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Mining at the Wasp No. 2, in the Black Hills, South Dakota

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Probably nowhere in the world has the mining and milling of low-grade gold ore been perfected as in the Black Hills of South Dakota. This was one of the first regions in the United States to adopt the cyanide process for the treatment of gold ores, and it is here that

ly horizontal, with a thickness of about 20 ft., underlying a plateau of 12 or 15 acres. Erosion has worn deep gulches on the east and northwest sides of the plateau, exposing the quartzite at many points. North and south from the low point of the plateau are prominent hills, that to the north being apparently a porphyritic plug, with characteristic flow distributed in all directions. Southward there is less porphyry, the capping over the quartzite consisting mainly of shales. At the low point



LOADING ORE DIRECTLY INTO SKIPS AT THE NORTH SIDE OF WASP NO. 2 OPENCUT; THE OVERBURDEN IS REMOVED BY STEAM SHOVEL

some of the greatest strides have been made in its evolution.

EIGHT YEARS' SUPPLY OF \$2 ORE

Not many are acquainted with the success being made by the Wasp No. 2 Mining Co., at Flatiron, S. D., where \$2 ore is being handled at a handsome margin of profit. The mining is cheap, and the ore, after coarse crushing, is cheaply cyanided. There are few mines where such a good profit is made on a similar grade of ore.

The orebody is a bed of Cambrian quartzite, lying near

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in the plateau the quartzite is covered by a foot or more of soil, at some places it is bare, the covering thickening toward the north and south. For many years the company will be able to work the orebody by stripping and opencut mining, but as the work progresses northward where the overburden is thicker, it will probably be necessary to do underground mining. The entire portion of the plateau owned by the Wasp No. 2 company has been prospected by drilling holes to the bottom of the quartzite at 50-ft. intervals. These holes show the entire area to be ore-bearing, and the company figures eight years' mill supply in sight at present.

Underneath the quartzite are the Algonkian schists, standing nearly vertical. This is a geological formation which in this district of the Black Hills at many points contains large veins of free-milling ore. There are excellent possibilities that this class of ores may be found on this property, but no development has been done so far, probably for the reason that a plentiful ore supply is in sight in the quartzite body. One fact that lends color to the theory of further orebodies existing in the schists, is that at other points in the vicinity where rich ores have been found in the Cambrian formation, large orebodies have been found in the schists. This is particularly true of the Homestake. There is undoubtedly a connection between the deposits, probably the ores in both formations were enriched at the same time by the same ascending solutions.

PRESENT ORE ASSAYS A LITTLE OVER \$2 PER TON

In former years the Wasp No. 2 was a large producer of high-grade smelting ores. Thousands of tons were produced which gave smeltery returns of over \$50 per ton. This was the typical refractory siliceous ore of the Black Hills, lying for the most part either directly on top of or within a short distance of the quartzite. These high-grade streaks have been occasionally encountered below the quartzite, as for instance, one that was found last

Gray, is in itself a most important feature, for without good management the property could easily lose more money than it is now paying in dividends.

The mine, for the subject of comparison, may be roughly divided into two sections, the north and south. Some slight differences are noticeable in the methods on the two sides. The mining method at the Wasp No. 2 consists of stripping off the alluvium covering the ore, and then quarrying the quartzite. The most economical method of stripping has been found to be the steam shovel, where the character and depth of the stripping warrant its use. The shovel now in use is at work on the north side, where the stripping is heavier. It was installed a year ago, and has been highly successful, materially cheapening costs. It is an Atlantic-type shovel, made by the American Locomotive Co., with a 1-cu.yd. dipper. It is purposed to use this machine for stripping during the warmer months only, shutting it down during the winter. When, as at present, the stripping is 10 to 16 ft. thick, the shovel's capacity for stripping is far in excess of the mining requirements of the north side. The overburden is composed of a foot or so of soil, and then compact shale and occasional sandstone. This is loosened up with black powder, holes being put down with air drills. One miner is employed a portion of his time drilling and blasting these holes in the overburden, and the



ORE FROM THE SOUTH SIDE IS DUMPED INTO THE ORE BIN ON THE LEFT DURING THE DAY AND AT NIGHT IS HOISTED IN SKIPS AND AUTOMATICALLY DUMPED INTO THE MILL BINS SHOWN AT THE RIGHT

spring that produced 40 tons of ore that gave smeltery returns of a little more than \$150 per ton. The mine has also produced a considerable quantity of tungsten ores, these ores invariably carried high gold contents, often running \$500 per ton.

But since the practical exhaustion of the high-grade ores, which were in small shoots, the company has turned its attention to cyaniding, and has been in that business for nearly 10 years. The mill supply, as at present maintained, assays a little better than \$2 per ton. Nearly 500 tons per day is treated at a cost of \$1 to \$1.25 per ton, thus leaving a good margin of profit.

NATURAL CONDITIONS FAVORABLE

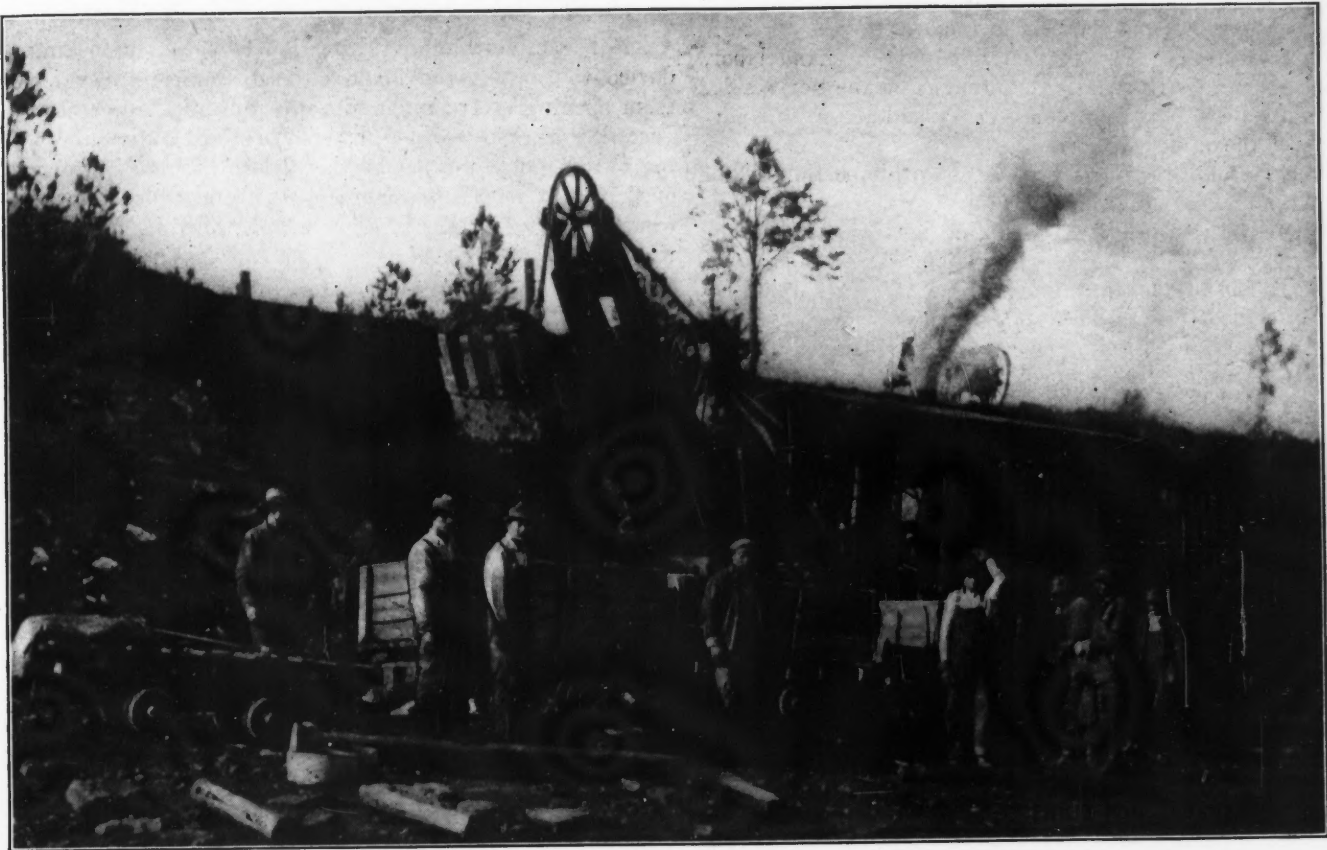
The Wasp No. 2 is fortunate in having some natural conditions in its favor. In the first place the orebody is large, lies near the surface and can be cheaply mined. At the mill it is subjected to leaching with cyanide solution after coarse crushing, and readily gives up three-quarters of its contents. These features are in its favor, but in addition to them the organization and system employed, which is largely to be credited to General Manager John

remainder of his time in drilling and blasting ore. The steam shovel dumps into 18-in.-gage wooden side-dump cars, which are trammed to the waste dump, two men pushing a car.

BLASTING 5000 TONS

After the top of the ore is cleaned, holes are put down with 2¾-in. Ingersoll-Rand air drills to the bottom of the quartzite, and chambered two or three times with 40% dynamite. The last chambering charge consists of about 75 sticks of powder. Finally a charge of black powder, approximating 50 kegs, is exploded. This breaks 4000 to 6000 tons of ore so that it is possible to shovel 90% of it into the mine cars. The remaining 10%, which is too large to handle, is blockholed, Ingersoll-Rand "Little Jap" machines being used for drilling and dynamite for blasting.

Ore from the north side is shoveled into skips; the illustration on the first page shows the thickness of the ore with overburden in the background where the ladder leans against the bank, and a glimpse of the steam shovel at the right.



STEAM SHOVEL USED IN STRIPPING THE OVERBURDEN AT THE WASP NO. 2



TRAMMING ORE FROM THE SOUTH SIDE OF THE WASP OPENCUT

On the south side hand stripping is followed, with occasionally plows and scrapers to remove the soil, where it is not too rocky. Except that it is done by hand labor, the system of stripping is the same as on the north side. About six feet of overburden is easily handled in this portion of the mine.

Skip tracks are not so convenient to this portion of the mine, and two methods of loading skids are used. One is to shovel the ore into 1-ton mine cars and tram them to bridges, crossing and skipway. The skips are stopped beneath the bridges and quickly filled, the cars dumping directly into them. The other method is to shovel the broken ore into 2-ton mine cars, tram them to an ore bin, where they are dumped. From this bin the ore is drawn to skips and hoisted to the mill on night shift only. These large cars, of the same pattern as the cars used in stripping, are built of 2-in. planks, on a frame of 4x6-in. timbers. The bottom is protected by a sheet of steel. These cars are built by the company, and are cheap and serviceable, and where side dumping is available, tramping is cheapened by their use. In the mine it is seldom necessary to tram more than 200 ft., unless conditions are such that the skip tracks cannot be placed any closer than that to the ore faces, a contingency that not often arises. The mine-car tracks are laid with steel rail, 18-in. gage. Permanent track is laid with 40-lb. rail and spurs with 18-lb. rail. The engraving shows the ore bins and covered skipway, surrounded by pile of waste. With two skips, operating on a double-track skipway, and 25 shovelers and trammers working on ore, 500 tons per day are handled, except that about one-third of this amount is taken to the mill on night shift, as explained.

The skip tracks are 48-in. gage, laid with 40-lb. rails on 6-in. ties, spaced 24 in. between centers. The track is double for its entire length of 1200 ft. Two 5-ton skips, one operating on each track, are used. The skips automatically dump into the ore bin at the mill, above the crushers.

The maximum grade of the skipway is 10 ft. in 100, and a 52-lip. double-drum hoist, driven by electric motor, easily handles the load. The air compressor is at the mill, in the room housing the skipway hoist, and in a class NE-1, Ingersoll-Rand machine; it is single-cylinder, single-stage, cylinder 12 $\frac{1}{4}$ x12 in., and at 200 r.p.m. has a piston displacement of 310 cu.ft. per min., delivering air at 100-lb. pressure.

