New York, Feb. 26, 1912.

Geology and Mining of Clay

In my article, entitled "The Geology and Mining of Clay," in the JOURNAL of Feb. 3, 1912, p. 263, reference should have been made to Dr. Heinrich Reis' book on "Clays, their Occurrence, Properties and Uses," from which valuable material was obtained.

E. K. SOPER.

Minneapolis, Minn., Mar. 2, 1912.

Osceola Report

The report of the Osceola Consolidated Mining Co., for the year ended Dec. 31, 1911, shows 1,246,596 tons of rock stamped at a cost of \$1.14 per ton for mining, transportation, stamping and taxes. From this 24,452,912 lb. of mineral were obtained, which contained 75.198%, or 18,388,193 lb. of fine copper. This is equivalent to a production of 14.8 lb. of fine copper per ton of rock stamped, as compared with 15.9 lb. per ton in 1910, 16.9 lb. in 1909, and 17.1 lb. per ton in 1908. The cost per pound of refined copper produced was 9.28c. per lb., as against 9.37 in 1910, 9.47 in 1909, and 10.25c. in 1908. This figure is arrived at as follows: Cost per lb. at mine, excluding construction, 7.73c.; cost of construction per lb., 0.49c.; freight, smelting, commission and general expenses, 1.06c. The cost of stamping alone may be judged from the footnote that 63,449 tons of North Kearsarge rock was stamped at the Tamarack mills at a cost of 27.28c. per ton. Of the 18,388,193 lb. of copper produced, 17,470,124 lb. were sold at 12.72c. per lb., leaving unsold 918,069 pounds.

No sinking was done during the year in the Osceola branch, the deepest shaft still being the No. 5 Osceola, 4623 ft. from the surface. In the South Kearsarge branch, 1222 ft. of openings were made, and in the North Kearsarge 5518 ft. of openings and 306 ft. of sinking. On the Osceola branch, no mining was done during the past year, but both Nos. 5 and 6 shafts have been repaired from top to bottom. Active work will probably not be resumed here until the mill is entirely remodeled, this being called for by the decreasing content of the North Kearsarge rock. The new equipment consists of Woodbury classifiers and jigs, Wilfley tables and Hardinge mills. The results show that the new washing system gives an extraction of about 79%, as compared with about 73% formerly, or a saving of 1.1 lb. of copper per ton on the present grade of Kearsarge rock. The capacity per head is about the same, with an added cost of treatment of about 1c. per ton of rock. The grade of mineral secured is substantially the same. The decrease in the copper content of the rock stamped is due to the falling off in content of the North Kearsarge ore. The drifts north with the exception of the thirteenth and fourteenth levels of this mine have been below average. At the South Kearsarge the copper contents have been 18.22 lb. per ton, as compared with 18 lb. in 1910.

The total net profit for the year was \$664,628, and, from this and the surplus, \$7 per share, or \$673,050 dividends were paid, the balance of assets over liabilities still remaining \$1,832,184. The Osceola company owns \$341,100 of Mineral Range Ry. Co.'s stock and \$60,000 worth of Lake Superior Smelting Co.'s stock, the

latter amounting to 15,000 of the 48,000 outstanding shares. The charges for smelting rendered by this last company have varied from \$6.50 to \$6.80 per ton of mineral. However, no dividend has been paid by the Lake Superior Smelting Co., as the profit has been in large part used for construction and improvement at the works.

February Dividends

The dividends paid by 29 mining and metallurgical companies, and industrials closely allied to mining, for the month of February, 1912, amount to \$11,627,188, which compares favorably with \$10,488,845 reported paid in February, 1911. In addition to the regular dividends disbursed in February, the Inspiration Consolidated Copper Co. has accorded its stockholders of record Feb. 1 the right

UNITED STATES MINING COMPANIES	Situation	Per Share	Total
Alaska-Mexican, g.	Alas.	0.20	\$ 36,000
Alaska-Treadwell, g.	Alas.	0.75	150,000
Alaska United, g.	Alas.	0.30	54,000
Arizona Copper, com.	Ariz.	0.30	461,668
Bunker Hill & Sul., l.s.	Ida.	0.20	65,400
Camp Bird, g.s.	Colo.	0.48	534,600
Cliff, g.	Utah	0.10	30,000
Frontier, z.	Wis.	2.00	2,500
Elkton, g.	Colo.	0.01	37,500
Hecla, l.s.	Ida.	0.02	20,000
Homestake, g.	S. D.	0.50	109,200
Mohawk, c.	Mich.	1.00	100,000
Parrot, c.	Mont.	0.15	34,477
Quilp, g.	Wash.	0.01	15,000
Tennessee, c.	Tenn.	1.50	300,000

COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES	Situation	Per Share	Total
Amalgamated, c.	Mont.	\$0.50	\$ 769,440
Am. Sm. Sec., pfd., A.	U.S.	0.50	85,000
Am. Sm. Sec., pfd., B.	U.S.	0.41	125,000
Cambria Steel.	Penn.	0.62	562,500
International Nickel.	U.S.	1.50	133,689
Lehigh Coal & Nav.	Penn.	1.00	482,936
National Carbon, pfd.	U.S.	1.75	78,750
U. S. Steel, pfd.	U.S.	1.75	6,304,919
Va.-Car. Chem., com.	U.S.	1.50	419,886

CANADIAN, MEXICAN AND CENTRAL AMERICAN COMPANIES	Situation	Per Share	Total
Amparo, g.s.	Mex.	\$0.03	\$ 60,000
Buffalo Mines, s.	Ont.	0.03	30,000
Coniagas, s.	Ont.	0.45	360,000
Crown Reserve, s.	Ont.	0.05	88,440
Dominion Coal.	Can.	3.50	175,000

to subscribe for an issue of its bonds to the amount of \$6,000,000 *pro rata* for full or fractional amounts, but only in multiples of \$500, payable Mar. 1, 1912; Sept. 1, 1912; Mar. 1, 1913, and Sept. 1, 1913.

Of the amounts paid by U. S. mining companies, \$1,951,556, it is noticeable that \$966,306 was paid by the precious-metal mining companies. Alaska-Treadwell increased its dividend from 50c. to 75c. per share, while Camp Bird again paid over half a million. This company continues to prosper; Santa Gertrudis has developed favorably, while it is stated that the Camp Bird mine itself shows some new discoveries.

Total dividends for the first two months of 1912, as reported to the

ENGINEERING AND MINING JOURNAL, amount to \$25,855,833, against \$24,967,454 for the corresponding period last year.

None of the above figures includes the disbursement by the Kennicott Mining Co., controlling the Bonanza copper mine in Alaska. This is a close corporation. It is understood that this company paid \$1,000,000 in February, but official detailed information is not given out. As to the figure being approximately correct, there seems to be no doubt.

Chronology of Mining for February, 1912

Feb. 7—Sixty-eight miners, temporarily imprisoned in the Bunker Hill mine, California, by a falling skip which caused a blocking of the shaft.

Feb. 12—Equipment for a 100-ton mill of the Peaceful Valley company, was totally destroyed by fire, near Cuba City, Wis.—An accident in a coal mine at Antonienhütte, Prussia, reported to have killed 27 men.

Feb. 15—Smelting resumed by the Consolidated Arizona Smelting Co., at Humboldt, Arizona.

Feb. 19—Announcement of initial dividend of \$1,000,000 by the Bonanza copper mine, in Alaska.

Feb. 23—Eight men reported killed and 20 injured in a fire at No. 5 mine of the Western Coal & Mining Co., at Lehigh, Okla.—Sixth section of the Miami mill was placed in operation, giving the mill its full capacity.

Feb. 26—The U. S. District Court at Trenton, N. J., decided that the Butters stationary filter was not an infringement of the Moore movable filter, in the suit of the Moore Filter Co. against the Tonopah-Belmont Development Company.

Feb. 28—Ray Consolidated stockholders voted to increase stock to 1,600,000 shares, to absorb the Ray Central company.

Feb. 29—British coal-miners strike was inaugurated, before official time, by a walkout of about 800,000 men. Tooele lead smeltery put into commission.

The Anglo-American Club of Freiberg, Saxony

The report of the Anglo-American Club at Freiberg, Saxony, for 1910-11, which has recently been received, shows that the club is doing well. The new quarters occupied have been found very satisfactory, being spacious, quiet, well lighted and comfortable. The rooms include the large club room proper, the writing room and library and the room for the mineral and geological collection. Several new members joined, and the club was able to entertain a number of visitors. The annual dinner was held in June.

The club is intended for the benefit of the English and American students at the Bergakademie at Freiberg. Its past membership includes a large number of Freiberg graduates, scattered all over the world. It has joined heartily in the movement started by Edward Hooper to organize a central association of old Freiberg graduates, having its headquarters in London.

The club desires to obtain addresses of old members, whenever possible, in order to keep in touch with them, wherever they may be.

January Operations at Goldfield Consolidated

The total production of the Goldfield Consolidated Mines Co. for January, 1912, was 28,870 tons, containing \$733,344, an average of \$25.40 per ton; this was milled with an average extraction of \$24.14 per ton, or \$95.02%. The total net realization was \$471,139, or \$16.32 per ton. Development work amounted to 3302 ft.; the total cost of mining, development, milling, office and general expense was \$7.92 per ton.

GOLDFIELD CONSOLIDATED OPERATING COSTS

Mining:		
Development	\$1.00	
Stoping	3.14	\$4.14
Transportation		0.07
Milling		1.98
Marketing		0.50
General expenses		0.50
Bullion tax		0.21
Construction		0.52
Total cost of operation	\$7.92	
Miscellaneous earnings	0.10	
Net cost per ton		\$7.82

At the Clermont, Supt. J. F. Thorn reports that the 413 sill was extended and produced 722 tons of \$24.18 ore. The new 428 sill between the 600- and 750-ft. levels produced 500 tons of average \$41.34 ore. The 604-H raise from the 1000-ft. level, going up toward the 534 on the south end of the 900-ft. level, produced 381 tons of average \$72.06 ore. At the Mohawk, the 3-E sill on the 150-ft. level, near the old Sheets-Ish workings, was extended and produced 503 tons of average \$56.43 ore. The sill in the 111-K section was extended and produced 571 tons of average \$57.46 ore. The 111-M section sill produced 218 tons of average \$18.19 ore. The 415-X crosscut from the 491 intermediate between the 450- and 600-ft. levels, produced 174 tons of average \$38.44 ore.

At the Red Top, the 305-DX stope was extended above the second level, and the resulting sill produced 70 tons of average \$22.73 ore. The 403-CX stope on the fourth level at the 442 crosscut, produced 70 tons of average \$22.53 ore. The 403 sill was extended and produced 18 tons of \$28.52 ore. The third level was connected with the Laguna shaft, and the station and pocket completed at this

point; during the present month the Red Top surface plant will be dismantled. At the Combination, the 295-X on the fourth level south and west of the Hampton stope, produced 45 tons of average \$41.34 ore.

The roasting plant at the mill was completed, and both furnaces are now in successful operation. The results from the new plant have fully justified all expectations.

Iron Mining in the Urals

The accompanying illustration shows the opening into an iron mine in the Ural



ENTRANCE TO RUSSIAN IRON MINE

Mountains. The pretentiousness of the architecture will remind our readers of some of the old Mexican works.

Breitung Aid Fund

The Breitung-Kaufman interests of the Marquette Iron Range, Mich., consisting of the Mary Charlotte Mining Co., Ltd., and the Washington Iron Co., have reorganized their miners' aid fund.

In the past, the fund was supported by a 50c. monthly contribution from each man; the new arrangement provides for the same contribution from the men and also a contribution from the company equal to one-half the contribution from the men. Under the new rules, the compensation to injured miners can be much larger, and if the money on hand is at any time insufficient to pay the claims, the company will donate enough money to make up the balance.

Under the old rules, an injured man received \$20 per month, for 12 months, if necessary; if partially disabled he received \$240; in case of death his family or relatives received \$300. By the new arrangement, an injured man will receive \$30 per month, for 20 months, if necessary; if partially disabled he will receive \$800 in a lump sum; if permanently disabled he will receive \$1250; in case of death \$1000 will be paid his family or relatives.

Foster's Amendment to Bureau of Mines Act

WASHINGTON CORRESPONDENCE

It is understood that the Foster bill to amend the Bureau of Mines Act will be passed this week or next by the House. The bill provides:

Sec. 2. That it shall be the province and duty of the Bureau of Mines, subject to the direction of the Secretary of the Interior, to conduct inquiries and scientific and technologic investigations concerning mining, and the preparation, treatment and utilization of mineral substances with a view to improving health conditions, and increasing safety, efficiency, economic development, and the prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; to investigate explosives and fuels and unfinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient use; and to disseminate information concerning these subjects in such manner as will best carry out the purposes of this act.

Sec. 3. That the director of said bureau shall prepare, publish and distribute, subject to the direction of the Secretary of the Interior, under the appropriations made from time to time by Congress, reports of inquiries and investigations, with appropriate recommendations of the bureau, concerning the nature, causes and prevention of accidents, and the improvement of conditions, methods and equipment, with special reference to health, safety and prevention of waste in the mining, quarrying, metallurgical and other mineral industries; the use of explosives and electricity, safety methods and appliances, and rescue and first-aid work in said industries; the causes and prevention of mine fires, and other subjects included under the provisions of this act.

Sec. 4. That nothing in this act shall be construed as authorizing the Bureau of Mines or any employee of said bureau to undertake any investigation or operation in behalf of any private party, except, with the approval of the Secretary of the Interior, for the health and safety of persons employed in the mining, quarrying, metallurgical or other mineral industries; nor shall the director or any member of said bureau have any personal or private interest in any mine or the products of any mine under investigation. Provided, that nothing herein shall be construed as preventing the employment by the Bureau of Mines, in a consulting capacity or in the temporary investigation of special subjects, of any engineer or other expert whose principal professional practice is outside of such employment by said bureau.

Sec. 5. That for tests or investigations authorized by the Secretary of the Interior under the provisions of this act, other than those performed for the Government of the United States or state governments within the United States, a reasonable fee covering the necessary expenses shall be charged, according to a schedule prepared by the director of the Bureau of Mines and approved by the Secretary of the Interior, who shall prescribe rules and regulations under which such tests and investigations may be made. All moneys received from such sources shall be paid into the Treasury to the credit of miscellaneous receipts.

Cornish Mining Notes

LONDON CORRESPONDENCE

The Levant mine has just declared a dividend for the 16 weeks of \$1.75 on its 2385 shares, of which the committee owns 1400 shares, and carried forward a balance of \$17,500. The profit shown was only \$8000. The black tin sold for \$68,000. Altogether the developments were disappointing. The tin sold for a higher price, yet the decrease was \$340. Copper sales fell from \$7800 to \$6000; arsenic from \$1460 to \$900. Altogether the decreases were \$3000, while the increase for labor was \$2500. The lowest level, 350 fathoms, has not equalled anticipations, there being a considerable reduction in metal contents from the level above. In the palmy days it used to be said that black tin paid the costs and the copper ore the dividends. This mine was for many years the principal copper-producing mine in England, but in 1910 it had to take second place.

At Wheal Jane mine, owing to the repairs and additions to the electric pump at Giles' shaft, nearly 100 miners were discharged. The latest mishap was said to be the "burning of the motor." This mine has had a varied experience during the last six years.

Wheal Kitty and Penhalls are asking for further capital in order to sink Sara's shaft a little deeper and to extend a crosscut to the West Kitty lode. These mines made a loss during the year of \$1500, the first loss for over four years. The average yield per ton for four years was 35 lb., but the second half of 1911 was less than 20 pounds.

Grenville United has just paid a dividend of 25c. per share for the six months ended Dec. 31, 1911. The dividend for the previous half year was 8c., or for the year nearly 30%. The black tin sold during the six months was 331½ tons, and the future is most encouraging. In January, 1911, these shares were quoted at 85c.; in January, 1912, \$2.12. Seven of the leading producing mines during the year have appreciated in value over \$1,200,000. South Crofty alone has increased in value over \$500,000.

Carn Brea and Tincroft mines are certainly forging ahead, as the returns for the six months ended Dec. 31, 1911, are nearly \$40,000 over the previous six months for the tin alone, not to mention wolfram and arsenic; \$17,300 of the increase being due to enhanced price of metal, and \$22,500 due to increased quantity of tinstone crushed. It is expected that the debt will be decreased \$20,000 as the result of the six months' working.

The manager is anxious to improve the method of testing the samples. The vaning results for December show that the tinstone treated averaged 27.11 lb. of black tin per ton, or \$5.50 per ton, whereas the actual yield was a little less than 24 lb., or a loss of over 75c. per ton, which,

on the 6700 tons treated, represents a loss of \$5000. Again, on the vaning shovel, but little, if any, of the slime tin is saved, while all the mines sell slime tin at the "ticketings." Dr. Pearce, late of the Argo Works, Denver, in 1904 wrote an interesting letter in the *ENGINEERING AND MINING JOURNAL* on the losses of tin by the vaning shovel, which was much criticized in the local papers, and by some of the tin dressers. This time it is hoped that Mr. King's efforts to improve, if not abolish, the old method, will be effective.

Western Branch Canadian Mining Institute

VICTORIA CORRESPONDENCE

The twelfth general meeting of the Western Branch of the Canadian Mining Institute was held at Vancouver, B. C., on Feb. 15 and 16. The four sessions held were presided over by Robert R. Hedley, of Vancouver, chairman of the branch. In the chairman's address, particular prominence was given to the new coal fields in the northern interior of British Columbia. One of these fields is situated on Copper River, and the headwaters of Skeena River, and the other is known as the Groundhog Mountain field.

Statistics concerning the mineral production of British Columbia for the year 1911, were presented by William Fleet Robertson, provincial mineralogist. The total value of the mineral production in 1911 is estimated at \$23,211,816, as compared with \$26,377,066, in 1910. Coal and coke and the metalliferous minerals, except copper, showed a decrease in value, while building stone, etc., gave an increase of about \$500,000. The coal mines and coke ovens in the Crow's Nest district were closed for eight months in 1911, because of labor difficulties. A great part of the decrease in silver and lead, and practically all the decrease in zinc is accounted for by the continued crippled condition of the producers in the Slocan district. The mine and concentrating plants, railway bridges and trestles, which were destroyed by forest fires, have not yet been wholly replaced.

The cost of mining and treating a small vein of free-milling ore was presented by A. H. Gracey, of Nelson, B. C. About 14,000 tons of ore were handled, the cost being divided as follows: Mining, \$5.04; milling, \$0.925; cyaniding, \$0.725; aerial tramming, \$0.16; marketing products (concentrates and bullion), \$0.135; management, general expenses, insurance, taxes, \$0.675; maintenance of plant, \$0.26; total cost, \$7.92 per ton of ore.

W. M. Brewer gave information concerning the Marble Bay mine, on Texada Island, and the Britannia mine, on Howe Sound, within about 30 miles of Vancouver. He stated that a good grade of bornite ore is being mined down to a

depth of 1360 ft. in the Marble Bay mine. In the Britannia, he said, R. H. Leach last year blocked out 400,000 tons of ore, and the mine is now shipping ore at a profit of about \$50,000 per month.

E. Jacobs gave a short description of a new slag-disposal plant, put in at the Granby company's smeltery, Grand Forks, B. C. This was followed by some notes on the "Coal Resources of Western Canada." Attention was also drawn to the lower average rate of deaths from accidents in coal mines in British Columbia, as compared with an earlier period.

The following papers were also presented:

"A Brief Description of the Electrolytic Lead Refining Plant of the Consolidated Mining & Smelting Co. of Canada, Ltd." (illustrated), by J. Miller, refining superintendent, Trail, B. C.

"The Coal Fields of the United States" (illustrated), by E. W. Parker, statistician of the Division of Mineral Resources, U. S. Geological Survey.

"The Roslyn Coal Field, Kittitas County, Washington," by Prof. J. Daniels, University of Washington, Seattle, Wash.

"Recent Developments in Mining and Metallurgy on the Pacific Coast" (illustrated), by Prof. Milnor Roberts, dean of the College of Mining, University of Washington, Seattle, Wash.

"Some Work of the U. S. Bureau of Mines" (illustrated), by H. M. Wolfkin, engineer in charge of mine-safety and first-aid work in the Northwest.

"Work of the St. John Ambulance Association," by Doctor McTavish.

"Earthquakes, Strains and Stresses, and their Relation to Coal-Mine Disasters," by F. Napier Denison, Dominion Meteorological Office, Victoria, B. C.

"Notes on the Groundhog Coal Basin," by G. S. Malloch.

"Notes on the Progress of Development Work on Coal Areas in Alberta and Saskatchewan," by D. B. Dowling.

Suitable resolutions were adopted concerning the death of John B. Hobson, who was active in inaugurating large-scale placer-mining operations in the Cariboo district. The next general meeting of the branch is to be held in May, at Ainsworth and Kaslo, Kootenay Lake, West Kootenay, B. C.

Kimberlite, the matrix rock of the South African diamond pipes, occurs in Elliott County, Kentucky, intruded in the horizontal sandstones and shales of the coal measures. Sporadic prospecting has been done for diamonds since the scientific determination of the character of the rock was announced about 10 years ago, and more recently by reason of the renewed interest created by the discovery of diamonds in Arkansas in a similar formation, but, so far as known, no diamonds have been found in Kentucky.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

A Wagon Oil Tank

CHESTER STEINEM*

In view of the increasing use of crude oil as a fuel and for combustion in oil engines, a description of a tank designed specially for transporting crude oil may be of interest.

In the Mogollon district, oil has dis-

oil, caused the substitution of a plug. The wagon itself is not shown in the illustration, only the tank arranged to go on the running gear just like the body of a wagon.

Lowering the Water in A Choked Shaft*

By CYRIL BRACKENBURY

In unwatering the Harvey shaft of the Tresavean mine, in Cornwall, considerable difficulty was experienced in placing the suction pipe of the sinking pumps so as to draw off the water below the many places where the old shaft was choked.

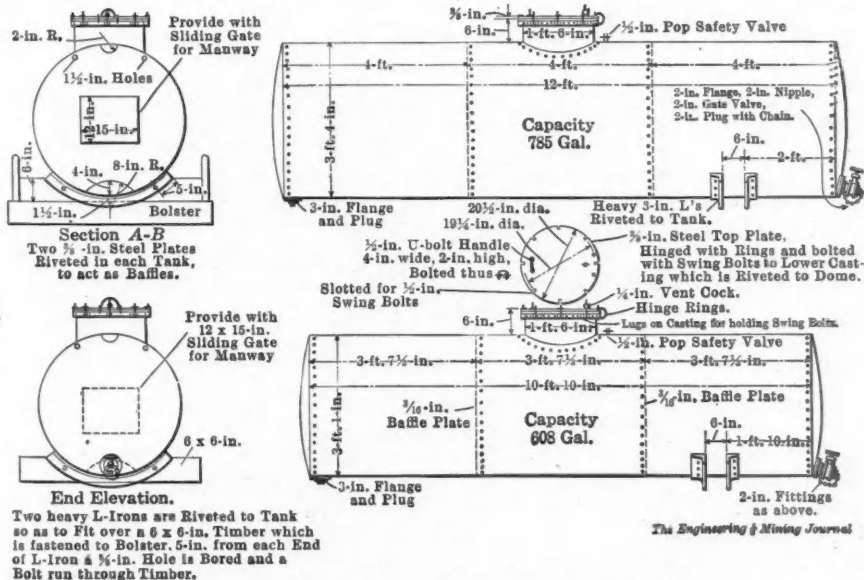
The sinking pumps were not designed to handle the broken rock, gravel, crushed timber, and grit, found in all the chokes, and it was necessary to resort to special means of safeguarding to spare the sink-

out the sides of the old column to let the water in, after having first secured it firmly with chains and timber.

One such blast was fired, electrically, at a depth of 57 ft. below the top of the pipe, which projected two or three feet above the water level. A special strainer had been made to put down inside the column pipe, with special connections across the shaft to the pump; also, since the blast completely severed the old column pipe, it was necessary to secure and support the column above the blast with chains below each 9-ft. length. In one instance, when the old column pipe was itself choked with debris, the difficulty was overcome by driving down a 2-in. pipe through the choke, a distance of 18 ft., and then blasting out the bottom, which fortunately cleared the debris and left a clear passage for the suction pipe.

When the 162-ft. level was reached, a method was resorted to, which was subsequently found to be most satisfactory for all deep solid chokes. The method consisted in substituting for an ordinary suction pipe, a special one with a sharp point at the lower end, to enable it to be driven down through the choke, and with a connection at the upper end, through which a special valve box containing a strainer could be fitted. The conical point was made of mild steel, and could be welded or screwed on to the lower end of the suction pipe. It was found that the iron suction pipe should preferably be made in convenient lengths, to suit the distance for each lowering of the pump, that is to say, in about the same length as each section added to the rising main. Although this might have been a convenience it is not a necessity, as the suction pipe, after having been driven through the choke, could generally be raised or lowered a little without difficulty to suit the position of the pump. As the pump was lowered, and each length of suction pipe uncoupled, a screwed flange was taken off the last length which had just been removed, and screwed to the upper end of the next length remaining on the suction, in place of the coupling which was used to connect the two lengths together.

The valve box was fitted with connections, so that the bottom could be bolted to the flange at the top of the special suction, and the top bolted to the flange of the short pipe connection to the pump. Inside the box there was an



The Engineering & Mining Journal

TANKS FOR WAGONS FOR HAULING FUEL OIL

placed wood as fuel for generating power, although wood is plentiful. It commends itself as being cheaper for many purposes, and to supply outlying districts a wagon-tank is often necessary.

D. Ford McCormick designed the tank shown in the accompanying illustration. It is giving good service on a 90-mile haul over rough mountain roads. An accident to the projecting outlet valve resulting in a considerable loss of

ing pump as much as possible. Sometimes the best way out of the difficulty was to put the suction pipe down through holes in the chokes whenever, by so doing, they could be put into clearer water below. Sometimes this was done by putting the suction pipe down in the old pump column, which was still standing in place in the shaft. In such cases it was occasionally necessary to blast

*Excerpt from an article entitled "Unwatering Tresavean Mine," Bull. 88, I. M. M.

*Mining engineer, Mogollon, N. M.

ordinary clack valve at the bottom, and a strainer fastened to the top, but bent into a synclinal fold, so as to expose as large an area as possible to the inflowing water. The box was divided in the middle, and could be easily opened to examine and clean the strainer or valve. In the first instance this method was used to pump through a choke only a few feet thick, resting on doors at the 162-ft. level, and the steel pointed pipe was easily driven down through some eight feet of debris and through the wooden doors which were supporting it. After having driven the end of the pipe a few feet below the doors, the point was blasted off, the upper end was connected to the valve box, and the valve box connected to the suction end of the pump by a short length of pipe forming a reverse bend. The special suction pipe used was 4-in. diameter, and the pump worked satisfactorily with this arrangement, keeping the water well down below the top of the choke, and enabling the men to conveniently clear it away.

Between the 996- and the 1128-ft. level, three nearly solid chokes, each from about 10 to 15 ft. thick, were passed through. The rest of the way was partly choked, and the walls of the shaft were rotten. Fortunately, weak spots in these chokes were found, and by means of various grab hooks, it was possible to make holes in different places, through which it was possible to put down the suction pipe and so keep the water level down to or below the top of the choke. Everything possible was done to protect the strainer, which had to be cleaned constantly, sometimes with a long-handle brush used under water, but often it was necessary to raise it out of the water to clean it properly. Working through chokes in this way caused severe wear on the pump, as a certain amount of dirt would continually pass through the strainer, and up the suction pipe into the pump chambers. The thrust bearings of electrically driven turbine pumps were also liable to become heated, on account of the small cooling water pipes getting choked, and thus preventing free water circulation through the water jacket.

The extreme length of the suction lift that can be used with electrically driven turbine sinking pumps depends chiefly upon the condition of the strainer, which, of course, should be clean, and upon how near the limit of its hydrostatic head the pump is working; the nearer the limit the less the suction lift allowable. When using a long 4-in. pipe, driven through a choke, the friction of the water passing through the suction pipe had a considerable effect in reducing the actual height of the suction lift, and this was particularly the case when the quantity pumped was sufficient to cause a high velocity of the water passing through the

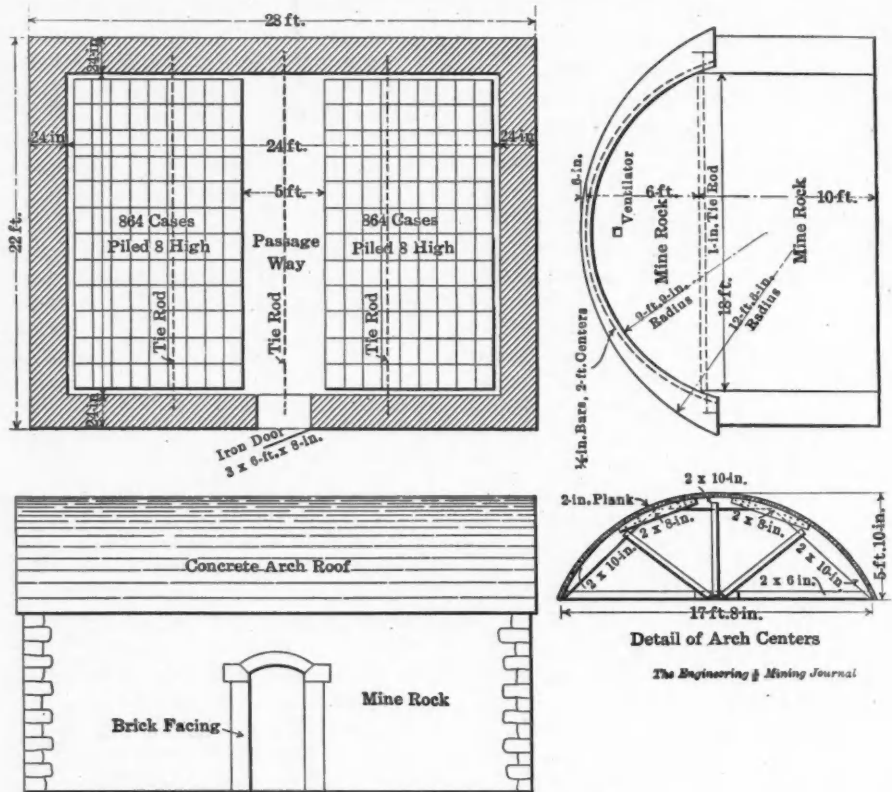
pipe, that is to say, when the friction head in the suction pipe became an important factor. At one time, when there was 73 ft. of 4-in. suction pipe through the choke, the theoretical head, due to friction in the pipe, and entry of water into the pipe, amounted to about 11 feet.

The biggest choke encountered in the shaft, below water level, was that occurring at and above the 1272-ft. level, where it was found to be over 70 ft. deep, and so compact that the water could only percolate slowly through it. When at first pumping above this choke, the water level in the shaft was continually taken down below the level of the main body of water in the mine; also, when first starting the pumps, the water level would be very rapidly re-

Powder House with Concrete Roof

BY CLAUDE T. RICE

A powder house with a concrete roof, such as is used by the Copper Range Co.'s mines in Michigan, is shown in the accompanying drawing. In designing the roof the weight of 150 lb. per cu. ft. of concrete and 31 lb. pressure per sq. ft. for wind, snow and other loads were taken, and the ordinary force diagram for designing arches used in proportioning the thickness. The concrete differed at the several mines; from about 1:2:4 to 1:3:5 was used. No waterproofing mixture was added, but instead the whole roof was covered with a thin, smooth



POWDER HOUSE AT THE CHAMPION MINE

duced the first 8 or 10 ft. in the shaft, and after stopping the pumps the water would rise abnormally fast to begin with. Again, when the 4-in. pipe was first driven through this choke, and the end blasted off, although the upper end stood two or three feet above the water level in the shaft, water began to overflow from the top of it. All these phenomena proved the choke to be stopping up the shaft something like a rather porous cork in a pipe full of water.

The ladder compartments in an inclined shaft should be closely covered, preferably by a hinged door, at each level, to prevent material from falling through that compartment.

layer of 1:1 cement so as to seal all pores. The concrete is reinforced with rods of 1/2-in. iron at 24-in. centers. Expanded metal or strands of old wire rope could have been used, but the rods proved to be more convenient.

The side walls are of masonry built of waste rock from the mine, and are tied together at the top crosswise by three 1-in. rods. A small ventilating hole is left in the end walls near the top.

The building is not for the thawing of the dynamite, but merely for its safe storage at the surface. With such a building, there is no danger from stray bullets, and danger of accidents of all kinds is reduced to a minimum.

Dam for Settling Pond

In the Florida pebble-phosphate mining district there exists a need of dams that can be constructed cheaply and rapidly and although not having to last long, be efficient while they do last, states H. D. Mendenhall in *Engineering News*, Feb. 22, 1912. The dams are used to form ponds for settling solids from water before re-using it in hydraulic operations. As the water often contains 10% solids and 4000 gal. is added to the reservoir every minute it does not take long to silt up a large pond. The site of a new pond is rarely chosen before the need for it is felt, and as breakage of the dam may result in flooding adjoining farm land with silt, entailing lawsuits, a cheap dam that can be built in short time and yet be strong is required.

The material most readily available for building dams is the natural earth of the region. This earth, composed of loam,

One day the necessity arose for a dam that was proof against breaking, and at the same time could be built six feet high on a ledge about 15 ft. wide. The core wall was built on the outside instead of the center of the dam.

The dam as designed and erected is simply an impermeable facing built on a timber framework and filled with earth. The framework for the typical six-foot dam consists of 4x6-in. pine posts nine feet long, sunk three feet into the ground and spaced 10 ft. apart. At a point 9 ft. 6 in. horizontally back from these posts are other posts 4x6-in.x3 ft. long, sunk two feet into the ground, and inclined away from the front posts about 30° from the vertical.

From the intersection of the short post with the ground line to a point on the long post one-third the distance from the top to the ground, is put in a 4x4-in. strut, so connected to the two posts with 2x4-in. cleats as to withstand

distance below the ground surface also serves as a check to the water washing under too rapidly. Since it is expected that a small amount of water will percolate through, anyway, as well as quite a quantity will wash down from the top during rains, a 12-in. retaining wall is laid along the inside face of the short rear posts, the bottom edge being flush with the ground. This prevents the toe from washing, and also serves to help the short posts resist the overturning pull that they are subjected to during the earth filling period and before the water has risen.

After the structural part is completed, the back is filled as shown with ordinary earth, and sodded with Bermuda grass. Adequate spillways are of course supplied to prevent overtopping the dam.

One of these dams about 7 ft. high under a hydrostatic head of about 5½ ft. is shown in the accompanying illustration. It has fulfilled its function perfectly, and is in splendid condition even after the heavy rains of the Florida rainy season. The toe has not washed at all.