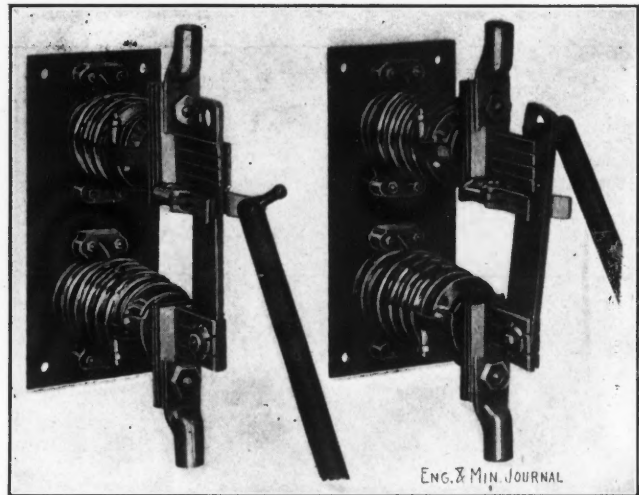
During 1911 the total cost of mining was \$0.5348 per ton, as shown by the annual report. The largest item of expense was labor, \$43,770. Other costs included stripping, \$12,692; explosives, \$5763, and power, \$2722. During the year 160,860 tons of ore were mined and milled, for a yield of \$286,160, of which amount \$84,641 was profit. Of the profit, a total of \$60,000 was disbursed in dividends.

Supplies cost about as follows, prices fluctuating from time to time: Black powder, \$1.5225 per 25-lb. keg; dynamite, 40%, \$13, cwt.; steel rails, \$36.50 per long ton; lumber, \$14 per M. These prices are figured f.o.b. Wasp No. 2 spur, on the C. B. & Q. Ry. Labor costs are as follows: Shovelers and trammers, \$3; miners and powder men, \$3.50; steam-shovel engineers \$4; steam-shovel firemen, \$3; crane men, \$3; hoisting engineers, \$4. The mine payroll carries about 60 men, of which 50 are shovelers and trammers, half of whom are employed on ore.

Locking Device for Electric Switch

In the accompanying illustration is shown a locking device to prevent the blade of a disconnecting switch from opening except under the direction of the operator. Instances are on record where the blade of a disconnecting switch not protected by this device has been thrown open or partly open by magnetic repulsion and destroyed when a short circuit has occurred on the line, not only resulting in the loss of the switch but also putting the circuit on which the switch was installed out of commission until a new switch could be installed.

The safety catch or locking device is a unit in itself and can be applied by anyone to any General Electric type I, form G-6 switch merely by clamping it to a support placed between the clip block and the insulator cap. It is of rugged design and is operated with a switch hook. This locking device consists essentially of two brass bell cranks hinged together at the ends of the two shorter arms and held closed by compression springs. The projections or jaws in the outer ends of the two longer arms close in front of the blade thus pre-



METHOD OF OPENING SWITCH EQUIPPED WITH LOCKING DEVICE

venting the latter from coming out of the clips. Each bell crank is provided with a dog which moves in a slot in the elbow of the bell crank, the dog being hinged at this point.

To open the switch the outer ends of the bell cranks are pressed back away from the blade allowing the dogs to come forward so as to rest upon the sides of the blade, in which position they hold the jaws in front of the blade apart allowing the switch to be opened. Withdrawing the blade of the switch from between the dogs causes the jaws automatically to close against the sides of the blade and to snap shut as soon as the blade is completely withdrawn.

As the outer edges of the jaws are beveled the switch blade can be readily pressed back in the clips into the closed position, when the jaws close automatically in front of the blade locking the latter in the closed position. This device is made by the General Electric Co., Schenectady, N. Y., in sizes to fit 300-, 600-, 800-, and 1200-amp. switches as standard and can be furnished for a switch of any capacity.

An Outline of Mine Accounting

BY HENRY B. FERNALD*

SYNOPSIS—Accounts should show not only the financial status of a company, but should reflect physical conditions accurately. An outline of the relations of capital charges, operating expenses and deferred charges, and of assets and liabilities.

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The difficulty in writing of mine accounts comes from the fact that each mine has its own peculiarities, problems and methods. The varying conditions of operation and organization will naturally call for corresponding differences in forms of cost sheets, divisions of accounts, timekeeping methods, storehouse accounts, etc. There is, therefore, no fixed standard by which mine accounts should be judged since each mine should have the accounts and records which will present with accuracy, clearness and economy the facts regarding its operation and financial condition.

ACCOUNTS THE COMMON GROUND OF THE FINANCIAL AND TECHNICAL MEN

But in spite of the multitude of varying details to be considered in each case, there is a general scheme of accounts which must apply to every mine in accord with the very nature of the mining business. If its general outline can be kept clearly in mind, the questions regarding details are much more readily settled, and more satisfactory operating and financial statements will result. It also gives a common ground for the operating and accounting departments to meet, without requiring the one to consider bookkeeping details nor the other to pass upon engineering matters.

The outline as here presented will not, therefore, attempt to recommend special bookkeeping methods nor to decide engineering propositions. We should know the cost of mining irrespective of whether it is surface or underground. This must include development costs, either as the expenditures are incurred, or proportionately to the tonnage of ore extracted. All the accounts may be kept at the mine or they may be divided between the mine and the home office.

ESSENTIALS OF MINE ACCOUNTING

But whatever is done along these and other lines, the essential facts stand out that, having at hand the mining property:

Expenses are incurred as labor, supplies and sundry charges, for operation, equipment or development.

The result of all expenditures is the tonnage of ore, of a certain metallic content, which is mined and is marketed (either before or after treatment).

This yields a profit or a loss on the mining operations, which, together with the result of rentals, and any other miscellaneous transactions of the company, will be its net profit or loss. A profit may be distributed to stockholders as a dividend, may be held as current working capital, or may be expended for equipment, development, etc.

The financial condition of the company at any time is shown by the statement of its resources and its liabilities. The resources may be the current working cap-

ital of the mine, the deferred charges to be made against its subsequent operations, and the fixed investment in property, equipment, etc. The liabilities may be for current or for bonded indebtedness.

This statement of resources and liabilities does not, however, take note of the most important factor in determining the value of the mine, i.e., the value of the ore remaining in the mine. The current assets, such as cash, accounts receivable, inventories, etc., are usually to be considered as worth their face value. The liabilities should, of course, be paid in full. But the accounts for property, equipment and development can only represent the expenditures which have been made therefor—the question of value being dependent almost entirely upon the more or less uncertain problem of future ore supply.

This is the situation common to every mine, and is the common ground which all mine accounts must cover. The accounts must, therefore, lead to four statements or groups of statements:

I—Costs.

II—Production.

III—Profit and loss (and surplus).

IV—Assets and liabilities.

The series of outlines which follows is planned to show the general scope of each and their relations each to the others, understanding that the various details of these statements and the forms for their presentation must be a matter for separate determination in each case.

THE MAKE-UP AND DISTRIBUTION OF COSTS

For convenience of phrasing, we will consider the current costs as being primarily incurred for:

Labor—As shown by the pay roll and time-keeper's records.

Materials—As shown by the storehouse records.

Sundry expenses—To include the numerous items, which are neither labor nor materials, as shown by the records of the general office.

The records in each case should show how these apply as:

Direct costs of operation.

Direct cost of improvements, construction and other capital accounts.

Distributing accounts (where the labor, materials, etc., do not apply, as such, directly to operation or capital accounts, but require an intermediate grouping, such as power, etc., which is in turn to be distributed to the various operating or capital accounts).

The total current cost for each division of operating or capital accounts will accordingly be the direct cost, plus the proportion of the distributing accounts which apply thereto. The "current costs" which thus result will not take into account the items of depreciation and of deferred charges.

Whatever may be the basis for charging depreciation, as determined from the engineering standpoint, we must in some way or other make a charge to operation which will, on a proper basis, cover the loss in value of equipment, construction, etc., as operations proceed. There-

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fore, instead of charging to operation the current costs of construction, equipment, etc., these would be charges to the proper capital accounts; operation being chargeable with the depreciation applying to the current period, which might be more or less than the current construction or equipment costs.

The matter of deferred charges is probably the most difficult question in mine accounting. Briefly, it is the question of what operating costs are to be stated against future as distinguished from current product. It is manifest that the cost of mining and transportation for ore on hand in the mill bins at the end of the month is not properly a part of the cost of the mill product for that month, but is a charge which should be deferred until it can be stated as a part of the cost of the product resulting from that ore. It is also a fairer measure of cost to apply the cost of stripping proportionately to the tonnage made available than to charge against current production the stripping done during that period. These, and other more difficult features, are primarily engineering questions, the answers to which must come from the facts in the case, rather than from accounting methods.

What the accounts should show clearly and definitely is the amount of expenditures for capital accounts or deferred charges, the amounts charged against operations and the basis on which the charges have been made.

WHAT OPERATING COSTS SHOULD SHOW

A summary of operating costs may therefore be shown as follows:

Direct charges to operating accounts for labor, materials and sundry expenses;

Add charges for the proportion of distributing accounts which apply to current operation;

Giving the total current operating costs;

Add depreciation;

Add any previous deferred charges applying to current production;

Deduct any current costs which are to be deferred charges against future production;

Gives total cost chargeable against current production.

The corresponding summary for capital accounts would be:

Balance of capital accounts at the first of the period;

Add current charges to capital accounts (being the direct charges for labor, materials and sundry expenses, plus the proportionate charges from distributing accounts, if any);

Deduct depreciation chargeable to operating accounts;

Gives balance of capital accounts at the end of the period.

A summary of deferred charges would be along the same lines.

PRODUCTION RECORDS

The details of production records will be determined almost entirely by the character of the ore and its treatment, and the manner of its sale. They should be such as will clearly follow the movement of the product from the ore mined to the ore, concentrates or metals sold, giving all the important information from stage to stage. Although the ledger accounts only take up the facts which can be expressed in dollars and cents, there is such a close relation between the metallurgical data and the final

value of the product as to form a single, continuous set of records to correspond to the progress of the ore.

At first the ore simply stands in the accounts as representing its cost to the stage it has reached. Finally, however, it reaches the point where it is to be taken into the accounts at the value of its metallic content which is in marketable shape. The distinction must be made between the gross value of the metallic content, the amount of metal which will be paid for, and the net amount to be received after deducting the charges for treatment, transportation, etc.

Although the general law is that profits can only be considered as earned when an actual sale is made, it is customary in mine accounts to consider the profits when the product reaches its marketable form, as ore, concentrates or bullion ready for shipment. The advantage of having the clear statement of what the mine is doing more than balances the comparatively slight variations which will result from the use of mine assays and estimated marketing expenses.

SUMMARY OF THE PRODUCTION RECORDS

The summary of production, on this basis, would be as follows:

Gross value of production;

Less smelter deductions, treatment and freight;

Gives net settlement value of production.

If, as is usually the case, part of this production is on hand, in transit or at smelters and not yet paid for, there would also be a summary to show:

Production for the period;

Product on hand, in transit and at smelters at the first of the period;

Giving total production to be accounted for;

Less production settled for during the period;

Leaves the product on hand, in transit and at smelters at the end of the period (which should agree with the total of the individual lots of unmarketed product).

PROFIT AND LOSS

While one purpose of the cost and production records has been to show from an operating standpoint the costs per ton, foot, yard, etc., and the recoveries from ores, these same records should lead to the balancing of production against cost, to show the profit. It will be recognized that this is practically nothing more than a grouping of the summaries previously given.

The profit is not the difference between the cash received from production sold and the cash disbursed in payment of bills.

As already pointed out, consideration must be given on the one hand to the production not yet settled for, and on the other hand, not merely to the distinction between cash paid out and expenses incurred, but also to the questions of capital and deferred charges and the cost which is properly chargeable against current production.

In addition to the profit from mining operations, there will usually be certain miscellaneous items such as rentals, store sales, etc. Although these may sometimes be of such importance to require a complete set of accounting records for each, such accounts will merely follow the ordinary commercial methods, showing the resulting profit or loss.

SUMMARY OF PROFIT AND LOSS ACCOUNT

The summary of profit and loss may accordingly give:

- Gross value of production.
- Less cost of production.
- Less smelter deductions, treatment and freight.
- Giving mining profit and loss.
- Add or deduct miscellaneous profits or losses.
- Giving net profit or loss for the period.
- Add the balance of profits at the beginning of the period.
- Deduct dividends paid.
- Gives the balance of profits remaining at the end of the period.

The general relation of all these accounts may be briefly presented by the accompanying diagram.

GENERAL SCHEME OF MINE ACCOUNTS

Costs		Production and Profits	
Current charges for Labor		Gross value of Sales	
Materials		+Product unsold at end of period.	
Sundry Expenses		-Product unsold at first of period.	
will give (after apportionment of distributing accounts)			
Current charges to capital accounts	Current charges to operating accounts	=Gross value of production for period.	
+Previous balances of capital accounts.		-Deductions, treatment and freight.	
-Depreciation	+Depreciation	=Net value of production.	
=Balances of capital accounts carried to subsequent period.			
	+Deferred charges from previous period.		
	-Deferred charges to future period.		
	=Cost of production		
		-Cost of production	
		=Profit on production	
		+Miscellaneous income or profits	
		-Miscellaneous expenses or losses.	
		=Net profit for period.	
		+Previous surplus profits.	
		-Dividends.	
		=Present surplus profits.	

ASSETS AND LIABILITIES

The general divisions of assets and liabilities have already been referred to. Under the divisions will appear such accounts as the conditions in each case may call for. The exact title to be used for each account is of comparatively little importance, so long as it signifies clearly the nature and scope of the account, and so long as the accounts are so carried that the value of each and its relations to other accounts will be readily apparent.

In addition to the accounts for actual indebtedness which will appear on the liability side of a financial statement, there will also be the accounts for reserves, capital stock and surplus. Reserves do not represent actual present indebtedness, but stand on the liability side of the statement to represent a reduction in the net value of the assets to allow for indebtedness which will have to be paid at some future date or for assets which must sooner or later be replaced or written off. Capital stock appears on the liability side to show what the business should return to the stockholders to make good the par value of their stock.

If the total assets exceed the total indebtedness, reserves and capital stock, this excess will be a surplus appearing upon the liability side to balance the account. A deficit will be the necessary figure to balance on the asset side.

A brief statement of the relations which increases and decreases in the various accounts bear to one another, may be of value. For example: An increase in the working capital of the mine can be obtained by increasing the indebtedness, by selling capital stock, by earning

profits or by liquidating other assets. Similarly, borrowed money may be used for paying other liabilities, for increasing current, deferred or fixed assets, or may be paid out for expenses.

In considering any statement of assets and liabilities, it should, therefore, be remembered that:

- An asset increased means either
 - Income earned;
 - A liability incurred;
 - Another asset decreased.
- A liability increased means either
 - An expense incurred;
 - An asset increased;
 - Another liability decreased.
- Income earned means either
 - An asset increased;
 - A liability decreased.
- An expense incurred means either
 - An asset decreased;
 - A liability increased.

It is accordingly evident that any increases or decreases of assets and liabilities which do not affect other asset and liability accounts, must apply to accounts for income and expense. This gives one of the best methods of guarding against errors in the accounts, such as are almost sure to occur if the volume of business is large. A careful checking of the balances of these various accounts to see that they agree with the actual facts which they are supposed to represent will often show items improperly omitted or improperly included in preparing the statements of income and expense.

A statement of assets and liabilities will present in general outline, the following facts:

ASSETS

- Current Assets:
 - Representing cash, accounts receivable, product not yet paid for, inventories and such other assets as constitute the current working capital of the mine.
- Deferred Charges:
 - Representing operating expenses to be charged against future, as distinguished from present, production.
- Fixed Assets:
 - Representing the net investment in property, construction and equipment (the property being carried on the basis of its cost and not at the value of its future production).
 - Making the total assets of the company.

LIABILITIES

- Current Liabilities:
 - Representing the current indebtedness outstanding.
- Fixed Liabilities:
 - Representing bonded or mortgage indebtedness not requiring immediate payment.
- Reserves:
 - Representing an allowance made for future indebtedness or for the replacement or writing off of assets.
 - Making the total liabilities and reserves outstanding against the assets.
- Capital Stock:
 - Representing the par value of the full-paid capital stock outstanding.
- Surplus:
 - Representing the difference between the total assets and the total liabilities, reserves and capital stock. (The surplus must also represent the net result of profits from operation, or from other sources, less the dividend disbursements.)
 - Making a total on the liability side to equal the total of the assets.

In concluding such an outline, it may not be amiss to mention a few matters essential to a clear, consistent set of accounts and records:

RESUME OF MINE-ACCOUNT RECORDS

(1) The original records should give the information on which all subsequent entries are to be based. Whatever divisions are to be made in the accounts should be considered in the original records. It is much easier to summarize items to get a total than to analyze an amount to obtain its details.

(2) The records should be so planned that the original entries can readily be referred to. Even the outside records kept in pencil can be arranged for proper files or binders. Each record should show clearly where its entries come from and any other records to which they go. Care in planning the records so that they will run in proper series will avoid a duplication of work and will make it much easier to trace individual items throughout the accounts.

(3) A clear and correct statement of the facts is the main object of the accounts. Undue formalities are neither necessary nor desirable. It is often better to make a clear record in statement form, rather than a debit and credit account. The order in which facts and figures would naturally and logically be entered in the original record is usually the best to follow. There must be a certain amount of formal bookkeeping to give a ready proof that every item is fully accounted for, but this should summarize rather than duplicate the various operating statements.

There are many other features of the accounts which might be discussed at length, but the purpose of the above has been to present such an outline as might enable the operating men on the one side and the office men on the other to have a clearer conception of the general nature and meaning of accounting statements.

If the accounting force realizes clearly just what the various accounts and statements are intended to show, much cleaner and more accurate records will result. If the operating men can count on promptly receiving correct statements showing the facts with which they have to deal, presented in a manner which they can readily understand, there will be a practical value in the accounts far beyond their mere proof of the honesty of the employees and the amounts owing to or by the company.

Finally, the best test of a system of accounting is whether it gives promptly, clearly and simply the desired information with no unnecessary loss of time or labor in keeping the records, or making up statements therefrom.



Tungsten Mining in Nova Scotia

Nova Scotia has been a gold-mining country, in a modest way, for about 50 years, but to understand the nature of the veins it may be well to recall briefly that the Nova Scotia peninsula consists of granite and Lower Cambrian quartzites and slates; the latter being in a series of folds parallel with the Atlantic coast. The quartzites are dark colored and evidently contain much feldsparthic material. Layers of the hard, pure type are rare.

Scheelite Camp, which is the source of tungsten, is situated in the central part of Halifax County, Nova Scotia, 12 miles from the Atlantic coast and 34 miles from the nearest railroad point. The veins bearing the tungsten ore are in the same system and on the same anticline as the old Moose River gold mines, two miles distant. The scheelite veins had been prospected for gold years before, as shown by trenches overgrown with brush. A little scheelite was found in the old gold mines at Moose River; but so far no gold, above a trace, has been found in the tungsten mines.

The vein matter consists substantially of quartz, scheelite, ankerite and arsenopyrite. There is a little pyrite

and calcite, and a few slender black tourmaline crystals, said Victor G. Hills in part before the Colorado Scientific Society. The scheelite seems to be strictly a primary deposit. Not a particle of either of the black tungsten ores has ever been found in these veins; and such an occurrence would be looked for if the tungsten ore was formed as an alteration, and replacement of the ankerite which contains the very elements necessary to form wolframite. Further, no partly altered specimen has ever been found, and where scheelite occurs touching the ankerite, there is a distinct line of demarkation between the two.

The discovery of tungsten in this locality was made in the fall of 1907, by a trapper, who picked up a piece of the scheelite in the bed of a small brook. Some development work was done during the short summer seasons of 1909 and 1910, and in 1911 the construction of a concentrating plant was undertaken.



Talc Milling in New York

The preparation of the Gouverneur tale for the market is described by the geological department of the New York State Museum in *Bull.* 161 on the "Mining and Quarry Industry in New York." The lump talc is broken in jaw crushers of the Blake type, and is then passed through a cone grinder or through rolls where it is reduced to 1/2-in. mesh or finer. In the third stage the crushed talc may be ground between buhrstones of special manufacture or in a centrifugal grinder, of which the Griffin mill is a common type. The talc is then passed through a bolt of about 60 mesh and goes to the finishing cylinders, or the finest material may be separated by air currents which blow it into settling chambers and then forms one of the grades for the market. The common practice is to make the final reduction in revolving cylinders charged with pebbles. The Alsing cylinder is the one generally used and is from eight to 10 ft. long and six feet in diameter. It is lined with porcelain brick. It is turned from 20 to 25 times per minute. The charge consists of one ton of talc and three tons of flint pebbles. The grinding of a single charge takes from two to five hours, depending upon the grade of product that is desired. The fibrous character of the talc is maintained throughout the grinding to the end product, so that it is difficult to size the ground talc by screening; consequently the degree of fineness is regulated entirely by the duration of the final grinding process.

In the new plant of the Uniform Fabrous Talc Co., the Hardinge conical mill is employed in preparing the talc for the finishing process. The crude rock is first passed through a jaw breaker which reduces the lump talc to about 1.25-in. size; the product is then screened and fed into the Hardinge mill, where it is ground to pass a 10-mesh screen for the cylinders. The latter are of the usual intermittent type.

Tube mills of large size, such as are used in the fine grinding of cement and ores, have been installed in one or two plants. They take the place of the Alsing cylinder. They have the advantage over the latter of being continuous in regard to feed and discharge, but are more difficult to regulate so as to give the desired finish to the product. A coarser grade known as buhr stock is produced by omitting the last stage of grinding in the Alsing cylinder.

Cyanidation at the Liberty Bell Mill

By HERBERT A. MEGRAW

SYNOPSIS—An ore containing both gold and silver is treated by a process the features of which are amalgamation in cyanide solution, careful concentration, and cyanidation of the resulting tailing. Stamps are used for primary crushing and tube mills of the tire type for regrinding. An early installation of the Moore filter is still giving good results. Zinc shavings are used for precipitating metals from solution. An increased percentage of silver recovery has been attained in spite of a material decrease of that metal in the ore.

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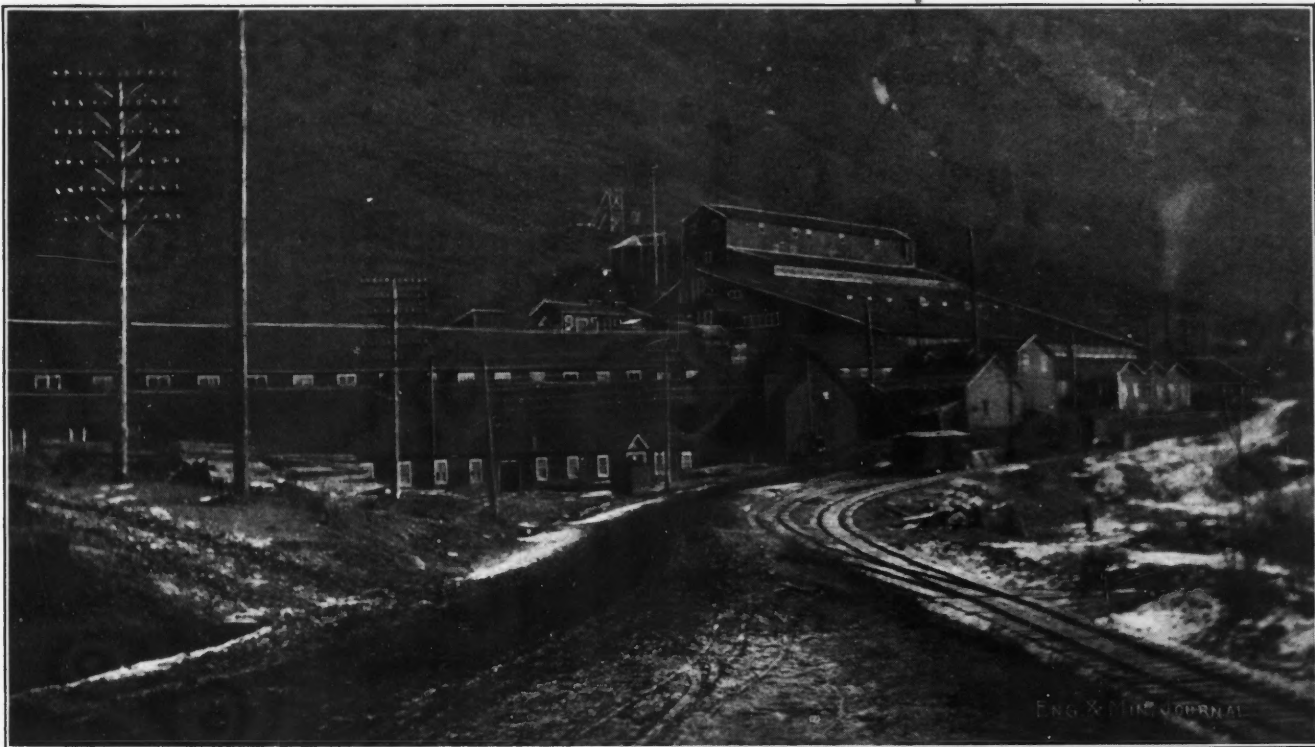
The mill of the Liberty Bell Mining Co., is situated near the town of Telluride in San Miguel County, Colo. It is an old mill, operations having commenced in 1898 and continued up to the present time with only a few interruptions due to reconstruction and improvement of the plant and the unavoidable loss of time on account

ore is not hard and milling is comparatively simple.