The total bill of material for a 20-ft. section of this dam six feet high is:

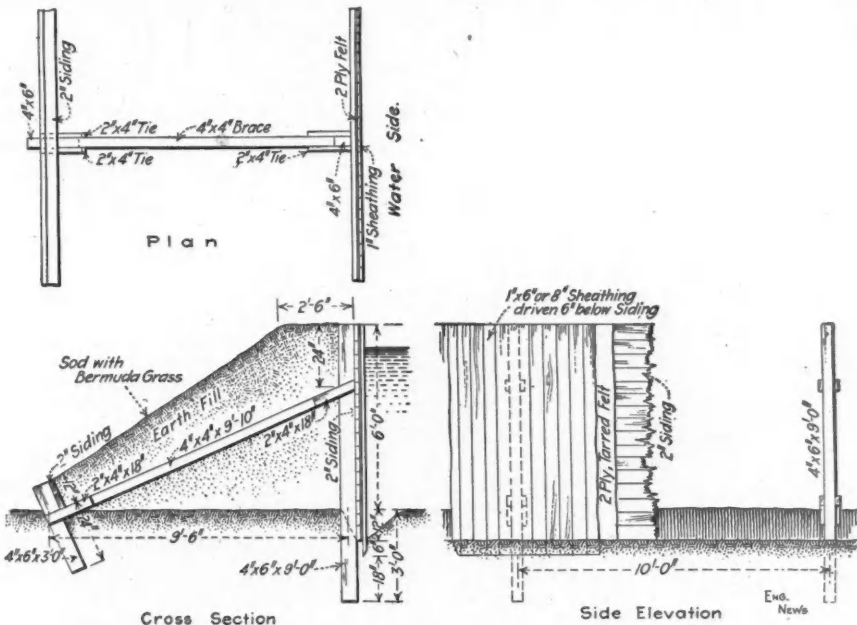
2 pieces rough pine 4x6	12 ft.	48 ft. B.M.
2 pieces rough pine 4x4	10 ft.	27 ft. B.M.
1 piece rough pine 2x4	12 ft.	8 ft. B.M.
2x6 or 8	20 ft.	280 ft. B.M.
1x6 or 8	15 ft.	150 ft. B.M.

Total lumber 513 ft. B.M.

- 1.4 squares 2-ply tarred felt.
- 5 lb. 20d wire nails.
- 2 lb. 8d wire nails.
- 27 cu.yd. earth fill.

From this it can readily be calculated what the cost will be for any given length and locality.

A low dam of this type appears to be well suited for use in impounding tailings as well as for forming a settling pond so that the water may be re-used.



Cross Section
Side Elevation
SETTLING POND FORMED BY INEXPENSIVE EARTH DAMS

fine sand, and a small percentage of clay, easily "melts" when exposed to the action of the water. This "melting" is a combination of sliding down to the natural angle of repose, which for this material, wet, is approximately 2: 100, and the actual going into solution or suspension of a certain percentage of the total. The material is also more or less porous, or at least permeable, so that water ultimately seeps through it, dissolving and washing away the toe of the dam.

The solution of the problem of building a substantial dam of this material would seem to be reached by putting some sort of a core wall through the middle. But on second thought it is obvious that the "melting" would still continue on the upper face. It would be out of the question to build a dam of the material on its angle of repose.

both tension and compression. On the front face of the long posts are spiked horizontally 2-in. rough pine planks; these planks extend to one foot below the general surface of the ground.

Completely covering the water side of this facing is tacked 2-ply tarred felt roofing, and on the outside of this is nailed a facing of 1-in. plank, applied vertically, and driven into the ground six or eight inches below the bottom run of 2-in. plank. After the facing is on, the trench for the bottom run of horizontal 2-in. plank is refilled with earth. The 2-in. planking acts as a combined retaining wall and backing for the waterproofing, the tarred felt serves to prevent the water washing through the dam, and the 1-in. facing serves as a mechanical protection to the felt.

The outside sheathing driven the given

Draining a Shaft through a Drill Hole

BY LUCIUS L. WITTICH*

By installing a deep-well pump in an 8-in. drill hole, sunk seven feet from the shaft, J. M. Short, operator of the Geronimo mine, on a lease of the Connor Estate at Ellisville, west of Joplin, Mo., is able to dispense with the pump that he has been using in sinking the shaft, thus reducing the cost of sinking from \$25 to \$17.50 per ft., a saving of \$7.50 per ft. As the shaft was 70 ft. deep when the pumping arrangements were changed and as the shaft must be sunk to a depth of 126 ft. to reach the ore, as indicated by the drill hole on which the shaft is being sunk, 56 ft. remain to be sunk. The total saving will be \$420. Deducting from this, \$150, the cost of sinking the 8-in. drill hole and installing the deep-well pump the net saving in money will be \$270. Of course this does

*Joplin, Mo.

not include the cost of the drill rig and pump which were on hand. Had the system been adopted earlier the saving would be much greater.

But the most important feature is not in the actual amount of money saved; it is in the saving of time in sinking. Before the drill-hole pump was placed in operation, the shaft was being sunk at the rate of five feet per week; now it is being sunk five feet in 16 hours. Previously it was necessary to remove the pump after loading each round of holes and to replace it after blasting, or, at least, it was necessary to guard the pump with heavy timbers, and even with this precaution the machinery was almost invariably damaged by the blasts. Because of this condition it was impossible to use heavy blasts when the pump was left in the ground. Now it is possible to use any amount of dynamite, and the working ability of the pump in the drill hole near-by is not impaired.

In following a system of this kind, adopted for the first time in the Joplin district by Short, it would seem necessary that the shaft should be either sunk through open ground, permitting free drainage of water to the drill hole, or that two drill holes should be sunk, one squarely in the center of the shaft and the other near-by for the pump. The latter is the system followed by the Geronimo company. The shaft is being sunk through hard limestone beneath which occurs the open ground in which the ore is found. Both holes penetrate the open ground, the deep-well pump having been installed to a depth of 150 ft. Care is taken to keep open the drill hole in the bottom of the shaft, for through it the water from the shaft seeps into the lower open ground, thence across the intervening space of seven feet to the second drill hole, whence it is pumped out. In this manner the shaft, formerly so wet that the miners were forced to wear rubber boots, is now dry and the excavated rock is handled with much greater ease.

Grounding Electric Circuits

The discussion of a paper, "Earthing, Earth Plates and Earth Detectors," by T. W. Ellis, at a recent meeting of the South Wales Branch of the Association of Mining Electrical Engineers of Great Britain, contained some interesting facts.

Sands and gravels appear to conduct principally by the moisture and damp clay in the interstices, but clays have a true conductivity, some of them giving less resistance than the water with which they are moistened. Some rocks have a conductivity depending not only on the water they contain, but also upon the nature of the rocks themselves.

These figures suggest that the excellent conductivities of clays are due to the fineness of their constituents and not so much to the conductivities of the

particles themselves. Temperature is also a factor; water at 60° F., which had a resistance of 2400 ohms, fell to 1400 ohms at 150° F. Long continued ac-

RESISTANCES OF NATURAL GROUNDS	
Natural conductor	Ohms per c.c.
Fresh rainwater.....	12,000
Stream, well and river water...	2,400
Thames water (at London Bridge).....	2,130
Sea water.....	350
Saturated solution of lime water	750
London blue clay.....	870
London red clay.....	950
Clay with sand.....	1,900
Plastic clay.....	1,900
Same clay (dry).....	1,850
Ordinary river sand.....	19,000
Whiting (levigated chalk).....	1,900

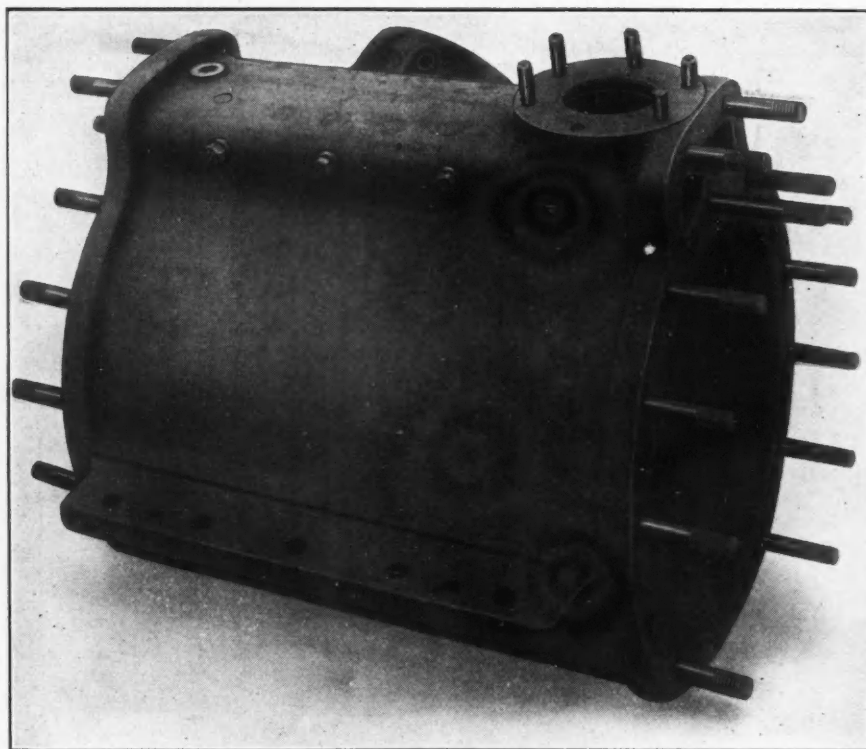
tion of electric current lowered the resistance of soils, while a rest raised the resistance.

The resistance of a ground-plate 2½ ft. square is about ¾ of an ohm, if sunk

connected to them. Of course, a connection to a gas or water main is sufficient where such pipe is not likely to be cut for repairs. The resistance of an earth connection made to a water line may be but a fraction of an ohm. A number of small plates, sunk some distance apart, are a more efficient earth connection than one large one. They are still more effectual if the conducting layer of soil is shallow.

Patching an Air Compressor Cylinder

An ingenious repair job was recently made on an air-compressor cylinder at the No. 7 colliery of the Susquehanna Coal Co., Nanticoke, Penn. For some unknown reason, water accumulated in



STAY-BOLTS TO STRENGTHEN CRACKED EXHAUST PORT OF COMPRESSOR CYLINDER

in the sea, 3 ohms if buried in pure clays, 10 to 15 ohms if in mixtures of both gravels and clays, and as high as 40 ohms when sunk in some mixtures of sands and gravels or porous rocks. The least resistance of an earth connection that Mr. Ellis has yet measured was 7 ohms, and the mean resistance of a large number of measurements was between 15 and 20 ohms.

In sinking a ground-plate, it is necessary to put it sufficiently deep to insure its being surrounded the whole year with soil saturated with moisture. It should be sunk in a hollow, and, if possible, beside a constantly running stream, with the top of the plate below the level of the bed of the water course. If sunk near a drain the plate should be placed near its under surface. If there are gas and water pipes, it should, where possible, be

the air-exhaust port of the cylinder and when the compressor was started the outer shell was cracked on both sides, as shown in the accompanying illustration.

It was a case of making a hasty but permanent repair and the master mechanic, states *Power*, decided to reinforce the fractured part through the top and sides by means of solid stay-bolts. The stay-bolts, running from the top of the air port, extended but part way through the cylinder wall. A second set was run from the side walls of the exhaust port, as shown. The crack was then dovetailed with a cold-chisel and plugged with strips of copper.

The repaired cylinder has been in use for three years and the cylinder was recently removed in order that it might be rebored, when it will again be put in service.

A Discussion of Mining Law

By H. V. Winchell*

The features of mining laws in general and of those in the United States in particular are critically considered. The shortcomings of existing laws are pointed out and remedies proposed.

Note—A paper presented at the annual meeting of the Canadian Mining Institute, Toronto, Ont., Mar. 6, 1912.

*Mining geologist, 505 Palace Building, Minneapolis, Minn.

The question of national mining laws is of special interest just now in both Canada and the United States. Attention has been widely called to the many defects and general insufficiency of existing statutes, and wherever the matter has been discussed, the need for revision has been admitted.

AGITATION FOR NEW LAWS IN UNITED STATES

In the United States during the last decade there has been frequent agitation of the subject. Public officials connected with the administration of our land and mining laws have urged legislation along certain lines; the Director of the Geological Survey, and the Secretary of the Interior have discussed it in their annual reports; and the matter has even engaged the attention of Presidents Roosevelt and Taft in messages to Congress. Associations and societies of various descriptions after due consideration have passed resolutions demanding this or that measure of relief, and in some cases committees have been appointed for the purpose of making recommendations as to the principles to be followed in new legislation. Thus, a few years ago a committee of prominent mining engineers, among whom were John Hays Hammond and James Douglas, united in a report upon this subject to the Government at Washington; but nothing came of it, and so far as I can learn, the report was never even published. More recently the matter has again been agitated and committees for its consideration have been appointed by the American Mining Congress and the Mining and Metallurgical Society of America.

We in the United States might well profit in this matter by the very sensible and systematic method which has been adopted in Canada to facilitate the proper settlement of this most important question. Here, as I am informed, a committee of engineers and attorneys has been selected by the Canadian Mining Institute to draft a bill for a Canada Mines Act, and to present the same for consideration and adoption by the Dominion Parliament. In other words you Canadians are proceeding in the best way to procure laws framed by experts; and none can doubt that statutes thus prepared are in every way superior to enactments whose subject matter is prepared by theoretical political economists on the one hand or by agitators and professional politicians on the other.

I wish, therefore, at the outset to commend the Canadian Mining Institute for its very wise procedure in this matter and admonish you not to weary in well-doing, nor to be disheartened at slow progress. When you have accomplished what

you have set out to do you will not only have that pleasant sense of satisfaction which succeeds the consciousness of duty worthily performed, but you will have made an investment of time and labor which will return a thousand-fold in actual wealth and prosperity. For that country which is willing to be guided as to the handling and development of its mineral resources by the crystallized policies of its mining engineers is the country whose mining industry will be at once the best managed and the most productive of material blessings for all the people.

The mining laws of a country are those legislative enactments or customs established by precedent which control the acquisition and tenure of mining rights and property, in contradistinction to "mining regulations" which have to do with the methods and appliances used in operating mines.

TWO GROUPS OF MINING LAWS

The principles underlying the mining laws of various countries have been found susceptible of classification into two groups:

(1) The "concession" system under which the state or a private owner of mining property has the right to grant concessions or leases of such mining property to individuals or corporations at discretion, or under certain general restrictions.

(2) The "claim" system, under which any individual, under certain general specified restrictions generally as to nationality and color, has the right to locate on discovery or otherwise certain limited areas of ground, and under certain conditions to hold, work and dispose of the same.¹

Under the concession system the right to grant lies with the owner, and it is said that five-sixths of all the mining areas of the world are held under it; under the claim system the right to claim mining ground lies with the locator or discoverer.

¹Mining Law of the British Empire," C. J. Alford, London, 1906; p. 1.

The latter is the system underlying the laws of Canada and the United States as well as South Africa and Australia; but there are fundamental differences in these countries as to the nature of the possessory right and the character of title finally obtained.

CONCESSION SYSTEM OF ANCIENT ORIGIN

Originating in the ancient proprietary rights of kings and feudal lords to the minerals in the ground, the concession system still prevails in more or less modified form under all the ancient civilizations of the world. Its chief advantage is in the retention by the state of the right to select and control the operations of its *concessionaires*, thus assuring proper capitalization and development, good management, economical use of raw material and the payment of rental or royalty.² To this system there have been objections as follows:

(1) That it places unduly large property control in the hands of a few men, and takes from the poor working man the chance of sudden wealth. (2) That by destroying competition in the sale of mines it places in the hands of the holders of large concessions the power of unlimited capitalization and speculation. (3) That it leads to the tying up of large areas of mining ground and thus restricts the employment of labor and the mineral production of the country.

To these objections it may be answered that a relatively small number of men will always have control of the money with which to buy and develop mining property no matter how it be granted; that the government may easily regulate the capitalization of its lessees; and that a large, strong corporation is usually better prepared to thoroughly prospect its territory than the unaided though far more numerous prospector. If diligent prospecting is required as a condition in the concession, the system of preference rights to explore large areas with the further right to take out leases of limited area would seem to present many practical advantages for new and unexplored countries.

CLAIM SYSTEM FOUNDED ON USAGE

The claim system grew out of conditions in early mining days in the United States and Australia. The Argonaut horde which invaded California in 1849 and a few years later rushed to Australia were in many cases allowed to make their own local rules as to size of claim, method of discovery, staking, recording and obtaining title. In the United States the usages thus established were later sanctioned by Congressional enactment which grew into our present system of

²Alford, loc. cit. p. 2.

mining law, and also served to greater or less extent as a model for Australia and other modern nations.

This system, "however necessary in the peculiar circumstances of its inception, should have been altered as soon as changing circumstances permitted," but instead it has been patched and interpreted by judicial decision until the United States has today the most wretchedly inadequate and antiquated law with which a great country is anywhere afflicted. Instead of fostering the mining industry the law as it stands today and as interpreted by the judicial and executive branches of the government creates confusion, entails unnecessary expense, causes waste and retards development.

TWO UNIVERSAL BASIC PRINCIPLES

Two fundamental principles are common to the mining law of all countries: (1) The right of the mine-holder to a perfectly secure and indefeasible title to his property so long as he fulfills certain specified conditions entirely within his own control, and (2) the right of the state or other landlord to certain rents, royalties or taxes on the property or its output, and to the reasonably constant operation of the mine.

In the power of the government to fix the rate of royalty or taxes lies also the ability to promote or to discourage prospecting and mining. If the chief aim of the government is the development of national resources and the increase of general prosperity and business, its policy for the disposition and holding of its mineral lands will be most liberal. If there is a desire to enrich the public treasury directly by means of revenues from taxes upon mines the result may be a rapid decline of the mining business, and a shifting of the population to more favored communities.

It is frequently stated, and truly as I believe, that the principal factor in the growth and development of the United States and Canada has been the liberality of their policy for the distribution of their public domain. Freely, or at a nominal consideration, homesteads and mines have been offered to all who chose to come and settle, to develop and use. If during the last 50 or 75 years the policy of conservation as now advocated by its most ardent proponents had been expressed in our statutes, North America would be for the most part as little developed as Alaska. There would be a line of settlement along the Atlantic and a few fishing hamlets on the Pacific. The interior of the country would still be to a large extent bottled up and conserved; and we should perhaps be still importing the bulk of our copper and iron as we are of our tin, platinum, potash and sulphur.

To speak to an audience of mining men of the importance of a liberal mining law is like carrying silver to Cobalt or copper to Butte, but since these remarks may

find a wider audience a few words upon the extent of our mining industry may not be out of place. First, with reference to the United States. The annual products of the mines of the United States now exceed \$2,000,000,000 in value. They contribute 65% of the freight traffic of the country. The industry employs over a million men at the mines and twice that number in handling, transporting and manufacturing the products.³

MINERAL WEALTH OF UNITED STATES

The total value of our metallic products during 1907 was \$900,000,000; of mineral fuels, \$788,000,000; and of non-metallic mineral products, other than fuels, more than \$378,000,000. During the year we imported mineral products to the value of \$255,000,000 and exported mineral products to the value of \$340,000,000. From the beginning of coal mining in this country in 1814 to the close of 1907, nearly seven billion (6,865,000,000) tons were mined. Adding to this the one-half additional supposed to have been wasted in mining, gives a total of more than ten billion tons taken from the supplies originally available. The amount of easily accessible and available coal in the United States, exclusive of Alaska, is estimated as 1,400,000,000,000, while the total, including Alaskan reserves of 150,000,000,000 tons, and the coal not easily accessible, is perhaps double this amount, with the country as yet but partially explored. It may be remarked in passing that since the United States is now mining about 500,000,000 tons of coal annually we would appear to have a coal supply sufficient for about 6000 years at the present rate of consumption, even without borrowing or buying from the enormous coal bins of Canada. Can anyone doubt that the provisions of the laws governing the disposition of the 50,000,000 acres of coal land still remaining in the hands of the government is a matter of importance to a nation with an annual coal consumption of five tons per capita?

Figures are wanting as to the quantity and value of other mineral products estimated to remain within the unappropriated public domain. The land area of the United States excluding Alaska and the insular possessions, is about 3,000,000 square miles, or 1,920,000,000 acres. Of this area over half is arable, and a little less than half is occupied as farm land. About two-thirds of the land has passed into private holdings. Of the original acreage there remained on July 1, 1908, 387,000,000 acres, or about one-fifth open to entry. Nearly all of this is arid or otherwise unsuitable for settlement by families. There are also about 235,000,000 acres in national forests, national parks, and other lands reserved for pub-

lic use. Of the entire area of 1,920,000,000 acres there remains unalienated about 622,000,000 acres or nearly one-third, within which valuable minerals may still be discovered. Is it not a matter of vast importance to provide most carefully for the exploration, disposition and development of this vast empire? In what direction can the fostering care of government be more profitably and properly extended? And when we take into account Alaska with its undeveloped area of about 360,000,000 acres and our island possessions with 90,000,000 acres more, is it not clearly one of the largest questions before the public today?

In Canada the percentage of unappropriated public domain is larger than in the older country lying along its southern border, and there is yet ample time to avoid the mistakes of omission and commission of the United States. With a total area of 2,118,814,000 acres, you have still in the hands of your provincial and dominion governments much the larger part of your acreage. Your annual production of minerals is valued at nearly one hundred million dollars. At the present rate of increase it may easily amount to five hundred million dollars by 1950. Can your engineers find any more truly national work than to aid in the framing and adoption of the best possible laws for the protection and encouragement of the mining industry?

CONSERVATION BY GOOD MINING LAWS

Is it not apparent that there is a very close connection between mining laws and that conservation idea so dear to the imagination of the majority of our people today? If the true aim of conservation be "maximum use with minimum waste," is it not evident that to be consistent with this theory; mining laws must be liberal as to opportunity and inducement for the individual or corporation, and at the same time as scrupulous and exact in supervision and scientific regulation as the conditions of industry and the laws of political economy will permit? If the terms and conditions for acquiring mining property be so difficult as to materially restrict the number of prospectors or development companies, there will be far less than "maximum use"; and if no right of supervisory control is retained by the government, there will seldom be "minimum waste." The best code of mining laws will inevitably aid in the development of natural mineral resources and at the same time have a tendency toward the right species of conservation, as contradistinguished from that variety of it which seems to aim at disuse, stagnation and paralysis.

In many particulars the present mining law of the United States is admittedly a failure, and in other respects it has both its critics and defenders. I propose to mention briefly some of its defects, and some possible amendments, not because

³Report of the National Conservation Commission, Vol. 1, p. 95, Washington, 1909.

there seems to be any danger that our worst faults will be copied by others, but in the way of general illumination of a question which is not always clearly understood even by our own people.

PROVISIONS OF ACT OF 1872

Briefly stated, the United States mining law, known as the Act of 1872, provides for location by discovery; possession perpetuated by annual assessment work; and title in fee simple to the surface and minerals obtained after the expenditure of a certain amount of money by the payment of \$5 per acre, and the observance of certain formalities as to survey, etc. The metal-mining laws do not apply to all of the states. They are made applicable to the Western states and territories with the exception of Michigan, Wisconsin, Minnesota, Missouri, Kansas and Texas.

Mining locations are not recognized in the states east of the Mississippi River, nor is there in any state legal authority permitting one man to prospect or mine beneath the surface of ground owned by another, without the latter's consent. To this statement there is one important exception, and that lies in what is called the "apex law," under which the owner of the outcrop of a vein in mining claims, has the right to follow and mine the vein on its downward course beneath the surface of a claim owned by another. "This law has proven more productive of expensive litigation than of economical mining, and in many of the more recently established and more progressive mining districts has been made inoperative either by common agreement or by compromise between adjoining owners."⁴

PLACERS LOCATED BY DISCOVERY

Placer mines are likewise located by discovery and held by annual work and acquired by purchase in fee simple forever. Known veins within placer locations must be declared and paid for separately or else they are excepted from the placer patent and can be located by others in "lode claims." All veins on placer ground not known to exist at the time of application for patent belong to the grantee, but without extralateral or apex rights. If an applicant for a placer patent can be shown to have had knowledge of a valuable lode within his lines prior to the making of his patent application, his title as to that vein may be canceled for fraud at any time upon application of a contesting locator. There is no limit to the time for such contests and they are still being brought in some cases 20 years after placer patent.

The law is very defective on this point; for it frequently happens that veins discovered today have a value by reason of

improved transportation facilities or metallurgical processes, although these same veins were of no value whatever when the placer claim was located and patented. The owner of such a claim is sometimes put to the expense and annoyance of defending such contests repeatedly, since there is no limit to the number of contestants. The law should be amended so as to make it impossible to attack a placer patent on such charges after a reasonable term of years. Another absurd feature of the placer act is that providing for the location of oil, gas, iron ore and other deposits in the same manner as auriferous gravel.

Coal lands are sold by the government upon an appraised valuation, and the amount of land that may be legally acquired is limited for an individual to 160 acres and for an association to 640 acres. Tracts of such limited area do not often justify the installation of the most efficient equipment, and economical operation is therefore impossible under the terms of the very law which was expressly designed to promote economy and prevent monopoly.

Under the present United States law there is no general system of separation of surface from mineral rights, no leasing of mines from the government, no payment of rental or royalty and no federal supervision or control after location and patent. Taxes are paid to the state and county and mining regulation is attempted by many states. Unfortunately there is no uniformity of principle and practice as to these matters, nor any stability nor assurance of permanence in any state either as to methods of operation required or basis of taxation.

Although it has been successful elsewhere and has much to recommend it, the government leasing system has never met with much favor in the United States. There is not at present strong opposition to grants in perpetuity by the government, although the leasing system has been recommended by some organizations and public officials. There is a hesitancy to create more bureaus, for bureaucratic administration is not popular with those who have tried to transact business with many of them.

REMEDIES PARTICULARLY NEEDED

Aside from the generally condemned apex law, there are two or three features of our present system which should be speedily remedied. The first is that provision of the law requiring a discovery of valuable mineral before location. There is really no sense in such a requirement. What seems valuable to one man is often worthless to another; and what is of no value whatever today may be worth a million in a year or two. Moreover, it sometimes requires a year's work and a shaft several hundred feet deep before the actual discovery of ore, even though

the surface indications give ample promise of its existence below. Every mining engineer and geologist knows that many ore deposits have no value whatever immediately upon the surface of the ground. Why not allow a prospector to stake out his mining claim wherever he chooses on the public domain, and hold it so long as he performs the required amount of development work?

Another defect in our present law is that permitting a prospector to locate an indefinite number of mining claims and to hold them without actually doing his assessment work. Many promising districts are kept from becoming hives of industry and producers of mineral wealth by the tying up of their territory in this way. The prospector should be restricted in the number of his locations, and real development work should be exacted.

PROVISION FOR APPEALS FROM DECISIONS NEEDED

The last important defect in the United States and Alaskan mining and land law to which I wish to call attention is the lack of any provision for appeals to the courts from the decisions of administrative officers. It is contrary to the general spirit of our institutions and an anomaly in constitutional government to take away from any citizen property rights to which he considers himself justly entitled under the law, by the mere fiat of an appointed government official who is here today and gone tomorrow. To place in the hands of such officers the final dicta in matters involving property valued at hundreds of thousands of dollars, and to provide no method of appeal to any duly constituted nonpolitical judicial tribunal is not only to subject the said officials to great and unnecessary tests of moral courage and fidelity, but to require in them the qualifications of superior judges and experience in the interpretation of the law which many of them cannot be expected to possess. Serious injustice may be done without any remedy at law to the defeated applicant. In the interests of justice, provision should be made for appeals in important cases and perhaps in all cases from decisions of the commissioner of the General Land Office or of the Secretary of the Interior to some court of competent standing and jurisdiction, whose decisions could and would be accepted by the public and the interested parties as justified by the law and the evidence. I am gratified to notice that this point has been carefully covered in the recommendations of the Canadian committee on this subject.

A comparison of the mining laws of the United States with those of other English-speaking countries will disclose a fundamental difference in the underlying theory of the proprietorship of minerals, and hence in the attitude of the courts upon the subject as reflected in

⁴Thirty-second Annual Report, Director U. S. Geol. Surv., p. 15. Washington, 1911.

their decisions. Recent publication of a report upon the "Mining Laws of Australia and New Zealand," has caused considerable discussion because of the fact that its recommendations have been to a certain extent adopted by other government officials in their annual reports and public addresses. This report apparently assumes a similarity between British laws and those of the United States in certain respects where actually a wide difference exists.

Neither regalian right, nor anything similar, has ever existed in or been asserted by the United States.⁶ While it has sovereign authority, and the power to enact such statutes as Congress in its wisdom sees fit, within the limits of the constitution, its right is dependent upon and controlled entirely by statute.⁷

Furthermore:

A distinction exists, and should be observed between ultimate ownership and right to govern on the one hand, and the exercise of regalian right, after possession and title are parted with, on the other. The former exists in the United States, and the latter does not. The ownership, as well as the manner of exercising control, of mineral lands is regulated in the United States by statute.⁸

The fundamental principles of the common law of England were to a certain extent ingrafted into our legal system when we separated from the mother country and was and still is the rule of action in the absence of legislation. As a general rule, under the common law minerals were the property of the owner of the land, the property in the surface carrying with it the ownership of everything beneath and above it.⁹ Wherefore the ownership of the surface was the best prima facie title to the ownership also of the mines.¹⁰ This prima facie ownership continued until rebutted by showing: (1) That the land contained "royal mines"; or (2) that it was subject to some particular custom that defeated the prima facie ownership, as in the case of the tin mines of Cornwall and Devon and the lead mines of Derbyshire; or (3) that the ownership of the mines and minerals had become in fact, from divers causes, several and distinct from the ownership of the soil and surface.¹¹

GOLD AND SILVER MINES TERMED ROYAL

By the term "royal mines" was meant mines of gold and silver. These belonged exclusively to the crown, by prerogative, although in lands of subjects. In this respect the rule was the same as under the civil law. It was at one time contended

⁶Bull. 505, U. S. Geol. Surv., by A. C. Veatch with a preface by Walter L. Fisher, Washington, 1911.

⁷There is a possible exception to this statement in the case of lands owned by some of the original thirteen states and never controlled by the federal government.

⁸Synder on Mines, Vol. 1, p. 15.

⁹Lindley on Mines, First edition, Vol. 1, p. 4.

¹⁰Blackstone's Comm., p. 18; Arundel on Mines, p. 3.

¹¹Bainbridge on Mines, 4th ed. p. 118; MacSwinnney on Mines, p. 27; Rogers on Mines, p. 247.

¹²Bainbridge on Mines, Fourth edition, p. 27.

that mines or mineral deposits containing the baser metals in combination with either gold or silver were royal mines. This contention, however, was set at rest by statutes enacted during the reign of William and Mary,¹² wherein it was declared that no mine should be deemed royal by reason of its containing tin, copper, iron or lead in association with gold or silver. Thus, those mines only came to be classed as royal in which were found the precious metals in the pure state. Briefly stated, the regalian right to mines, as recognized in England, was confined to those of the precious metals, gold and silver. The baser substances belonged to the owner of the soil except in certain localities where immemorial custom had modified the rule.¹³

At the present time "England has no general mining laws. Legal questions governing the ownership of mines and minerals have been determined on the general principles of the common law."¹⁴

As distinguished from the common law the theory of the civil law is thus clearly stated by H. W. Halleck:

All continental publicists who have written upon the subject lay down the fundamental rule, that mines, from their very nature, are not a dependence of the ownership of the soil; that they ought not to become private property in the same sense as the soil is private property; but that they should be held and worked with the understanding that they are by nature public and that they are to be used and regulated in such a way as to conduce most to the general interest of society.¹⁵

CONFLICTING OPINIONS AS TO GOVERNMENT'S RIGHT TO PRECIOUS METALS

C. H. Lindley has presented concisely the theory of our leading mining lawyers as to governmental control after patent, as follows:¹⁶

The government of the United States does not concern itself with mining lands or the mining industry after it parts with the title. This title vests in the patentee absolutely to the extent of the property granted. No royalties are reserved; nor is any governmental supervision (except perhaps in the isolated case of hydraulic mines in California) attempted. Upon the issuance of the deed of the government the mineral land becomes private property subject to the same rules as other property in the state with reference to the transfer, devolution by descent, and all other incidents of private ownership prescribed by the laws of the state. Briefly stated, property in mines, once vested absolutely in the individual, becomes subject to the same rules of law as other real property within the state.

But lately we are told that the United

¹²William and Mary C. 30; 5 William and Mary C. 6.

¹³Lindley on Mines, First Edition, Vol. 1, p. 4.

¹⁴Lindley on Mines, Loc. Cit.

¹⁵Introduction to De Iooz on the Law of Mines, p. x; Lindley on Mines, First Edition, Vol. 1., p. 14.

¹⁶Lindley, loc. cit., p. 29.

States "has never waived its right to the precious metals,"¹⁷ and that "in all states where the federal government has never owned the land, and there are 19 such states, the ownership of the precious metals lies with the state government," and "that in states where the ownership of the land has been vested in the federal government the ownership of the precious metals in like manner, lies with the nation, and that as against the government no person has a right to gold and silver in any lands in the United States unless this right has been specifically granted to him in the deed of conveyance."¹⁸

Here is a most radical difference of theory. Mr. Veatch would have the government resume dominion and control of gold and silver and by implication of other metals beneath the surface of all lands except those in which minerals were specifically conveyed. He thinks the government has the right to grant prospecting permits beneath private property and the power to collect royalties on minerals produced as a result of such explorations. In other words he insists upon it that the United States is in possession of a regalian right, but does not know it or has forgotten it. He would have the people wake up and seize what is theirs from all mine operators who are thus wrongfully removing from the ground valuable minerals never specifically granted to them by the government.

HAS UNITED STATES REGALIAN RIGHTS?

It can readily be seen that it is a matter of no small moment to ascertain whether such a thing is possible. Here is proposed mining-law revision with a vengeance. I have not at hand the figures to show the relative proportion of lands patented as mineral lands and in all other classes; but have no doubt that the lands granted under the homestead, preemption, desert land act, private entry, town site, timber and stone, railroad grants and all other laws exceed in the aggregate the lands patented under the mining laws four to one.

Now, if the minerals under three-fourths of the privately owned land west of the Mississippi, and practically all the lands east of it, really belong to the government it is high time for the government to assert its right and to exercise some sort of control over its vast possessions. This is either a nebulous and iridescent dream or a very important discovery. If the former, the bubbles should be punctured and the mist dispelled before arousing too many false hopes; if the latter, the work of mining-law revision at once assumes paramount importance. Fortunately, we have some illuminating opinions of the United States Supreme Court, as a guide and cloud dispeller

¹⁷Bull. 505, U. S. Geol. Surv., p. 110.