Cyanidation was early installed. In 1899 an experimental plant was built and tested and, success having been demonstrated, a 250-ton leaching plant was erected in 1900. It was soon shown that a substantial profit could be obtained by this method, although at that time it was about the lowest grade of ore being profitably handled by such process. Conditions were facilitated by the delivery of power from the plant of the Telluride Power Co., which had just begun operations. All these conditions aided in securing the satisfactory result which has been continuously improved upon up to the present time.

ORE CRUSHED AT THE MINE

The primary crushing plant is installed at the mine and consists of two 11x18-in. Blake sectional crushers. The



LIBERTY BELL MILL AT TELLURIDE, COLO.

of labor troubles. The mill began operations with 10 stamps and the scale has gradually been increased until at present there are 80 stamps in operation, crushing a total of about 485 tons of ore per 24 hours.

ORE IS QUARTZ AND CALCITE

The ore consists of quartz or calcite, banded, occurring either alone or together, and often having bunches of the feldspathic country rock. The vein material is generally fractured and contains large quantities of clay which produces a colloid slime in the milling process. The

Note—This is the sixth in a series of articles by Mr. Megraw on American cyanide practice. Previous papers appeared Nov. 2, Nov. 23, Dec. 14, Dec. 21 and Dec. 28, 1912.

ore is delivered above the crushers on to a grizzly having 3-in. openings. The pitch of the grizzly is steep, about 52°, in order to secure a satisfactory run of the ore, which is wet, averaging in general about 8% moisture. The crushers break the ore to the same approximate size as the product which has passed the grizzly, so that the material delivered to the mill is sufficiently small in one direction to pass the 3-in. opening. It should be noted, however, that this is a much different thing from passing a 3-in. ring, as material having one 3-in. dimension, no matter what its length and breadth may be, will go through the grizzly and large slabs of rock are frequently run into the mill.

The ore is carried to the mill by means of an aerial cable tramway $1\frac{1}{2}$ miles long. The cableway crosses a high divide between the mine and mill, which necessitates a more substantial construction than when the whole line is on one approximate level. The highest point on the tramway is 1800 ft. higher than the mill. At the mill a steam-heated detention room is provided, which is useful in winter for thawing the buckets which have been loaded between shifts. Each bucket carries about 700 to 800 lb. of ore.

AMALGAMATION IN CYANIDE SOLUTION

There are 80 stamps of 850 lb. each in the mill, having a 7-in. drop and 106 drops per minute. Four of the five-stamp batteries are equipped with 12-mesh screen, due to a difference in construction, but the rest carry 14-mesh wire screen. The milling is done in cyanide solution carrying two pounds of KCN per ton. The sodium salt is used but the records are kept in terms of KCN as is customary practice at present.

In front of each five-stamp battery is placed a copper amalgamating plate, 4 ft. 7 in. wide and 8 ft. long, with a slope of $2\frac{1}{4}$ in. to each foot. Over this plate the pulp passes and is amalgamated. This detail is worthy of particular attention, as some authorities have maintained that amalgamation can not be successfully carried out in cyanide solutions. It is done successfully at the Liberty Bell mill. Care and attention are essential to good results and a knowledge peculiar to this particular work must be obtained to operate it successfully.

The plates are maintained in a rather "wet" state, for if they are run fairly dry as is usual when milling in water, they soon become too hard and crusted to be of any use in recovering the gold. Keeping the plates wet avoids the excessive hardening of the amalgam and allows the retention of a large percentage of the gold. In view of the fact that some quicksilver and amalgam may be scoured off the plates while in this wet condition, traps are used to recover any particles which may escape. It is not claimed that the extraction under these conditions is as high as when the operation is carried out in water, but the object of the operation, which is the recovery of any coarse gold which might not readily dissolve in cyanide, is attained and the system has obvious advantages over milling in water where cyanidation is to follow.

When milling is done in water there is an appreciable amount of it introduced into the cyaniding system and it follows that an equal amount must be discharged with the residues.

It is almost impossible to get rid of the residual moisture without losing some cyanide and dissolved metal along with it. To avoid the discharge of excessive moisture with residues as far as possible is an important item in cutting down losses and by milling in cyanide solution, wherever it is possible, this discharge and its valuable content is saved to a large extent.

One development of milling in water, where that measure seems unavoidable, is the system in use at the mill of the Smuggler-Union company, where the pulp delivered to the cyanide plant has previously been crushed and concentrated in water and contains an enormous preponderance of the liquid. This pulp is here thickened and then filtered, from which point it begins cyanide treatment containing a minimum of moisture. This is

a system which cannot be generally recommended and its use in special cases will be considered later.

CLASSIFICATION AND CONCENTRATION BY STAGES

The pulp from the batteries is carried to Richards hindered-settling classifiers, which make a coarse, middling and fine product in addition to the slime overflow. The latter is taken to 6x6-ft. settling cones, the underflow of which is concentrated on Wilfley tables, the overflow going to Dorr thickeners.

The underflow product from the Richards classifiers is concentrated separately on Wilfley tables, the tailing going to an Akins classifier and the middling passing over a Bunker Hill screen which is fitted with 16-mesh, No. 22 wire screen. The oversize from this screen also goes to the Akins classifier, the undersize being concentrated on a Wilfley table the tailing of which goes to the same classifier. The accompanying flow sheet gives the details of the pulp flow and machinery in operation.

The Akins classifier delivers the sand to a 5x22-ft. tube mill of the Abbé tire type, the mill feed containing about 40% moisture. The discharge from this mill is raised to a diaphragm cone where a separation is made, the overflow going to a simple cone and the underflow from both of them going to a second tube mill identical with the first one mentioned. The overflow from the simple cone, together with the product of the second tube mill, is elevated to a second series of amalgamating plates, and from the plates to cones, the underflow being led to Deister slime concentrators and the overflow to Dorr thickeners. Kidney pulp distributors are largely used in the mill. These machines having already been described.¹

The tube mills are of the tire type, which is convenient in allowing any desired size of inflow and outflow openings. In some cases mills of this type have proved more or less unsatisfactory, due to difficulty in keeping the tires running true on the supporting rollers, but here this difficulty has been overcome by careful installation on heavy, rigid concrete blocks and the use of a deep flange. No difficulty is now experienced and the mills run true and without vibration.

The mills are lined with silex blocks four inches thick set on edge. The lining lasts from nine to ten months without renewal and the type has been found generally satisfactory. In order, however, to take advantage of any economy which might be available, experiments are now being made with a lining of the Komata type, but as yet this work has not been carried far enough to give any conclusive results. Danish pebbles are used in the mills, about 130 lb. per mill per day being the consumption. The mills require about 43 hp. to keep them moving. The feeders are of the usual spiral-dip type.

There are three of these mills installed, but only two are in regular use, the third being held in reserve. This reserve mill is so arranged that it can be used in place of either of the other mills when one is cut out for relining or repair.

AGITATORS OF THE HENDRYX TYPE

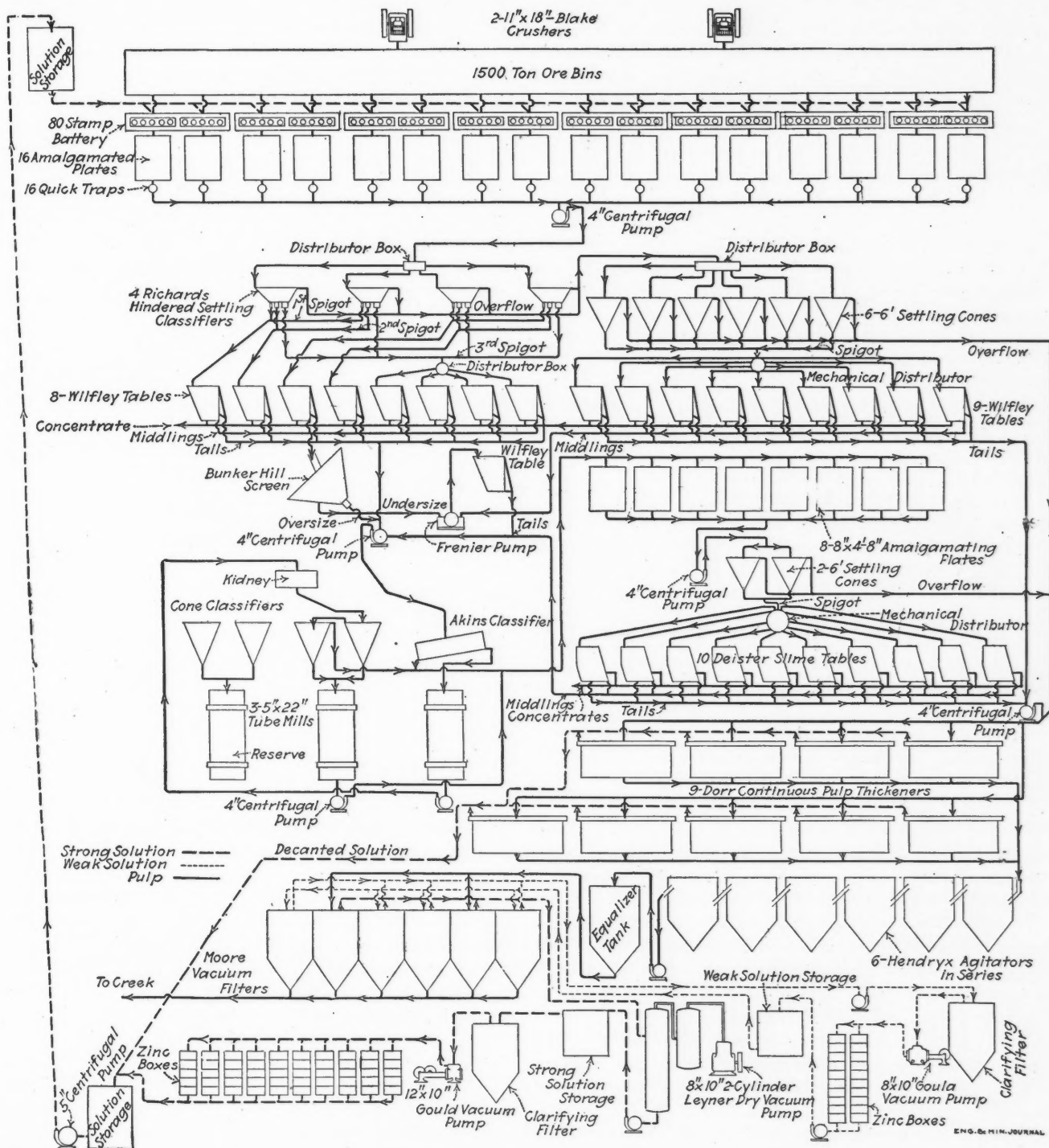
The Dorr thickeners deliver a pulp thickened to about 2:1 to the Hendryx agitators, of which there are six.

¹Eng. and Min. Journ., Nov. 26, 1910, p. 1046.

The pulp flow is continuous through the Dorr thickeners and the agitators, delivering continuously into the equalizer tank which feeds the filter. The agitators were originally installed to take advantage of the Hendryx specialties in cyanide metallurgy, but these having been

PULP NOT FINELY GROUND.

Due to the soft and clayey character of the ore, extremely fine grinding is not necessary. The statement would probably be more accurate were it said that grinding the ore through an 80-mesh screen is sufficient to



FLOW SHEET OF THE LIBERTY BELL MILL, TELLURIDE, COLO.

found of questionable value, were abandoned and the tanks retained simply as agitators. They agitate by elevating the material in a central tube in the tank by means of a propeller screw. The system is considered expensive of power consuming 7 hp. each for the tanks, which hold about 33 tons of dry slime.

reduce it to such fineness that it may be treated as slime. The battery grinding alone produces a pulp of the following analysis: On 20 mesh, 2.9%; on 40 mesh, 20%; on 60 mesh, 10.6%; on 80 mesh, 7.3%; on 100 mesh, 5.6%; on 200 mesh, 7.6% and through 200 mesh, 46.6%. After regrinding, the pulp which is subjected to agita-

tion treatment has the following analysis: On 80 mesh 7.5%; on 100 mesh, 4.9%; on 200 mesh, 14.2% and through 200 mesh, 73.4%.

The pulp is easy to keep in suspension and is sufficiently fine to give the maximum economical extraction. The pulp as treated contains about 30% of colloid slime and one of the principal problems is the handling of the product and inducing settlement. In order to promote satisfactory settlement a milk of lime is prepared and added to the inflow to the Dorr thickeners, an average of seven or eight pounds per ton of ore being required. The average specific gravity of the dry slime is about 2.68, a figure which indicates no extreme either way, but about an average ore density.

MOORE FILTER USED

The Moore filter plant is one of the earliest examples. The tanks are of wooden construction, but are well put together and are still in good condition. For filtering there are four baskets of 66 leaves each, the leaves measuring 6x8 ft. These baskets are operated in two groups of three tanks each, the middle tank being the one in which loading is carried out and the others used for washes and discharging. The cycle is as follows: Loading, 50 min.; drying and transferring, 10 min.; washing, strong solution, 15 min.; washing, weak solution, 30 min.; discharging, 10 min.; transferring, five minutes.

The thickness of the cake made varies from seven-eighths to one inch, approximating 10 tons per basket of dry slime. The plant was constructed to treat a much smaller tonnage than is now being put through it, but has been forced up to its present capacity by increasing the efficiency of each operation. One of the refinements is the installation of a vacuum pump of high efficiency to expedite the filtering. This machine is of the type usually used for obtaining a vacuum in the manufacture of incandescent electric lamps. The system is a dry-vacuum operation, no solution passing through the vacuum pump. The solution discharge is into a specially constructed deep pit for securing a barometric discharge.

The loss in dissolved metal amounts to about three cents per ton of dry ore and the cyanide mechanically lost to about 0.3 lb. per ton. The pulp filtered has an average dilution of 2:1 and air lifts are used to assist in maintaining an even consistency vertically in the tank. The solids do not settle rapidly, as has already been mentioned, but the air lifts are used as an additional assurance of homogeneity. Solution under 18 lb. pressure is used for discharging the cake and the operation is concluded with air under 10 lb. pressure.

The filter leaves require acid treatment about every three months, and to facilitate this operation without delay of filtration, a separate basket is always kept in readiness for instant use. The basket requiring acid treatment is removed from service and the extra one immediately put into action. A separate tank is provided for containing HCl for treating the leaves, and the cost of the acid-treating operation amounts to about 0.6c. per ton of ore.

PRECIPITATION ON ZINC SHAVINGS

Precipitation is accomplished by means of zinc shavings, using boxes of the ordinary type. It is recognized that the use of zinc dust offers conveniences and in many

eases economies, but the question has been given careful study here without seeming to justify a change of system.

The precipitation at the Liberty Bell mill gives no trouble in any way, the only requirement being that the clarified solution be allowed to pass over the zinc at the stated rate of about 0.7 ton per cu.ft. of zinc shaving per 24 hr. Precipitation is good, head solutions carrying \$1 per ton give tailing assays of one to two cents per ton. The solution going into the pregnant-solution tanks is metered by the use of a device similar to that described in the article on the Hollinger mill at Poreupine, Ontario.

The precipitate is melted in oil-fired tilting furnaces, one Steele-Harvey and one Donaldson furnace being installed. The operation is extremely simple and presents no difficulties. The precipitate is lightly acid treated, fluxed and melted, the bullion obtained averaging over 900 fine.

A small blast furnace is used for cleaning up all waste product such as flue dust, slag, sweepings, etc. This material is all briquetted with portland cement in such proportion that a satisfactory slag will result and periodical runs are made which eliminate all waste products. The results are altogether satisfactory, there being a substantial saving over selling such material to the smelters.

SOLUTIONS ARE HEATED

The heating of solutions has been found of assistance in the mill. This measure was adopted primarily for the purpose of bringing extractions up to the normal point in cold weather, but it was considered advisable to continue to warm the solutions throughout the year in order to take advantage of the additional recovery of the silver. The effect upon the gold is not noticeable.

The matter of warming solutions is one that has received some attention from metallurgists in various countries and in many cases has not shown any particular benefits. At any rate there has been no consistency in the results obtained. The silver mills in Mexico, particularly, have experimented with solutions of various temperatures and generally speaking the improvement has been so small and variable that benefits have been considered not proven. In case of the Liberty Bell, the action of the warm solution has not been studied for sufficient time to warrant final conclusions. The benefit, if any, may not be confined to the dissolving effect of the solutions but may extend to the amalgamation and concentration, as will be mentioned later.

ORE IS NOT SAMPLED

The ore delivered to the mill is not regularly sampled nor weighed. In order to approximate the weight, a number of the tram-way buckets are weighed each day and the total weight of ore delivered is calculated from this information, together with the number of buckets coming into the mill. The latter are counted automatically by means of an electrical device which records each bucket as it enters the mill, the counter being installed in the mill office. No sample is taken of the ore, the average content being obtained by summing the total mill production and the content of the tailing leaving the mill. The latter is sampled automatically by a de-

vice invented and perfected by W. E. Tracy, mill superintendent. The sampler has been described before² but a sketch of it is herewith presented as it is worthy of note.

It consists of a disk mounted on a shaft and moved by means of a worm gear. A pipe is fixed to the disk, the pipe having a slot through which the sample enters. The worm gear moves the disk slowly until a point is reached where the weight fixed to the disk over-balances the pipe and the disk swings around rapidly, the slot in the pipe passing the tailing stream and taking a sample of it. The momentum is sufficient to carry the disk far enough to raise the pipe into a vertical position again and the sample runs out of the curved end of the sampling pipe into a small launder which is properly placed to receive it and conduct it into the sample receptacle. The movement is so rapid that the solids in the sample do not settle and the pipe drains cleanly. A pawl engaging a ratchet cut in the disk prevents a return swing of the disk.

This system of estimation of ore content cannot be recommended at all times. It may be fairly satisfactory if every care is taken to avoid mishaps and losses within the mill, but its great weakness is that such losses and shortages of production cannot be readily detected.

CHEMICAL CONSUMPTION AND COST AT LIBERTY BELL MILL

Material	Consumption per Ton Ore Lb.	Cost	Unit
Zinc.....	0.5	\$0.115	lb.
Lime.....	7-8	0.005	lb.
Cyanide (KCN).....	1.3	0.215	lb.
Litharge.....	0.3	0.085	lb.
Pebbles.....	0.54	37.75	ton

The period of agitation which the pulp receives in the mill is about 14 hr. in the mill circulation and about 12 hr. in the Hendryx tanks. The consumption of chemicals and the cost per unit is about as given in the accompanying table.

METALLURGY NOT COMPLICATED

The metallurgy of the Liberty Bell ore is not complicated, as there is no rebellious element to be reckoned with. The fact that silver exists in sufficient quantity to make its extraction an object introduces an element which is somewhat more complicated than when only gold is to be extracted. In this case, however, the quantity of silver is small and strong solutions do not have to be resorted to. A 2-lb. KCN solution is used throughout the mill. The use of a lead salt, however, has been found advantageous. At first lead acetate was used, added to the agitators, but now litharge is in regular use, the addition being made to the tube mills where it is readily ground up and put into solution.

The thorough system of concentration used is based upon the belief that it does not pay to attempt to extract the contents of the sulphides in contact with the remainder of the ore as the strong solution required and the long time would entail a loss of cyanide and cost of agitation out of proportion with the recovery. By removing the sulphides the siliceous ore may be treated, as has been shown, with weak solutions and short time of agitation and the sulphides may be handled in some satisfactory way.

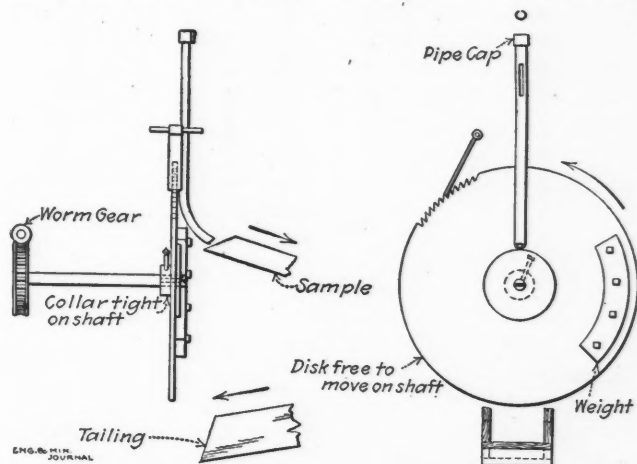
²Trans. A. I. M. E., October, 1911.

Up to the present the sulphides have been sold to the smelters, but experiments are under way looking toward a cyanidation of the product on the ground. While these experiments have not been carried to conclusion, it may be said that the indications are that the process is feasible, and if this is true an additional saving will be made possible. The idea is to treat the concentrate in a separate system using stronger solutions and more time. The residues from the concentrate treatment will be thrown in with the regular siliceous ore and will thus be given an additional treatment, with the possibility that the total recovery, compared with its cost, will show a greater profit than the method now followed will produce.

TWO SPECIAL METALLURGICAL FEATURES

The two special metallurgical features, as have been described, are first, amalgamation on plates in cyanide solutions, and second, the heating of mill solutions in order to increase extraction of silver.

The first of these items is one that has been called unsuccessful and impossible in many cases, but it has here demonstrated its value, and there can be no reasonable doubt that it is useful in some cases. I should con-



AUTOMATIC TAILING SAMPLER AT LIBERTY BELL MILL

sider it a valuable system to adopt in cases where amalgamation was considered essential for the purpose of recovering coarse gold which would not dissolve in cyanide solutions in any reasonable length of time, and which existed in such large quantities that the regrinding process would not reduce it to some form readily dissolved. It should be preferable to milling in water, which has manifest advantages.

PERCENTAGE EXTRACTION AT LIBERTY BELL MILL DURING FISCAL YEAR 1912.

	Gold	First Half	Second Half
Amalgamation.....	48.98	48.98	50.20
Cyanidation.....	35.71	35.71	34.40
Concentration.....	7.52	7.52	8.40
Total.....	92.21	92.21	93.00
Silver			
Amalgamation.....	7.12	7.12	11.30
Cyanidation.....	37.67	37.67	39.70
Concentration.....	17.24	17.24	21.60
Total.....	62.03	62.03	72.60

EXTRACTION AND COST

Due to certain changes which took place in about the middle of the present fiscal year and the changes in

mill results which followed, the ore content and recovery are given as types for these periods. The ore content for the first half of the year was 0.27 oz. of gold and three ounces of silver; for the second half, 0.27 oz. of gold and two ounces of silver.

TABLE I—LIBERTY BELL MILLING COSTS.

	Labor	Supplies	
General Mill Labor.....	\$0.0901	\$0.5811	
Crushing.....	0.0531	0.0194	
Stamping.....	0.0935	0.0973	
Regrinding.....	0.0104	0.0665	
Settling and agitating.....	0.0150	0.0390	
Filtering.....	0.0372	0.0509	
Concentrating.....	0.0476	0.0199	
Amalgamating.....	0.0426	0.0224	
Precipitating.....	0.0137	0.0755	
Total labor.....	0.4032	Total 0.9720	
Total supplies.....	0.9720		
Total cost.....	1.3752		
Depreciation.....	0.1200		
Realization.....	0.3100		
Total Mill cost of Production.....	1.8052		

The increase in silver extraction in the second half is noteworthy in view of the fact that the ore content is one-third less, a situation which is opposed to general experience. There are two factors which have changed,

TABLE II—DISTRIBUTION OF GENERAL EXPENSES AT LIBERTY BELL MILL.

Labor	Per Ton	Supplies	Per Ton
Superintendence.....	\$0.0268	Pipe Lines.....	\$0.0061*
Heating.....	0.0129	Bins.....	0.0085*
Electric Plant.....	0.0106	Building.....	0.0628*
Lubrication.....	0.0034	Electric Plant.....	0.0111
Pumping Plant.....	0.0212	Pumping Plant.....	0.0198
Watchman.....	0.0083	Fuel and Heating.....	0.0471
Examination and Tests...	0.0068	Tools.....	0.0043*
	0.0901	Cyanide.....	0.2614*
		Lime.....	0.0426*
		Lead Salts.....	0.0330
		Light and Power.....	0.0378†
		Oil and Waste.....	0.0091
		Assaying and Melting...	0.0347*
		Examination and Tests...	0.0027
		Miscellaneous.....	0.0001
			0.5811

* Combined labor and supply.

† The power in this item is that used in pumping between departments

either of which, or both, may be in part or wholly responsible for the difference in results. The first change, the mining of the ore from a different and deeper level, may have its effect, and the second change, the increase in solution temperature, would naturally influence results to some extent.