¹⁸Bull. 505, U. S. Geol. Surv., p. 101.

COURT DECISIONS CITED

In the case of *Deffeback vs. Hawke*, 115 U. S., p. 400, Justice Field, after reviewing at length the various acts of Congress relating to the public lands of the United States, concludes as follows:

It is plain, from this brief statement of the legislation of Congress, that no title from the United States to land known at the time of sale to be valuable for its minerals of gold, silver, cinnabar, or copper, can be obtained under the preemption or homestead laws or the town-site laws, or in any other way than as prescribed by the laws specially authorizing the sale of such lands, except in the States of Michigan, Wisconsin, Minnesota, Missouri, Kansas. We say "land known at the time to be valuable for its minerals," as there are vast tracts of public land in which minerals of various kinds are found, but not in such quantity as to justify expenditures in the effort to extract them. It is not to such lands that the term "mineral" in the sense of the statute is applicable. In the first section of the act of 1866 no designation is given the character of mineral lands which are free and open to exploration. But in the act of 1872, which repealed that section and reenacted one of broader import, it is "valuable mineral deposits" which are declared to be free and open to exploration and purchase. The same term is carried into the Revised Statutes. It is there enacted that "lands valuable for minerals" shall be reserved from the sale except as otherwise expressly directed, and that "valuable mineral deposits" in lands belonging to the United States shall be free and open to exploration and purchase. We may also say lands known at the time of their sale to be thus valuable, in order to avoid any possible conclusion against the validity of title which may be issued for other kinds of land, in which years afterward, rich deposits of mineral may be discovered. It is quite possible that lands settled upon as suitable only for agricultural purposes, entered by the settler and patented by the government under the preemption laws, may be found, years after patent has been issued, to contain valuable minerals. Indeed this has often happened. We therefore use the term "known" to be valuable at the time of sale, to prevent any doubt being cast upon titles to lands afterward found to be different in their mineral character from what was supposed when the entry of them was made and the patent issued.

And in the case of the *Colorado Coal Co. vs. the United States*, 123 U. S., p. 328, Justice Matthews uses the following language:

A change in the conditions occurring subsequently to the sale, whereby new discoveries are made or by means whereof it may be profitable to work the veins as mines, cannot affect the title as it passed at the time of the sale. The question must be determined according to the facts in existence at the time of the sale. If upon the premises at the time there were not actual "known mines" capable of being profitably worked for their product, so as to make the land more valuable for mining than for agriculture, a title to them acquired under the preemption act cannot be successfully assailed.

Since these are the opinions of the

highest court in our land it is probable that although the advocates of radical revision of our mining law may be able to change the form of its superstructure they will hardly be able to mine deep enough to disrupt its solid-rock foundations. It will continue to present fundamental differences from the mining law of Canada on the north, and from that of Mexico on the south, but rights already granted will not easily be set aside.

Summarizing these somewhat disjointed remarks, it appears in general that:

(1) The development and prosperity of all countries are vitally affected by the provisions of their laws relating to mines.

(2) Greater inducements and more liberal rewards should be offered in unsettled countries than in districts of denser population.

(3) Continuous development work should be required and rigidly enforced, but (4) no narrow limit should be placed on the amount of property held by an individual or corporation so long as the aggregate amount of work equals the product of the net units of area held multiplied by the amount of development required for each unit area.

(5) In case of any contest either between rival claimants or between a locator and the government full privilege should be given of appeal to the courts as in other matters wherein the title to property is involved.

SIX RECOMMENDATIONS

In addition to the above and with particular reference to the United States, taking into account the system of mining law there already established by long years of precedent and custom, the following recommendations are tentatively presented¹⁹:

(A) The apex law should be abolished.

(B) Mining claims should be locatable regardless of a "discovery" and held only so long as the specified development work is performed in good faith.

(C) Placer locations should be limited to deposits of loose material above solid bedrock.

(D) A statute of limitations should establish a reasonable term of years beyond which placer patents shall be immune from attack on the ground of misrepresentation in the patent application.

(E) Special statutes should be enacted providing for the location and working of oil, phosphates, rare earths, haloids and other mineral substances not specifically mentioned in the present laws.

(F) Existing titles should be fully recognized and confirmed and no effort should be made to create retroactive legislation.

¹⁹It should be clearly understood that for these suggestions I am alone responsible. They do not in any sense pretend to reflect the views of the Mining and Metallurgical Society of America nor its committee on mining law.

I have purposely avoided any discussion of the relative advantages or disadvantages of permanent alienation of title as opposed to the government-leasing system. For Canada I am confident the latter system is to be preferred, and am pleased to find myself upon this point in accord with the majority of Canadian mining men.

Byproduct Coke Ovens

A list of byproduct coke ovens in the United States has several times been asked for. The following (Circular No. 97, U. S. Dept. of Agriculture) gives the list as of Jan. 1, 1910, and may be of some interest.

Semet-Solvay Ovens—Solvay Process Co., Syracuse, N. Y.; Semet-Solvay Co., Pennsylvania Steel Co., Steelton, Penn., also Lebanon, Penn.; Semet-Solvay Co., National Tube Co., Benwood, W. Va.; Semet-Solvay Co., Milwaukee Coke & Gas Co., Milwaukee, Wis.; Semet-Solvay Co., Detroit, Mich., also Ensley, Ala.; By-Products Coke Corporation, South Chicago, Ill.; Semet-Solvay Co., Empire Coke Co., Geneva, N. Y.; Semet-Solvay Co., Dunbar Furnace Co., Dunbar, Penn.; Semet-Solvay Co., Central Iron & Coke Co., Tuscaloosa, Ala.; Philadelphia Suburban Gas & Electric Co., Chester, Penn.

Otto-Hoffmann Ovens—New England Gas & Coke Co., Everett, Mass.; Lackawanna Steel Co., Lebanon, Penn.; Dominion Tar & Chemical Co., Sydney, Nova Scotia; Hamilton-Otto Coke Co., Hamilton, Ohio. The following use both the Otto-Hoffmann and United Otto: Camden Coke Co., Camden, N. J.; Cambria Steel Co., Johnstown, Penn.

United Otto—Carnegie Steel Co., South Sharon, Penn.; Maryland Steel Co., Sparrows Point, Md.; Citizens Gas Co., Indianapolis, Ind.; Pittsburgh Gas & Coke Co., United Coke & Gas Co., Glassport, Penn.; Zenith Furnace Co., Duluth Minn. The Lackawanna Steel Co. at its Buffalo, N. Y., plant uses both the United Otto and the Rothberg ovens.

Koppers—Illinois Steel Co., Joliet, Ill., and Indiana Steel Co., Gary, Indiana.

South African Sulphur

It is reported that deposits of sulphur have been discovered in South Africa, which are said to contain about 65% sulphur. These deposits should prove of importance to the explosive works out there, as they at present are using large quantities of imported pyrites. (*Chem. Trade Journ.*, Feb. 3, 1912.) In addition to this, large supplies will be required by the Cape vineyards, which use considerable quantities of flowers of sulphur. E. Wykeham Hodgson, of Cape Town, is interested in the syndicate formed to exploit these deposits.

Cyaniding Tailings in Colombia

By Ralph W. Perry*

The following notes on the construction and operation of cheap temporary cyanide plants, where the quantity of tailings is not sufficient to warrant the construction of expensive works, may be of use to engineers and miners who have small mines or tailings dumps and are deterred from working them on account of the first cost of plant and the fear that a cheap plant cannot do the work.

THREE DUMPS TREATED

The tailings treated consisted of three dumps, situated within a few miles of each other in the mining district of Santa Rosa de Osos, department of Antioquia, Colombia. The district of Santa Rosa is situated about 40 miles north of Medellin, the capital of the department, and the same distance from Cisneros, at present the terminus of the Antioquia railroad.

Costs of the principal materials used in construction are given in the accompanying table. Freight charges from Medellin and Cisneros to the plants vary from \$3 to \$5 per *carga* (250 lb.), de-

A description of the methods and costs of construction and operation of three small temporary plants for treating accumulated tailings. The process consists of leaching, zinc-shavings precipitation and melting; the bullion and slag produced were shipped to New York.

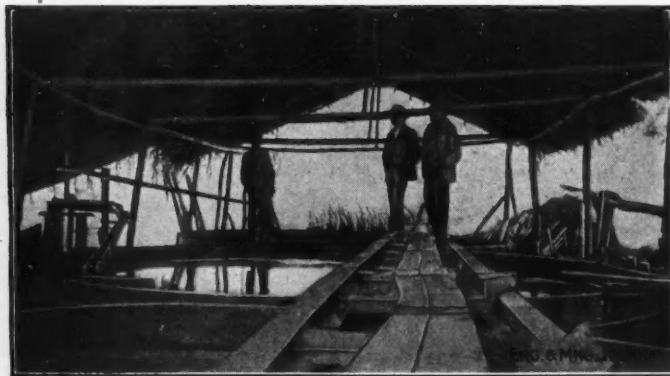
*Mining engineer, Medellin, Antioquia, Colombia.

although many other kinds of wood were also employed. No timber is found there free from worm holes and much trouble was encountered in finding these and plugging them, but after once being fixed, no more difficulty was experienced from this cause. Carpenters received from \$0.60 to \$1 per day, none of them having had previous experience in constructing tanks. They learned rapidly and their work improved much with the experience gained.

their term of service. Some of these tanks were knocked down at the end of a year and erected on another dump and were found still to be in excellent condition.

The staves were dressed on the outside only and were 1 5/8 in. thick. The bottoms were of the same thickness but dressed on both sides and grooved for tongues. The croze in the staves was 3/8 in. deep and 1 1/2 in. wide, the bottoms of the tanks being slightly beveled around their circumference. The hoops were made of 7/8-in. round iron and were fastened with cast-iron lugs made in Medellin and weighing 2 kg. each.

The leaching tanks were provided with wooden side discharge doors 10 in. square. These doors were made by cutting an opening, slightly beveled, at the level of the filters, through which projected a box cut to fit the opening. In the interior of this box grooves were cut to receive a sliding door, which could be wedged in the groove to form a tight joint. This door consisted simply of a 2-in. plank. It was easily removed and



TWO TEMPORARY CYANIDE PLANTS IN COLOMBIA—NATIVE CANE PUMP RAISING CYANIDE SOLUTION

pending on the condition of the roads and the movement of other freight.

PRICES OF CONSTRUCTION MATERIAL IN COLOMBIA

Lumber:	Price	Other material:	Price
6x6 in., per ft.	\$0.05	Nails, per kg.	\$0.30
3x10 in., per ft.	0.05	Castings, per kg.	0.40
2x6 in., 6 ft. long.	0.20	Pipe, 2 1/2 in., per ft.	0.90
2x10 in., 10 ft. long.	0.25	White lead, per kg.	0.66
1x8 in., 8 ft. long.	0.16	Tar, per keg.	0.50
3x3 in., 10 ft. long.	0.15	Rope, 1 in., per ft.	0.10
Other material:		Filter cloth, per yd.	0.40
Round iron, per kg.	0.16	Cocoa matting, per yd.	0.20
Flat iron, per kg.	0.22		

The prices given are Medellin prices. Much of this material can be purchased abroad if time allows, from three to four months being necessary to fill an order.

All lumber was whipsawed and carried on men's backs for a distance of two to five miles. Laurel was used almost entirely in the construction of the tanks

The first plant was completed within five months from the time of cutting the first timber, so that it was impossible to season it. The green timber caused no difficulty if kept moistened and protected from the direct rays of the sun, but shrunk quickly if allowed to become dry for a short time. The zinc boxes were the only part of the plant inclosed and this was done with the cheapest of material.

METHOD OF CONSTRUCTING TANKS

The bottoms of the tanks were nailed to 6x6-in. timbers, spaced with 36-in. centers, which were laid on 3x10-in. mud sills. These mud sills were laid on ground levelled off and well tamped; where necessary stone work without lime was employed in getting a level surface. Through leakage from the new tanks considerable settling took place, but the tanks remained in good condition during

caused no trouble from leaking. Both rectangular and circular zinc boxes were used, the latter proving much more satisfactory, both in cost of construction and

CONSTRUCTION COSTS OF TAILINGS CYANIDE MILLS, COLOMBIA

	San Francisco	San Ramon	Pastora Mira
Administration	\$363.26	\$363.26	\$261.12
Timber	562.12	410.47	475.37
Carpenters	766.08	586.77	500.42
Iron	416.20	347.00	207.96
Blacksmiths	171.19	142.00	56.61
Excavating, roofs, etc.	233.81	176.63	216.18
Assay office	67.89	67.90	67.90
Trails	14.00	14.00	14.00
Filters	300.00	250.00	207.97
Pipe, pumps, lathe, cars, etc.	358.00	65.53	22.16
Total	\$3252.55	\$2421.56	\$2029.69

convenience in cleaning up. The costs of construction of each of the plants is shown in the table.

The San Francisco plant, shown in the accompanying cut, consisted of the following tanks and accessories; 4 leaching tanks, 20x6 ft.; 1 sump, 18x5 ft.; zinc boxes; one 24-in. pelton wheel driving a 2½-in. rotary pump and a small lathe which cuts the zinc for the three plants. The San Ramon had 3 leaching tanks 20x6 ft.; 1 sump 18x4 ft.; 5 circular zinc boxes, 2½ ft. high by 2½ ft. in diameter; and a native cane pump shown in the accompanying engraving. The Pastora Mira was the same as San Ramon except that all the tanks were 22x4 ft. The assay office was equipped with a pulp scale and a button balance, a muffle furnace and a bullion furnace to take No. 30 graphite crucibles. The cost of the assay outfit was charged equally to the three plants. Thatched roofs were erected over the tanks both as a protection against the sun and the heavy rains. No permanent buildings were constructed, a house in the vicinity being rented which served as a dwelling house and assay

that it would leach. The extraction in the dry season averaged 80% and dropped to less than 50% when the rains started.

They all contained a large amount of soluble and insoluble iron and aluminum salts and the consumption of lime was high. Without using a large excess of lime it was impossible to keep the efficient solutions alkaline for the first few days, after which they became more alkaline. This was probably caused by the lime being retained by the slime in the charge. After receiving water washes before discharging, the solutions became much more alkaline and their cyanide strength was also greater than at any previous time.

Extraction seemed to be higher if the solutions were neutral or even slightly acid, but the results were erratic and much trouble was caused in the zinc boxes. This, of course, applies to the effluent solutions and not to the solutions used on the charges. The higher extraction is probably accounted for by the acid solutions being more effective in re-

TREATMENT BY LEACHING ONLY

All three plants were run in practically the same manner, filling being done in the day with wooden cars at the San Francisco and San Ramon plants and with wheel barrows at the Pastora Mira plant, the required amount of lime being added to the cars.

The charges first received several water washes and as a rule no cyanide was added until the solutions showed an alkaline reaction, when a weak solution from the sump was run on. This was followed by two solutions from the sump at intervals of eight hours to which were added 10 lb. of cyanide on top of the charge, then two solutions with five pounds of cyanide. The rest of the treatment consisted of giving washes from the sump every eight hours and two water washes before discharging. The charges at the time of discharging carried 28% moisture after draining 24 hours. The tanks at San Francisco were discharged by one peon in six hours by sluicing with water under a 50-ft. head. At the other two plants two peons aided by a stream of water not under pressure could discharge a tank with shovels in six hours.

The sump solutions used as a weak solution varied in strength from 0.02 to 0.05% total cyanide, and the strong solutions from 0.05 to 0.1%. Precipitation was fairly good if the strength of the solutions did not fall below 0.03% KCN, but at times was interfered with by the large quantity of iron and aluminum salts in the boxes.

Much short zinc was produced and many times it was richer in gold than the precipitate. Most of this zinc was removed from the boxes at the regular cleanups, roasted and melted with 40% of its weight of borax, 30 of bicarbonate, and 20 of sand. The slag from these melts was exceedingly rich and was crushed in a stamp battery and panned for the shot, after which it ran from 50c. to \$1 per pound. This slag was shipped to New York at a cost including freight, treatment charges, and smelter deductions of \$200 per ton.

No filter presses being available, all precipitate was filtered through a piece of canvas stretched over a frame. Except for the delay no difficulty was experienced, even residues from acid treatment being filtered in the same manner. A great deal of short zinc was destroyed by the use of strong cyanide solutions which saved much time and fuel in melting and of course the expense of shipping an excessive quantity of slag was avoided. All of the zinc was de-dissolved in acid at the final cleanup. Native coke of good quality and costing at the plants \$60 per ton was used for melting. This coke was packed from Amaga, a distance of 80 miles.

MATERIAL LEACHED IN THREE COLOMBIAN MILLS

	+ 40 mesh	+ 100 mesh	+ 200 mesh	- 200 mesh
San Francisco.....	7	20	35	38
San Ramon.....	7	20	35	38
Pastora Mira.....	9	13	32	46

RECORD OF THREE MILLS TREATING TAILINGS

Mill	Tons	Head Assay	Tail Assay	Extrac-tions, Per Cent.	CHEMICALS USED PER TON		
					Cyanide, Lb.	Zinc, Lb.	Lime, Lb.
San Francisco.....	8892	\$4.63	\$1.05	77.4	0.79	0.30	13.8
San Ramon.....	8565	4.75	1.21	74.5	0.72	0.26	22.2
Pastora Mira.....	3750	5.88	2.34	60.2	0.99	0.35	27.0

office. The three plants as run had a daily capacity of 69 tons per day.

TAILINGS THE ACCUMULATION OF 70 YEARS

The tailings treated had been accumulating for the last 70 years and were in great part derived from sulphide ores. They were well oxidized and gave an extremely high extraction if the sand and slime were separated. Owing to the high cost of installing a power plant for slime treatment no attempt was made to separate them, although as seen from the screen analysis, it was hardly ideal material to leach.

The sand and slime from the San Francisco and San Ramon dumps had been well mixed when placed on the dumps and gave a fair extraction by leaching, but the sand and slime from Pastora Mira had been kept well separated and while the extraction was satisfactory in the dry season when the sand and slime could be well mixed while charging, in the rainy season it was nearly impossible to mix a charge so

moving dissolved gold from the charge. Caustic soda, costing 14c. per lb. was used for a short time to replace the lime, but did not prove satisfactory on account of the iron and zinc salts precipitated in the zinc boxes, although the precipitation was not bad even when the boxes were so full of these salts as to render the zinc nearly invisible.

It is possible that the use of an extra tank for the alkaline washes would have lessened the trouble with the precipitate in the boxes, but it is more likely that the charge when transferred would have packed so hard that leaching would have been interfered with. Owing to the poor quality of lime used, one pound of caustic soda would replace six pounds of lime. The greater part of the cyanide consumption was caused by the retention of the cyanide in the charge, and the extraction suffered from the same cause. The solutions at the time of discharging a tank carried from 20c. to \$1 per ton, but the percolation became so slow at the end of 7 or 8 days treatment that nothing was gained by prolonging the treatment.

BULLION SHIPPED TO NEW YORK

The bullion produced ran 550 fine in gold and 280 in silver, after being melted a second time. This was sold to the U. S. Assay Office in New York. The bars were assayed by public assayers in Medellin and the royalties to the owners of the dumps paid on their returns. The owners of San Francisco and San Ramon received 25% of the gross production and of Pastora Mira 30 per cent.

Lime was brought from Yarumal, San Andres and Amalfi, all about 50 miles dis-

OPERATING COSTS FOR CYANIDING TAILINGS IN COLOMBIA

	San Francisco	San Ramon	Pastora Mira
Administration	\$0.133	\$0.133	\$0.133
Superintendence	0.000	0.098	0.14
Labor on tanks	0.067	0.068	0.0709
Filling tanks	0.0859	0.132	0.119
Discharging	0.0039	0.0109	0.12
Lime	0.386	0.587	0.718
Cyanide	0.179	0.162	0.222
Zinc	0.047	0.04	0.0538
Assaying and melting	0.10	0.10	0.10
Marketing bullion and slag	0.161	0.161	0.161
Depreciation	0.36	0.28	0.53
Royalties	0.865	0.835	1.00
Total, per ton.	\$2.3878	\$2.6069	\$3.2597

tant, on pack animals and was of poor quality, having been slaked a long time before using; the packers refusing to pack unslaked lime. Lime cost 5c. per kg. at the mill. Peons received 40c. per day and a man at \$2 per day was employed as superintendent at two of the plants. Two peons at \$1 each per day

COMPARATIVE COSTS OF MATERIALS PURCHASED LOCALLY AND IMPORTED

	Purchased in Medellin	Imported
Cyanide, potassium, per kg.	\$0.70	\$0.50
Zinc, per kg.	0.40	0.37
Borax, per kg.	0.46	0.28
Soda, per kg.	0.46	0.22
20-gram crucibles, each.	0.25	0.05
Graphite crucibles, No. 30, each.	8.00	4.00
Litharge, per kg.	0.60	0.35

were employed as shift bosses at each of the plants. An American at \$150 per month assisted in the melting. Most of the material used was imported from the United States, but at times it was necessary to purchase small quantities of supplies in Medellin. The comparative costs of these are given laid down at the plants. The results obtained and the operating costs are given in the accompanying tables, no account being taken of the small amount of silver in the tailings.

Dividends were declared and paid by 18 mining companies in Utah, during 1911, amounting to \$8,973,856, as compared to a total distribution by 19 companies of \$8,758,873 during the preceding year.

Taxation in Arizona

PHOENIX CORRESPONDENCE

Certain rather disturbing reports as to prospective radical mining legislation by the legislature of the new State of Arizona, have been current recently in New York and other mining centers. In this connection the new executive, Gov. G. W. P. Hunt, who is a business man from Globe, and whose interests are closely identified with the mining industry of that important camp, has denied that there was any real foundation for such rumors and has given assurance of his personal desire to foster and encourage the mining industry of the state in every way. He said:

The new state government will cost about \$200,000 more annually to maintain than did the territorial government. This additional cost must, of course, be distributed on the taxable property of the state and, of course, the mining industry will have to bear its proportionate and fair share of this increase. Certainly I have no intention of encouraging any discrimination against mining or of seeking to impose any unfair tax burdens upon it. The general increase in the agricultural operations in the state and the rapid extension of its railroads and general business are such that in fact the necessary increase of state expenses resulting from statehood will be hardly felt by any of the interests of the state.

INCREASE ASSESSABLE VALUATION

Attorney-General Bullard stated that a suggestion had been made to place the basis of the assessable valuation of the mines, for taxation, at 50% of the annual gross output, instead of 25%, as under the present law. This, of course, would result in an increase of the taxes on the operating mines, but not necessarily an increase in the proportion of 50:25, as the actual tax would be determined by the rate of taxation, which would be automatically lowered by the act of an increase in the assessable valuation; the fairness of such an increase on mining would also be directly contingent on the action with regard to the valuation of other taxable property in the state.

THE TERRITORIAL LAW OF 1907

The present enactment in Arizona relating to mine taxation is of interest in itself, and by way of explaining the application of the suggested increase in the assessment basis. The law was enacted in 1907 by the legislative assembly of the territory. It provides that for the purposes of taxation all mines and mining claims in the territory shall be divided into two classes, (1) productive and (2) nonproductive. The first includes all claims that have produced \$3750 or more per claim during the year and groups of claims belonging to the same owner that have produced \$3750 or more per claim. The owner is required to make statement

under oath of the tonnage, character and yield of the ore produced, and the assessor "shall compute the value thereof on the average market quotation of each such metal in New York City, as evidenced by some established authority or market report, such as the ENGINEERING AND MINING JOURNAL, of New York, or any other standard paper giving the market reports, and 25% of the gross value in money shall constitute the total amount from which the levy of taxes for the current year shall be made and fixed."¹

The second class, including all mines and mining claims not in the first class and designated as nonproductive, is valued for taxation by the assessor the same as other property, and is taxed the same. It is provided also that all non-productive, unpatented mines or mining claims shall be free from taxation, except for the improvements thereon, such as machinery, plants and equipment.

The tax, as above provided, constitutes the full tax on mining property, except that the machinery, equipment and personal property of all mining companies shall be separately valued and taxed as other property, and also where the surface ground of any mining claim is used for farming or townsite or other productive purposes, this surface property shall be separately valued and taxed. In default of the mine owner making statements required by law, the assessed valuation is by penalty fixed at the full gross value of the output.

Generally, the law has been considered fair and reasonable, although, as is the case with any application of the gross output for a taxation standard, the low-grade mines pay out of proportion to the high-grade mines, considering net earnings as the actual value standard of any operation. Apparently the mine owners are not dissatisfied with the form or substance of the present law. It remains to be seen whether any change as suggested will be considered by all of them as fair and equitable.

London Mica Market in 1911

The supplies of all grades of block mica fell short of the demand in 1911 and closing prices in London showed a full 25% advance. India furnished the bulk of the supply, while Canada, Africa and South America also contributed. European demand has been brisk, and American trade improving. Stocks of unsold mica at the close of the year were light, and consisted chiefly of Bengal splittings. Including purchases uncleared, the warehouse stocks, Dec. 31, 1911, were 750,200 lb. (*Min. Journ.*, Jan. 13, 1912). African amber mica has been more in evidence during the last year, and has sold at steady rates.

¹Chapter 20, Laws 1907, Territory of Arizona.

Ore Dressing in the Joplin District—III

By James L. Bruce *

The favorite practice of the district and I think a commendable one is to keep the plant as compact as possible so as to save labor, surface space, heat losses by long steam line, and housing, at the expense of a slight increase in the insurance rates. Power is usually required for milling, hoisting, pumping and air compressing and it is customary to have the mill engine and compressor under the same roof as the boilers with only a partition separating them so that the engineer can with the least labor attend properly to both, and so that radiation losses will be as small as possible.

MILL NEAR HOISTING SHAFT

The mill is usually built immediately adjoining one of the hoisting shafts so that the ore bin or mill hopper will serve as a joint storage bin for both. Ore from other shafts within a distance of about 500 ft. is conveyed to this hopper in cars on an incline tramway as already described. The crushing, coarse concentration and fine concentration are usually all done in the same building and on the same floor, and are driven off the same lineshaft. This often calls for a long lineshaft with its consequent disadvantages and it is probable that in some large mills, especially if electric power is used, it would be advisable to drive the heavier and more variable load such as the crushing department, with a separate engine or motor. This would cut down the lineshaft friction losses and at the same time give a steadier speed for the concentrating plant.

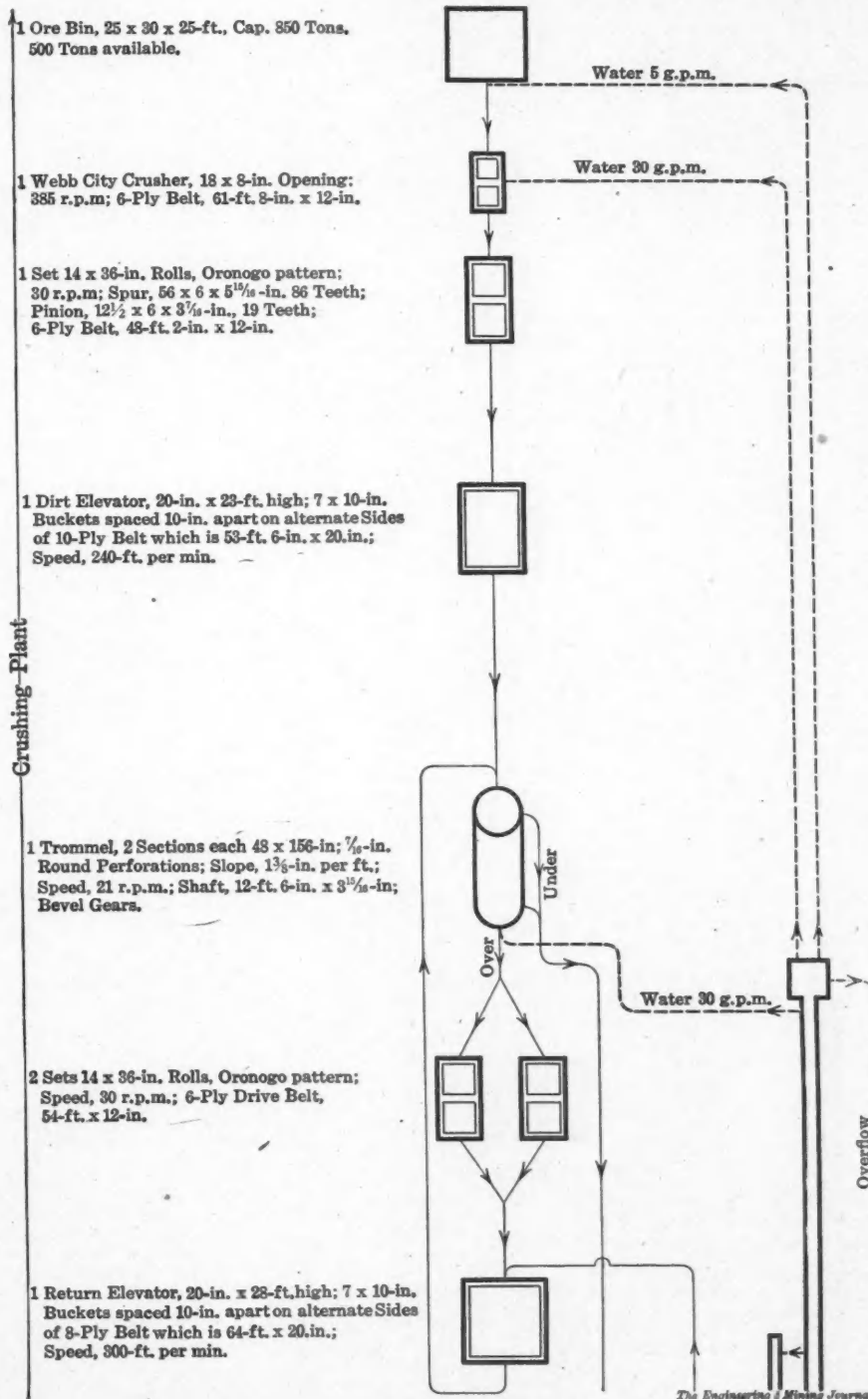
The favorite lineshaft speed is about 180 r.p.m., some running as high as 200 r.p.m. With the latter speed however, smaller pulleys have to be used on the lineshaft with greater tension on belts and consequently greater friction losses and more severe belt service. Drive pulleys for the heaviest loads are placed as near the lineshaft bearings as possible so as to avoid springing the shafting. Where heavy loads have to be driven from a point midway between bearings an extra bearing should be built in to reinforce the shafting. This may be done with three timbers two of which run parallel to the lineshaft from mill bent to mill bent while the third reaches between them and supports the extra bearing. Much of the expense for drive belts can be saved by removing the belts from the heavier service before they are completely worn out and utilizing them for the lighter or steadier service.

None of the mill designers seem to have appreciated the quantity of power required to run the centrifugal pumps for elevating the supply of mill water, nor do they seem to have made any

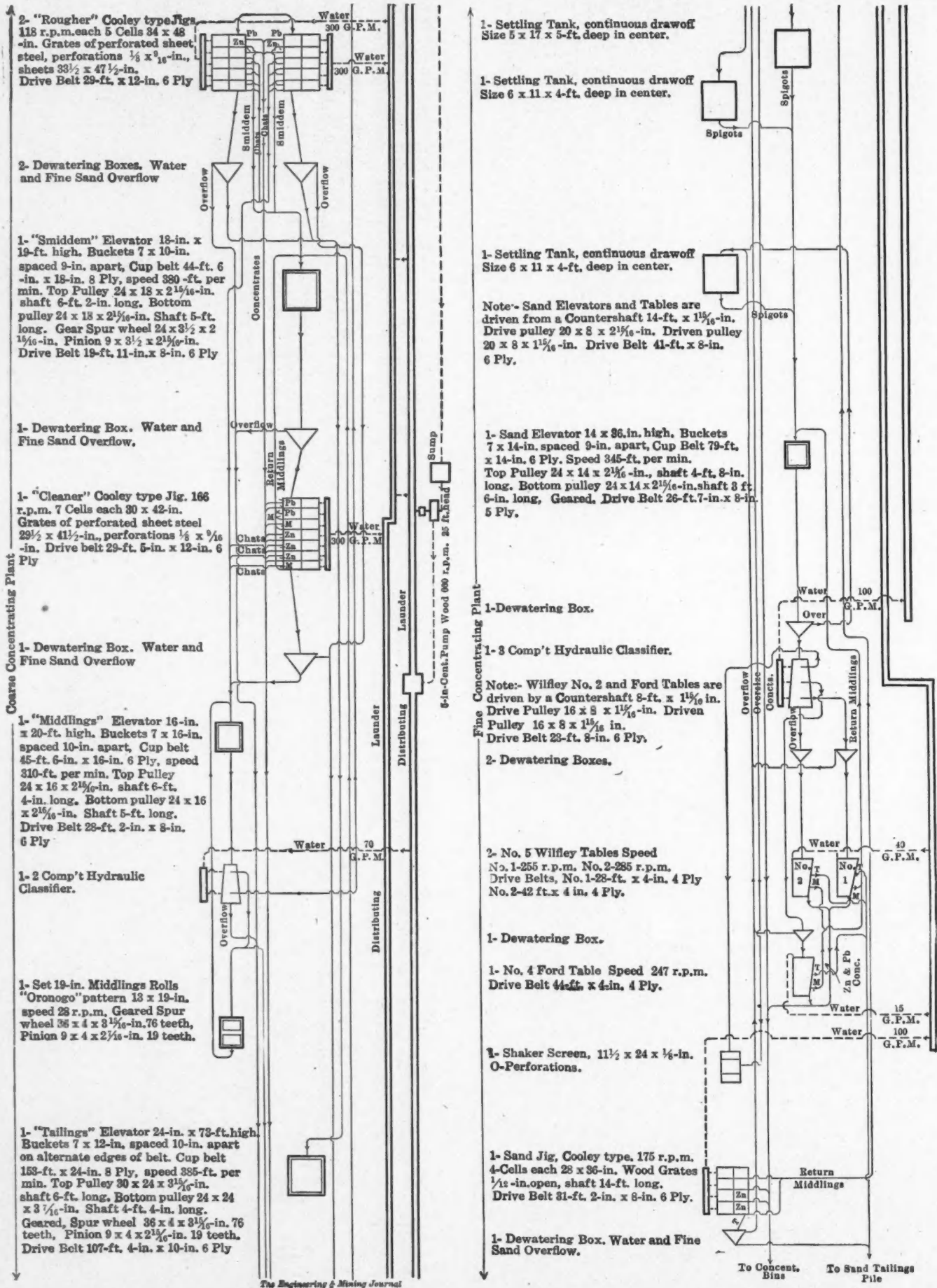
The features of the general practice are critically considered; compact plants, long lineshafts and centrifugal pumps for raising water being characteristic. Flow sheets of typical mills are given.