Of a total gain of 10.57% only 2.03% is due to improved recovery in the cyanide solution. The coincident alteration of two important factors makes it impossible to say without further study just what part each has played in producing the final result. The temperature of the solution in agitators and filter plant has been raised to about 80° F. and that on plates, concentrators and settlers to about 70°. The cost of operation, based on the milling of 104,460 tons in seven months, is shown in the accompanying tables.

Dry Concentration in Colorado

DENVER CORRESPONDENCE

In addition to the 50-ton Sutton, Steele & Steele dry-concentration testing mill, ground for which was broken in Denver recently, the same interests have purchased the American Zinc Extraction Co. mill at the mouth of the Yak tunnel in Leadville, which was built at a cost of \$350,000. It is to be equipped with the Sutton, Steele & Steele separating machinery and used to treat the custom lead- and zinc-sulphide ores of Leadville. The machines are to be manufactured at Dallas,

Tex. The consulting engineer in Denver is J. M. McClave. The title of the Denver company is the Sutton, Steele & Steele Manufacturing, Milling & Mining Co. Articles of incorporation were filed in Colorado; capital stock \$500,000.

Natural Gas in Ohio

The conditions of natural-gas production are particularly interesting in Ohio, where three natural-gas zones are recognized, the distinctions being important, particularly as the great decline in the northwestern Ohio or "Trenton" field has been compensated to a considerable extent by the rapid development of the Clinton or central Ohio field. The third field is in southeastern Ohio and yields besides gas the light oil of "Pennsylvania grade." The earliest of these fields to be developed was that of northwestern Ohio, where the gas originally found at Findlay furnished the second important field in the industrial development that followed the application of natural gas in manufacturing enterprises.

Gas was discovered at Lancaster in 1887, and further discoveries followed rapidly. The regularity of the gas sand led to comparatively easy prospecting, the rock structure being fairly simple. In the region of the Bremen field, Fairfield County, the dip is about 57 ft. to the mile, with some small rolls having a reverse dip. West of this region the sand thins and disappears before the longitude of the middle of the state is reached, its place being taken by shales. The great reservoirs of gas are usually found near the western margin of the sand, the oil existing at greater depths to the east.

A report recently issued by the U. S. Geological Survey shows that 1911 was one of the best years in the history of the natural-gas business in Ohio. The central Ohio district, which comprises chiefly the counties of Licking, Knox, Hocking, Fairfield and Ashland, was actively developed and extended northward into Lorain and Medina counties, many remarkable wells having been discovered, particularly in Ashland County. At the end of the year many of the completed wells were closed in for future use. It is reported that the pressure in the older gas fields of this state is gradually being reduced.

In the Homer field, including Knox and Licking counties, the average pressure decreased from 207 lb. in December, 1910, to 180 lb. in December, 1911; in the Sugar Grove field, including Fairfield and Hocking counties, the average pressure decreased from 125 lb. in December, 1910, to 92 lb. in December, 1911. In the new Ashland-Lorain field, however, including Ashland, Medina, Richland, Lorain and Wayne counties, the average pressure increased from 663 lb. in December, 1910, to 770 lb. in December, 1911, owing to the opening of new territory.

As a consumer of gas in 1911, Ohio takes second place, having consumed 112,123,029,000 cu.ft. The total quantity of gas produced in this state in 1911 was 49,449,749,000 cu.ft. The difference between the gas produced and that consumed in Ohio is the quantity piped into the State from West Virginia and Pennsylvania.

In grinding copper on a carborundum wheel, the copper is apt to clog, says "American Machinist." By rubbing on tallow this is avoided, and the cutting action of the wheel is not impeded.

Government Gold Mines in South Africa

BY A. COOPER KEY*

SYNOPSIS—The South African government has adopted a unique scheme of letting the Crown lands for mining. Public bids are invited for the lands, the allotment being based on the proportion of the profits offered the Government.

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In the earlier days of the Rand it was the practice to peg out mining claims, and eventually blocks, and peggers were amalgamated into mining companies, somewhat small on the outcrops, but larger in the case of deep levels. But as the potential value of the district became known, pegging days became the occasion for scrambles which developed into riots, and it became necessary to devise some more peaceful method.

Just prior to the Anglo-Boer War, the authorities of the South African Republic decided to allot the claims of certain persons under the lottery system, but the advent of hostilities prevented the scheme being proceeded with. When the British government under Lord Milner assumed the administration of the Transvaal Colony, it was decided that lotteries were contrary to the public interest. Throughout the Rand, but especially in the further Eastern section, there are large areas of blanket-carrying ground belonging to the Crown, which await exploitation.

PROGRESS OF THE FIRST STATE MINES

Late in 1909, the Transvaal government offered two portions aggregating 2633 claims on the farm Modderfontein. It was stipulated that the tenderer should pay as a basis tax such a proportion of the new produce (i.e. profit) as the profit bore to the value of the precious metals produced; subject to a minimum of 10% and a maximum of 50%. Guarantees had to be given of ability to provide the necessary working capital, and 12½% had to be offered at par to the public of the Transvaal.

Little time was lost in starting work, and not long ago the reef was intersected in the northeast shaft at 2395 ft. and in the northwest at 2273 ft. Development from these is now proceeding. The two southern shafts are making steady progress, one being 2800 ft. and the other 2200 ft. deep. Mr. Munro, the chairman of the Johannesburg Consolidated Investment Co., closely identified with the flotation, recently said of this property: "Although the opening up of this mine is only just beginning, yet the success which is attending the working of the neighboring mines, Modder B on the north, Brakpan on the south, New Modderfontein on the west and Geduld on the east, is so noteworthy that one cannot but feel a strong confidence in its future. The excellent assays over considerable thicknesses encountered in the Modderfontein Deep shafts are also most encouraging. The work so far done has made satisfactory progress, and in another year I trust to be in a position to report considerable development accomplished and a satisfactory grade of ore exposed."

UNION GOVERNMENT'S LATEST OFFER

The Union government has now issued a fresh invitation for the lease of 2235 claims on Brakpan and Scha-

penrust, lying immediately south of Brakpan, which is doing so well, and the Modder state mine just referred to. Two years ago a similar offer was made, but the condition of the money market was such and the risk deemed so great that no tender was put in. Passing over the alternatives now offered to the tenderers, it may be noticed that a sum of at least £650,000 will, it is officially estimated, be required for shaft sinking and preliminary development, and a further sum of £550,000 for bringing the property to the producing stage. At least £150,000 in shares must be offered to residents in the Union of South Africa, no difference having been made now that subscription is open to a population three times as great as that of the Transvaal. No vendors', promoters' or founders' shares are to be created, nor is any underwriting or other commission allowed. All shares of the first batch (£650,000) must be offered at the same price.

REVISED TERMS AND THE SLIDING SCALE

The government in the present instance offers a sliding scale as the basis of tender. As before, the award is made upon the premium offered over and above such primary tax. Under the new and old scales the percentages are identical up to 30% of the profit, but thereafter the government's share diminishes under the new scheme, as will be seen from the following condensed table. The actual scale makes provision for rises of 1% from 30 to 60% with proportional interpolation.

Ratio profit to recovery	Percentage of profit Payable to the government
35	34.29
40	37.50
45	40.00
50	42.00
55	43.64
60 and over	45.00

The adjudication of the tenders depends upon "such additional percentages of the amount" determined on the main scale as is offered by applicants.

THE FIRST STATE MINES SUPER TAX

The successful applicant in the Modderfontein lease revised a sliding scale form of super tax, which was as follows: Up to 20% an extra 7½% of the tax payable; between 20 and 33⅓% an extra 10% of the tax payable; between 33⅓% and 49% an extra 17½%; above 49% an extra 22½%. To give an illustration, assuming that the yield is 24s. per ton and the costs 16s. per ton, leaving a profit of 8s., the government would get one third (i.e. eight twenty-fourths) of 8s. or 32d. plus 10% or 3.2d., or 2s. 11.2d. in all, the company's share being 5s. 0.8d. per ton.

LITTLE BENEFIT OF NEW SCALE IN PRACTICE

The question arises, is the revised main scale sufficiently attractive to induce active competition for the area, always remembering that it was open to those desirous of tendering on the first basis to quote only a small incremental payment. A glance at the table will show that the differences in the payment to Government under the old and new scales is not great until high ratios are reached. The economic conditions of the district are

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such that high percentages are not likely to be realized in practice. In other words, the advantages are to a certain extent illusions.

A bonus is not of much good if there is little or no chance of securing it. Michael Dodd, the chairman of the company owning Schapenrust, has assumed a yield of 24s. and an expenditure of 15s. working the area on the basis of treating 1,000,000 tons per year. The difference in payment on the main scale is only that between the 40.5d. per ton of the old scale and the 39d. of the new. Naturally, the incremental factor is obscure until the tenders are actually opened. In the event of the new area proving as valuable as that of the Brakpan mines, as noted, one of the most successful of recent Rand enterprises, the revised scale would prove of considerable advantage. This mine's recent figures have been: Recovery, 32s. per ton; costs, 17s. 6d. per ton; profit, 14s. 6d. per ton, representing a ratio of 45½%. Under the new schedule a company so favorably situated would pay in the primary scale just over 40% against 45½%, an advantage of 9½d. per ton, making £39,500 a year on a projected capacity of a million tons.

A 30-YEAR "LIFE" AT A MILLION TONS A YEAR

It seems quite probable that the estimated capital cost of £1,200,000 will be exceeded. This is practically the sum which it cost the Brakpan mines to reach the producing stage. But that company's area is little more than half the size of the projected state mine, and it must be remembered that it has only two shafts against a minimum of three required in the present case. The Modder state mine with its 2633 claims has four shafts. Three shafts of 4000 or 4250 ft. each will alone run into a considerable sum of money. It looks as if the new concern may expect a yield of about 12,500 payable tons per claim which would indicate a life of 30 years on crushing a million tons per year. One must allow four years for the shafts to reach the reef, after which another two or three years will be required for development.

In case the tenderer proposes to amalgamate the area with adjoining ground, the conditions vary somewhat. While as in the other case no vendors', promoters' or founders' shares shall be created, the Minister of Mines has discretion to permit underwriting or other commission. The sliding scale does not apply, the consideration to be quoted to take the form of a percentage of the annual profit of the amalgamated property. The Transvaal Coal Trust, the parent company of the Brakpan mines, is the owner of the freehold of Brakpan, and it is regarded as probable that the Consolidated Mines Selection Co., associated with both, will tender for the ground, possibly to be worked with the Brakpan Mines to the north. The Modder state mines might also consider a scale or joint exploitation of the new area, though this is less likely.

Swedish 1911 Mineral Production

The mineral production of Sweden for 1911 was as follows, the items being arranged in order of decreasing value: Iron ore, 6,153,778 metric tons; blende, 37,537; other zinc ore, 51,242; bituminous coal, 311,809; lead and silver ore, 2999; feldspar, 36,235; pyrites, 30,096; manganese ore, 5377; quartz, 24,927; copper sulphate, 320; copper ore, 1623; alum, 159 metric tons.

Phosphate in Montana

The phosphate deposits, discovered by J. T. Pardee, of the U. S. Geological Survey, in the Garnet Range, six miles north of Garrison, Mont., are but 35 miles from Anaconda. The combination of immense deposits of phosphate rock and a practically unlimited and readily accessible supply of sulphuric acid, obtainable as a by-product of smelting operations at Anaconda, may have a great bearing on agricultural progress in the West, says the press bulletin of the U. S. Geological Survey.

Two other phosphate deposits were discovered in Montana in 1911 by Mr. Pardee, one at Philipsburg on the south slope of Flagstaff Hill and the other half a mile east of Elliston, north of Little Blackfoot River. Rock phosphate was also discovered in the same year by R. W. Stone, of the Geological Survey, about two miles east of Cardwell, Mont., on the Northern Pacific Ry., at the summit of the cliffy slope rising to the west from Jefferson River. The deposits discovered by Mr. Pardee lie from 60 to 70 miles north, and that by Mr. Stone 40 miles northeast of Melrose, Mont., where phosphate was found in 1910 by Hoyt S. Gale, of the Geological Survey. These deposits extend the limits of the known phosphate field, of which the extensive Idaho-Wyoming deposits form a part.