*General manager, Continental Zinc Co., Joplin, Mo.

effort to cut it down. In every case known to me all of the water used is elevated several feet higher than the highest point at which any of it is required. As a matter of fact less than one-fourth of the total water is required at a higher elevation than the jigs, and is needed only for the screens, crusher and classifiers. At least one-third of the power required for pumping, which often reaches 30 or 35 hp. could be saved by using one large pump to elevate water just high enough for the jig and table



CRUSHING PLANT, LITTERAL MILL, CONTINENTAL ZINC CO.



FLOW SHEET OF COARSE AND FINE CONCENTRATING PLANT OF LITTERAL MILL OF THE CONTINENTAL ZINC CO., JOPLIN

Ore Bin

18-in. Webb City Breaker,
415 r.p.m.

1/2 x 48 x 96-in. Trommel,
1 1/2-in. Slope per ft., 30 r.p.m.

2- 30 x 15-in. Carterville Rolls,
40 r.p.m.

Dirt Elevator, 24-in. Belt,
30-in. Top Pulley, 28-in. Bottom Pulley

5-Cell Foust Rougher Jig,
Cells 54 x 60-in., 98 r.p.m.

Smiddem Elevator, 20-in. Belt

Dewatering Box.

6-Cell Foust Cleaner Jig,
Cells 48 x 54-in., 140 r.p.m.

2- 12 x 36-ft. Settling Tanks,
Intermittent Type.

Tailings Elevator, 22-in. Belt

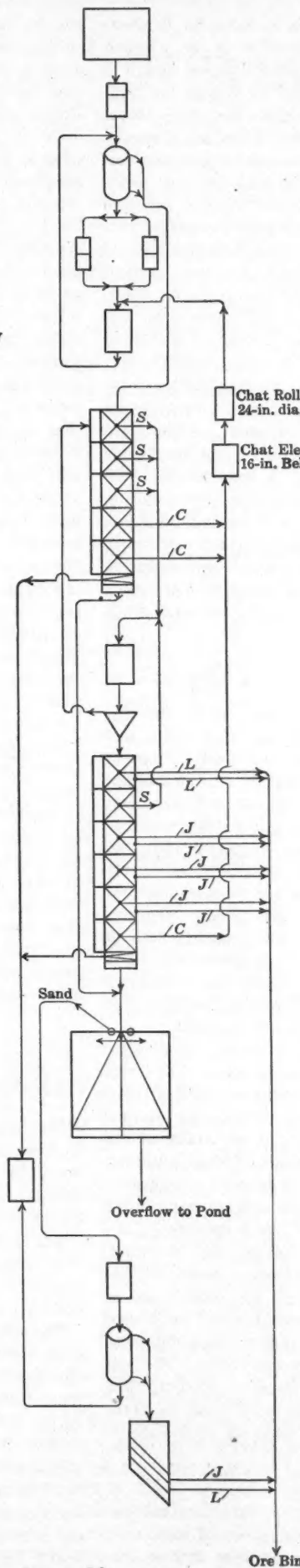
Sand Elevator, 10-in. Belt

Sand Trommel, 1 1/2-in. x 36 x 72-in.
30 r.p.m.

"New Standard" Table.

S = Smiddem.
C = Chats.
L = Lead Ore.
J = "Jack" or Zinc Ore.

SAMSON MILL, JOPLIN, MO.



Ore Bin

Crushers No. 1 and No. 2, 14-in. Carterville.

No. 1 and No. 2 Rolls, 24-in. Carterville.

Elevator No. 1, 18-in. Belt, 47-ft. 6 in. long,
18 x 7-in. Buckets.

No. 3 Rolls, 36-in. Rogers Conklin

Trommel No. 1, 36 x 60 in. long,
3/8-in. Punched Screen.

Chat Rolls,
24-in. dia.

Chat Elev.
16-in. Belt

Rougher Jig No. 1, 6 Cells 36 x 48-in.
Lead shoveled from 1st Compartment,
Jack from Gates of 2nd & 3rd Compartments.
"Smiddem" from Hutches of 1, 2, 3, 4 & 5. "Chats" or Middlings from Gates of 4, 5, 6 and Hutch of 6.

Settling Box.

Elevator No. 3, 10-in. Belt, 45 ft. long,
10-in. Buckets.

No. 3 Rolls, 24-in. Carterville.

Elevator No. 2, 12-in. Belt, 43 ft. long,
12-in. Buckets.

Trommel No. 2, 36 x 48 in. long,
1/4-in. Punched Screen.

Settling Box.

Settling Tank.

Cleaner Jig, 7 Cells, 29 x 36-in., Lead
from Hutch and Gate 1st Compartment,
Lead Middlings Hutch and Gate 2nd
Compartments. All other Compartments
Clean Jack.

Settling Tank.

Elevator No. 4, 8-in. Belt, 8 in. Buckets,

Shaking Screen, 1 1/2-mm. Punched Screen.

Wilfey Table No. 1

Elevator No. 5.

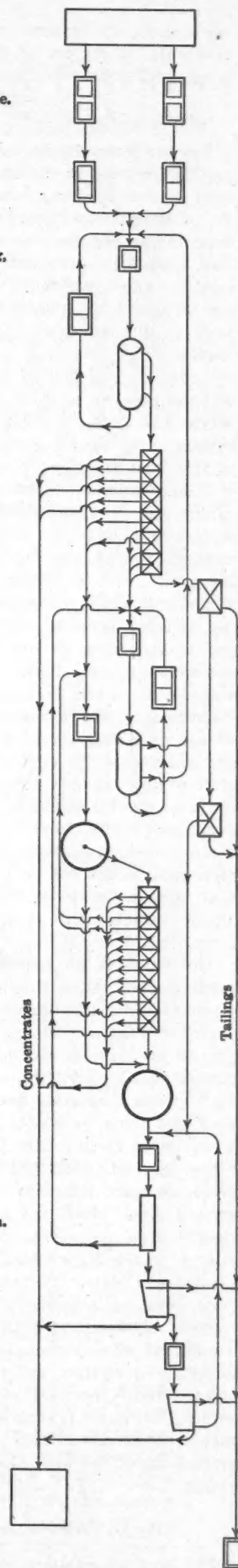
Wilfey Table No. 2

Concentrate Bin.

Elevator No. 6.

Ore Bin

GRACE MILL, JOPLIN, MO.



wash water and a smaller pump to elevate water to the top of the mill for the screens, crusher and classifiers.

ACCURATE SAMPLING DIFFICULT

Few of the mills in the district place any dependence in the sampling of mill feed or tailings nor does it appeal to me as being of any practical value when done in the desultory and unmethodical way sometimes practiced. Without automatic and continuous sampling and the averages of numbers of analyses, such results are more apt to be misleading than otherwise. If anyone is not convinced of this let him divide such samples into two or three parts for a few times and note the differences in the results reported on parts of the same sample sent to different analysts. Even with automatic and continuous sampling of the mill feed and the tailings, which would be expensive; and with reliable analyses, which are hard to secure on low-grade feed or tailings, the results would only show the percentage of saving, without showing where the principal losses were, or the difficulties of overcoming them. I am thoroughly convinced that careful and unabating visual inspection of the various waste products of the mill with occasional sizing tests and analyses of the same, will do much more to improve the milling practice than the most careful sampling and analyzing of the mill heads and tailings alone would without such inspection. Of course this statement would not be true except for such ores as show the metals in a distinctly visible and readily recognized form.

The opinions of operators differ regarding the relative situation of tailings piles and mill settling ponds. A few prefer to turn the tailings to the lowest ground adjacent to the mill in order to permit of a larger pile, trusting to the mine water, natural drainage, or an auxiliary pump to supply the mill pond, which must in that case be situated on higher ground. The majority, however, prefer to place the ponds on the lowest ground from which the mill pump can readily draw its water, and to turn the tailings to the higher ground so that the ponds may catch the water with the least loss by evaporation or leakage. Natural drainage conditions and the amount of mine water, are variable and uncertain quantities and the amount of leakage and evaporation incurred by using an auxiliary pump is surprisingly large, so that it seems self evident that the lowest ground should be kept clear for settling ponds.

SORTING COSTS 2c. PER TON

The cost of "culling out" the waste rock is about 2c. per ton of dirt, most of which is for labor, and as only 5 to

10% of the material is removed as waste there is some question as to whether it would not be advisable to install a crusher large enough to handle the largest pieces of rock from the mine, thereby dispensing with the culling entirely. It must be borne in mind, however, that when culling is practiced, the mill capacity is increased by the amount removed in this manner, also that the passage of this extra material through the mill would increase the losses. Another method which suggests itself, especially on sheet-ground ores, which are clean and not disseminated, is to crush every thing to about 3 in., and handpick the oversize from about 1½-in. screen. This would create quite an expense for picking and disposing of the waste which might or might not be offset by the saving effected in milling a considerably decreased tonnage and in the resulting betterment of the mill saving. I think this experiment would certainly be worth trying at some plant which was suffering from lack of milling capacity, although I believe ordinary conditions would show no economy.

CALLOW TANKS FOR SETTLING

For settling facilities I think the best arrangement would be to run the fine sand including the finest part of the re-ground chats, to one or two good-sized Callow tanks, with just enough clear water added to the spigot to overflow the slimes, classify the spigot product of these for the tables and run the overflow from the Callow tanks, together with any other mill water containing slime, to an intermittent settling tank such as heretofore described. The settlings from this tank should be pumped or elevated without further classifying to one or more tables for treatment.

I would prefer one or two large cone tanks to the intermittent tank, were it not for the lack of elevation at practically all of the mills, and the consequent impracticability of installing a cone tank of the requisite size and depth without pumping the feed up to it. It might be suggested here that six or eight smaller cone tanks be used in lieu of the larger ones, because they would not require so much height. I think, however, that the intermittent tank would be preferable as the table feed would have to be drawn from six or eight spigots with the cone tanks and would be too dilute. The use of goosenecks to thicken the pulp has never in my experience proved satisfactory on account of frequent choke-ups.

GERMAN SIZING METHODS TRIED

The German sizing system of milling, although tried in a number of instances, has met with little success in the district. In most cases its failure was not due to the system but to the unsuitability

of the equipment utilized and to poor arrangement of the same. For instance, rigid rolls have been used for grinding the oversize from the head trommel. These proved to be unsatisfactory on account of the lack of a uniform rate of feed which caused them to choke down frequently. Small Harz jigs, which without doubt would be suitable for handling small tonnages of certain classes of comparatively rich ore, have been used with poor results on account of their small capacity and lack of flexibility. Complicated screen sizing and classifying has been attempted and has failed because the increased cost of attendance and operation has exceeded the value of any possible increase in saving that could be hoped for. The only two sizing plants that I know of which have met with any considerable measure of success have stuck religiously to the type of machinery and equipment in common use in the district. Even these were not an unqualified success as they lacked the flexibility and ability to handle irregular tonnages of dirt from the mine as readily as the ordinary type, and therefore increased the cost of mining by delaying its operations unduly at times.

Flow sheets of the Grace mill of the Grace Zinc Co. made in 1908, of the Litteral mill of the Continental Zinc Co. made in August, 1910 and of the Samson mill of the Samson Mining Co. made in November, 1911 are shown herewith as illustrations of types of mills used in the district. Some changes have been made in some of these plants since that time and the flow sheets are not exactly representative of the present practice but will serve to show types of mills used here.

(To be concluded)

Hedley Gold Mining Co.

The report of the Hedley Gold Mining Co. operating at Hedley, B. C., for the year, 1911, shows a net profit for the year of \$318,152, out of which \$300,000 or 25% was paid in dividends, leaving a net undivided profit account of \$200,961. All expenditures of every kind during 1911 were charged to operating expenses.

The mill was operated continuously and 57,815 tons of ore treated, of an average value of \$11.99 per ton, from which an extraction of 94% was made. A reserve of about 10,000 tons of broken ore in the stopes has been maintained throughout the year. It is also stated that there is now a tonnage of ore in sight equal to the ore reserve at the time the property was purchased. During the year, 1315 ft. of development work was done and 3160 ft. of diamond drilling.

A Method of Showing Ore Reserves

The work of a consulting engineer or manager, when controlling mining operations, requires that he have all the information concerning the mine is as concise a form as possible, and as the ore reserves and their depletion and enlargement are the vital points to be studied, it is well to have them kept up to date and in some convenient form.

This article describes a method that I have adopted, which shows in a clear manner the ore reserves in a mine. The case illustrated is that of a vein near enough to the vertical for the vertical elevation of the mine to be the main working map. A flat orebody would be represented on a similar plat, but instead of the horizontal thickness of the vein being shown in the circles, the vertical thickness would be inserted.

DIAGRAMS SHOW DEVELOPMENT

An ideal longitudinal elevation of a mine, plotted in the ordinary way, using 100-ft. blocks and section-lines, is represented by Fig. 1. In a mine where the block-numbers are posted by the engineer underground, the system of keeping the ore tonnages extracted from the different blocks is easily maintained, and the actual tonnages of ore extracted can be kept so that the surveyor can have a check on his estimate from time to time.

The ore-reserve sheet, Fig. 2, should be the same size as the map it is to accompany. Each square is used for the description of the ore reserve in the block it corresponds to on the elevation. Where the section lines cross the levels, a circle is drawn, in which are written the widths of ore at that point, these widths being used in the calculations of each block cornering in the circle. It has been found convenient to show the figures in black in the lower half of the circle when the actual widths of ore are known, and, when it is necessary to make up the figures of probable ore, as at the time of making annual or semi-annual reports, red figures are written in the upper half of the circle to represent the probable thickness of the ore; and later on, when the development warrants it, the black figures are inserted underneath. The same color scheme may be used for ore actually developed and probable ore, red figures representing the probable ore being first inserted in the column headed "Developed," and when the ore is developed the black figures should be inserted in the time space when the development is completed.

There should be an ore-reserve sheet for each year, and the space between the levels divided into four spaces if quarterly estimates are made, as shown on the 130-ft. level, or into 12 spaces if the figures are worked up monthly, as shown

By N. H. Emmons, 2d*

Ore reserve statements kept on modified mine plans show at a glance the progress of development and rate of removal of ore by stoping, forming an index to the condition of the mine of value to manager and owner.

*Mining engineer, Knoxville, Tenn.

Note—From an advance proof of a paper read at the New York meeting of the American Institute of Mining Engineers, Feb., 1912.

ried a little further by using squares instead of circles at the corners, in which the widths and values are written, and making a circle in the center of each large block in which to insert the average value of the block of ore.

RECOVERY OF ORE INDICATED

As it is always well to have the figuring in some permanent form, so that it can be readily checked, a sheet, as shown in the accompanying table, should be kept for each level, showing clearly how the tonnages were calculated.

If the ore-reserve sheet is posted monthly, a great deal of information can

LONGITUDINAL ELEVATION — MINE

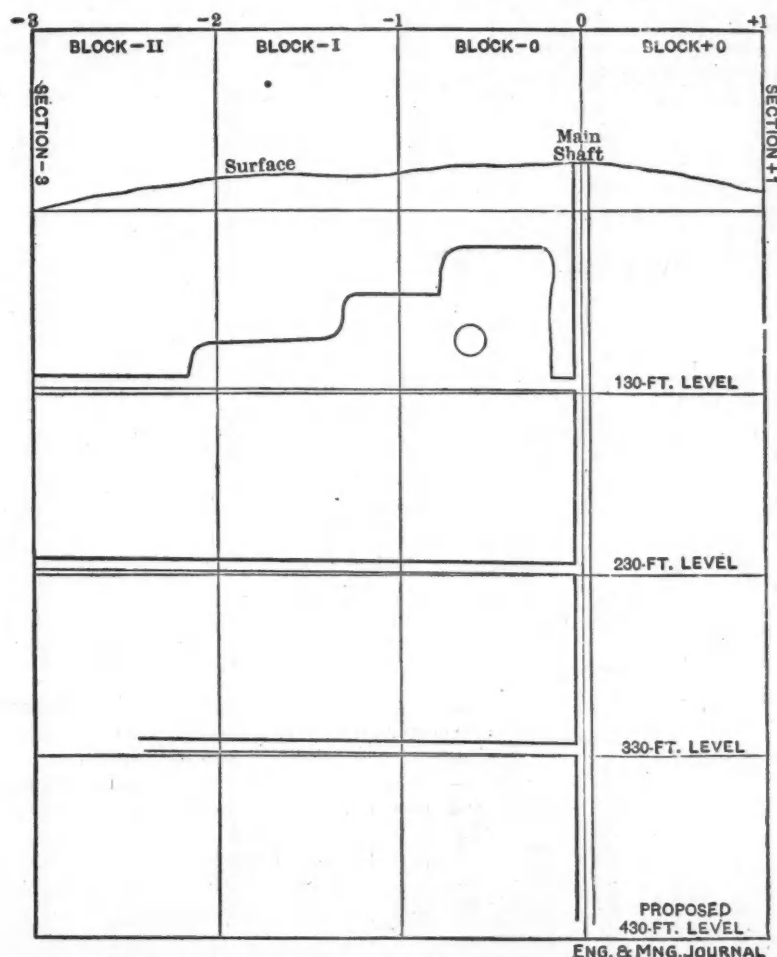


FIG. 1.—IDEAL LONGITUDINAL ELEVATION OF A MINE.

on the 230-ft. level. Then there should be a sheet kept to enter the ore developed and extracted each year, 10 spaces being a convenient number, thereby covering 10 years, so that the record of the development and extraction by years can be seen at a glance.

In mines where the value of the ore is kept it is convenient to insert in one lower quarter of the circles the width of the ore, and in the second lower quarter the value of the ore. The idea can be car-

ried a little further by using squares instead of circles at the corners, in which the widths and values are written, and making a circle in the center of each large block in which to insert the average value of the block of ore.

be gleaned, a splendid record of operations is obtained, and the work for the future is planned to the best advantage. Another important point is that the percentage of ore recovered, when a stope or block is worked out, can be readily seen, and estimates of the available ore in other blocks can be made with greater accuracy. Each problem may require a different form of reserve sheet, and the sheet can be varied to suit any mine map.

One of the main advantages of the sheet is that it will teach the mining engineer to make careful estimates of ore reserves, and not, as in many cases is done now, allow the mine foreman to say that there are so many tons in such and such a stope that will require so many months to take out.

The development of the mine is so clearly shown, if the sheet is kept prop-

erly posted, that the management can tell at any time whether the development is running behind the extraction, or just what is going on. There is no reason why a mine should not have its ore-reserve book balanced every month in as careful a manner as are the accounts, if such a system as the above is kept, and at the end of the year it will save many disappointments at the small amount of new

ore developed if the question has been kept continually before those in charge.

CALCULATIONS PRESERVED

Another point that is so often handled in a dilatory way at mines is the method used for figuring an estimate, and the keeping of this information regarding widths of ores, values of ore, and estimates of orebodies on various slips of paper or in numerous note-books. If the reserve sheet is being kept, there will be definite methods and exact figures needed at least once a month or a quarter, and as these figures are obtained if there is a place to put them, they will be entered on the final sheet as soon as obtained.

Take, for instance, a drift in ore of varying width and assay. If the method of estimating ore in use at the mine is to sample and assay every 10 ft., then the average width and assay of the 50 ft. on each side of the circle or corner is made up and inserted in the circle, the amount of ore in the four blocks contiguous to the circle worked out, and posted in the month when the actual figures are made up.

If ore reserves are classified, then a separate sheet should be used for each class of ore. Many mines produce smelting-ore and concentrating- or milling-ore from the same block. A smelting-ore sheet should be kept and the width of this class of ore alone be entered on one sheet, and that of the concentrating-ore on another.

Another far reaching point in favor of such a record is that it can be seen at a glance if the high-grade stopes are being pushed too rapidly and the low-grade being neglected.

It is the custom of many companies to have maps of the mines sent in with annual reports, with the intention of keeping the directors posted regarding the development of their property. How much better would it be to send in an ore-reserve sheet as outlined above, that would convey the exact information about what was actually being done at the property, and be easily understood.

ORE RESERVE SHEET _____ MINE
1912

SECTION-3	BLOCK-II		BLOCK-I		BLOCK-0		SECTION-1	BLOCK+0	SECTION-4		
	Developed	Extracted	Developed	Extracted	Developed	Extracted					
5	8208	1000	10	13050	5000	15	12696	8000	10		
100 Ft.									Brought Forward		
									1st Quarter		
									130-Ft. LEVEL		
									2nd Quarter		
										3rd Quarter	
										4th Quarter	
										Year	
8	8750	400	12	10208	500	14	8541	1050	9		
										Brought Forward	
										230-Ft. LEVEL	
										Year	
9	8333	150	13	9692	500	10	8750	1000	8		
										Brought Forward	
										330-Ft. LEVEL	
										Year	
8			10	8750		14	8333	460	10		
										Brought forward	
										430-Ft. LEVEL	
										Year	
			8			10			6		

FIG. 2.—ORE-RESERVE SHEET TO ACCOMPANY ELEVATION, FIG. 1.

ORE-RESERVE CALCULATION-SHEET _____ MINE
First Level. January 1, 1912.

Block No.	Section No.	Average width of ore at section	Depth of ore, feet	End area or area at section	Average areas	Length of block	Volume cubic feet in each block	Developed ore, tons, 12 cu.ft. = 1 ton	Probable ore, tons, 12 cu.ft. = 1 ton	Remarks
-0	0	$\frac{10+9}{2}$	130	1235	$\frac{3047}{2}$	100	152,350	12,696		All ore developed previous to Jan. 1, 1912.
-I	-1	$\frac{15+14}{2}$	125	1812	$\frac{3132}{2}$	100	156,600	13,050		
-II	-2	$\frac{10+12}{2}$	120	1320	$\frac{1970}{2}$	100	98,500	8,208		
	-3	$\frac{5+8}{2}$	100	650						

Removing Rust from Steel

Iron or steel from which rust is to be removed is made the cathode in a 0.25 to 5% solution of sodium sulphate in water. Carbon plates are used for the anodes. The hydrogen gas evolved at the cathode loosens the rust so that it may be removed entirely. A weak current is used and the article allowed to remain in the solution over night. It is stated (*Chem. Zeit.*, XXXV, 1911) that the removal of rust is so complete and the iron or steel so free from attack that the method may be used for the accurate determination of the rust.

The California Gold Dredge—IV

The early California dredges used a head line to dig on and even after the spud system was introduced it was a mooted question which was the better. The standard California-type dredge uses the spud system exclusively, the head line being abandoned except in a few cases where the nature of the gravel or other conditions are unusual.

STEEL SPUDS BEST

At first, wooden spuds were used, then one wooden and one steel, the wooden spud being used to step up with and the steel one to dig on. Now both spuds are often made of steel. This plan is by far the best, since if one breaks the

By Robert E. Cranston*

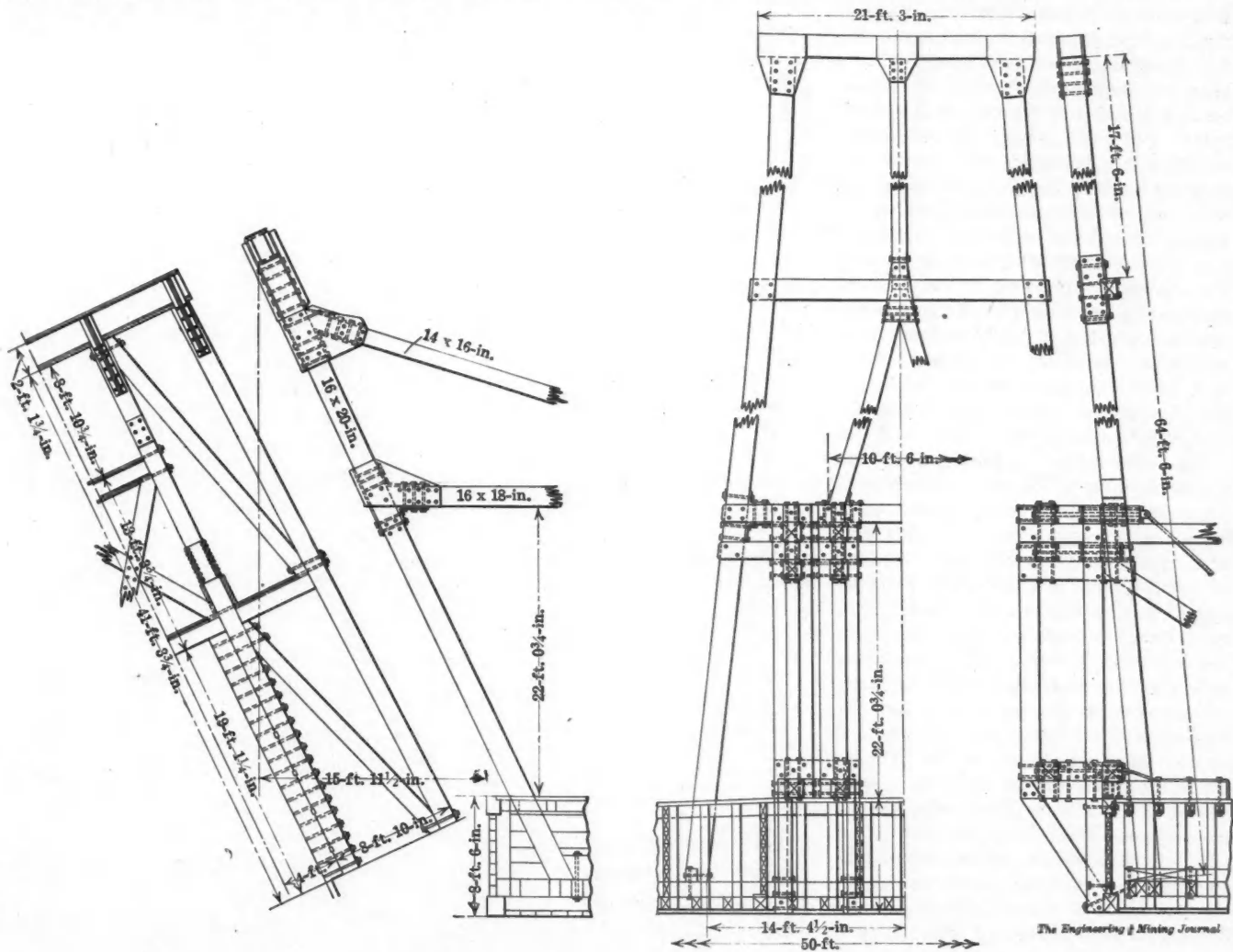
The design of spuds, hull, gantries and housing is considered. Wooden spuds, formerly used exclusively, are being displaced by those made of steel. Hulls are made of Douglas fir. Average construction costs, dimensions and other data are given.

Note—An article entitled "Design and Mechanical Features of the California Gold Dredge," published in Journ. A. S. M. E., February, 1912.

*Mine manager, Ashburton Mining Co., Sacramento, Calif.

to give ample riveting area. The later designs are made longer than the older ones. At the bottom they are acorn-shaped and change gradually from a circular to a rectangular cross-section at the point where they enter the structural portion of the spud, and they often extend 8 or 10 ft. below this point.

Heavy car springs are often used in the spud frames to reduce the shocks of digging and those using them think that they lessen the danger of breaking very much. This is doubtless true, but I am of the opinion that it also reduces the digging capacity of the dredge and that the best remedy for broken spuds is to build them stronger.



BOW AND STERN GANTRIES OF A 9-CU.FT. DREDGE

other may be used to dig on, using the head line to step up with. If only one steel spud is provided and a break occurs, the dredge must be shut down at once and the broken spud taken out, repaired and put in again before any digging can be done. Several forms of spud are used, and their make-up can best be understood by referring to the accom-

panying illustration, which shows views and cross-sections of a common design. An extra cover plate riveted to the tension side of that portion of the spud having the greatest strain adds strength with comparatively little increased weight.

The lower ends of the spuds are protected by cast-steel points, which extend far enough into the structural part

The modern dredges are provided with traveling or boom cranes covering the heavy machinery so that repairs and replacements may be made expeditiously and without calling in more men than the regular dredge crew. A thwartship I-beam with traveler, or a swinging boom covering the forward portion of the dredge and bucket line, is used for chang-

ing buckets. Brackets are riveted to the ladder, into which chains are hooked to hold the bucket line after parting. It is well to have an I-beam or at least an eye or hook well secured above the ladder hoist, main winch, pumps, transformers and screen. Over the bucket line a thwartship traveling crane is most useful. It should be of sufficient capacity to lift the upper tumbler, shaft and gears and should extend far enough so that these parts may be lowered over the side of the dredge. If a hatchway is provided through the upper deck on each side of the bucket drive this crane may also prove useful for handling parts on the lower deck.

HULL OF DOUGLAS FIR

The hull is built of Douglas fir and is proportioned to accommodate properly the machinery which it supports. Before designing the hull the general dimensions and weights of all machinery should be determined and the hull built accordingly. The depth largely depends on the weight to be supported, the beam on the gold-saving area desired, the length and width of well on the dimensions of the digging ladder, and the digging ladder in turn on the depth of gravel to be dug. The distance from well to stern is determined by the length of screen and the general distribution of machinery fore and aft. The hull rides on an even keel when digging at an average depth and should have a free board of not less than one-fourth its total depth.

The cross-section is rectangular, with the deck slightly crowned. Thwartship frames are used, the bottom planking being spiked to the bottom thwartship timbers, the decking to the upper timbers or deck beams, and the side planking bolted to the upright side posts. Besides these, two or more pairs of posts are put in each frame and to these the well planking and bulkheads, or fore-and-aft trusses are bolted. Clamps or fore-and-aft strengthening timbers are bolted inside the frames at the corners where the posts join the deck beams and bottom thwartship timbers. The size of these clamps depends on the size of the hull. Drift bolts are driven in the side planking and bulkheads, each bolt passing through 2½ planks. They may be put in as thickly as desired, and add considerable strength to the planking and bulkheads. Four-inch deck and bottom and 6-in. side planking is commonly used. The stern is often planked with the same size as the sides, put edgewise instead of flat. At the point where the spuds are situated a short bulkhead or extra bracing is often used. Just aft of the well and below the bucket drive, one or more vertical cross trusses are often used, likewise horizontal cross bracing is put in on top of the thwartship frame timbers

GENERAL DATA ON CALIFORNIA GOLD DREDGES.