At the point near Garrison the phosphate bed is eight feet thick and more than four feet of it is shown by analysis to be high-grade material. The outcrops of Philipsburg and Elliston show that the beds are in each case at least a foot thick. At Cardwell, the deposit probably exceeds two feet in thickness. It is apparent from the examinations made that in the Garnet Range, at least, a large amount of phosphate is present. The deposits are favorably situated as to railroad facilities.

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The Iron and Steel Industry

WASHINGTON CORRESPONDENCE

Some time ago the Senate adopted a resolution directing the Secretary of the Treasury to collect information regarding the profits and business of corporations engaged in iron and steel industry, metal manufacturing and mining, woolen and cotton industries and sugar refining. The instructions have been partly carried out by the secretary and communicated to the Senate. The following table shows the data collected with reference to iron and steel products, and the figures for the total in all industries, classified by items as directed in the resolution already referred to.

Items	1910		1911	
	Iron and steel products.	Total	Iron and steel products	Total
Capital stock.	\$1,084,759,462	\$1,859,044,114	\$1,082,054,578	\$1,913,050,893
Indebtedness.	512,846,721	915,364,534	484,800,723	870,361,243
Gross income.	382,121,790	858,094,779	290,784,918	745,587,095
Expenses.	220,143,679	599,548,898	171,769,203	526,685,911
Losses.	6,525,278	9,137,480	6,152,725	9,508,452
Depreciation.	27,235,343	51,793,202	21,644,326	44,061,091
Interest.	17,072,903	32,619,208	16,932,646	32,724,475
Taxes—				
Domestic.	5,548,570	14,488,169	5,936,911	15,089,330
Foreign.	24,990	88,945	135,177	188,507
Dividends.	11,460,740	16,704,773	9,102,153	22,511,096
Net income.	102,194,199	154,289,692	68,461,501	121,174,893

The totals include the sugar, cotton, wool, cotton goods and woolen goods industries, and the totals are given in order to show the relative magnitude of the iron and steel industries.

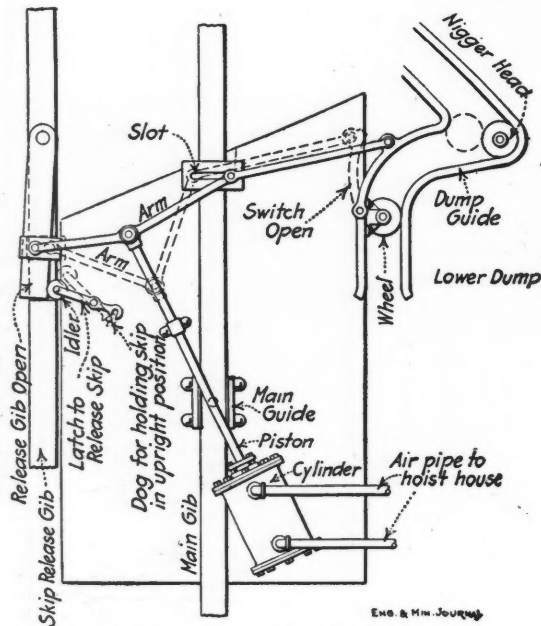
another breaks until the rope is torn apart, says a recent catalogue of the C. W. Hunt Co. of New York. The following approximate efficiencies of knots in percentage of the full strength of the rope are given, based on experiments of Prof. Edward F. Miller of the Massachusetts Institute of Technology: Dry rope, average of four tests from the same coil as the knots, 100%; eyesplice over an iron thimble, 90%; Shot splice over the rope, 80%; timber hitch, round turn and half hitch, 65%; bowline, slip knot and clove hitch 60%; square knot, weaver's knot and sheet bend, 50%; Flemish loop and overhand knot, 45%. These results are sufficient to cause care to be exercised regarding all rope fastenings employed in important work.

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Compressed-air Dump Control

By J. R. McFARLAND

The Giroux Consolidated Mines Co. at Kimberly, Nev. has recently changed from cage to skip hoist. As it was desired to get the greatest possible production from the shafts considerable care was used in designing the



COMPRESSED-AIR DUMP CONTROL

dumping arrangement. The peak load of the day in the hoist room is after dinner. Almost the entire work of hoisting rock is done in the two or three hours before the shift goes off. As the rock is composed of both ore and waste it must be handled with discretion.

In order to avoid wasting time by having the skip dump into one chute and having a man climb up into the headframe and adjust a gate so as to direct the material into the ore bin or waste bin as the case requires, a new arrangement was made. Two bins are built. The lower one is for waste and the upper one is for ore. The man at the bottom of the shaft gives a signal by pulling a rope which rings a bell in the hoisting room. The signal designates a skip of ore or one of waste as the case may be, ready to be hoisted from the bottom. If it is a car of waste the engineer, by the operation of a lever at his side, controlling air to the dump machinery, closes a switch in the lower dump guide and

releases a latch on the skip allowing the skip to swing at its center on the main guide. Thus the waste is dumped into the lower bin. If it happens to be a car of ore, by the operation of the same lever, he opens the switch in the lower dump guide, allowing the guide wheel to pass through, and at the same time the release gib is held closed so as to maintain the upright position of the skip. The skip thus passes through the lower dump and dumps the ore into the upper bin.

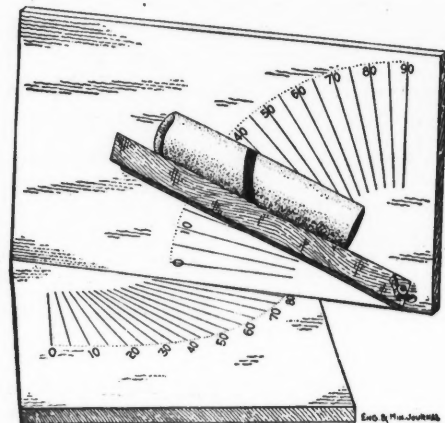
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Device for Orientation of Drill Cores

By GEORGE A. PACKARD*

In diamond-drilling formations having a number of vein systems, as at Butte, it is often difficult, when a vein or fault is shown by the core, to determine to which system it may belong. To aid in this determination, the device illustrated herewith has been developed. It consists of two pieces of board 12x18 in. in size, and a core shelf of the proper size to hold the core under examination. Each board has lines radiating from a point near one corner, marking off a quadrant of a circle in five-degree units. Single degrees between these lines are indicated by points.

One of the boards is placed horizontally, while the other, placed vertically, revolves upon it, being pivoted at the point from which the horizontal line radiates. On the upright board, pivoted at the point from which



DEVICE FOR ORIENTATION OF DIAMOND-DRILL CORES

the lines in the vertical plane radiate, is the core shelf.

The method of using the device may, perhaps, be best explained by an assumed condition: For example, with a hole drilled south 15° west at an angle downward of 15°, a narrow seam of blende is cut, and the probable dip and strike of the seam is desired.

The board in a horizontal plane is placed so that the line of zero degrees is north and south. The board in the vertical plane is then turned until it points in the same direction as the hole, south 15° west. The core is then placed on the core shelf, which is turned on its pivot until it corresponds with the downward dip of the hole. It is held in place by a wedge, or by a clamp at the pivot. The core is then rotated on the shelf and the possible variations in dip and strike of the seam noted. From these the probable vein system to which this particular seam belongs may be determined.

*Mining engineer, Butte, Mont.

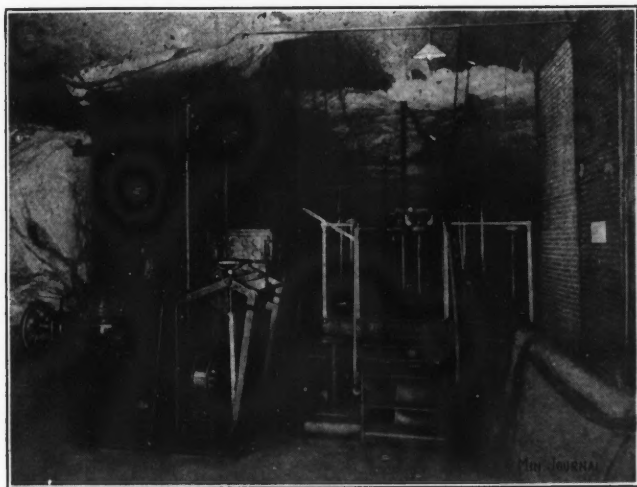
Electric Power for Underground Winding at the New Heriot Mine

Owing partly to the great depth at which mining operations are now carried out, and partly to the distribution of the mineral, winding and hauling engines have frequently to be installed underground. Such engines range from the small single-drum haulage used for pulling tubs up an incline, to the large double-drum winding engines used in South African gold mines.

In deep mines, where steam could not readily be operated underground, compressed air was tried, with varying degrees of success, but today electricity is the principal power considered by the majority of users.

Although not designed for great depths, nor for an extremely great output, the underground electric hoist at the New Heriot Gold Mining Co., Ltd., Denver, Transvaal, is an interesting example of this type of machine. The service for which it was designed is: Depth of shaft, 1080 ft.; incline, 45°; weight of rock, 5000 lb.; weight of skip, 3000 lb.; weight of rope, 1840 lb.; maximum speed, 2000 ft. per minute.

All parts of the hoist were designed to pass through an opening 7 ft. 8½ in. by 3 ft. 6 in. so as to permit it to be



ELECTRIC UNDERGROUND HOIST, NEW HERIOT MINE, TRANSVAAL

taken underground and along a drift about ½ mile long. The British Westinghouse Electric & Manufacturing Co., Ltd., supplied the entire electrical equipment.

There are two winding drums, each six feet in diameter and three feet wide, arranged in tandem but displaced sideways in relation to each other so as to obtain a good lead from the sheaves. The drums are driven through single-reduction double-helical cut gears of a ratio of approximately 3 or 4:1 by means of a 500-b.hp. (1250 hp. maximum), 2000-volt, three-phase, 50-cycle, 375 r.p.m. slip-ring induction motor.

The speed and direction of rotation of the motor are governed by the liquid controller shown in accompanying illustration. The controller is of the type usually supplied for winding engines, the resistance liquid being continually circulated over cooling coils by means of a small centrifugal pump, and the resistance in the rotor circuit varied by altering the depth of immersion of the iron electrodes connected to the slip rings. The reversal of the motor is carried out by two independent three-

pole oil switches, either one of which can be closed at a given time, but not both at the same time.

At the rear of the driver's platform, as shown, is the main switchboard, equipped with an overload release oil circuit breaker, with inverse time limit relay, and integrating watt-hour meter and an oil circuit breaker for a small transformer, used to supply power at a low voltage to the small pump motor on the controller and other auxiliary apparatus. The main oil circuit breaker is arranged to be mechanically tripped from the emergency device seen in front of the driver's platform, in case that device should for any reason fail to act.

The emergency device is designed to drop heavy weights automatically across the foot-brake levers in the event of overwinding, failure of power supply or any other contingency necessitating sudden and powerful braking. A lever is provided on the platform so that the driver can operate this emergency device should it be necessary. While the hoist described is representative of modern practice, it is but one of the many to be found in the South African gold field, either in service or in course of erection.

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Notes on Diamond Drill Sampling

By H. L. BOTSFORD*

Much has been written on the scientific sampling of material cut with the diamond drill. E. E. White, in the *JOURNAL* of Oct. 7, 1911, describes a sampling box for catching sludge from diamond-drill holes, with instructions for its use. In the *JOURNAL* of May 6, 1911, W. J. Mead gives an ingenious chart for obtaining the average analysis of material drilled, when the samples are taken on 5-ft. sections of hole. The "cuttings" or sludge is analyzed, and likewise the core which is produced in the five feet of drilling. These assay values are combined in the final result, in the proportion which each represents of the total amount of material cut by the drill in the five feet drilled.

This method will give correct results in all cases where the sludge collected is a true sample of the cuttings made by the drill bit. In those holes where all the water supplied to the drill does not return to the surface, but a portion percolates into the surrounding strata, some of the sludge will be lost, and it is an open question as to just how well the part which is saved represents the total amount of sludge made. In deep holes the sludge collected may not be more than 10 or 15% of the total amount.

Another prolific source of error in diamond-drill sampling is the contamination of the sludge sample by material caving from the upper part of the bore-hole and being mixed with the cuttings from the bit. The error from this latter source may be large, yet the danger is not always recognized by diamond-drill operators.

In drilling through material which caves badly, the practice is either to cement the hole, or else ream it and put down a flush-joint casing pipe. Cementing the hole is usually the first resort. Portland cement, mixed into a thin grout, is pumped down through the drill rods until the cavities are filled. A mixture of equal parts of portland cement and a quick-setting plaster of paris

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may be used instead of the neat cement; this mixture will harden quicker. In difficult cases tubes made from cotton cloth are filled with the grout and dropped down the drill hole. When tamped the tubes rupture and the grout runs into the fissured or caved zone.