Name of Maker	Risdon	Bucyrus	Link Belt	Risdon	Marion	Marysville Dredging Co.
Date built	September 1897	1907		1910	1905	1911
Capacity bucket, cu. ft.	3.2	5	5	5.6	7.5	9
Depth to dig below water line, ft.	20	38	35	30	65	65
Depth to dig above water line, ft.	8	10	12	10	10	10
Nature of digging	Loose	Medium hard	Hard	Medium	Medium	Medium
Hull:						
Draft with all machinery	3 ft. 6 in.	5 ft. 9 in.	5 ft. 8 in.	5 ft. 3 in.	6 ft. 6 in.	6 ft. 2 in.
Length, ft.	70	102	106½	88	115	115
Depth, ft.	5	7 ft. 9 in.	7 ft. 10½ in.	7 ft. 6 in.	8	8½
Width, ft.	29	36	40	36	40	50
Overhang on each side, ft.	0	2	0	0	2½	4
Length of well, ft.	42	56 (approx.)	51 ft. 1 in.	48	63	63
Free board, ft.	1½ (approx.)	2 ft. 3 in.	2 ft. 2½ in.	2 ft. 3 in.	1½	2 ft. 4 in.
Side planking, ft.	3	4	4	4	4	6
Bottom planking, ft.	3	4	4	4	4	4
Height of bow gantry above deck, ft.	22	36	34 ft. 6 in.	34	39 ft. 6½ in.	37
Height of stern gantry above deck, ft.	24	50	61 ft. 8 in.	36	58 ft. 9 in.	58
Height of main gantry above deck, ft.	16	23	21 ft. 8 in.	21 ft. 6 in.	20 ft. 2 in.	22
Total amount of lumber in hull, gantries, housing, etc., ft.	75,000	136,000	263,600	156,000	300,000	400,000
Digging ladder:						
Weight, lb.	14,000 (approx.)	48,400 (approx.)	53,575	33,000	79,000	94,400
Distance between centers ft.	40	87	84½	71 ft. 6 in.	114 ft. 1 in.	115
Extension beyond bow, ft.	12 (approx.)	25½	26	18	38	43
Width, ft.	3	4½	5 ft. 8 in.	3 ft. 8 in.	4 ft. 7½ in.	4 ft. 7½ in.
Maximum depth girder, ft.		7	5 ft. 6 in.		8	8
How upper end is supported	Fixed hanger-shaft with telescope bearing	Concentric	Steel pin, 8 in.	Fixed hanger-shaft with telescope bearing	Concentric	Concentric
General design	Plate girder Bucket elevator	Plate girder Belt conveyor	Plate girder Belt conveyor	Plate girder Bucket elevator	Lattice girder Belt conveyor	Lattice girder Belt conveyor
Stacker:						
Length ladder, ft.	42	90	106	72	136	139
Width ladder, ft.	3 ft. 2 in.	4	3 ft. 8½ in.	3 ft. 8 in.	3 ft. 8 in.	4 ft. 4 in.
Depth ladder, in.	15	5	4	15	8	7
Weight ladder, lb.	12,000	18,000	15,000	19,365	22,500	24,000
General design	2 I-beams	Lattice girder	Lattice girder	2 I-beams	Lattice girder	Lattice girder
Width belt, in.	Buckets 15 in. pitch	30	30	Buckets 15 in. pitch	32	32
Speed belt	48 buckets per min.	350 ft. per min.	Variable	54 buckets per min.	350 ft. per min.	400 ft. per min.
Horsepower motor	Driven by main engine	15	20	10	25	35
Maximum height of discharge, ft.	20	30	35	30	50	54
Bucket line:	Open connected	Close connected	Close connected	Open connected	Close connected	Close connected
Number in line	30	82	93	40	93	84
Maximum speed of buckets per min.	16	22	22	14	19	50
Weight bucket complete, base, hood, lip, pin, bushing, lb.	570	1300	1490	1200	2187	2268
Pitch of bucket, in.	24	28½	24½	25	32½	36
Number front eyes	2	2	1	2	3	2
Number back eyes	2	1	2	2	2	1
Length back eye, in.	4	16	19½	6	8½	16½
Width front eye, in.	4	3½	6½	6	3½	4
Diameter pin, in.	1½	4½	4½	2½	4½	5½
Length pin, in.	10½	23½	30½	12½	2 ft. 3¼ in.	24
Ladder roller:						
Number on ladder	6	12	19	10	17	17
Diameter, in.	8	14	12	12	14	14
Diameter shaft in roller, in.	2	3½	3½	3½	4½	5½
Diameter shaft in bearing, in.	2	3½	3½	3½	3½	5
Length shaft in bearing, in.	6	11½	8	8	12	11½
Material used	White iron	High carbon and manganese steel	Semi-steel	Manganese steel	High-carbon steel	Chrome steel
Weight roller and shaft, lb.	280	1030	1008	778	1160	1140
Upper tumbler:						
Diameter shaft in tumbler, in.	8	14	14	11	17	17
Diameter shaft in bearing, in.	8	12	12	11	14	14
Span between bearing	4 ft. 6 in.	6 ft. 6 in.	.....	5 ft. 2 in.	9 ft. 3¼ in.	9 ft. 3¼ in.
Weight complete with shaft and plates, lb.	3010	11,200	10,185	6,200	18,750	21,310
Lower tumbler:						
Diameter shaft in tumbler, in.	6	10½	11½	10	11½	12
Diameter shaft in bearings, in.	6	9	7½	10	10	10

GENERAL DATA ON CALIFORNIA GOLD DREDGES—Continued

Name of Maker	Risdon	Bucyrus	Link Belt	Risdon	Marion	Marysville Dredging Co.
Length of shaft	4 ft. 2 in.	4 ft. 9½ in.	6 ft. 5½ in.	5 ft. 3 in.	4 ft. 11¼ in.	5 ft. 3½ in.
Maximum height side flanges at corners above wearing plates, in.	7½	6½	9½	11	12½	11½
Thickness side flanges at top and bottom, in.	1-2½	1½-3½	2½-3	1½-3½	1-1½	2
Inside flare of side flanges	....	2 in. in 12 in.	Curved	....	¾-in. in 12 in.	Straight
Weight complete with shaft and plates, lb.	4,176	10,000	8,355	7,746	11,340	12,758
Ladder hoist:						
Total weight, lb.	Part of mainwinch	14,800	20,000	5,660	....	39,000
Diameter of drum, in.	18	30	30	18	20	3 ft. 6 in.
Diameter of drum shaft, in.	6½	6½	6½	8	8	9½
Speed of drum, r.p.m.	19.2	9.6	....	....	12.8	7.6
Maximum speed ladder line, ft. per min.	....	....	....	10	67	100
Horsepower required to raise ladder at above speed	....	....	....	35	....	120
Diameter of sheaves, in.	....	30	30	36	30	42
Main winch:						
Total weight, lb.	10,385	23,700	32,500	24,200	....	23,275
Horsepower of motor	12	20	35	25	25	25
Diameter of drums, in.	15	16	18	18 and 24	18	16
Diameter of drum-shaft, in.	3½	4½	4½	5½ and 7	4½	4½
Maximum number r.p.m. drum	....	14	20.5	2	9	16
Minimum number r.p.m. drum	....	2.6	....	....	2.5	4.7
Maximum speed of side swing at end of digging ladder, ft.	....	62	....	....	17.5	38
Minimum speed of side swing at end of digging ladder, ft.	....	11.5	....	....	5	11
Speed of raising spud, ft.	....	10	....	....	4.5	9.5
Horsepower necessary to raise spud at above speed	....	10	....	....	6	15
Bucket drive:						
Horsepower digging motor	50 h.p. steam	100	100	100	150	200
Diameter and face engine pulley, in.	66	96x24	86x21	96	96x24	96x25½
Pitch diameter and face pulley shaft pin	....	10.82x7 in.	11.52x 6½ in.	....	11.936x 8 in.	11.936x 8½ in.
Speed pulley shaft, r.p.m.	....	160	143	156	113	115
Speed intermediate shaft, r.p.m.	....	44	22.5	56	21	21
Pitch diameter and face intermediate shaft gears	....	39.67x7 in.	74.49x6 in.	47½x6 in.	62.87x8 in.	62.87x 10 in.
Pitch diameter and face intermediate shaft pinions	....	13.5x8 in.	14.32x 10 in.	....	20.136x 10 in.	20.136x 10 in.
Speed tumbler shaft, r.p.m.	8	4½	4.5	7	3.1	3
Height tumbler shaft above deck	....	23 ft.	25 ft. 2½ in.	....	22 ft. 5½ in.	24 ft. 6 in.
Pitch diameter and face tumbler shaft gears (bull wheels)	....	119x8 in.	71.62x9 in.	....	143.55x 10 in.	143.55x 10 in.
Weight bull wheels, lb.	2,100	5,500	3,110	3,200	8,985	10,200
Spuds:						
Total weight including castings, lb.	....	20,400	43,800	....	32,000	36,000
Total length, ft.	....	50	58 ft. 10 in.	....	60	61
Width, in.	....	24	26	....	24	24
Depth, in.	....	36	36	....	36	36½
Type of construction	....	Box type	Box girder	....	Center web	Center web
Screen:						
Type	Revolving	Revolving	Shaking	Revolving	Revolving	Revolving
Total length, ft.	20	25½	32	24	30	36 ft. 3 in.
Width or diameter	3 ft. 6 in. diameter	6 ft.	7 ft. 4 in. upper 7 ft. 11 in. lower	4 ft. 6 in. diameter	6 ft. diameter	6 ft. diameter
Size of holes	¾ in. dia.	¾ to 1 in.	¾ in.	¾ in. dia.	¾ to 1 in.	¾ in.
Grade	1½ in. in 12 in.	2 in. in 12 in.	1½ in. in 12 in.	1½ in. in 12 in.	2 in. in 12 in.	2 in. in 12 in.
Horsepower of motor	Driven by main engine	20	20	15	35	50
Number r.p.m. or strokes per min.	12	7	....	9	7	8
Gold-saving tables:						
Total area, sq. ft.	160	800	....	370	1600	2400
Grade	1½ in. in 12 in.	1½ in. in 12 in.	1½ in. in 12 in.	1½ in. in 12 in.	1½ in. in 12 in.	1½ in. in 12 in.
Wood or steel	Steel	Wood	Steel	Steel	Wood	Steel
Width of bays, in.	28	36	30	32	33	36
Dimension of riffles	Cocoa matting and expanded metal	1½x1½ in. wood	1x1x½ in. L.	Cocoa matting and expanded metal	1½x1½x½ in. L.	1½x1½x½ in. L.
High-pressure pump:						
Horsepower of motor	....	15	100	30	50	100
Head, ft.	18	65	70	31	50	68

along the compartments adjacent to the well and extending some distance aft from the well throat.

The bow is made narrower than the rest of the barge, the frames being shortened and the side planking steamed and bent around them. How much this portion of the hull should be narrowed down will depend on the width of cut it is desired to make, together with the distance the digging ladder projects beyond the bow. Using one spud as a center and drawing the outline of the hull, digging ladder and cut to scale, will graphically illustrate how much to bring in the bows so that the dredge may dig its way along any desired width of cut.

STRONGER CONSTRUCTION SOMETIMES USED

The above is a general description of the most common type of hull construction. I have been using what I consider a somewhat stronger construction, but one which is more expensive. Fore-and-aft stringers are laid below the thwartship timbers. The posts are bolted to both the fore-and-aft and the thwartship timbers, the bottom planking being laid athwartships. Clamps are used above the thwartship timbers the same as in the other form of construction, the difference being that there is an extra set of fore-and-aft timbers, to which the bottom planking is spiked, this planking running athwartships instead of fore and aft. This construction requires more lumber and labor, but is stronger, and by using thwartship planking full lengths can be used, doing away with all butt joints. The tendency of dredge hulls is to sag along the fore-and-aft center line. Where fore-and-aft planking is used this movement of the hull tends to open up the seams, but where thwartship planking is used the strain is lengthways of the planking. When a hull is new these weaknesses do not show, but after years of service all such little things count, and since the life of a hull determines the life of a dredge, it pays in the long run to use every precaution possible to add to the stability and length of life of the hull. Solid fore-and-aft bulkheads are recommended, also the use of well plates made up of 6x14-in. planking (for the 7- to 9-cu.ft. dredge), laid horizontally below the deck beams and filling the roof of the first compartment on each side of the well for 30 ft. each way fore and aft from the throat of the well. These well plates are particularly useful in dredges having long well holes.

Another plan which will add strength at small cost is to put in diagonal wooden braces from the fore-and-aft timbers near the bottom of the intermediate bulkhead to the clamp near the top of the well hole. This will aid materially in preventing sag toward the well hole.

Still another form of strengthening construction being used, particularly on the larger boats, is an overhead thwartship truss with heavy hog rods running diagonally from the upper chord near the sides of the dredge to the bottom of the hull at the well, thus preventing sag at this point.

The bottom, sides, bow, stern and deck are all calked with oakum and the seams pitched or similarly treated. The inside is treated with carbolinum, Stockholm tar, painted or left without any treatment whatever. On the outside below the water line the planking may be painted or not as desired. Above the water line all timber work is thoroughly painted. Before putting timbers together all joints are painted with white lead, mineral paint, or coated with tar or carbolinum.

The deck beams are extended beyond the sides of the barge at the after portion of the dredge. Braces are put under these in order to support the housing uprights. This gives extra room for gold-saving area or passageways. Hatchways are provided for entrance into each compartment, also a system of ventilation should be installed, using either mechanically driven fans or natural ventilation induced by cowled ventilators. Proper ventilation will do much towards prolonging the life of the hull. Sea cocks are often installed in order to sink the dredge in case of a fire which has gone beyond hope of being extinguished. If sea cocks are used they should be placed near the bows where a hot fire in the housing will not prevent their being approached and quickly opened.

MAIN TRUSS AND GANTRIES

A large proportion of the California dredges have a truss along the sides of the well and extending from bow to stern gantry, with wooden chords, posts and braces and steel hog rods. This truss is made 15 to 25 ft. high, the upper chord often being used to support the upper-tumbler bearings and the upper end of the digging ladder. In the earlier dredges there was a tendency for the hulls to go down at bow and stern and hump up near the throat of the well. This truss assists in preventing this condition, strengthens all the gentries and spud frame, and makes an excellent support for the housing, screens, etc. It should be designed as a truss supported at the middle with weights suspended at each end.

At the bow is a gantry which supports the forward end of the digging ladder, the details varying in the different dredges. A steel cap of box or double I-beam section on four posts is a common type. In some dredges the four posts are parallel; others have two posts parallel to the well sides and two slop-

GENERAL DATA ON CALIFORNIA GOLD DREDGES—Continued

Name of Maker	Risdon	Bucyrus	Link Belt	Risdon	Marion	Marysville Dredging Co.
Quantity of water, gal. per min.	3000	500	2800	2400	....	3200
Size suction pipe, in.	....	4	12	14	10	12
Size discharge pipe, in.	....	....	10	9	8	10
Make of pump	Risdon	Yuba Con. Co.	Worthington	Risdon	Worthington	Abner Doble
Low-pressure pump:						
Horsepower of motor	No low-pressure pump	50	No low-pressure pump	....	25	35
Head, ft.	....	60	....	18.6	25	25
Quantity of water, gal. per min.	....	2000	....	2200	....	3800
Size suction pipe, in.	....	8	....	....	10	12
Size discharge pipe, in.	....	....	....	9	8	12
Make of pump	....	Yuba Con. Co.	....	Risdon	Worthington	Abner Doble
Fire pump:						
Horsepower of motor	....	Use high pressure	5	5	10	10
Head, ft.	....	....	65	40	90	100
Quantity of water, gal. per min.	....	....	150	....	....	....
Size suction pipe, in.	....	....	3	3	4	2½
Size discharge pipe, in.	....	....	2½	2½	3	2
Make of pump	....	....	Worthington	Krogh	Worthington	Abner Doble
Lines:						
Size ladder hoist, in.	½ in.—	¾ to 1	1	¾ in. diameter	1	1½
Size stacker hoist, in.	....	....	3	1½ in. diameter	....	....
Size spud hoist, in.	....	....	1 to 1½	¾ and 1	1 and 1½	....
Size swinging lines, in.	¾-in. rope 300 ft.	¾ to 1	1 to 1½	¾ and 1	1 and 1½	1
Total weight machinery, tons	90	260	305	220	300	400

ing inward joining the first at the cap. Still others have the four posts parallel for half their length, the two outside ones being cut at this point, and from here diagonal braces run to the intersection of cap and inside posts. The whole gantry is inclined forward in order that it may have a more direct pull on the digging ladder. In a good many of the California dredges the gantry posts go through the deck and are stepped on heavy foundation timbers or castings near the bottom of the hull. A few dredges have rigid foundations for these posts on the deck, and at least one uses a socket casting into which the posts fit loosely.

This gantry has thwartship bracing and is guyed by ropes or tie rods to the main gantry, hull timbers or both. The top chord of the main truss runs to the middle portion of this gantry and is fastened to it by means of steel plates. It is also customary to run a brace diagonally from near the cap to the top of the first truss post. Some form of pin and plate clamp is provided for the bow-gantry cap, to which is attached the ladder hoist blocks and gantry guys.

The main gantry is a support for the bucket drive and the after end of the digging ladder. It has a very severe duty to perform and should be built in a most substantial manner. I prefer to place a post under each bearing and use heavy lattice bracing between the posts. Too many plates should not be used to tie the timbers together, and arrange matters if possible so that all bolts will be accessible. Where many plates are used it is extremely difficult to assemble the parts and in case of repairs the delay is great in taking apart and re-assembling,

owing to the difficulty of lining up the holes in the different plates.

The stern gantry supports the spuds and the stack ladder and must be made high enough to raise the spuds so that they will nearly clear the bottom of the hull. It is inclined slightly aft so that the spud hoist blocks will be vertically above the center of the spuds. The design is simple, two, three or four posts being used with a wooden or steel cap. Clamps are used for the spud hoist blocks, ladder support and guy ropes. The posts may rest on foundation timbers or castings situated near the bottom of the hull or on the deck.

SPUD HOUSING

At the stern of the dredge the two spuds are inclosed in a housing which allows them to slide up and down but holds them in a vertical position. At some point above the deck, usually at the elevation of the upper chord of the main truss, heavy timbers are framed around the spud, with tie-rod connections to the hull or main gantry. This framing together with the tie-rod connections resists the tendency of the upper part of the spud to move backward as the buckets engage the gravel and thrust the hull toward the rear. This clamp must be made strong enough to withstand the full digging power of the dredge, increased to some extent by the slight fore-and-aft movement of the hull and the consequent momentum of the full weight of hull and machinery. I do not approve of running the tie rods to the main gantry, since no matter how strong this part is made the constant pulling and jerking on one side will tend after a time to throw the bucket-line shafting out of line.

The guy rods should be run into the hold or to some other part which does not support shafting.

Many different spud-housing designs are used, but the present tendency seems to be to use heavy castings covering a large area of the stern to resist the forward pressure of the spud and a structural or cast-steel clamp 20 ft. or so above the deck. In order to keep the spud from moving backward heavy steel keepers are used which can quickly be removed when it is necessary to change spuds. The timber construction will work well enough, but it is likely to get loose in time, and it is difficult to design a wooden structure so that it will be at the same time strong and easily removable. Whatever form of spud housing is used it should be so inclosed that small rocks can not lodge where they will be caught between the spud and its guide.

HOUSING OF DREDGE

The after portion of the dredge is housed in, this housing covering the gold-saving tables, pumps, main winch, ladder hoist and transformers. The after central portion is extended up and covers the screen and screen drive. A covering should also be provided for the bucket drive, but this is not essential. The roof of the housing is made with a slight crown or slope to the sides and covered with painted canvas, ship fashion. The roof joists should be made heavy enough to support a considerable weight, since in repairing it is often convenient to lay down one of the big gears or the like, and for this reason the flooring should be at least 1 1/4 in. thick, or made of two thicknesses of planking. The stern and sides along the gold-saving tables are not usually boarded up. It is thought that an unobstructed view lessens the danger of amalgam stealing.

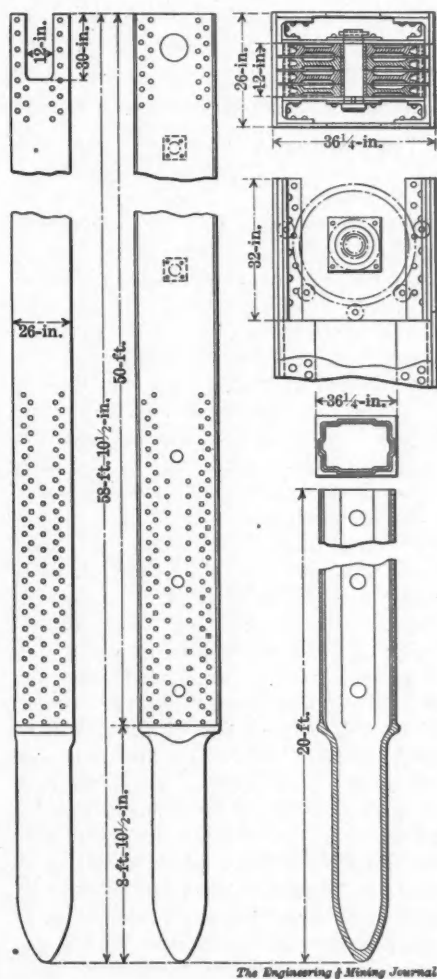
The pilot house from which the digging motor and winches are handled is usually situated on the starboard side of the upper deck above the main winch and a little forward of the bucket drive. This is the common situation, but the pilot house on the central line of the dredge above the bucket line and just forward of the bucket drive seems preferable. The only objection to this situation is that the lever connections to the winches are a little more complicated. This situation gives an excellent view in all directions around the dredge and down the bucket line. By proper arrangement of gratings the main winch may be seen. The bucket drive, stacker and spuds are also within sight of the winchman. In my opinion there is no question as to the proper situation for the pilot house, and all my dredge designs have their pilot houses well up in the center of the boat.

In the tables on pp. 508-510 the more important dimensions and some other data of several California gold dredges built at different times, of different sizes, and for different conditions are given. Most of the data were kindly furnished by the makers, and will serve to give a general idea of typical dimensions. In checking over the figures furnished several discrepancies were noted, but on the whole the figures are no doubt approximately correct.

CONSTRUCTION COSTS

The construction costs vary greatly, of course, according to the quality of workmanship and material desired, facili-

with freight, bolts, nails, hog rods, steel plates, oakum, paint, etc., will make the hull material cost about \$50 per 1000 ft. of lumber used; labor of building costs about \$40 per 1000 ft., giving \$90 per 1000 ft. as a total cost of the completed hull. In addition the direct costs chargeable to hull or machinery, insurance, traveling, superintendence, camp equipment, temporary buildings, shop, derrick, office expense, design, etc., amount to between \$10,000 and \$25,000, depending on whether new designs have to be gotten out, what construction tools and equipment are on hand, the size of the dredge, and situation of the ground on which it is to be built. For a complete dredge, \$180 per ton, on a basis of its displacement, is a fair average.



SPUD FOR 5-CU. FT. DREDGE

ties of the builders in the way of properly equipped shops and foundries, and the geographical situation of the ground on which the dredge is to be built. The following may be considered a fair average of many cost records in California, for rough estimating purposes:

For all the machinery, including motors, pumps, wire rope, electric supplies, etc., 12 1/2 c. per lb., delivered on the ground; for installing, 4 1/2 c.; or a total of 17 c. per lb. for the machinery installed. The lumber costs about \$30 per 1000 ft. at Portland, and this together

Prospecting for Alunite

Owing to the fact that alunite is associated with the rich gold ores of Goldfield, Nev., and owing to the fact that it may have some commercial value of its own, the following suggestions (Bull. 511, U. S. Geol. Survey) as to its occurrence are of interest. Alunite deposits may be formed by the action of descending acid solutions, derived from the oxidation of sulphides, on potassium-aluminum silicate. Several occurrences have been noted where the mineral is thus associated with oxidized ore, usually in or close to feldspathic rock, and a more careful examination of material that has been called kaolin or talc will doubtless show some of it to be alunite.

Or the deposits may be caused by the deposition in veins from ascending thermal solutions. In connection with the alterations which produce alunite there is usually a silicification of the rock which renders it resistant to weathering, so that the outcrops are usually rugged and stand high above the surrounding rock. Pyrite will also be commonly formed in the wall rocks during the alteration, and in places the oxidation of this mineral at the surface will give an iron stain to the outcrop. The alunite in the Marysville, Utah, deposits is closely associated with metallic veins of a type widely distributed through the Western States, while in general the alunite may be expected to occur in districts with metal veins and is believed to be closely related to them in origin. The alunite deposits themselves may not contain any metals of value, as is indicated by the Marysvale deposit and the two chief Colorado deposits. As already mentioned, at Goldfield it is closely associated with workable metallic deposits.

A simple field test for alunite is suggested by W. T. Schaller. Boil the powdered rock with water or with hydrochloric acid for several minutes. After allowing the insoluble residue to settle, pour off the liquid and repeat the oper-

ation to insure the removal of all soluble sulphates. Dry the powder and heat to a dull red. Again boil in water and after settling pour off some of the clear liquid. To this solution add a little of a solution of barium chloride. If the mineral is alunite, a heavy white precipitate will form. One must make sure that the water used in this test does not contain sulphates in solution, so it should be tested with barium chloride and if it gives a marked precipitate, it cannot be used. For this test all that is required that is not included in the ordinary miner's or prospector's outfit is a little barium chloride which can be readily carried in a small bottle. Attention is again called to the fact that the known Marysvale alunite deposits have been taken up by companies or individuals who are not in need of assistance either financial or technical, and that wide advertising for contributions or the attempt to distribute large quantities of stock should in itself be a warning to the prospective investor.

Sealing Off Water in Catskill Aqueduct Shafts

By J. F. SPRINGER*

The construction work on the Catskill aqueduct is of interest to the mining engineer because of the shaft-sinking and tunnel-driving operations. This article describes how some of the problems of sealing water were solved in connection with the sinking of one of the most troublesome of the shafts.

The aqueduct for a distance parallels the Hudson River. The route cuts across tributary streams; creeks, or brooks of no especial importance so far as size goes, but some of the valleys of which are a number of miles in width. One of the largest is the valley of Rondout Creek. In making the crossing at this point the aqueduct drops far below the bottom of the creek and makes a 4½-mile passage from one side to the other. A vertical shaft at each end and a third at an intermediate point will remain permanent features. The contract for sinking these shafts was awarded to the T. A. Gillespie Co., 50 Church St., New York. In addition five other shafts were sunk to the tunnel grade in order to facilitate construction. One of these, construction shaft No. 4, is 500 ft. deep. It is 10x22 ft. in horizontal section, and 18 months were occupied in sinking. It was flooded six times. The strata passed were: Glacial drift, 6 ft.; Helderberg limestone, 226; Binnewater sandstone, 39; High Falls shale, 92; Shawangunk grit, 134; total, 497 feet.

The trouble with the water came from the sandstone and the shale, but the water made its presence felt long before these strata were reached. At the site

of the shaft a 4-in. test hole had been put down. When a depth of about 80 ft. had been reached, a sudden inrush occurred through this hole, filling the shaft half full. The emergency pumping plant had not yet been delivered, so the contractors were caught unprepared. However, by the use of an air lift and sinking pumps, the water level was lowered to a point near the bottom. A nipple was driven into the hole and casing attached to it. The purpose was to grout up the hole. In order to carry this out a 1-in. pipe was put down to the level of the Shawangunk grit, that is, to the 363-ft. level. The water was then permitted to return. Pressures were thus equalized and currents prevented. The 1:1 grout was poured down the 1-in. pipe, which was withdrawn as the grout was filled in.

SHAFT FLOODED THROUGH BORE HOLES

The problem of this hole was thus solved, but fears began to be entertained as to whether the ordinary methods of shaft sinking would prove successful. It was understood that there was a large quantity of water under pressure. A special pumping chamber in the side of the shaft should have been provided before sinking below the limestone. This arrangement was made later, but the delay was the source of much trouble. However, excavation went on, and the sandstone was penetrated. At the 260-ft. level, the quantity of incoming water was only about 225 gal. per min. During the drilling of the sump, an additional 600 gal. per min. came in suddenly through one of the drill holes, with the result that the shaft was flooded again. After some trouble the shaft was unwatered, only to be flooded three additional times in as many weeks. Almost all of this water came in through bore holes, none of which was probably over two inches in diameter. When the fifth unwatering had been completed, the conditions below were known to forbid further progress without taking special precautions. In fact, it had been ascertained that there were large crevices a short distance beneath the bottom of the excavation. One of the largest of these crevices was only a foot and a half distant. The size of the crevices ran up to eight inches. As compared with the 2-in. bore holes, they promised plenty of trouble.

It was proposed to deal with the water question by means of grout. Four special machines were set up at the mouth of the shaft. A 2½-in. pipe led down the shaft to the bottom, where a 2-in. hose carried the grout to the point where it was to be used. At the beginning of operations, the grout gave trouble by leaking back. It would come in through the spaces around the pipes and through cracks in the bottom. This difficulty was successfully overcome by mixing finely ground horse manure with the grout. In

this procedure a total of 2900 bags of portland cement was consumed. When the grout had hardened in the crevices a few more holes were drilled. Water under a pressure of 65 lb. was found 14 ft. below. These holes were soon grouted up, only 60 bags of cement being required.

WATER-BEARING STRATA GROUTED

But sinking was not at once resumed. It was deemed advisable to deal further with the question of the water. The grit was then about 100 ft. farther down. It was proposed to grout up the intervening water-bearing strata with more grout. Accordingly, six diamond-drill holes were put down to the grit. Half were of the size corresponding to a 1-in. core; and half to a 2-in. core. With a pressure of 275 lb. per sq.in., these holes were grouted with 175 bags of cement. It was not known whether this small quantity of cement meant that the problem was a small one or whether it had been only partially solved. It would seem that the thorough application of the method of grouting ahead of the excavation should have been employed sooner; that is, before the water-bearing strata had been penetrated.

Sinking was then resumed and continued until a depth of 320 ft. was reached. A pair of collecting-rings had been arranged, and many sinking pumps installed in the shaft. The working space was much confined. Besides, it was difficult to secure easy, certain and adequate pumping capacity by the use of sinking pumps alone. It was determined to construct a pumping chamber to one side at the 309-ft. level. This chamber was quite large, 10 ft. high, 17 ft. wide and 24 ft. long. Beneath its floor a sump 5½ ft. deep and 16x22 ft. in area was cut out. It had a capacity of 14,500 gallons.

In the special chamber were installed three Cameron horizontal condensing pumps furnished by the Cameron Pump Works, of New York. All these were of the 24x10x20-in. size and had a combined capacity of 1050 gal. per min. They were run by steam supplied by three 100-hp. boilers set up at the collar of the shaft. As the pumps were of the condensing type, this whole arrangement was a possible one. Before the installation of this powerful pumping plant, the sixth flooding of the shaft took place. Subsequently no especial difficulty was encountered from the water. More grouting was done, but none of the seams required more than 100 bags of cement, with one exception. When the grit was reached, a hole gave trouble and required 348 bags of cement. The quantity of water pumped from this one shaft was equivalent to 86,181,000,000 foot-gallons. The total quantity of portland cement consumed in the grouting operations was 971 barrels.

*608 West One Hundred and Fortieth St., New York.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Absorption of Gold by Retorts

The absorption of gold by cast-iron retorts and amalgam trays has been investigated by G. H. Stanley, and M. P. Murray (*Journ. Chem. Met. and Min. Soc. of South Africa*, Dec., 1911). A section of a cast-iron retort, which had been used probably from one to two years, was taken. The scrapings from the inside surface showed 79.0643% of gold and silver. A slice 1/16 inch from below these scrapings showed 30.696% gold and silver. A slice 1/8 inch thick below this showed 6.388% gold and silver; the next 1/4 inch, 0.016%; the next 1/2 inch, 0.0013%, and a section below this—nothing.

In this case there is evidently a considerable penetration of gold to a depth of over 3/16 inches. While it is not claimed that the piece examined is representative of the whole retort, it shows the presence of a valuable quantity of gold which could not be removed by mere scaling or chipping of the interior. It is believed that the graphite in the original retort iron is oxidized, which leaves minute cracks down which the gold penetrates. Although no gold was found in some of the interior sections, a section from the outer surface, after the utmost pains were taken to prevent salting, showed 0.001% of gold, which leads to the belief that it may permeate the entire interior of the retort.

Strength of Rolled Zinc

When it was proposed recently that zinc be used for the hangers of electric cables the fact was brought out that data on the strength of American zinc were lacking, and tests were made by the Materials Testing Laboratory of the University of Illinois on this subject. Thin zinc plates were found to have an ultimate tensile strength of about 24,000 lb. per sq.in. The modulus of elasticity was found to average 11,500,000 lb. per sq.in. Under the action of punches and shearing tools, zinc plates developed about 40% of the shearing resistance of mild steel and required the expenditure of about 30% of the energy required for plates of mild steel of the same thickness. No clearly defined elastic limit or yield point was found for cast or for rolled zinc. Zinc plate was found to break under pull with much less stretching than steel, but a zinc cylinder could be flattened without cracking. The result of tests of American zinc showed

that its strength does not differ from that shown by European laboratories for foreign spelter. The results of these tests are published in Bull. 62 of the Engineering Experiment Station of the University of Illinois.

Effect on Steel of Oxyacetylene Cutting

In an Austrian contemporary the results of tests made to determine the effect on the metal near the cut made by oxyacetylene blowpipe are given.

Tests were made with two mild steels, a nickel steel, and a chrome-nickel steel, the latter being of the armor-plate variety, and tested in the hardened condition. Test pieces were cut out by the ordinary method and by the oxyacetylene blowpipe, and tensile tests made. It was found that in the case of the mild steels and of the nickel steel no change in the quality of the metal had occurred, but in the case of the hardened chrome-nickel steel the material had been considerably softened, the effect being greatest nearest the cut, and gradually diminishing as the test piece was farther away from the cut; the effect was noticeable even at 1 1/2 in. from the cut.

A confirmation of this result was obtained by firing 38-caliber hardened-steel projectiles at a plate, the edge of which had been cut by the oxyacetylene blowpipe, and noting the depth of penetration at different distances from the edge. At 1/10 in. from the edge the penetration was 0.005 in.; at 1/3 in. the penetration was reduced to 0.003 in., and at 1 3/10 in., 0.001 in., which was also the depth of penetration over the remainder of the plate. A chemical analysis disclosed no changes, but micrograph sections plainly showed the softening of the steel.

Ankylostomiasis at Linares, Spain

There are about 200 lead mines in the district of Linares, Spain, but owing to the depressed condition of the lead industry, only about 35 of these are at work, and in 20 of them ankylostomiasis is prevalent, says *Revista Minera*. The number of persons employed underground is about 2500 to 3000 and of these it is estimated that about 10 per cent. are affected. Conditions are favorable for the propagation of the parasite, as the lodes worked are in wet granite, and most of the work is being done at a depth

of about 1500 ft., the temperature varying between 80 and 86° F. All the usual symptoms of the disease are noted among the miners, and newcomers to the mines have been found to succumb to the disease within 12 months. It is stated that up to the present no sanitary precautions have been taken either to alleviate the infection or to provide against it, but *Echo des Mines*, Feb. 15, 1912, says that the Spanish government is about to take up the matter.

Fertility of Dredged Ground

That ground which has been worked over by gold dredges can be used for orchards has been known for some time. The *Australian Mining Standard* (Jan. 11, 1912) is responsible for the statement that this land is equally applicable to raising crops of grass and clover. J. D. Bromley, of Harrierville, Victoria, has been experimenting with a variety of seeds, and, according to his experience, those grasses which give the best returns are paspalum and cow grass, but red clover also gives excellent results. He states that during prolonged droughts crops on these lands which have been worked by a dredge do better than those on the undredged land.

Experiments in Pole Treatment

The San Joaquin Light & Power Corporation, of California, has been conducting experiments lately in the treatment of poles for transmission lines¹. They were yellow pine, thoroughly seasoned, some of them receiving a brush treatment with carbolineum or creosote, the remainder being treated in an open tank with creosote, zinc chloride, or crude oil, the butt only being treated. The penetration with creosote and zinc chloride averaged three inches. The penetration with crude oil about 1 1/2 in. At the end of 27 months untreated check-test poles were completely rotten. Of the poles brush-treated with carbolineum or creosote, the conditions were about the same, 27% of the latter, and 29% of the former showing decay.

Of the open-tank poles, 35% of those treated with crude oil had been slightly attacked. Of the poles treated with zinc chloride, 28% showed decay. The poles treated with creosote in the open tank were all perfectly sound, and showed no

¹Abstract of a paper read before the Wood Preservers' Association, Chicago, Ill.

signs of decay whatever. Fourteen months later, the poles which had a brush treatment only, began to fall. The difference between a creosote-treated pole and one treated with zinc chloride, is only about 75c. in cost, and it has been found that this difference did not pay where any of the poles were set in irrigated land, as the preservative salt was washed out of the poles, and the poles had to be replaced after a service of about two years.

Blasting near Buildings

That it is occasionally necessary to consider the effect of explosives on buildings and structures some distance from the work in hand is remarked in *Engineering Record*, Jan. 27, 1912. It is sometimes found that the shock resulting from a blast may be moderate at points comparatively near the charge and serious at points so far distant as not generally to be considered. This danger to structures some distance away is particularly great when there are long ledges or tongues of rock running out from the point at which blasting is being carried on to the buildings in question. In such cases the disturbance is likely to be concentrated and carried to a long distance in just the same way that the shock of a heavy hammer blow can be transmitted through a long section of iron pipe. In case the jarring of particular buildings gives notices that there is some danger, the use of slow-burning and low-power explosives should be made compulsory. In fact, most of the dangers of blasting come from an indiscriminate use of high explosives which really need to be employed in comparatively few cases.

The Bleeker Process for Vanadium Ores

A process for the production of copper, lead or iron vanadates from vanadiferous ores has been patented by Warren F. Bleeker, of Boulder, Colo. (U. S. pat. 1,015,469). The first steps in the process consist in grinding the material fine, roasting for at least 15 min. at a heat a little above redness, and fluxing with sodium chloride and a fixed alkali, such as potassium or sodium hydroxide, or sodium or potassium carbonate, either during or after the roasting process. This converts the vanadic acid into soluble form.

The fluxed ore is then leached, either with or without agitation, with water, and the solution of alkaline vanadates removed. The residue is then leached with a dilute mineral acid (such as hydrochloric), which leaves the ore practically free from vanadium. It is necessary to produce a neutral solution, which is then done by mixing the aqueous and the acid extracts, although either of these solutions may be taken and neutralized separately.

The final step consists in precipitating the vanadium from the neutral solution by adding a soluble salt of copper, iron or lead. While other insoluble vanadates may also be produced in this way, those mentioned are the most important.

Seeger Cones as Pyrometers

Numerous tests were made on the melting points of Seeger cones with regard chiefly to duration of firing and variety of kilns. (*Sprechsaal*, 1911, pp. 726, 741, abstr. in *Journ. Soc. Chem. Ind.*, Jan. 31, 1912.) These cones have no definite melting-points like metals and most chemical compounds. The chief factor is the duration of firing, which may affect the apparent melting-point by 60°—100° C. Other conditions being similar, a cone will melt at a lower temperature if the firing be prolonged. But, according to the author, cones 012a—1 are an exception; they melt with more difficulty in a slow fire. Cones cannot be regarded as pyrometers for accurate measurement of temperature, but they have the advantage over optical and thermoelectric pyrometers in the burning of pottery that they are affected by the time factor as well as by the actual temperature attained. A cone that has remained unmelted in one fire cannot be reliably used in a subsequent one.

Electric Furnace for Dross Melting

A new form of electric furnace for the melting of drosses, scrap metal and cyanide precipitates is described in the *Brass World*, Jan., 1912. This furnace is the invention of Raymond S. Wile, of the Pittsburg Electric Furnace Co., and is a combination of the arc and resistance furnaces. Four carbon electrodes are used, two passing up through the bottom of the furnace and the other two down through the top. When melting is to be begun, the furnace is partly filled with broken glass and the carbon electrodes arranged so that they touch. After the current is turned on they are drawn apart and an arc is formed, which soon melts the glass in its neighborhood. As the glass melts it becomes a conductor of the electric current, where before melting it was a nonconductor. The electrodes are now drawn further apart so that the current passes through the molten glass and finally the whole charge becomes fluid, the glass being kept liquid by the resistance offered by it to the passage of the current.

When all of the glass is in a molten condition, the metal or dross to be melted is charged directly on top of it. The initial heat of the glass melts the metal, and then, on account of its greater specific gravity and the fluid condition of the glass, it sinks to the bottom of the furnace where it is completely protected

from oxidation. After several months the glass becomes more or less impure and must be tapped off and replaced, but broken bottles form a cheap mixture for refilling it. The furnace is lined with chrome brick, as that is found to be the best resisting material for such work. A furnace with a capacity of 1000 lb. of brass will pour about one ton of metal per hour and, if run continuously, consumes about 68 kw. in doing so. If the current is not run continuously, and electric current costs 2c. per kilowatt-hour, it has been found that the current cost for melting 1000 lb. of brass is about \$1.36. This is somewhat higher than the cost of melting with oil or coke, but the waste in melting is less and is said to more than compensate for the extra power cost.

Bat Guano in Mexico

The exportation of bat guano from Mexico through the port of Nogales during the last three fiscal years ended June 30, was as follows: 1909, 1111 tons; 1910, 2226 tons; 1911, 1893 tons. The guano is found through various caves in the state of Sonora and along the west coast of Mexico, and is gathered into sacks and carried on burros to the nearest railway station, then shipped to fertilizer works in California. (*Daily Cons. and Trade Reports*, Feb. 17, 1912.) The average of the shipments is from 12 to 15% of ammonia. The guano hunter mixes a small portion of the guano with a little unslacked lime and water in a small pan or cup and judges from the ammonia fumes which arise, whether it will pay for the handling.

Effect of Varying Zinc in Brass

Zinc alloys with copper to form brasses in all proportions from 1 to 43%. After the latter figure is passed (*Metal Industry*, Feb., 1912) the alloy becomes hard and no stronger than cast iron, and is useful only in ornaments, having a fine golden color. After the proportion of 66% of copper and 33% of zinc is passed, aluminum should be used in making the casting, for without that as a deoxidizer the alloy will be dirty in appearance and full of blow-holes.

Operating Mines in Turkey

Commercially valuable mineral deposits in Turkey are comparatively few and far between, writes Hugh Whittall in the *Levant Trade Review*. The important mines known and being worked today are the following: Argana copper mine; Sultan Tchair borocite mines; Bahlia lead mine; Thassos calamine mines; Whittall & Abbott emery mines; Karaburnu mercury mines; Heraclea coal mines.

The Determination of Platinum

The usual method of determining platinum is to obtain a silver alloy by the regular fire assay, part in strong sulphuric acid, and weigh the residual metal. Realign this with silver by a second cupellation, part in nitric acid and again weigh. The difference between the two weighings is assumed to be platinum. Frederic P. Dewey, in a paper presented at the New York meeting of the American Institute of Mining Engineers, criticizes this on the ground that other members of the platinum group may also go into solution in nitric acid and be reported as platinum. Moreover, any indirect method is always likely to be indecisive and sometimes erroneous.

Mr. Dewey suggests the following method: In the regular course of assaying for the precious metals, part the silver bead as usual by dissolving in nitric acid. If platinum is present in small amounts only, it will readily go into solution. This dissolved platinum is now collected, together with a certain amount of silver, by an extremely dilute solution of hydrogen sulphide. Dilute one portion of strong hydrogen-sulphide solution with from 10 to 20 parts of water. If the solution of silver nitrate be strongly acid, as it usually is, it should be largely diluted, or, better still, first evaporate to drive off the acid, and then dilute it. The sulphuretted-hydrogen solution should then be added very slowly to the silver-nitrate solution with constant stirring. The silver-nitrate solution is at once darkened, but there should be no immediate separation of a visible precipitate. The solution should be stirred occasionally, and in about 2 hrs. a precipitate should begin to appear. It may be filtered in from 3 to 4 hrs., but it is better to let it stand over night.

The amount of hydrogen sulphide required depends upon the amount of platinum present. If this should be roughly known or suspected, the amount used should generally be enough to precipitate the platinum and from 3 to 5 times as much silver.

On an entirely unknown ore, Dewey suggests using 1 cc. of strong hydrogen-sulphide solution diluted to 15 cc., saving the filtrates from the sulphide for retreatment, if necessary. On an unknown bullion about 2 cc. of strong solution diluted to 30 cc. would be used. However, even if it is known that only minute amounts of platinum are present, it is still necessary to use enough hydrogen sulphide for the silver bead to be large enough to handle comfortably. For this reason it is seldom advisable to use less than 1 cc. of strong solution.

The sulphuretted-hydrogen precipitate should be filtered and washed; the moist

filter is transferred to a small porcelain crucible, dried at a low heat, and gently ignited. The sulphide precipitate is transformed into a metallic sponge, which is then wrapped in a small piece of lead foil and cupelled. The resulting bead is then parted in strong sulphuric acid, when the platinum will be left as a dark residue, generally collected in spongy form, even when minute in quantity. This sponge, after reboiling in fresh acid, if necessary, is washed by decantation, annealed and weighed. If any doubt as to the metal's being platinum it may be dissolved in a drop or two of *aqua regia* and evaporated. The solutions may then be tested with potassium iodide or with ammonium chloride, when the characteristic precipitate will show. As a further test this may be filtered off and ignited to produce spongy platinum. If the amount of the final metal be considerable, the platinum may be determined by the double chloride method. Any decided difference shown would indicate the presence of other members of the platinum group, for which direct tests could then be made in the solution.

It may happen that the final metal shows the yellow color of gold due to the fact that fine float gold passes over in decanting the solution of silver nitrate from the first parting. In such a case the metal must be re-alloyed with silver and the treatment repeated. When the proportion of gold to silver in the metal being parted is so small that the gold separates in a finely divided state it will often save trouble to filter the silver-nitrate solution to separate any float gold before adding the hydrogen sulphide. [It would appear that if the amount of gold were large enough to interfere with the platinum assay, that correction should be made in the original gold assay for it.—EDTCR.]

This method (the partial precipitation of silver-nitrate solution) may also be used for gathering gold where the gold occurs in minute quantities, as in high-grade silver, such as that produced in electrolytic refining. The author also suggests this method as a possible means of determining gold in metallic copper and similar material in which the gold is finely divided.

The Vanadium Industry in France

The factory of Cire les Mello, Department of Oise, France, which has a capacity of about six tons of vanadic acid monthly, has been purchased by the Santa Marta Co., to work under the patents granted to Doctor Berret. The company will make ferrovandium and other alloys, as well as vanadic acid (*Min. Journ.*, Jan. 27, 1912). In a recent consignment delivered to the marine workshops at Ruelle, the quality was so good

that other orders immediately followed, and the output of this works has been adopted as the market standard. The products of the Santa Marta Co. were awarded the Grand Prix at the Turin Exhibition. In the opinion of the *Echo des Mines*, the growing employment of vanadium steel assures the success of this company.

Elkton Consolidated Report

The report of the Elkton Consolidated Mining & Milling Co. for the year ended Dec. 31, 1911, shows that the gross value of the ore mined and shipped was \$340,111; the net profit, \$67,852; dividends paid during year, \$225,000; dividends of \$2,929,460 have been paid to date.

The recession of water in the mine was only about $\frac{3}{4}$ in. per day until an extension of the Roosevelt tunnel resulted in a largely increased flow the latter part of 1911. This additional flow allowed the sinking of the main shaft and the opening up of the tenth level, 50 ft. below the ninth level. Shaft sinking is to be continued and it is expected that a depth 150 ft. below the tenth level will be reached within the next few months. The grade and quantity of ore on the tenth level are reported as being satisfactory.

The grade of ore mined during 1911 was lower than the preceding year by about \$4.50 per ton. This is because the bulk of it was taken from the depleted orebodies above the ninth level. Shipments of lessees' and company ore amounted to 21,026 dry tons of an average value of \$16.28 per ton.

The 12 lessees who worked the outlying blocks of the mine and the dumps paid the company \$6915 in royalties. The leasing of the dumps was discontinued with the view that a greater profit might be obtained should the company build a mill at some future time.

The report contains the following data as to company work and costs:

Hoisted, 29,565 tons; shipped, 16,951 tons; waste sorted, 42 $\frac{2}{3}$ %. Cost of breaking ore and waste for labor and powder was \$1.05 per ton; cost of ore hoisted for underground labor and powder, \$1.36; cost of ore shipped for underground labor and powder, \$2.32; sorting and sampling per ton of ore hoisted, 33.7c.; sorting, sampling and loading per ton of ore shipped, 67c. The cost of sinking an 82-ft. winze was: Labor, \$10.67; powder, \$1.84; total, \$12.51 per ft. The cost of 82 ft. of upraising was: Labor, \$3; powder, \$1.62; total, \$4.62 per ft. The cost of sinking the shaft 55 ft. was: Labor, \$12.46; powder, \$2.92; total, \$15.38 per ft. The cost of drifting on company account was: Labor, \$2.66; powder, \$1.36; total, \$4.02 per ft. The cost of drifting by contract was \$5.97 per foot.

PERSONAL

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

Henry W. Turner has been in New York and has left for London.

Walter G. Perkins, of London, has gone to Argentina in behalf of the Famatina Copper Co.

R. E. Schultz has been inspecting the iron works near Ekaterinburg, in the Ural district of Russia.

R. E. Smith is on his way to Eastern Siberia, to examine mines near the mouth of the Amur River.

Fred B. Reece, of the Gualcala Mines Co., at Tuquerres, Colombia, is returning to the United States.

Ralph W. Perry has returned to Medellin, Colombia, after a visit of several months in New York.

Victor G. Alderson, president of the Colorado School of Mines, spent Feb. 23 and 24 in Telluride and Ouray.

W. B. Shakerford has been elected secretary of the Southwestern Lead & Zinc chapter of the American Mining Congress.

Joseph P. Keene is on his way from San Francisco to Vladivostok and Nikolai-ievsk, Siberia, where he will drill placer ground.

Herman L. Schneider has opened an office for consulting work in mining and metallurgy, at No. 905 East D St., Grant's Pass, Ore.

Edward W. Rabb, of Denver, is now at Magnolia, Boulder County, Colo., conducting a series of mill and cyanide tests at the Cash mine.

H. Kenyon Burch is in Globe, Ariz., preparing preliminary plans and specifications for remodeling the Old Dominion crushing plant and concentrator.

J. R. Painter, general manager of the Salmon River Mining Co., has been spending some time in New York and Philadelphia. He leaves Mar. 10 for Idaho.

Hiram W. Hixon will leave Philadelphia shortly for La Aurora, Tezuitlan, Puebla, Mexico, and will have charge of the smelting works of the Tezuitlan Copper Co., at that place.

Theodore B. Comstock has resigned his position as engineer executive officer of the Board of Public Utilities, of Los Angeles, Calif., and is open for professional engagements.

E. P. Earle, of New York, has resigned as a director of La Rose Mines, Ltd., and La Rose Consolidated Mines Co., in consequence of differences of opinion with a majority of the board.

Dr. George H. Ashley, state geologist of Tennessee, will resign to accept a position with the U. S. Geological Survey

as a member of the land classification board in charge of the coal work.

A. W. Stickney is leaving the U. S. Geological Survey on a furlough for two years. He has accepted the position of geologist for the Kyshtim Mining Co., in the government of Perm, Russia.

E. Mackay Heriot, consulting engineer and general manager of the mining department of Kittel & Co., Ltd., of London, passed through New York this week on his way from Honduras to London.

Smith, Emery & Co., Los Angeles and San Francisco, are installing for custom work a thoroughly equipped ore-testing plant. The machinery is in a separate building in the rear of their main building at Los Angeles.

E. J. Carlyle, who has been in charge of the smelting works of the Kyshtim Copper Co., has returned to America. After a brief vacation at his home in Woodstock, Ont., he intends to go to Arizona to become engaged in smelting construction there.

Charles Kirchhoff, last year president of the American Institute of Mining Engineers, and for many years editor of the *Iron Age*, was married, on Feb. 26, to Miss Erwina Diepenbrock, of New York. Mr. Kirchhoff's many friends extend him sincere congratulations.

F. W. Draper has been appointed consulting engineer for the Verk Isetz Corporation, of Ekaterinburg, Russia, and sailed for Europe Mar. 7. He will have charge of the design and construction of a copper-smelting plant at the Kalata mines, and with the complete reconstruction of the existing plant at the Pushminsky mines.

Charles H. Repath and A. G. McGregor announce that they have formed a partnership for the purpose of conducting an engineering business, making a specialty of the mechanical and electrical engineering of metallurgical and mining plants. Both have been associated with the Amalgamated Copper Co. Their offices are at Douglas, Arizona.

OBITUARY

T. Guilford Smith died at Buffalo, N. Y., Feb. 20, aged 72 years. He was born in Philadelphia, educated as a civil engineer and for a number of years was employed on the Philadelphia & Reading R.R. Later he represented the Philadelphia & Reading Coal & Iron Co., afterward becoming Buffalo representative of the Carnegie Steel Co. and then of the United States Steel Corporation. He was a regent of the University of the State of New York, a member of the American Society of Civil Engineers and the American Institute of Mining Engineers.

Societies and Technical Schools

Colorado School of Mines—The junior class made an inspection trip, Feb. 23, through the Simson mine at Lafayette.

Wisconsin Engineering Society—H. P. Conolly, of Racine, was elected president at the annual meeting held in Madison, Wis. The other officers elected are: Vice-president, Prof. J. G. F. Mack, University of Wisconsin; secretary and treasurer, J. C. White, Madison; trustees, Prof. L. S. Smith, University of Wisconsin, and J. S. McCullough, Madison.

Columbia University—Beginning with September, 1914, the Schools of Mines, Engineering and Chemistry, which comprise the faculty of applied science, will be substantially graduate schools, a baccalaureate degree being required for admission. But students will have the privilege of following a combined collegiate and professional course in engineering, as they now have in law, medicine and teaching. The strictly technical or professional course of study will be three years in length instead of four as at present.

Pacific Association of Consulting Engineers—At its December meeting this association adopted resolutions disapproving of the present practice relating to expert evidence, whereby engineers, acting nominally as advisers of the court, are employed as witnesses and compensated by the respective litigants. A wider order of procedure would extend the usefulness of the engineer to the court in technical questions and further the ends of justice. The president and secretary were directed to bring these resolutions to the notice of the judiciary and bar of California and to the attention of engineers throughout the United States.

American Society for Testing Materials—The fifteenth annual meeting will be held at the Hotel Astor, New York, on Mar. 28 and 29. Two sessions will be held each day and the meetings on Thursday afternoon and Friday morning will be devoted to the discussion of committee reports on standard specifications for coal, coke, steel, wrought iron, cast iron and finished castings. At the opening session on Mar. 28, committee reports will be submitted as follows: "Magnetic Testing of Iron and Steel," "Tempering and Testing of Steel Springs and Standard Specifications for Spring Steel," "Standard Specifications for Cold-Drawn Steel," "Hardness Tests," "Rules Governing the Form, But Not the Substance of Specifications," "Specifications for Hard-Drawn Copper Wire," "Non-Ferrous Metals and Alloys." A committee will also report on the definition of the term "modulus of elasticity" in its application to materials, including nonferrous metals and their combinations.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Feb. 28—Suits were filed at Los Angeles recently by Ralph Arnold against the Buick Oil Co., demanding 750,000 shares of stock or their equivalent. The individual defendants are D. D. Buick, J. M. Herndon, J. B. Lehigh, Stacy C. Lamb, John W. Miner and Fred Van Orman. Arnold alleges that in February, 1910, he was employed by Buick and Herndon as consulting geologist and engineer and that as a result of his examinations and reports the Buick Oil Co. was organized and successfully operated. It is alleged by the complaint that Arnold was to share equally with the others in the results of the venture, but that he had received no compensation. On Jan. 23, 1912, Arnold made formal demand for his proportion of the 3,000,000 shares of stock issued and the demand was rejected. He demands an accounting, and charges Buick with fraudulent acts in the manipulation of the stock issue.

There is a possibility that the present dry weather may continue to the detriment of the mining industry. In the early part of February there were favorable indications for rain at the lower elevations and snow in the higher mountains that would prove sufficient for the ordinary demands of the mines; however, there was only a small precipitation and the fear is now expressed that should there be even a heavy snowfall and rain in March it may come too late to be of great benefit. In the Mother Lode region, the mine operators are still hopeful, but in Nevada County there is considerable alarm expressed by the local press. This alarm is based on the belief that a sufficient snowfall would not remain on the ground long enough to be of permanent benefit. That will depend, of course, upon whether or not there may be a considerable season of cold weather. While March storms are not always dependable, they have in the past frequently given ample supply of water. However, the reservoirs and the streams are in the present season carrying less water than is usual at this time of the year. The shortage of water will not be as detrimental to general operation as in the past, for the reason that many of the mines are now equipped with electric power, and only a small proportion dependent on water for power. If the coming season is a repetition of last year's, the situation may be serious.

Denver

Mar. 1—For the last 10 days the weather has been a succession of blizzards, snowstorms and zero temperature. Trains from the East and the West have been blocked, mails behind time, and a general stagnation of business has prevailed all over the state. The snow in the mining districts of the northern part of the state has become packed by occasional short warm spells, and then frozen so that ore-hauling has been suspended. In many of the mining districts the snow is 10 ft. deep. The barometers, however, have been steadily rising for some time and there is a probability of warmer weather; meanwhile there is an unprecedented dearth of mining news from the high camps.

Cripple Creek, however, which is never much troubled with snow, being sheltered by the Pike's Peak Range, has kept up its average for February with an output of 69,089 tons, worth \$1,144,535. Central City, likewise little troubled by snow, nearly all the mines being reached by rail or tram, shows an increased production, and following thereon, a demand for mills which will result in the starting of several which have been idle for years, and the dropping of more stamps than for a long time past. Such mines as the War Dance are a great incentive to increased activity. This mine has been extensively developed since the War Dance Mining Co. was organized about a year ago, and is said to have made a total production of 1624 tons of ore which gave net returns of \$36,332. Occasionally, however, the ore is extremely rich, carrying from 4 to 40 oz. of gold per ton. Another property, the U. P. R., idle for years but now reopened by leasers, has just sent a gold retort of 109 oz. to a local bank. All of this is stirring up the adventurers and is producing some results.

The search for and production of vanadium ores is largely on the increase in Colorado and in Utah. From Green River, Utah, it is reported that freighters are hauling two wagonloads of 46 sacks each to that town each day from the Cameron vanadium mines, twenty men being employed and the shipments being in charge of Kirk Gregory. O. B. Willmarth, manager of the Colorado Carnotite Co., has started a car of 27½ tons of carnotite to Europe from Placerville station near Telluride. Breckenridge is exceptionally busy and three dredges will resume as soon as the season opens.

Salt Lake City

Feb. 29—The last steps have been taken in the formation of the Michigan-Utah company, the new Alta merger, which takes in the Utah Mines Coalition, City Rocks, Grizzly, Copper Prince, General May and General Monk properties. Copies of the articles of incorporation were filed with the secretary of state, Feb. 27, the originals having been filed at Wilmington, Del. The capitalization is 1,000,000 shares, par value \$2.50. The directors are as follows: Duncan Mac Vichie, president; J. P. Edwards, E. G. Woolley, L. H. Farnsworth, Norman Haire, R. H. Strickland, W. S. Zehring, D. O. Hastings and J. A. Pollock. Development is being carried on through the Lake Solitude tunnel, which cuts the Utah Mines Coalition at depth, and from which there is an opening into the City Rocks. With 600 ft. of work, a crosscut from the tunnel will reach Grizzly ground.

A 10-mile branch road from St. John, on the Salt Lake route, to Ophir, will be built within two months. This will greatly reduce freight rates for the Cliff, Ophir Hills, Lion Hill and other properties of the district, which are hampered by the wagon haul to the railroad.

The International company's new lead smeltery, at Tooele, was placed in commission on Feb. 29. One furnace was blown in and is reported to be operating successfully. Reports state that the United States Smelting, Refining & Mining Co. has purchased the properties of the Castle Valley Coal Co., of Utah, and that arrangements are now being made for railway extensions and development of the property. The coal company in the past has been producing about 500 tons per day, but the deposit is said to be capable of a larger production. It is expected that this will remedy to some extent the past inability of the smelting company to obtain an adequate fuel supply.

Negaunee, Mich.

Mar. 2—In the Lake Superior iron country, where cheap electrical power is being introduced at mines, several companies have purchased electric-driven, direct-connected air compressors. At the North Lake mines of the Cleveland-Cliffs Iron Co., four miles west of Ishpeming, an 1800-cu.ft. compressor has been successfully driven by electricity for several months. The adaption of electricity,

which is best employed for fast-revolving machinery, to the slow-moving compressor, was accomplished without difficulty. The problem of adjustment of compressed air to meet the varying needs of supply, is solved by the "clearance control" device which, as the air pressure in the line rises, automatically opens pockets connected with the cylinders; this has the same effect as lengthening the cylinders, so that air is compressed into the pockets and then released. There are four pockets to be opened, depending upon how much the supply of air needs to be cut down. The amperage drops during the operation so that current is economized. Peak loads result, but the costly motor-generator set is unnecessary. Several new companies in the Iron River district have ordered electric-driven air compressors of the same type; one company purchased a 2500-cu.ft. machine, and another purchased one of 2500-cu.ft. and one of 1000-cu.ft. capacity. Power will be furnished by the Peninsula Power Co., which is completing a water-power installation on the Menominee River, near Iron Mountain.

The new Carp River power plant of the Cleveland-Cliffs Iron Co., situated one mile south of the city of Marquette, is in operation. During flood periods the plant will develop nearly 8000 hp., but during dry periods its capacity may be as low as 3000 horsepower.

Tucson, Ariz.

Feb. 20—One of the problems before the new State of Arizona will be the proper provision for a state geological survey. Heretofore practically all of the public geological work has been done by the federal survey, which conducted the important work in the Bisbee and Globe districts and reconnaissance investigations in Mohave and Yuma Counties and elsewhere. The state university at Tucson, under the inspiration of the late Doctor Blake and with the assistance of Professors Tolman and Guild, has been in close touch with the scientific side of mining and is now, through its free assay department and general activities, a factor of considerable assistance to the mining industry. Recently, Professor Tolman has completed a geological map of Arizona and a general sketch of the geology of the state. This so far has not been published, although it is in the records in manuscript. It is hoped that the new legislature will provide for the publication of this and other data and for the continuation of the work of geological investigation along advanced and practical lines. It is likely that a general report on the state as to its mining and mineral resources will be provided for on the occasion of the San Francisco Exposition, and in this same connection a collection of the economic minerals of the state is proposed.

Porcupine

Feb. 29—The shortage of coal is becoming quite a serious factor both here and in Cobalt. In the latter place particularly, on account of the small amount of wood available, the shortage is causing much inconvenience, and unless the situation is relieved, some of the mines may have to cease operations. The cause of the shortage is principally on account of a blockade of 3000 cars of coal at Niagara Falls, due to the inability of the Canadian railroads to move them. The probability of the strike of coal miners in the United States makes the condition much more serious. In order to relieve the suffering in some of the southern towns, the Canadian coal dealers' association has asked the railroads to give coal the preference over all other freight.

The annual meeting of the Temiskaming company resulted in the election of the old directors, despite the efforts made by the insurgents. The fight was largely over the acquisition of the North Dome property in Porcupine to which the shareholders objected. At the meeting it was brought out, that while a few years ago the directors owned 900,000 shares, their present holdings amount to only 50,000 shares.

Attention has again been drawn to the West Shining Tree district, by the concluding of negotiations, whereby the well known Gosselin claims have been optioned to Duluth men. The deal is of considerable importance to the district, the properties being among the most promising yet found there.

Chairman Englehart, of the Temiskaming & Northern Ontario Ry. Commission, has announced that passenger service to Timmins, the end of the Porcupine branch, will be inaugurated on Mar. 13. A local service between the three towns will also be started soon.

Toronto

Mar. 2—The Dominion Metals, Ltd. company, which has been in business here for about two years, has gone into liquidation and the court has appointed Clarkson & Clarkson interim liquidators. It has a nominal capital of \$500,000, of which \$33,500 were paid up. The assets are estimated at about \$50,000 and the liabilities to the public at \$23,000. It undertook to do a smelting and refining business with a process by which silver, cobalt, nickel and arsenic could be extracted from Cobalt ore by one separation, and for some time was under the management of Prof. Charles G. Richardson, who claimed to have discovered the process. In spite of much experimenting, however, it was not a commercial success, and Prof. Richardson's connection with the company terminated last September. The enterprise was backed by a number of prominent local men, includ-

ing John N. Lake, president; Hon. Thomas Crawford, W. G. Harris, president of the Canada Metal Co., S. F. Whitman and John Lowdon. It is stated that the Metals-Chemical Co., Ltd., a new concern being financed by M. E. and J. W. de Agüero, of New York, has leased the plant of the Dominion Metals Ltd. It is said to be the intention of the new company to install a complete silver refinery, to treat some of the Ontario silver ores. Members of the company are interested in mining in New Ontario.

Sir James Whitney has announced in the legislature, the terms of the boundary settlement between Ontario and Manitoba. Ontario receives a strip of territory, five miles wide and a half mile long, from the present eastern boundary of Manitoba to the Nelson River, from any point Ontario wishes to choose within 50 miles of Hudson's Bay. While neither Fort Nelson nor Fort Churchill have been awarded to Ontario, the province secures running rights over a strip 200 yd. wide through Manitoba's new territory, to connect with the Hudson's Bay Ry. This is to permit the extension of the Temiskaming & Northern Ontario Ry. to the north and to provide an outlet on Hudson's Bay.

Johannesburg

Jan. 25—The Way-Arbuckle process was adopted at the Benoni mines, where crushing was begun in November. Trouble was experienced with the screw elevators designed to remove sand and slime from the dewatering cone. Centrifugal pumps are now being employed for this purpose, and the plant is stated to be working satisfactorily.

The Brakpan mine is one of the deepest of the East Rand basin; work is being done at a depth of about 4000 ft. The vein is nearly flat, dipping at about 10°. The mine is being worked on a modified longwall system, and efforts are being made to control roof pressures by a system of waste packing. Last month 110 stamps and the tube mills crushed 40,090 tons of ore for a recovery of 28s. 3d. per ton at a cost of 18s. 3d. The costs are low, considering the conditions of work.

The output for the Rand for 1911 was 7,896,802 fine oz. of gold, valued at £33,543,479, being an increase over 1910 of £2,839,567. In December, 1911, there were 10,195 stamps at work, and 257 tube mills had been erected. The chief producers were the Randfontein Central, with 775 stamps and 25 tube mills; the Crown Mines, with 620 stamps and 19 tube mills; the East Rand Proprietary Mines, with 820 stamps and 25 tube mills; the Robinson, with 250 stamps and 6 tube mills, and the Rose Deep, with 300 stamps and 7 tube mills. The tons crushed for each mine were, respectively, 208,005, 135,100, 162,876, 48,700 and 61,600 tons.

The Mining News

The Current History of Mining

Arizona

GILA COUNTY

Miami—The concentrator is now in full operation and is handling 3000 tons of ore per day. It is reported to be running satisfactorily and making a recovery of about 75%. While some changes will be made, especially in the crushing machinery, they will be introduced gradually and without interfering with the mill's operation. The mine is easily furnishing all the ore the mill can handle and considerable development work is being done. Assembling of machinery in the power house at the town of Miami continues and should be finished in a few weeks. The ground northeast of the orebody is being explored by churn-drilling, one drill being in use; another may be added later.

Inspiration—Tests on the concentration of the ore are still in progress; they have lasted three months and constitute an elaborate series. Not only are various makes of machinery being tried but also various methods and systems of concentration. Work is progressing satisfactorily on the water-supply dam across Pinal Creek and also on the well on the Inspiration ranch.

Barney—The churn-drill hole is 1070 ft. deep and is in granite-porphry, having passed from dacite into this formation at a depth of 1030 ft. Another drill was started this week at the eastern end of the property near the Live Oak boundary.

South Live Oak—This company will soon incorporate under Arizona laws with a capital of 50,000 shares, par \$10. The plan is to explore with churn drills the Schulze group of claims, lying directly southwest of the Live Oak property and along the southwest boundary of the Southwestern Miami. The officers are George J. Lonstorf, president; Linwood D. McClure, vice-president; Clifford C. Fares, secretary; Simeon A. Dunn, treasurer. The Eastern office is 518-520 Railway Exchange Bldg., Milwaukee, Wisconsin.

PIMA COUNTY

Pioneer Smelting Co.—This company, headquarters Tucson and plant south of Tucson, expects soon to start the 150-ton oil-burning copper smeltery installed about a year ago. The company owns the Gould and Plumed Knight copper properties and will take custom ore. Probably a contract with the Twin Buttes

mine will be made, as this company has until recently been shipping to El Paso. The Pioneer stack was built by the Colorado Iron Works after plans developed by experimentation at the Denver works. J. H. Waters is superintendent in charge.

MARICOPA COUNTY

Relief Gold Mining Co.—This company, operating at Glendale, north of Phoenix, will resume development extensively, under the direction of Schuyler S. Moore, of Phoenix. The main shaft is now down 400 ft. and about 50,000 tons of commercial-grade, free-milling gold ore are blocked out according to Mr. Moore.

YAVAPAI COUNTY

Columbia Consolidated—This gold-mining company operating at Columbia, George Dillard, manager, has installed a Primm crude-oil engine and will develop the property which is northeast of Hot Springs Junction.

United Verde Extension—At the recent special meeting of stockholders in New York, the necessary vote was cast approving a reorganization plan for future financing and authorizing the sale of 25,000 shares of stock for \$25,000. A development shaft is down 800 ft. A winze extends to the 1200-ft. level and a drift will be driven from the bottom of the winze.

United Verde—Despatches from Prescott credit Manager Clark with a statement to the effect that plans for the new smeltery, being drawn by Repath & McGregor, of Douglas, Ariz., will be ready within three months, and will provide for a capacity of 6000 tons per day, the plant to be ready within two years. During this time the old plant at Jerome will be used.

California

AMADOR COUNTY

South Amador—This mine, about three miles south of Jackson, is being reopened by modern methods. The mine has been unwatered down to the 500-ft. level and the vein developed for a length of 800 ft. A new electrically driven compressor is being installed. The hoist will be enlarged and the water taken out to the 1100- and 1200-ft. levels. J. McSorley is superintendent.

Zeila—C. D. Porter, of San Francisco, W. D. Henry, of Pasadena, and C. H. Griffin, of Los Angeles, have made an ex-

amination of this mine, at Jackson. No information has been given out regarding the examination nor the capital that is represented, save that they are looking for a mine. This property is situated near the Moore mine, owned by W. A. Neville, and which is included in the negotiations respecting the App and the Rawhide, in Tuolumne County.

Plymouth Consolidated—The new electric hoist and air pump commenced operation on Feb. 20. The property is being unwatered and will be developed by the California Exploration Co., a Bewick, Moreing & Co. incorporation. J. F. Parks is superintendent.

Argonaut—The short-circuiting of a 17,000-volt wire in the transformer house melted the wires, damaged the switch box and caused a brief shutdown at the mill.

Oneida—The 60-stamp mill will probably be put in commission in April. The mine is now a part of the South Eureka, and is being explored for new orebodies with satisfactory results. The two mines adjoin, and both are under the superintendency of W. H. Schmal, of Jackson.

Eagle—This is a new prospect, being developed near Jackson. An upright plunger pump has been installed. George Hambric is superintendent.

CALAVERAS COUNTY

Lightner—The 60-stamp mill is closed down temporarily for repairs, pending the deepening of the shaft.

Gold Cliff—A skip cable broke in the shaft, Feb. 17, dropping a loaded skip and causing damage to the timbering, but without injury to any of the men.

ELDORADO COUNTY

Carpendar-Kumfa—W. W. Wheeler, engineer of this mine, at Placerville, was badly burned in the hand and received a severe shock through the body while connecting the electric-power wires to the pump at the 175-ft. level.

INYO COUNTY

Skidoo—During January, 1615 tons of ore were milled, producing bullion worth \$15,315. Development totaled \$823; operation, \$8114, and \$6377 net profits.

PLACER COUNTY

Valley View—An electric plant is being installed at the mine, and mill, seven miles northeast of Lincoln. The mill equipment, which is being erected consists of a Blake crusher, Graupner stamps, Challenge ore feeders, eight

Deister tables, Corliss engines and a 160-hp. boiler. The ore being developed is hauled to Lincoln and shipped to San Francisco. The new shaft is down 180 ft. The mine has been worked for the last 50 years. W. B. Hollings, of San Francisco, is the present owner.

SIERRA COUNTY

Kate Hardy—Another rich strike has been made at this mine, on the Mountain House-Goodyear Bar belt of serpentine, over \$3000 having been taken out in one day in specimen rock. W. M. Beggs, of San José, and associates are the owners.

Sierra Buttes—At this mine at Sierra City a new oreshoot has been opened in the Whiskey vein. This ore will enable the mill to operate at full capacity. J. C. Folsom is superintendent.

Sovereign—Nearly a mile of flume has been built at this mine in Ladies cañon to handle tailings from the mill and cyanide plant. The mill has resumed work and the cyanide plant is said to be making an extraction of 90%. F. O. Richardson is manager.

SISKIYOU COUNTY

California-Oregon Power Co.—This is a new incorporation, organized to take over the Siskiyou Electric Power & Light Co., the Ashland Electric Power & Light Co., the Rogue River Electric Co., and the Prospect Construction Co. Water rights have been secured which will develop 160,000 hp. The directors are: J. W. Churchill, of Yreka, president; Phillip de Tustan, of San Francisco; A. J. Roseborough, of Oakland, and D. O. Welch, of San Francisco.

Freshout Bar—C. E. Winters, of San Francisco, has taken a bond on this mine near Gottville. A drift from the 60-ft. shaft disclosed gold-bearing quartz of good grade. The shaft will be deepened to 90 feet.

Colorado

CRIPPLE CREEK DISTRICT

At the deep drainage tunnel of Cripple Creek, the Mabel M. water course has been tapped, giving an additional flow of 800 gal., and a total from the portal of 11,000 gal. per min. In the deep shaft the subsidence is about 6 in. per day.

Los Angeles—Lessees Chillson and Polly, who have been running a crosscut from the 525-ft. level of this mine to tap the orebody in the Six Points, report that they have reached the vein, but will have to drift about 50 ft. before reaching the oreshoot. The output from the Six Points at a depth of 250 ft. is eight cars of ore per month, the grade being from \$100 to \$200 per ton.

Kittie Gold Mining Co.—This company has been incorporated with a capitalization of \$2,000,000 by Harold C. Harmon, Arthur Cornforth and others, of Colorado Springs.

American Eagles—Paul Hinds, superintendent of the Colorado Mining & Investment Co., lessees, states that they will ship 20 cars of good ore in February. Sixteen machines are being worked in the mine.

Stratton's Independence—Cable advices state that during January production amounted to 2222 tons of \$23.66 ore. Low-grade mine and dump ore, amounting to 4500 tons, was milled. Special development cost \$1400, and net working profit was \$15,700.

LAKE COUNTY-LEADVILLE

Siwatch—This tunnel has now been driven into the mountain 4400 ft. with an east and west lateral, the latter driven 700 ft.; 14 men are employed.

Sugar Loaf—Rich silver is being taken out through the tunnel of this company, most of it from the old Sherrill workings.

Dinero—Thirty-five men are employed by this company, and a drift has been started on the Buckeye Vein in addition to the work being done in the main breast of the mine. Most of the ore is coming from the No. 15 upraise.

Colonel Sellers—From this mine, in California Gulch, Manager Bargler is shipping 75 tons per day. He has just installed an electric pump.

Helena—Manager Grant has the plans perfected for the new jig mill, which he is going to erect at this mine.

OURAY COUNTY

A great deal of activity is now being shown in the high-grade silver district about four miles north of Ouray on the east side of the Uncompahgre Valley; in the Bachelor mine a strike of rich ore is reported by Luna and Harlan, lessees. This mine produced over \$1,000,000 worth of ore in former days. Another strike is reported in the El Mahdi, and the force on the Calliope is to be increased soon by Manager Seaton. The Wedge is on the same vein as the Bachelor and it is thought that the shoot just discovered extends into the former's territory. These veins occur in the shales, quartzites and limestones lying underneath the later volcanics. The fissures, however, do not extend upward into the andesite.

Revenue—It is rumored that H. Platt, lessee, has decided to build a new mill on this property, the old one being entirely inadequate.

Camp Bird—Net profits for January are estimated at £38,733; London expenses, £300; £38,433 balance applicable to profit.

SAN JUAN COUNTY

On Pole Creek, Yeager and Lowe are crosscutting to encounter a vein from which some rich gold float is supposed to have come. The float is reported to have

been found last autumn. The Raoul brothers, of Creede, and other prospectors have reported the discovery of rich float in the Pole Creek section for several years, but the vein from which it came has not yet been found.

Smuggler-Union—The company is preparing to cyanide the slime tailings by agitation and filtration.

Sunnyside—At this mine the recently installed Huff electrostatic separator is running commercially with three shifts per 24 hr. It is reported to be producing a rich lead-iron product and a good grade of zinc concentrate.

Gold Bug—Information has recently been received at Silverton that a cyanide plant for the mine at Bear Creek is en route to the property. Chicago men are interested.

Idaho

COEUR D'ALENE DISTRICT

Amy and Matchless—The orebody found on this Pine Creek property recently is steadily improving and is sufficient to warrant the construction of a mill. About 15 in. of the 4 ft. of ore are of shipping grade and this is being handsorted and sent to the smelter. The concentrating ore is being stockpiled. The shaft on the Matchless vein is down to the 200-ft. level and a drift will be driven under Pine Creek to the Amy vein.

Rainbow—The tunnel on this property is now in 1100 ft. The work has all been done on contract and a new contract will be let to drive the tunnel the distance necessary to strike the orebody.

Mayflower—This property on Nine Mile Creek will resume work soon. A contract has been let to continue the tunnel.

Reindeer—A concentrator will be erected at this property in the spring.

Michigan

COPPER

It is reported that a new company is being formed to explore about 2000 acres near the Eastern sandstone, in the vicinity of Torch Lake. The tract is at present owned by the Quincy, Franklin, Tamaraack and St. Mary's Mineral Land Company.

Hancock—The shaft is down about 3360 ft. and is bottomed in trap streaked with copper; it is momentarily expected that the Pewabic lode will be cut.

Adventure—The new vertical No. 5 shaft on this property is bottomed at a depth of 1525 ft. All activity is centered in driving a crosscut from the 1500-ft. level to cut the No. 2 lode, which is estimated to be about 450 ft. from the shaft. The crosscut has been extended

over 400 ft. Drifting on No. 1 lode from the shaft did not disclose any mineralization of a consistent nature. The drill core from the No. 2 lode was heavily charged with copper.

New Baltic—A crosscut is being driven to the eastern limits of this property and drifting is also underway at the second level. Results so far have been good and the property is attracting much local interest.

Franklin—This company's shaft on the Pewabic lode is nearing the 33rd level. Production at the rate of about 700 tons per day is being maintained but will be gradually increased as conditions are met. Eighteen drills are in operation at present and the working force is being increased.

Quincy—The annual report soon to be issued is expected to show a surplus of \$60,000 above dividends for the year 1911. The \$150,000 paid for new properties were taken out of surplus.

South Lake—The annual report for 1911 shows: Total receipts, \$52,219, of which \$44,623 were from loans; payments, \$49,596; balance, Jan. 1, 1912, \$2623. President Watson states that shaft sinking commenced in July, 1911, but was discontinued at a depth of 30 ft., owing to water troubles. The shaft site was moved to a point above the water level, but shaft work was discontinued in the autumn of 1911. The directors believe that the property contains the westerly extension of the Lake lode.

Houghton—This company is drifting at the second level and the ground that is being broken is well mineralized and has all the characteristics of the lode that is being mined at the Superior property. A crosscut is also being driven from this level to reach a lode that is known to lie west of the formation.

Ahmeek—The annual report for the year 1911 shows: Copper sold, 14,336,750 lb.; average price received, 12.78c. per lb.; rock stamped, 598,549 tons; refined copper per ton rock stamped, 25.4; total cost per lb. refined copper, 7.17c., total openings, 11,691 ft.; net profit, \$870,272, equivalent to \$17.40 per share.

IRON

Iron River Steel Co.—This company, recently organized under the laws of the State of Utah, has changed its name to the Iron County Steel Co., because J. B. Weimer, of Iron River, incorporated an Iron River Steel Co., under Michigan laws, before the articles of incorporation of the Utah company were filed at Lansing. It is reported that the capital stock will be changed to \$1,000,000, par value \$1 per share instead of the \$300,000 specified for the Utah company, and that 500,000 shares will be sold publicly.

Mansfield—At this mine of the Oliver Iron Mining Co., in the Crystal Falls dis-

trict, fire broke out on the 12th level recently. Six men who were underground were rescued, but the mules used for haulage were lost. The fire was near the shaft which was sealed.

Jones & Laughlin—A contract has been let to J. S. Wahlman, contractor, of Ishpeming, for the erection of a boiler house and engine house at the mine, north of Iron River. Several dwellings and an office building are in course of construction at the property. Two diamond drills are being operated two miles southeast of Ishpeming, on Sec. 14, between Lake Ogden and Lake Sally. The Duluth Diamond Drill Co. has the contract.

Mineral Mining Co.—This company will reopen the James mine, north of Iron River, although operations will be on a small scale at first. The mine was closed down several months ago, following a partial walkout of the miners for a petty grievance.

Chapin—The annual statement of the Aid Fund of this mine, at Iron Mountain, for 1911, has been issued. During the year \$2111 were paid out and the balance on hand, Dec. 31, 1911, was \$13,643. No monthly collections were made from June 1 to Dec. 31. It is reported that as a result of a conference of O. C. Davidson, general superintendent, with Steel Corporation officials in Chicago, the Chapin and Aragon mines will be worked five days per week on both day and night shifts.

Wickwire—This company, operating at Iron River, has contracted to take electrical power from the Peninsula Power Co., of Iron Mountain. Two air compressors will be driven by direct-connected motors. The power company has contracted to deliver electrical power by Mar. 1.

MISSOURI

JOPLIN DISTRICT

Reports state that 5000 men in the St. Francois lead district are preparing to ask for higher wages. It is rumored that the increase demanded will amount to \$1 per day. A strike is feared generally, although some officials of operating companies are optimistic regarding the situation which has been more or less unsettled since the 1907 reduction of wages.

The series of storms since Jan. 1 has greatly curtailed the production of ore in the entire district and has made mining most difficult.

Point Milling & Manufacturing Co.—J. W. Wood, engineer for this company, recently returned from New York and Pennsylvania, where he inspected machinery and let contracts to the Traylor Engineering & Manufacturing Co., for tube mills, crushing rolls, classifiers and a Hendryx system of agitators.

Jungle—This mill, at Thoms Station, burned to the ground recently.

Baby Kitty—The shaft at this mine, at Lehigh, has entered the ore. The drill records on which the shaft is being sunk showed about 25% ore. Frank Nicholson, of Joplin, is manager.

Ray—The shaft of this company, on the General land at Thoms Station, has entered 14 ft. of rich lead ore.

MONTANA

BUTTE DISTRICT

Tuolumne—In February, production amounted to 225,000 lb. of copper. The mine was shut down for 15 days while a new hoist was being installed. Present production is about 150 tons of ore per day, and mining is reported as being confined to first-class ore which runs about 150 lb. copper per ton.

Butte Coalition—The books of the company closed finally on Mar. 1. Fractional scrip certificates will be issued to stockholders owning fractions of Anaconda stock. Actual distribution of assets will commence in a few days and by Apr. 1 the company is expected to be dissolved.

Davis-Daly—Shaft sinking in the Colorado mine has been commenced and the 200 ft. of sinking, from the 1700-ft. to the 1900-ft. level, are expected to be completed by May 1. The ore on the 1700-ft. level is said to be increasing in width and grade. It is reported that returns from shipments to the East Butte smelter are more than paying operating and development costs.

Anaconda—The shaft at the St. Lawrence mine is being sunk to connect at depth with the High Ore mine, to enable draining through the latter, which now has connections with all the principal mines of the company. The St. Lawrence is 2300 ft. deep and the High Ore 2800 feet.

North Butte—High-grade ore is being shipped from both the Snowball vein and the Berlin claim. The Snowball vein is opened for about 270 ft. and has 10% ore.

Butte Central—The ore going to the Washoe smelter is from the 300- and 500-ft. levels and runs about \$15 per ton with fair gold content. It is intended to maintain shipments at a rate sufficient to meet all operating expenses.

Butte & Superior—The company is shipping 550 tons of ore per day to Basin, but when the new mill is in operation the capacity will be 750 tons. Development work in the Butte-Milwaukee mine, owned by the company, is said to be showing strong copper veins at a depth of 700 feet.

Butte-Alex. Scott—It is reported that 6% copper ore is being mined on the 1200-, 1400-, 1600- and 1800-ft. levels. The company is sending 150 tons per day to the East Butte smelter; after certain

installations are completed this will probably be increased to 250 tons.

BROADWATER COUNTY

May Day—A standard double-compartment shaft is being sunk to 300 ft. An electric plant is being installed and necessary buildings erected. Surface indications are reported good.

JEFFERSON COUNTY

Robert Emmet—The equipment of this copper property at Amazon, with new machinery, is progressing. Two cars of machinery have been installed and as soon as the remainder, which has been delayed in shipment, arrives and is put in place, work will be started unwatering the mine, after which crosscutting will be commenced on the 500-ft. level.

Baltimore—A force of 35 men is now on the payroll of this mine in Boomarang Gulch and the number will be increased soon.

Nevada

COMSTOCK LODGE

Mexican—The mill was brought up to further efficiency last week, 415 tons of ore being treated in six days, the average assay value of which was \$22.72 per ton. The tails averaged \$1.74 per ton, so that the theoretical extraction obtained was 92%. A partial cleanup was made, and five bars of bullion were shipped to the smeltery.

Union Consolidated—The west crosscut from the joint Sierra Nevada winze on the 2500-ft. level is now passing through a fractured zone on both sides of a small dike, which strikes northwest and dips about 55° east. The formation shows an intense crushing with the development of clay seams. Some mineralization by sulphides appears, together with a mixture of quartz, which gave assays of \$3.90 per ton. The crosscut will be turned to connect with an east crosscut from the north drift from the Mexican side of the mine; this will give greatly improved ventilation.

Con. Virginia—Sill-floor sets are being installed in the oreshoot on the 2550-ft. level, and two sets have been put in to the south, all in ore. An opening is now being made to the north and timbers will be put in there to the extent of the mineral-bearing quartz. Ore averaging \$33 and \$81 per ton, was saved from this work.

Comstock-Phoenix—A report made by this company for the quarter ended Dec. 31, 1911, shows that during that period 1300 tons of first-class ore were shipped to the smeltery, the net bullion return on which was in excess of \$69,000. The Phoenix is one of the recent new producers of the district.

Segregated Belcher—Work has been started reopening the main north drift

on the 1100-ft. level, the object being to enter old stopes and to extract ore left during former operations at that point. The east crosscut on the 1200-ft. level is showing more quartz and the formation gives indications of becoming much stronger.

Crown Point—The ore recovery last week was 700 tons from the 1400-ft. level stopes, and 934 tons were shipped to the Yellow Jacket mill for treatment.

Combination—A new gallows frame is being erected preparatory to repairs in the shaft down to the 1700-ft. level.

ESMERALDA COUNTY

Goldfield - Belmont—The property is stated to be in a condition to maintain ore shipments at a good rate, and these will be increased in volume when the orebody is further opened on the 400-ft. level. The ore appears to be widening with depth.

Goldfield Consolidated—The estimated February production was 27,641 tons of ore; gross value recovered, \$685,000; operating expenses, \$210,000, and \$475,000 net realization for the month.

NYE COUNTY

Tonopah ore shipments for the week ended Feb. 22 were: Tonopah Mining, 3500 tons; Tonopah Belmont, 2600; Montana-Tonopah, 952; Tonopah Extension, 980; West End, 770; McNamara, 350; total, 9152 tons, and \$228,800 total estimated value.

Montana-Tonopah—The McDonald vein on the first intermediate level is showing improvement. Prospecting is still in progress on the lower levels to pick up the downward extension of orebodies opened on the upper levels.

Tonopah-Belmont—Construction work at the new mill is progressing satisfactorily. The ore-crushers are in place, the trommel screens are being set and work is in progress on the conveyor. The steel ore bins back of the crushers have been erected and are being riveted. In the main mill, the Pachuca and agitator tanks are being erected, the battery posts are being placed in position and the sides and roof of the building are being covered. The machinery is also being placed in the bullion refinery room. Five cars of machinery have been received recently as well as one car each of brick, corrugated iron and filter bars.

West End—Little ore is being stoped, most of the daily supply of 110 tons for the mill being supplied by development.

Tonopah Mining—Work has been discontinued in the Desert Queen and the latter shaft turned over to the Tonopah-Belmont company. Work will be resumed there at some future time. The machine drills have been transferred to the Red Plume shaft and operations resumed there. In the Mizpah mine work is almost entirely confined to stoping.

New Mexico

GRANT COUNTY

Gold ore is reported to have been found near Apache Creek, 55 miles northwest of Silver City. El Paso men have taken a bond and lease on 11 claims in the vicinity.

Chino—The company is reported to be considering further financing, which may take the form of an issue of 50,000 shares of stock, to be offered to the stockholders at \$25. The proposed new issue will give the company an additional working capital of \$1,250,000. A special meeting will be necessary to authorize the increase.

SOCORRO COUNTY

Chloride Flat—A body of good ore was opened recently on the Julia vein, and a 3-ft. vein of ore was also opened on the Francisco vein. The company has sunk a new shaft, following the latter vein at a dip of 45°, and the new oreshoot was opened at 40 ft. depth.

Ernestine—The cleanup for the first 10 days in February amounted to 10,365 oz. of gold and silver bullion and six tons of high-grade concentrates. The new oil engine are reported to be a complete success.

Deep Down—Development work is being pushed by the leasers and arrangements have been made to begin regular shipments to the Deadwood mill soon.

Oaks—The new Olds 12-hp. gasoline hoist was placed in commission recently at the south shaft and started satisfactorily. A winze has been started in the tunnel, where some good ore was found. All ore taken out in development is being treated in the Deadwood mill.

Deadwood—Good ore, 6½ ft. wide, has been cut on the 500-ft. level. The mill is running regularly.

Oklahoma

Chapman & Lennan—This company, at Miami, is installing a pumping plant of 3000 gal. capacity, and will soon start the erection of two mills on the Emma Gordon and Miami Royalty Co. leases.

Prairie Mining Co.—This company has made several deep drill strikes on the Emma Gordon lease at Miami.

Texas

WILLIAMSON COUNTY

A mica deposit of importance is reported near Georgetown. French interests have taken an option and will make an investigation. Sheet mica and mica for grinding is produced. The later product has been shipped to El Paso and treated in small lots successfully for "flour" mica.

Utah

JUAB COUNTY

Tintic shipments for the week ended Feb. 23 were 200 cars.

Iron Blossom—The new electrically driven 400-hp. hoist and other equipment for the No. 1 shaft have been shipped. With the installation of the new machinery, it will be possible not only to handle the increased tonnage of the Iron Blossom and to take up prospecting on the 1900 and at a greater depth, but also to take care of the ore from the Dragon and to prospect in that mine. The output for the week ended Feb. 23 was 52 cars.

Dragon Consolidated—A body of shipping ore running 0.5% copper and from 20 to 50 oz. silver per ton has been opened on the 600-ft. level. The ore is being hoisted at the rate of 20 tons per day.

Black Jack—Development has been resumed in the Star section. The shaft here is down to the 800-ft. level and work is being done on this level and on the 300. Leasers have been shipping from this section during the last year.

Chief Consolidated—During the week ended Feb. 23, 13 cars were shipped from the 1400- and 1600-ft. levels. The orebody supplying the present output was opened in December, after a year of development work.

Crown Point—About 200 ft. from the shaft on the 500-ft. level, drifting to the southeast is being done and the face is in brecciated limestone. During the last 18 months, 1300 ft. of development have been done.

Mammoth—Regular shipments are being made from the orebody opened in a raise from the 700-ft. level. Up to Feb. 23, 38 cars were shipped for the month. The ore runs 0.66% copper and 0.9 oz. silver, with some gold.

Iron King—This property has closed down with approximately 100,000 tons of iron ore blocked out, there being at present no market for its output.

Lower Mammoth—Drifting west is being done on the 1000-ft. level and indications are reported encouraging.

Carisa—Work is being done on the 100- and 400-ft. levels and occasional shipments are being made.

Beck Tunnel—Half of the indebtedness has been paid, and the company is making expenses. The vein has been shown to continue to the 1100-ft. level, where milling ore has been opened.

SALT LAKE COUNTY

Ohio Copper—The average monthly profits for November, December and January were approximately \$25,000. The mill handled as high as 2400 tons in one day, with 16 Wall rolls in operation. When the 20 rolls are installed, the capacity will exceed 3000 tons per day. During November 52,243 tons were mined

and milled. The ore averaged 1.142% copper, and concentrates, 26.50%. Profits were \$26,412.

Utah Copper—The January production was 8,156,612 lb., as compared to 9,093,557 lb. in December. The January production in 1911 was 6,707,116 pounds.

Columbus Consolidated—Two ore-shoots, 500 ft. apart, are reported on the 400-ft. level. One of these is 18 in. to 3 ft. wide.

Alta Consolidated—An 18-in. streak of first-class ore, with considerable milling ore on either side, has been opened in a raise from the west drift on the tunnel level about 500 ft. from the surface. The high-grade ore runs 761.6 oz. silver, 20c. gold, and 30.7% copper, a total of between \$500 and \$600 per ton.

Utah Apex—Three cars of ore were recently shipped by Kirk & Leavell, leasers on the upper levels. The leasers are employing 70 men.

UTAH COUNTY

Nebo Highland—High-grade lead-silver ore has been found in the new lower tunnel, which is in 75 feet.

Eva—Four cars of ore have been shipped recently, one of which is reported to have run over 50% lead and about 20 oz. silver.

Canada

BRITISH COLUMBIA

Shipments and receipts in tons in the Boundary district for the week ended Feb. 22 were as follows:

Mine	Week Ended Feb. 22	Year to Date
Granby	21,958	170,897
Mother Lode	8,142	61,773
Rawhide	4,416	7,534
Jack Pot	275	2,848
Athelstan	24	251
Others	272	1,441
Totals	35,087	244,744
Smelteries		
Granby	23,045	214,595
B. C. Copper Co.	13,345	79,127
Totals	36,390	293,722

ONTARIO

What appears to be an important strike of oil has been made at the town of Milton, Ont., by James Peat & Co., of Petrolea. An attempt to find oil was made three years ago, but proved unsuccessful. Last December, drilling was begun on the property of the Brandon Pressed Brick Co., and a good showing of oil has been encountered at a depth of 1440 ft. Pumps will be installed at once. The formation in which the oil occurs is Trenton limestone and the oil is of amber quality with an estimated specific gravity of at least 36 degrees.

ONTARIO—COBALT

Cobalt ore shipments for the week ended Mar. 1 were: Nipissing, 143,728 lb.; La Rose, 129,428; Coniagas, 124,267; Drummond, 120,000; McKinley-Darragh, 117,523; Cobalt Townsite, 73,014; Temis-

kaming, 64,500; Beaver, 64,187; Trethewey, 60,290; Buffalo, 58,634; Chambers-Ferland, 64,000; total, 1,019,601 lb. Nipissing shipped 149,712 oz. of bullion.

Cobalt Lake—At the annual meeting held in Toronto, Feb. 29, the financial statement showed a favorable balance of \$80,847, the deficit of \$209,004 at the end of 1910 having been paid off. Net returns from ore production amounted to \$323,793, of which \$64,216 were expended on the concentrator. The outstanding capitalization had been reduced to \$3,304,051, par value, by the purchase of 625,115 shares, which were retired into the treasury. The report of Manager B. R. Gordon estimates the ore reserves at 2,851,180 ounces.

Trethewey—The annual meeting was held in Toronto, on Feb. 28. The decline of the output from 865,777 in 1910 to 770,838 last year, was explained on the ground that much of the ore last year was taken from old workings. President Hayes stated that the recent finding of silver in the Keewatin at the Coniagas mine was of the utmost importance and would influence future operations. The former directorate was reelected.

Temiskaming—At the annual meeting of shareholders, held in Toronto, on Feb. 24, 1,903,069 votes were cast, the management being sustained by a majority of 47,167. President Cartwright states that the directors have made no decision as to future plans in connection with the North Dome mine at Porcupine.

Nipissing—A forecast of the annual report, soon to be published, gives the ore reserves, as of Dec. 31, 1911, at approximately 7,800,000 oz., representing an increase of 1,300,000 oz. over the figures for Dec. 31, 1910. The gross value of the high-grade ore is expected to show a small increase and the ore on the dumps will probably contribute an additional \$1,000,000. It is expected that the figures for production and costs will be approximately the same as those of 1910.

ONTARIO—PORCUPINE

McIntyre—The mill on this property is to be started in a few days. The capacity is 10 stamps and the process includes only amalgamation and concentration. Rich ore has been encountered in the drift from No. 1 shaft.

Standard—The development of recent discoveries is giving good results.

Pearl Lake—As soon as the 400-ft. level of the main shaft is reached, a crosscut will be run to the McIntyre boundary, to intercept some of the veins coming in from the latter property.

Little Pet—The management expects to have the 5-stamp mill running in about a month.

Plenaurum—Both shafts are down 200 ft. and crosscuts to intercept the veins will be started soon.

Bewick-Moreing—The development of this company's properties has been practically barren of results and little work is being done at present.

West Dome—James Reilly was killed and Matthew Ronan severely injured by an explosion, on Feb. 24, thought to have been caused by drilling into a missed hole.

Dome—An orebody 300 ft. long and 200 ft. wide has been definitely blocked out in 100-ft. blocks on the 50-ft. level, ready for the crushers. No. 7 shaft has been sunk to the 200-ft. level for exploration purposes and some high-grade ore opened up by a drift.

ONTARIO—SUDBURY

Tough & Stobie Swack—M. T. Cockrell, representative of the Englishmen who have an option on this property, recently left Sudbury for South America, after inspecting the development work in progress.

Mond—Plans are now ready for about 70 houses, which will be started as soon as the weather will permit, on the smeltery townsite at Conniston. The company has withdrawn the diamond drills from the Cochrane and McVittie Blue property and has abandoned its option.

Dominion Nickel-Copper Co.—Dr. Gorman, of Ottawa, has taken a drilling contract with this company and now has one shot drill in operation.

QUEBEC

East Canada Smelting Co., Ltd.—Pres. Charles E. Force, of the Precious Metals Corporation, the holding company, with offices in the Whitehall Building, New York, informs us that in the lenticular orebody now being developed there are 39,500 tons of 5% copper ore and 26,500 tons of 2% ore blocked out on four sides, 22,750 tons blocked on two sides and 50,000 tons additional ore indicated by diamond drilling but not yet fully developed. During the half-year ended Dec. 31, 1911, the company shipped principally to the Nichols Copper Co., New York, over 12,000 tons, averaging Cu 4.73%, Au 0.01 oz., Ag 0.63 oz., S 43.98, Fe 37.20, insol. 7.65, Zn 3.65, MgO 0.10, CaO 0.25. The company is spending a liberal amount for development with highly satisfactory results. It has two shafts down to 100 and 300 ft., respectively, the latter to be the main working shaft. The company is now shipping at the rate of 40,000 tons per year and has contracted with the Trenton Iron Co. for a 3½-mi. Bleichert tramway to be completed in June, when it is expected to cut the haulage charge from the mine to the railroad at Weedon from 75c. to 4c. per ton. Mining costs have been reduced from \$4.95 in August, 1910, to \$2.98 per ton in January, 1912, this figure including 88c. per ton for development work. Leland D. Adams is superintendent.

Mexico

BAJA CALIFORNIA

The means of transportation between General and La Paz have been greatly improved. The road between Triunfo and La Paz has also been improved. The establishment of a branch of the Banco de Sonora in La Paz has aided operations.

Cia. Metalúrgica de la Baja California S. A.—The cyanide plant has been running continuously and extraction has been improved by the installation of a new separator in place of the cones that were installed at first. The mines have experienced a general improvement and with the exception of a dearth of miners, the prospects are bright. During February President Felix Diaz, accompanied by Director José Verea and Celso Acosta, visited the hacienda and mines.

Progreso—This company has had the Triunfo plant and the San Antonio plant running continuously and preparations are being made to increase the output.

San Juanes—This reduction plant is in full blast and the new roasters are giving satisfaction. The plans are to increase the capacity and additional equipment is already on the way.

CHIHUAHUA

Mary—J. E. Carnahan, of Canton, Ohio, one of the officers of this company, is at Año Nuevo with a staff of engineers making an examination of the company's extensive property. The mine is equipped with a 10-stamp mill and has been closed for over a year. It is in western Chihuahua and is reached via Alamos, Sonora.

DURANGO

The fuel supply of the American Smelting & Refining Co.'s smeltery at Velardeña is running low and unless the railroads resume operations soon, a shut-down of this plant may result.

JALISCO

Como No—This property, adjoining the Santo Domingo mine on the Santiago River in the Hostotipaquillo district, is being developed by a San Antonio, Tex., company. Henry Bryan is in charge.

OAXACA

Zopotote—This Chicago company is making small shipments from the Conejo claim at Parian on the Mexican Southern Ry. The ore yields gold. The property is partly developed but has been idle for more than two years.

SAN LUIS POTOSI

A deposit of high-grade kaolin is being developed near San Luis Potosi by O. V. Waggoner and associates, of San Luis Potosi. Samples of the material have been submitted to experts in the United States and it is believed that the product can be shipped to the States.

The sulphur deposits at Los Cerritos, east of the city of San Luis Potosi, are being regularly operated under lease from the owners, the Virginia-Carolina Chemical Co. Part of the product is sold in Mexico and some small shipments are made to Germany.

SONORA

Oil has been discovered in the north-eastern part of the state in a well being drilled for water near El Plomo. The flow is small.

Cananea Consolidated—Dr. L. D. Ricketts is reported to have announced recently that the company has acquired control of the Superior-Bonanza company, formerly the Sonora-Bonanza. As soon as supplies can be freighted in, 25 men will be put to work. It is planned to sink one of the shafts 200 ft. to a depth of 650 ft. The equipment includes a steam plant with three boilers, two hoists, two pumps, air compressor and electric-light plant. Improvements include a general store, dwellings, brick plant and concentrator.

San Felipe—This lead-silver mine, about 10 miles east of Sahuaripa, is being developed under the direction of W. M. Asher, one of the owners. Shipments of high-grade ore are being made to Tonichi.

Greene-Cananea—Reports state that revolutionary troubles are not interfering with operations. The February production is expected to exceed that for January, although insufficient crane capacity is said to have limited operations somewhat in the converter department.

ZACATECAS

A tin deposit near Pinos, in the southern part of the state, is being developed by E. L. Porch and associates, of San Antonio, Tex. At a depth of 150 ft. an average of 3% tin is reported. Other tin deposits west of Pinos in the State of San Luis Potosi have recently been investigated.

South America

CHILE

Braden—Reports state that the tonnages being handled at the new concentrator are being increased gradually, the plant at present treating about 1200 tons per day. Considerable improvement is said to have been made in extraction, which, at present, is about 63%, but the new plant is not yet in perfect adjustment. The old mill is treating 300 tons per day, making the total tonnage treated about 1500. At the Teniente mine No. 1 tunnel has been advanced several hundred meters in commercial ore. The main crosscut on No. 3 level is being continued in 2½% ore. The new smeltery is handling concentrates and a lot of 3000 tons was recently smelted. The third and last unit of the mill is expected to be in commission by Apr. 1, giving the plant its full capacity.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Mar. 6—The coal trade has been generally affected by the strike in Great Britain and the possibilities of strikes here. These conditions have sent up prices and have stimulated the demand for storage coal to a high degree. The ability to meet demands depends largely upon the railroads, and they are not in the best condition, transportation being still slow and car supply in poor shape.

There have been no exports to Great Britain as yet, except of a few cargoes on an order for West Virginia coal placed by the British Admiralty some weeks ago. The British strike is general, no mines being in operation, and there is no prospect of immediate settlement. German miners are also preparing to strike in the important Rhenish-Westphalian district, where an increase in wages is demanded.

At the meeting on Mar. 5 the anthracite operators decided to reject all the demands made by the miners. These resolutions were adopted:

"Resolved, That J. L. Cake, Alvin Mar-
kle, Percy Maderia, E. B. Thomas, W. H.
Truesdale, F. D. Underwood, L. F. Loree,
Joseph Dickson, George F. Baer, and
Morris Williams be appointed a commit-
tee with full power to represent the an-
thracite operators and with instructions
to formulate a reply in writing to the
anthracite mine workers declining their
demands."

The first three of these are independent operators. The next step is uncertain, but there is no doubt that further conferences will be held.

There is more disposition to believe that settlements will be made, both in the anthracite and the bituminous district. While there has been no actual change in the situation, there is a more hopeful feeling.

Arguments before the Interstate Commerce Commission on the question of coal rates to Lake Erie ports have been nearly concluded.

Exports of coal from the United States in January were: Anthracite, 221,854 long tons; bituminous, 667,263; bituminous furnished to steamships in foreign trade, 552,965; total, 1,442,082 tons, a decrease of 32,503 tons from January, 1911. Exports of coke were 53,114 tons, a decrease of 34,464 tons.

Imports of coal into the United States in January were: Anthracite, 10; bituminous, 124,788; total, 124,798 long tons,

a decrease of 19,659 tons from January, 1911. Imports of coke were 8862 tons, a decrease of 4295 tons.

IRON TRADE REVIEW

New York, Mar. 6—The iron and steel trades show some improvement upon the whole. Specifications on contracts for finished material are reported to be coming in well, and there is rather more new business. In most lines mills are well employed, many concerns running up to 90 per cent. of capacity, which is about as much as could be expected.

The Steel Corporation mills shipped material at a greater rate in February than in January or December. Some of the independents did the same, but others did not do as well as in those months. The whole situation is in a delicate position, for the reason that recent market experience has shown that even a slight deficit of demand from capacity is sufficient to make the market weak even when prices are near the cost level, while on the other hand there are influences, like the prospective coal strike and the opening of spring, which could easily push demand slightly above the available capacity. Rarely before has the poise been so delicate. The reason the market has gotten into such delicate position is that on account of the general nervousness of the trade, on account of political and other influences, the market was not able to work up to the position of reasonable strength which the good buying of last November and December would produce in ordinary circumstances.

Pig iron is more active than it has been. Both buyers and sellers are holding off on second-half contracts. Sellers are not seeking for this business at present prices, and buyers will not close without concessions. The uncertainty about Lake ore prices is beginning to worry the merchant furnaces. They find it hard to adjust their own quotations until some sort of settlement is reached. Foundry iron is in a little better demand this week, and there is also more call for basic pig.

An inquiry from Italy is reported for 15,000 tons of basic pig, deliveries to run over several months. Pipe iron is in demand, and the pipe foundries have abundant orders on hand or in sight.

Hearings on the new tariff bill before the Finance Committee of the Senate have about closed. A large number of witnesses have been examined, but few

or no new facts have been brought out by their testimony.

Baltimore

Mar. 4—Exports for the week included 661 lb. selenium to Hamburg; 501,500 lb. car wheels, 1,353,833 lb. iron castings, 5,227,074 lb. structural steel and 2,093,141 lb. miscellaneous iron and steel to Panama. Imports included 110 casks manganese ore from Hamburg; 30,300 tons iron ore from Cuba.

Birmingham

March 4—The third month of the new year promises to be more active in the way of pig-iron buying with Southern manufacturers of metal than the previous month. The quotations for the product are \$10.25@10.50 per ton, No. 2 foundry. Some large contracts have been mentioned at lower figures but as far as can be learned the manufacturers are not willing to sell. The production in Southern territory is about the same. There is still plenty of pig iron in furnace and warrant yards and all business offered will be met promptly for some time to come.

Inquiries in hand are encouraging. Some of the larger consumers throughout the country are looking this way for their probable needs, but are also inquiring for concessions. It is believed that the business will be placed during this month.

The cast-iron pipe makers are melting pig iron steadily and orders in hand call for a large tonnage, while business in prospect is of some consequence also.

A little improvement is noted in the steel industry. Small orders for steel rails are still coming in the the aggregate is good.

Brass foundrymen in the Birmingham district say that their business and inquiries indicate there is considerable furnace repairing going on.

Charcoal iron shows no change and the price also remains firm at \$22@22.50 per ton. Machine shops and foundries expect a better trade this month.

Chicago

Mar. 4—Although sales of pig iron have not increased, the iron and steel market, in general, shows life and an optimistic tone. Sales of finished materials are fair and in the structural line are increasing. Prices of pig iron hold nearly firm, with a disposition on the part of foundry melters to test the market often by inquiries for the last half. The furnace agents, however, refuse to make

prices on these requirements lower than the \$14 for Northern and \$10.25@10.50, Birmingham—\$14.60@14.85, Chicago—quotations which have been current for No. 2 coke iron for the last few weeks. There are possibilities of slightly lower prices, made quietly, of course, but ostensibly the situation as regards prices is not changed. The sales of pig iron that are being made are of carload lots up to 500 or 600 tons, with a few inquiries running over the 1000-ton mark. Lake Superior charcoal iron again is quiet at \$16.50@17 per ton.

Bridge and building requirements for structural material are increasing and there are those in the market who prophesy a boom with the opening of spring conditions. Material under 15 in. continues at 1.28@1.33c. Railroad supplies are in good demand. Steel bars are in light demand, with prices continuing 1.25@1.33c., and bar iron is fairly active at 1.15@1.20c. Sheets and plates are quiet, with prices firm. Wire products are in fair demand, though not so active as in previous weeks. Conditions of general business are good, with many manifestations of spring activity.

Cleveland

March 5—The question of Lake ore prices is still in the air. Reported sales of Mesabi nonbessemers at \$3, Lake Erie port, have been denied. A common belief is that there will be a reduction of about 25c. from last season's schedule.

Pig Iron—Foundry is still rather slow, but there is an increased demand for basic pig. Prices are unchanged at \$15.15 for bessemer, \$13.10@13.25 for basic, \$13.25 for No. 2 foundry and \$12.50 for gray forge, all Cleveland delivery.

Finished Material—Specifications come in well, but new business is halting a little.

Philadelphia

March 6—Recent large sales of low-grade iron for near-by foundries are reported and additional inquiries within twenty-four hours have had the effect of hardening prices. The stock of pipe iron is practically exhausted. More cast-pipe business is heard of and the prospective requirements will probably appear within about a week. Basic is strong though sales are light and makers claim an advance is near at hand, especially if some export business in sight should be secured. Forge iron drags. Buyers asking for early delivery of No. 2 foundry find quotations firm. Malleable sells at full prices in small lots. The leading furnace interests are resting on their oars. Quotations are \$15.25 for No. 2 X foundry, with gray forge and basic at \$14.25. Offers of Southern forge are made again at \$13.50 per ton.

Billets—No transactions of note are reported.

Bars—Retail business in bars has improved with more favorable weather and orders at mills remain at about the same level. More common iron is selling than refined and concessions are reported on common in answer to recent car inquiries.

Sheets—No important business has been sent to the sheet mills.

Pipes and Tubes—Tube work is increasing steadily and large shipments have recently been made from mills to this territory. The cast-pipe foundries have their hands full and report of new business has become monotonous.

Plates—This week's orders for plates refer mainly to the closing of business started a week or two ago. The lowest prices are still quoted and they offer no special inducement.

Structural Material—Nothing of importance has transpired in shapes and the latest inquiries are for only moderate amounts.

Scrap—Scrap continues dull even with some inducements offered by some dealers to unload accumulation.

Pittsburg

Mar. 5—Mixed conditions prevail this week in the iron and steel trade. There has been a distinct advance in basic pig iron, due partly to an unexpected purchase of 10,000 tons by the Jones & Laughlin Steel Co. and partly to sentimental grounds, while another stiffening influence is the realization that consumers are very poorly supplied against the probable suspension of mining in the anthracite and union bituminous districts Apr. 1, so that any prolonged suspension would undoubtedly cripple some steel-mill operations. On the other hand, specifications for steel products, while slightly better on the whole, do not show as great an improvement as the progress of the season, after a prolonged period of record cold weather, would suggest, and several producers are actively out for new business at cut prices.

Pig Iron—As noted, the Jones & Laughlin Steel Co. has bought 10,000 tons of Valley basic iron, for immediate shipment to Aliquippa. The price was a trifle under \$12.50, or about \$12.40, Valley, and from the delivery being prompt, it is believed that a close price was made, and that it would be difficult to make an ordinary purchase even at \$12.50. It is reported that a prominent Monongahela Valley interest recently secured an option on three or four months' supply, about 50,000 tons, at \$12.60, Valley, and is having difficulty keeping the option open. A sale of 300 tons was made last week at \$13, Midland furnace, equivalent to \$12.70, Valley. The Midland Steel Co. has served notice on the holders of its pig-iron warrants that beginning Apr. 1 a storage charge of 2½c. per ton per month will be made, because the Pitts-

burg Crucible Steel Co., which bought the property, desires the room for building. The demand is being resisted, but it may result in several blocks of speculative iron coming on the market. A sale of 1000 tons of low-sulphur bessemer was made late last week at \$14.25, Valley, sulphur being guaranteed 0.03% or under. Foundry is strong but quiet. We quote: Bessemer, \$14@14.25; basic, \$12.50@12.75; No. 2 foundry, \$13@13.25; forge, \$12.50@12.75; malleable, \$12.75@13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market continues quiet, with prompt and forward quoted at \$41, Baltimore.

Steel—The market has stiffened, particularly in bessemer, owing to occasional inquiries from consumers who are not getting good deliveries on their contracts, as several large mills are behind. We quote: Bessemer billets, \$20; openhearth billets, \$19.50@20; bessemer sheet bars, \$20.50; openhearth sheet bars, \$20@20.50, all f.o.b. maker's mill, Pittsburg. F.o.b. maker's mill, Youngstown, bessemer billets are quotable at about \$19.50, and sheet bars about \$20. Rods are nominally \$25, Pittsburg.

Sheets—The market has been very irregular, about three mills having quoted materially below 2.80c. on galvanized and 1.80c. on black during the past 10 days. The low prices on galvanized have been withdrawn, so far as present information goes, but 1.80c. on black sheets can probably be shaded. Some of the mills, being well sold up, are quoting much higher prices. We quote: Black sheets, 28 gage, 1.80c.; galvanized, 2.80@2.85c.; blue annealed, 10 gage, 1.35@1.40c.; painted corrugated, \$1.33@1.35 per square; galvanized, \$2.47@2.50 per square.

St. Louis

March 4—The market for pig iron is just a trifle livelier this month and a number of inquiries for small lots of iron have been received. Some few foundries are running full, though the majority are not doing so well. A good many local buyers are holding off somewhat, owing to the coal strike which seems to be an assured thing on April 1. As business is not too brisk with any of the foundries some of them are figuring on shutting down for a few weeks until the coal situation is adjusted. The current price on Southern No. 2 foundry iron remains the same, \$10@10.25 Birmingham or \$13.75@14 St. Louis. No. 2 Northern foundry is quoted at \$14.25@14.75 per ton.

Coke is in good demand. Most interests are stocking up some ahead owing to the anticipation of trouble in the Pennsylvania coal fields. Foundry coke is bringing \$5.05@5.25 per ton St. Louis.

Iron Ore Trade

Imports and exports of iron ore in the United States, month of January, long tons:

	1911	1912	Changes
Imports.....	102,600	154,118	I. 51,518
Exports.....	3,817	11,861	I. 8,044

Imports this year included 106,040 tons from Cuba, 36,956 from Sweden, 11,086 from Spain and 36 tons from other countries.

Imports of manganese ore into the United States in January were 12,585 tons in 1911, and 28,401 in 1912; increase, 15,816 tons.

Lake Freight Rates

The *Marine Review*, of Cleveland, gives average Lake rates per ton on iron ore and coal for three seasons as follows:

	1909	1910	1911
Iron ore, Duluth to L. Erie....	\$0.65	\$0.70	\$0.60
Iron ore, Marquette to L. Erie..	0.60	0.65	0.55
Iron ore, Escanaba to L. Erie..	0.50	0.55	0.45
Soft coal, L. Erie to Milwaukee.	0.37	0.355	0.31
Soft coal, L. Erie to Duluth....	0.31	0.32	0.32
Anthracite, Buffalo to Chicago..	0.41	0.41	0.35
Anthracite, Buffalo to Duluth..	0.32	0.315	0.30

Rates to Milwaukee and Chicago are practically the same. In 1910 and 1911 the wild rate on iron ore was the same as the contract rate; in 1909 the wild rate was 1 to 2c. above the contract rate.

Foreign Iron Trade

German Iron Production—The German Iron and Steel Union reports the production of pig iron in the German Empire in January as follows, in metric tons:

	1911	1912	Changes
Foundry iron.....	272,114	245,333	D. 26,781
Forge iron.....	55,368	44,971	D. 10,397
Steel pig.....	144,775	186,519	I. 41,744
Bessemer pig.....	29,031	28,555	D. 476
Thomas(basic)pig	819,397	867,371	I. 47,974
Total.....	1,320,685	1,372,749	I. 52,064

Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

METAL MARKETS

New York, Mar. 6—The metal markets show a degree of activity, with a tendency to hardening of prices in some lines.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Jan. 1912..	\$ 1,915,202	\$ 5,165,543	Imp. \$3,250,341
" 1911..	923,676	9,540,830	Imp. 8,617,154
Year 1912..	1,915,202	5,165,543	Imp. 3,250,341
" 1911..	923,676	9,540,830	Imp. 8,617,154
Silver			
Jan. 1912..	6,027,905	4,358,009	Exp. 1,669,896
" 1911..	5,651,076	3,551,426	Exp. 2,099,650
Year 1912..	6,027,905	4,358,009	Exp. 1,669,896
" 1911..	5,651,076	3,551,426	Exp. 2,099,650

Exports from the port of New York, week ended March 2: Gold, \$368,700; silver, \$1,056,695, chiefly to London. Imports: Gold, \$56,004; silver, \$158,969, from the West Indies, Mexico and South America.

Gold—The price of gold on the open market in London was unchanged at 77s.

9d. per oz. for bars and 76s. 4d. per oz. for American coin. Gold is still being taken for India. In New York some additional gold was taken for Argentina.

Platinum—The market remains quiet, with no change in prices. We continue to quote \$45.50 per oz. for refined platinum and \$48 per oz. for hard metal.

Our Russian correspondent writes that the demand from abroad is rather active. Offers of small lots by the starateli are larger than last year at this time, and are readily taken up by buyers and speculators. Prices are 10 rubles per zolotnik—\$37.60 per oz.—at Ekaterinburg for crude metal, 83% platinum. The same grade brings 38,500 rubles per pood—\$37.73 per oz.—at St. Petersburg.

Silver—The market has shown some steadiness, though the buying is limited, and there are no special features. Much depends upon China.

SILVER AND STERLING EXCHANGE

Feb.-Mar.	29	1	2	4	5	6
New York....	58%	58%	58%	58%	58%	58%
London.....	27	27	27	27	26	26
Sterling Ex..	4.8705	4.8705	4.8715	4.8720	4.8725	4.8710

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

Exports of silver from London to the East, Jan. 1 to Feb. 22, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£1,482,700	£1,289,300	D. £193,400
China.....	406,000	400,000	D. 6,000
Total.....	£1,888,700	£1,689,300	D. £199,400

India Council bills in London brought an average of 16.14 d. per rupee for the week.

The United States Mint has bought 200,000 oz. silver for subsidiary coinage.

Copper, Tin, Lead and Zinc

LONDON

Feb.-Mar.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'd	Spot	3 Mos		
29	64 $\frac{1}{2}$	64 $\frac{1}{2}$	68 $\frac{3}{4}$	193 $\frac{1}{2}$	189 $\frac{1}{2}$	15 $\frac{1}{2}$	26 $\frac{1}{2}$
1	64 $\frac{1}{2}$	65 $\frac{1}{2}$	68 $\frac{3}{4}$	192 $\frac{1}{2}$	189 $\frac{1}{2}$	15 $\frac{1}{2}$	26 $\frac{1}{2}$
2							
4	64 $\frac{1}{2}$	65 $\frac{1}{2}$	68 $\frac{3}{4}$	194 $\frac{1}{2}$	189 $\frac{1}{2}$	15 $\frac{1}{2}$	26 $\frac{1}{2}$
5	65 $\frac{1}{2}$	65 $\frac{1}{2}$	69	196 $\frac{1}{2}$	191	15 $\frac{1}{2}$	26 $\frac{1}{2}$
6	64 $\frac{1}{2}$	65 $\frac{1}{2}$	69	194	189	15 $\frac{1}{2}$	26 $\frac{1}{2}$

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. 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 = 2.17 $\frac{1}{2}$ c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21 $\frac{1}{2}$ c.

NEW YORK

Feb.-Mar.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.		New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
29	14 $\frac{1}{2}$ @14 $\frac{1}{2}$	14.30 @14.35	43	4.00	3.92 $\frac{1}{2}$ @3.97 $\frac{1}{2}$	6.45 @6.75	6.30 @6.60
1	14 $\frac{1}{2}$ @14 $\frac{1}{2}$	14.30 @14.35	43	4.00	3.92 $\frac{1}{2}$ @3.97 $\frac{1}{2}$	6.55 @6.85	6.40 @6.70
2	14 $\frac{1}{2}$ @14 $\frac{1}{2}$	14.30 @14.35	43	4.00	3.92 $\frac{1}{2}$ @3.97 $\frac{1}{2}$	6.55 @6.85	6.40 @6.70
4	14 $\frac{1}{2}$ @14 $\frac{1}{2}$	14.35 @14.45	43 $\frac{1}{2}$	4.00	3.92 $\frac{1}{2}$ @3.97 $\frac{1}{2}$	6.55 @6.85	6.40 @6.70
5	14 $\frac{1}{2}$ @14 $\frac{1}{2}$	14.35 @14.45	43 $\frac{1}{2}$	4.00	3.92 $\frac{1}{2}$ @3.97 $\frac{1}{2}$	6.55 @6.85	6.40 @6.70
6	14 $\frac{1}{2}$ @14 $\frac{1}{2}$	14.35 @14.45	42 $\frac{1}{2}$	4.00	3.92 $\frac{1}{2}$ @3.97 $\frac{1}{2}$	6.55 @6.85	6.40 @6.70

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of 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 prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; 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.

Copper—At the date of our last report the market for electrolytic copper had become firmly established on the basis of 14 $\frac{1}{2}$ c., delivered, usual terms, corresponding to about 14.32 $\frac{1}{2}$ c., net cash, New York, and on March 1-2 some large sales were made at that price, both for domestic and foreign shipment. On March 4 some sellers raised their price by $\frac{1}{8}$ c., while others did not go so far, but buyers have not yet seen their way to pay the full advance. Considering that they have freely supplied themselves at a lower price it is not surprising that they should await developments before committing themselves further. In the meanwhile electrolytic has been freely offered at 14.57 $\frac{1}{2}$, delivered, usual terms, without finding takers. The business in Lake copper has been dull throughout the week. Some small sales at 14 $\frac{1}{2}$ @14 $\frac{3}{4}$ c. have been reported, while 14 $\frac{3}{4}$ c. is quoted as the price asked by the leading seller. At the close the market is dull, with Lake copper quoted at 14 $\frac{1}{2}$ @14 $\frac{3}{4}$ c., and electrolytic in cakes, ingots and wirebars at 14.35@14.45c. Casting copper is quoted nominally at 14.20@14.25c. as the average for the week.

The London standard market has been rather active throughout the week. The bear party has been dislodged from its position of a few weeks ago, and it was largely due to covering purchases that prices were quickly advanced, reaching the high point on Mar. 5, with £65 1s. 3d. for spot and £65 15s. for three months. The close is somewhat reactionary at £64 17s. 6d. for spot and £65 11s. 3d. for three months.

Tin—Like the standard market for copper, which, being influenced by specula-

tive activity, very frequently moves independently of that for refined copper, so is the standard tin market shaping itself on the London Metal Exchange. While the latter fluctuated considerably, it is reported that the Syndicate did not shade its asking price and held Straits tin steady throughout the week. In this market buyers are naturally to a large extent guided by the London standard quotations, as the private quotations of the Syndicate are not known to them.

Sentiment was influenced by the London coal strike, which may interfere with the shipments of tin to this side and thereby create a scarcity of spot material. Prompt, March and April tin was, therefore, in good demand. The close in both markets is weak at 42 7/8c. in New York, and £194 for spot and £189 for three months prompt in London.

Lead—The leading sellers are freely supplying the demand at 4c., New York, and 3.92 1/2c., St. Louis. There has been some speculative buying of Western lead for future delivery at higher than the ruling St. Louis quotation, which would indicate that the leading sellers are not supplying the speculative demand. The close is steady at 4c., New York, and 3.92 1/2@3.97 1/2c., St. Louis.

The foreign market has been practically stationary throughout the week, closing firm at £15 16s. 3d. for Spanish lead and 2s. 6d. more for English.

Spelter—It is the same story over and over again, a scarcity of near-by spelter, which is becoming more and more acute and which is causing very stiff premiums to be paid for relatively small transactions, while futures go a-begging at much lower prices. We hear of as high as 6.80c., St. Louis, paid for occasional carloads for prompt delivery, but some large tonnages for May shipment are reported sold at under 6.40c. On business for March and April the market has been irregular. The close is unsettled at 6.40@6.70c., St. Louis, and 6.55@6.85c., New York.

The London market is weaker at £26 10s. for good ordinaries and £26 15s. for specials.

Zinc dust is quoted at 7 1/8@7 1/4c. per lb., New York.

Other Metals

Aluminum—Business has not been especially active and there is little change in current prices. We quote 19 1/4@19 1/2c. per lb. for No. 1 ingots, New York.

Antimony—Business is still quiet, at unchanged prices. Cookson's is 7 1/4@7 3/8c. per lb., Hallett's is 7 3/8@7 1/2c., while 6 3/4@6 7/8c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is rather weaker, but prices are nominally unchanged. The New York quotation is \$46

per flask of 75 lb., with the usual advances for small quantities. San Francisco, \$45 for domestic orders and \$42.50 for export. The London price is £8 7s. 6d. per flask, while £8 2s. 6d. is quoted from second hands.

Imports and Exports of Metals

Exports and imports of metals in the United States, month of January, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	32,630	20,477	Exp. 12,063
Copper, 1911....	28,954	10,730	Exp. 18,224
Tin, long tons....	34	3,305	Imp. 3,271
Tin, 1911....	40	4,140	Imp. 4,100
Lead, short tons.	8,605	9,249	Imp. 5,644
Lead, 1911....	5,467	6,861	Imp. 1,394
Zinc, short tons..	1,007	2,189	Imp. 1,182
Zinc, 1911....	418	265	Exp. 153
Nickel, lb.....	1,584,986	2,758,843	Imp. 1,173,857
Nickel, 1911....	2,165,541	2,429,336	Imp. 263,795
Antimony, lb....	.....	1,283,298	Imp. 1,283,298
Antimony, 1911.	127,644	601,046	Imp. 473,402
Platinum, oz.....	.....	1,532	Imp. 1,532
Platinum, 1911.	.....	2,027	Imp. 2,027
Aluminum, lb....	1,690	1,301,375	Imp. 1,299,685
Aluminum, 1911	.....	.....	.....
Ores, etc.			
Zinc in ore, lb... 2,747,234	3,335,087	Imp. 587,853	
In ore, 1911.... 1,776,000	5,263,407	Imp. 3,487,407	
Zinc oxide, lb... 2,285,837	.....	Exp. 2,285,837	
Zinc oxide, '11.. 2,468,630	.....	Exp. 2,468,330	
Zinc dross, lb... 296,450	.....	Exp. 296,450	
Zinc dross, '11.. 479,887	.....	Exp. 479,887	
Chrome ore, l.t.	96	Imp. 96	
Chrome ore, '11	7,903	Imp. 7,903	

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 5828 tons; exported, none. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include re-exports of foreign materials.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 2—The highest price paid this week for zinc ore was \$50; the base price, 60% zinc, was \$47@48. The highest price paid for lead ore was \$50; the base price, 80% lead, was \$48@49 per ton.

SHIPMENTS, WEEK ENDED MAR. 2

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shullsburg.....	901,380	.....	.....
Mineral Point.....	789,800	.....	.....
Platteville.....	642,840	.....	301,900
Benton.....	406,100	.....	.....
Hazel Green.....	275,100	60,000	.....
Galena.....	239,000	.....	.....
Cuba City.....	163,960	88,390	130,700
Dodgeville.....	140,000	.....	.....
Harker.....	64,170	.....	.....
Montfort.....	62,800	.....	.....
Linden.....	.....	.....	60,000
Total.....	3,685,150	148,390	492,600
Year to date.....	31,627,440	889,780	2,413,000

Shipped during week to separating plants, 1,139,210 lb. zinc ore.

Joplin, Mo., Mar. 2—The high price is \$52, the base, per ton of 60% zinc, \$45@49.50, this week's delivery, with \$50 offerings today on next week's delivery. Zinc silicate sold on a base of \$25@28 per ton of 40% zinc. The average price, all grades of zinc, \$44.80. The highest price for lead ore is \$54.50 per ton and the average, all grades, \$53.68 per ton.

Despite the fact the past 10 days have been the stormiest of the year, though

not severely cold, very heavy shipping was done this week, hauling the ore alternately in snow and mud, as the storms came or the sun shone. There is very little unsold ore in the district, less than at any time for a number of years.

SHIPMENTS, WEEK ENDED MAR. 2

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville.....	5,554,110	.....	1,570,400	\$172,821
Joplin.....	1,649,180	.....	270,460	46,880
Jackson.....	1,301,990	.....	8,910	28,880
Alba-Neck.....	1,155,150	.....	.....	27,723
Duenweg.....	863,100	.....	57,940	21,845
Galena.....	590,240	.....	45,990	14,815
Miami.....	436,390	.....	174,380	13,000
Cave Springs.....	522,380	.....	.....	9,925
Granby.....	194,150	235,350	21,730	7,800
Spurgeon.....	117,860	211,210	22,120	6,115
Carl Junction.....	299,660	.....	.....	4,800
Oronogo.....	176,900	.....	68,060	4,459
Carthage.....	119,060	.....	.....	2,678
Aurora.....	54,480	56,420	.....	1,935
Badger.....	60,900	.....	.....	1,340
Quapaw.....	50,760	.....	.....	965
Totals.....	13,145,800	502,980	2,239,990	\$365,981

9 weeks... 85,298,010 4,864,770 13,446,630 \$2,331,350
Blende val., the week, \$298,653; 9 weeks, \$1,890,156
Calamine, the week, 7,210; 9 weeks, 66,624
Lead value, the week, 60,118; 9 weeks, 374,570

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January.....	\$41.85	\$44.90	\$40.55	\$43.54	\$55.68	\$58.92
February.....	40.21	45.75	39.16	43.31	54.46	52.39
March.....	39.85	.....	38.45	.....	54.57	.....
April.....	38.88	.....	37.47	.....	56.37	.....
May.....	38.25	.....	36.79	.....	55.21	.....
June.....	40.60	.....	38.18	.....	56.49	.....
July.....	40.75	.....	38.36	.....	58.81	.....
August.....	42.60	.....	41.28	.....	60.74	.....
September.....	42.63	.....	41.29	.....	59.33	.....
October.....	42.38	.....	40.89	.....	54.72	.....
November.....	45.40	.....	43.25	.....	57.19	.....
December.....	44.13	.....	40.76	.....	62.03	.....
Year.....	\$41.45	.....	\$39.90	.....	\$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Mar. 6—The general market shows no special changes.

Copper Sulphate—A fair trade is being done at last prices, \$4.90 per 100 lb. for carload lots and \$5.15 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is steady, with no material change. Quotations are 2.22 1/2c. per lb. for both spot and future positions.

Messrs. Mortimer & Co., New York, report the position of nitrate in the United States on March 1 as below, in long tons:

	1911	1912	Changes
Stocks, Jan. 1.....	12,790	9,000	D. 3,790
Imports, 2 mos.....	120,322	65,400	D. 54,922
Supplies.....	133,112	74,400	D. 58,712
Deliveries, 2 mos.....	120,362	70,900	D. 49,462
Stocks, Mar. 1.....	12,750	3,500	D. 9,250
Afloat for U. S.	95,000	100,000	I. 5,000

Quantities afloat include all cargoes due to arrive at United States ports by June 15 next.

Sulphur—The Union Sulphur Co. has

contracted for a second steamship of 4500 tons register, to be used in transporting sulphur from Sabine, Tex., to Atlantic coast ports.

Arsenic—Supplies are rather scarce. Imports have been limited by the troubles in Mexico and by high ocean freights. Quotations are \$2.75@3 per 100 lb. for white arsenic.

Sulphate of Ammonia—Messrs. Bradbury & Hirsch estimate the world's production of sulphate of ammonia in 1911 as follows: Germany, 400,000 tons; Great Britain, 378,500; United States, 127,000; France, 60,000; Belgium, 40,000; other countries, 144,500; total, 1,150,000 long tons.

Chemicals and Minerals

CURRENT WHOLESALE PRICES

Ammonium sulphate, cwt.	3.25@3.30
Arsenic, white, lb.	0.02½@0.03
Barytes, ground, sh. ton	12.00@13.00
" floated, sh. ton	16.00@17.00
Calcium acetate, gray, cwt.	2.25@2.30
carbide, ton lots f.o.b.	70.00
Niagara Falls, sh. ton	50.00@75.00
Carbons, good drill quality carat	1.33
Cement, Port., Am. 400-lb. bbl.	175.00
Chrome brick, f.o.b., Pittsburg M.	14.00@16.00
ore, 50%, ex-ship, N. Y.	0.55
Copperas, bulk, cwt.	0.65@0.85
bbl. cwt.	4.90@5.15
Copper sulphate, cwt.	8.00@9.00
Fluorspar, lump, f.o.b. Pittsburg,	7.50@8.50
ton	26.00@35.00
Magnesite, crude, 95% lg. ton	160@200
calined, powdered,	0.05½@0.06
brick, dom. lb.	0.06½@0.07
Pittsburg, M. lb.	0.05½@0.057
Paints, litharge, Am. powd. lb.	0.05½@0.064
red lead, American, lb.	0.05½@0.064
white lead, Am., dry, lb.	0.05½@0.064
zinc white, Am., dry, lb.	0.05½@0.064
Phosphates, acid:	
*Fla., hard rock 77%	5.75@6.25
land pebble 68%	3.70@3.80
†Tenn., 78@80%	5.00@5.50
75%	4.75@5.00
68@72%	4.25@4.50
†So. Car. land rock 60%	3.50@3.75
Potassium cyanide, 98@99% lb.	0.18@0.20
Pyrite:	
Domestic, non-arsenical, fur-	0.12@0.12½
nace size, f.o.b. R.R. per unit	
Domestic, non-arsenical, fines,	0.11½@0.12
per unit, f.o.b. mines	
Imported, non-arsenical, fur-	0.13@0.13½
nace size, ex-ship, per unit	
Imported, arsenical, furnace	0.12½@0.13
size, ex-ship, per unit	
Imported, fines, arsenical, ex-	0.11@0.12
ship	
Imported, fines non-arsenical,	0.12½
ex-ship, per unit	
Pyrite prices are per unit of sulphur. A deduc-	
tion of 25c. per ton is made when ore is delivered	
in large lumps.	
Sodium cyanide, 120 to 130%	0.18@0.20
KCN lb.	
nitrate 95% spot cwt.	2.20
95% future cwt.	2.20
Sulphur, Louisiana prime, N. Y.,	22.00@22.50
lg. ton	
roll cwt.	1.85@2.15
flour cwt.	2.00@2.40
flowers, sublimed cwt.	2.20@2.60
pow. com., bags cwt.	1.50
Sicilian, crude brim-	22.50
stone, lg. ton	
Zinc chloride, granular lb.	0.04½@0.04½
*F.o.b. Florida or Georgia ports. †F.o.b. Mt.	
Pleasant. ‡On vessel Ashley River, S. C.	

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.

Petroleum

The monthly summary of the Oil City Derrick gives the number of oil wells

completed in February as follows: Pennsylvania, West Virginia and southeastern Ohio, 238; Lima-Indiana, 25; Kentucky, 6; Illinois, 71; Kansas-Oklahoma, 397; Texas-Louisiana, 104. In all the divisions there were 841 wells completed, 203 more than in January. The new production was 43,525 bbl., an increase from the January report of 12,037 bbl. Of the completed wells, 129 were failures and 78 gas wells.

MINING STOCKS

New York, Mar. 6—Total sales on the New York Stock Exchange in February were 7,030,882 shares of stock and \$51,686,000 in bonds. This is the lowest record since 1904. The total is less than that of January by 4,316,437 shares of stock and \$53,986,600 in bonds.

Feb. 29 there was little change. Business on the Exchange was light and prices rather weak. Curb trading was more active. Cobalt and Porcupine stocks were in fair demand. The coppers were quite active but did not change in selling prices. Homestake sold at \$87@87.50 per share.

Mar. 1 business on the Exchange was more active and prices stronger; but trading was chiefly professional. On the Curb there were advances, but the trading was narrow. The largest business was in the copper stocks, Inspiration being the leader.

Mar. 2 the Exchange showed larger dealings and firmer prices generally. On the Curb there was a broader market for mining stocks, especially for the coppers, which were in fair demand at slight increases in quotations.

Mar. 4 the Exchange remained steady with prices firmer. Steel common gained a point on large transactions. On the Curb mining stocks were rather irregular, but generally advanced. Coppers and Porcupine showed the heaviest dealings.

On Mar. 5 and 6 the Exchange was rather strong, but dealings were almost entirely professional. The leading point was the continued advance in Steel common. On the Curb the trading was diversified and prices firmer, but mining stocks were the slowest section of the market. Prairie Oil stock advanced sharply on the declaration of an increased dividend.

Boston, March 5—The copper share market has shown increasing activity and strength, with a number of advances. Calumet & Hecla gained to \$464, the highest point for the year. Isle Royale was active and advanced to \$27.25. Mayflower and Old Colony were rather quiet, at \$10.75 and \$7.75, respectively. North Butte was active, rising to \$28, United States Smelting was also up on today's quotations. On the whole there was a substantial improvement, and the close gives promise of a broad and active market.

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Compar. y	Dec.	Jan.	Feb.
Alaska shipments.	4,995,008	3,701,010	.....
Anaconda	23,500,000	26,350,000	27,450,000
Arizona, Ltd.	3,100,000	3,200,000	.....
Balaskiala . . . . .	.....	.....	.....
Copper Queen	8,365,265	6,748,264	6,046,864
Calumet & Ariz.	4,486,000	4,544,000	4,452,000
Detroit	1,969,313	1,941,970	2,008,374
East Butte	1,496,000	.....	.....
Mammoth	1,721,404	1,665,319	.....
Mason Valley . . . . .	.....	600,000	.....
Miami	2,500,000	2,600,000	.....
Nevada Con.	4,679,674	6,309,228	.....
Old Dominion	2,610,000	2,044,000	.....
Ray	2,660,000	.....	.....
Shannon	1,255,898	1,550,000	1,300,000
South Utah	267,514	189,678	.....
United Verde	2,000,000	.....	.....
Utah Copper Co.	9,089,587	8,156,612	.....
Lake Superior*	17,500,000	.....	.....
Non-rep. mines*	8,500,000	8,400,000	.....
Total production	100,647,593	.....	.....
Imports, bars, etc.	21,101,266	31,790,590	.....
Total blister	121,748,849	.....	.....
Imp. in ore & matte	6,159,997	8,340,740	.....
Total	126,908,846	.....	.....
Brit. Col. Cos.:			
British Col. Copper	.....	1,607,558	.....
Granby . . . . .	.....	.....	.....
Mexican Cos.:			
Boleo	2,645,640	2,315,040	.....
Cananea	3,708,000	3,552,000	.....
Moctezuma	2,864,464	2,732,867	2,687,712
Other Foreign:			
Cape Cop., S. Africa	701,120	784,000	.....
Kyshtim, Russia	1,570,000	.....	.....
Spassky, Russia	721,280	795,200	.....
Famatina, Argen.	217,280	172,480	.....
Tilt Cove, Newf'd. . . . .	.....	153,257	.....
Exports from:			
Chile	5,824,000	8,064,000	.....
Australia	11,200,000	7,056,000	.....
Arrivals in Europe	.....	.....	.....
from other count.†	16,331,840	13,144,320	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
II, 1911	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,228	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,450,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II . . . . .	.....	.....	.....
VISIBLE STOCKS			
	United States	Europe	Total
III, 1911	156,637,770	233,385,600	390,023,009
IV	162,007,934	228,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,382	202,540,800	368,536,732
VII	157,434,164	196,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	135,441,501	191,228,800	324,670,301
X	140,834,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,765,188	164,281,600	276,066,788
I, 1912	89,454,695	158,325,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III . . . . .	.....	141,142,400	.....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

On the Curb business was fairly active. Eagle & Blue Bell and Majestic sold rather freely. Rhode Island Coal was quoted at 26c. Quite a lot of Porcupine stocks have changed hands recently.

Assessments

Table with columns: Company, Delinq, Sale, Amt. Lists various companies like Algoma, Alpha Con., Best & Belcher, etc., with their respective assessment details.

Monthly Average Prices of Metals

SILVER

Table showing monthly average prices for silver in New York and London from 1910 to 1912.

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

COPPER

Table showing monthly average prices for copper in New York and London from 1911 to 1912.

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

TIN AT NEW YORK

Table showing monthly average prices for tin at New York from 1911 to 1912.

Prices are in cents per pound.

LEAD

Table showing monthly prices for lead in New York, St. Louis, and London from 1911 to 1912.

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

SPELTER

Table showing monthly prices for spelter in New York, St. Louis, and London from 1911 to 1912.

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

PIG IRON AT PITTSBURG

Table showing monthly prices for pig iron at Pittsburgh in Bessemer, Basic, and No. 2 Foundry from 1911 to 1912.

STOCK QUOTATIONS

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

TORONTO

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

SAN FRANCISCO Mar. 5

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

N. Y. EXCH. Mar. 5

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

N. Y. CURB Mar. 5

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

BOSTON CURB Mar. 5

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

LONDON Mar. 6

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

†Last quotation.