It is only when the caving is slight and the drill runner is not afraid of losing a bit, that there comes in the real danger of contaminated samples, for such caving will not usually be reported by the runner, as would the more serious cases. An instance of this sort came to my attention in the Lake Superior iron country. The record of the drill hole shows soft black slate with much pyrite from 145 ft. to 215 ft.; from 215 ft. to 470 ft., banded ore and chert; from 470 ft. to 545 ft., soft iron ore; and below 545 ft., black slates to the bottom of the hole.

The sludge samples were taken in 5-ft. sections, and the core was removed when necessary. An analysis of the combined sludges from that portion of the hole from 470 ft. to 545 ft. showed sulphur 0.36%, which is higher than any ore mined in the district. An analysis of the corresponding core gave only a trace of sulphur. The high sulphur in the sludge was evidently due to contamination from the pyritic black slate in the upper part of the hole. Analysis on the core gave from 5% to 8% higher values in iron than the corresponding sludge samples.

Below 545 ft. the sludge collected resembled cuttings of ore and assayed from 40% to 50% metallic iron. The core produced was pure black slate. One analysis showed 5.1% metallic iron. Thus it is evident that the iron ore, caving from above, made the black slate material appear as lean ore. To prove the correctness of this assumption,

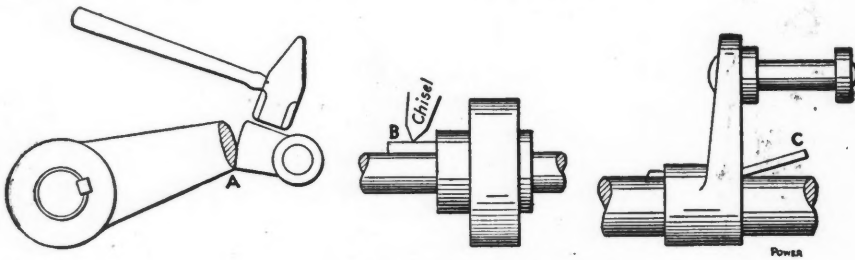


FIG. 1. REMOVING KEYS

the drill rods were raised two feet off the bottom of the hole when the drill was operating at a depth of approximately 600 ft. The drill was stopped and water pumped through the rods until it returned to the surface clear. This showed that the hole was clean of sludge. The rods were then rotated at normal drilling speed for the length of time required to drill five feet, and the sludge collected. Nearly as much sludge was made by the idle turning of the rods, as when the bit was cutting, and it assayed approximately 50% metallic iron.

This proved conclusively that material was caving from that portion of the drill hole which was in ore, and that the sludge collected by drilling below the ore zone had its iron contents raised at least 40%. At no time did the drill runners experience trouble from caving.

The above instance of actual drilling operations shows the necessity of watching the drilling and sampling most carefully if the results are to be dependable. The contamination of sludge samples is not usually as great as in the instance cited, yet the danger is always present, unless the drill hole is cased, which is expensive.

Keys and How to Remove Them

A man tried to remove a steel key from a crankpin and shaft by striking the arm with a hammer. He had previously tried to remove the key by the common method of driving it back, but had failed. He had also poured oil on the parts and tried other means to free the obstinate key. Then he lost his temper, says George Rice (*Power*, Dec. 3, 1912). It does not do to get impatient with keys, as they are pretty sure to hold tightly when driven correctly, for that is what is expected of them. Nevertheless, this man sought to remove the key by banging at the parts with the hammer, but he had not delivered many blows when the cast-iron arm broke as shown at *A*, Fig. 1. Another man used the sharp edge of a cold chisel as at *B*; the cold chisel was sunk well into the steel and the key was ruined when it was finally removed.

A common method of freeing refractory keys is to drive them through with a like key from the other side, as shown at *C*. This method is often used and is a good

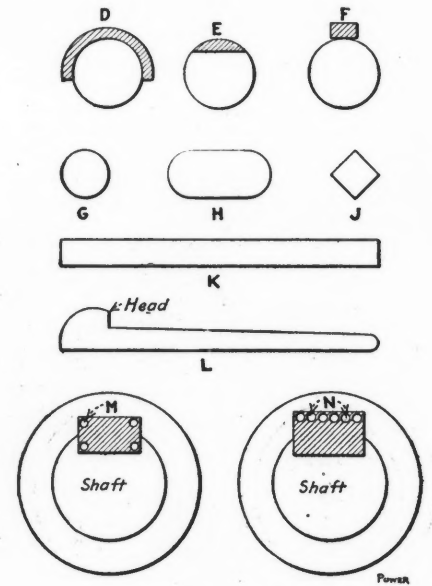


FIG. 2. TYPES OF KEYS

way of driving out stubborn keys when it is possible to get at the sides of the work. It will, however, be necessary to use a driving key of smaller dimensions than the keyseat; otherwise the driving key will bind so tightly in the seat that there will be trouble in getting it free.

Among the numerous types of keys in use is the half-moon-shaped key that covers about one-half of the shaft, as shown at *D*, Fig. 2. This key, when once set, is quite hard to remove. Then there is the key made to fit on a flat section of the shaft, like *E*, also the bothersome form of key *F* that is calculated to bind so tightly in the seat of the hub that the frictional contact with the shaft will cause the hub to hold firmly in place.

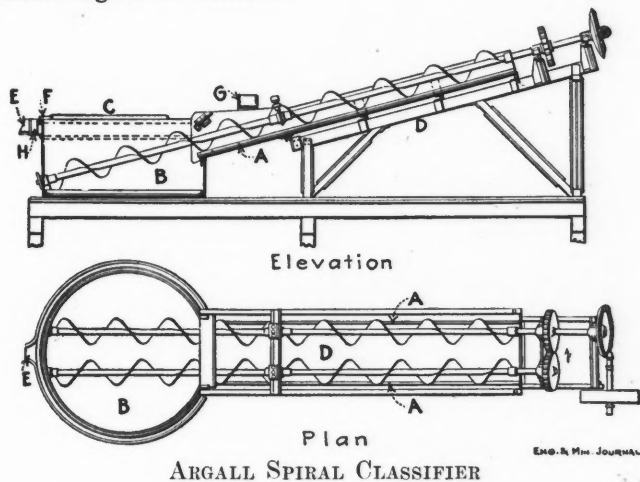
Still other forms are the round key *G*, the extended oval key *H* and the diamond-shaped key *J*. If the key has a head *L*, the chances are that it can be pried from its seat with a cold chisel. If it has no head *K* and cannot be otherwise removed, drill it out by drilling the corner holes as at *M*. Instead of drilling holes at the corners of the key, holes are sometimes made along the upper side of the key as at *N*. The key is then easily removed.

DETAILS OF METALLURGICAL PRACTICE

Argall Classifier

Phillip Argall, of Denver, Colo., was recently granted a patent (U. S. pat. No. 1,044,844) on an apparatus for separating sand and slime. The object is accomplished by means of oppositely rotating spiral conveyors operating within an inclined trough. The sand is discharged at the upper end of the trough, while the water and slime flow over a weir at the lower end of the trough. Classifiers of this general type have been employed successfully at Stratton's Independence Mill, Victor, Colorado.

In a second patent (U. S. pat. No. 1,044,845) Mr. Argall likewise uses spiral conveyors intergeared to rotate in opposite directions and further provides an especially long weir over which the suspended slime is flowed from the settling portion, so that slime of great fineness may be obtained. Provision is also made for adjusting the length of the weir to obtain slime of any desired degree of fineness.



The conveyors are adapted to be rotated slowly, conveniently from three to eight revolutions per minute. A small space is allowed between the conveyor and the bottom of the trough so that the sand may build up and form a bed. On the bottom of the trough *D*, and extending the full length thereof, are secured a pair of angle irons *A* which are placed just outside of the edges of the conveyors. These angles are of relatively short height to constitute, with the side walls of the trough, overflow channels. The feed launder *G* is placed at sufficient distance from the connection of the trough *D* with the settling tank *B*, so that the heavy sand will not enter the settling tank but will be pushed upward by the screw conveyor as fast as it falls thereon, thus leaving the tank for the free settling of the finest sand. The operation of the conveyors displaces the sand particles, causing the slime to be squeezed out of the sand and to be returned to the settling tank by the overflow channels mentioned above. The slime-freed sand is discharged from the upper end of the trough.

Seated within the channel between the wall of the overflow launder *H* and the settling tank *B*, and extending for the full length thereof, is a weir *F*, the upper edge of which is level and projects above the upper edges of the settling tank and overflow launder. By means of the dam *C*, which is preferably formed of a number of overlapping sections, any portion or all of the weir *F* may be cut out of operation. If the dam is not utilized, the entire length of the weir will be effective, thus providing a long weir, which is highly desirable when a slime of fine mesh is to be obtained. By varying the length of the weir and by changing the speed at which the conveyors are driven, the machine can be adjusted to give slime of any desired degree of fineness. It is also noteworthy that, by reason of the substantially circular form of weir employed, a weir of great length is obtained in a comparatively small area. The overflow launder is provided with a suitable discharge opening *E* through which the slime is discharged.

Sorting Belts Used in Rand Breaking Plants

Sorting belts have been in use on the Rand for several years, and in view of their general utility they are now preferred to sorting tables. A sorting belt, states C. O. Schmitt in "A Textbook of Rand Metallurgical Practice, Vol. II.," has the advantage over the sorting table in that its work is not limited to sorting only; and it can also be used for elevating the ore within certain limits. This is of considerable importance in plants where, either through lack of height in the headframe or through the use of preliminary breaking and washing trommels, the ore is delivered to the sorting appliance at a height not sufficient for feeding the fine breaker. The angle of rise of a sorting belt is limited to 10° , as otherwise the picking of waste becomes difficult, with a corresponding decrease in the efficiency of the labor. Apart from this, the height to which the ore can be elevated by the sorting belt is determined by its length, and this is again given by its tensile strength.

The sorting belts in use vary from 30 to 48 in. wide, but for good work 42 in. should be the limit. The sorting belt is really a much enlarged conveyor belt using a special type of troughing idler. The belt may be made of rubber, reinforced by canvas, which is the type generally in use on the Rand. Canvas belts, however, are also in use, but in view of the large amount of moisture present preference is given to the rubber belt. The waste picked from the sorting belt can be dealt with in various ways. It can be dropped into a bin underneath the sorting floor, as shown in Fig. 1, for removal to the dump by trucks or other means. Another method in use is to place it on conveyor belts running alongside and on a level with the sorting belt, as shown in Fig. 2. However, with one waste belt only one side of the sorting belt is available for sorting, and in order to use fully the sorting belt two waste belts must be provided, as indica-

ted in Fig. 2. If two sorting belts are used, only three waste belts are required, thus reducing capital outlay proportionately. A further method is shown in Fig. 3. In this case the waste belt is placed under the sorting belt and the waste need only be dropped through a hole in the floor; the operator therefore need not turn around, thus saving time and reducing the effort required. Another method of dealing with the waste rock is shown by Fig. 4. In this case the returning portion of the sorting belt is used as a carrier for rock.

The power required for driving sorting belts depends upon the amount of ore handled, the height to which it is elevated, and the length of the belt; it should not exceed 10 hp. in any case.

The sorting capacity depends upon the length of the belt, that is, upon the number of picking hands for whom there is room, from $2\frac{1}{2}$ to $3\frac{1}{2}$ ft. being the allowance per man on one side. The carrying capacity, if not overloaded, is somewhat less than that of a sorting table of the same width, and can be taken as follows: A 30-in. sorting belt will carry 54 tons per hr.; a 36-in. belt, 66

The life of a sorting belt is usually not long, depending on its length, the quality of the material used, and the method of feeding the ore to the belt. If the ore is not fed on in a broad even stream, as, for instance, when feeding from a washing trommel, the belt is liable to be loaded more on one side than the other, resulting in uneven running and rapid wearing out of the edges against the side idlers. The cost of operating sorting belts may be taken as follows: Maintenance per ton milled, 0.40c.; power, 0.16c.; capital charges, 0.24c.; or 0.8c. total cost.

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Methods of Fastening Amalgamating Plates at the Homestake

It is well known that when copper amalgamation plates are fastened to the wood tables or sluices by steel nails or screws, the heads of the latter are rapidly attacked by electrolysis and rust off. In some mills, using relatively narrow tables, this difficulty is overcome by using wood cleats at the sides to retain the plates. With wide tables this is

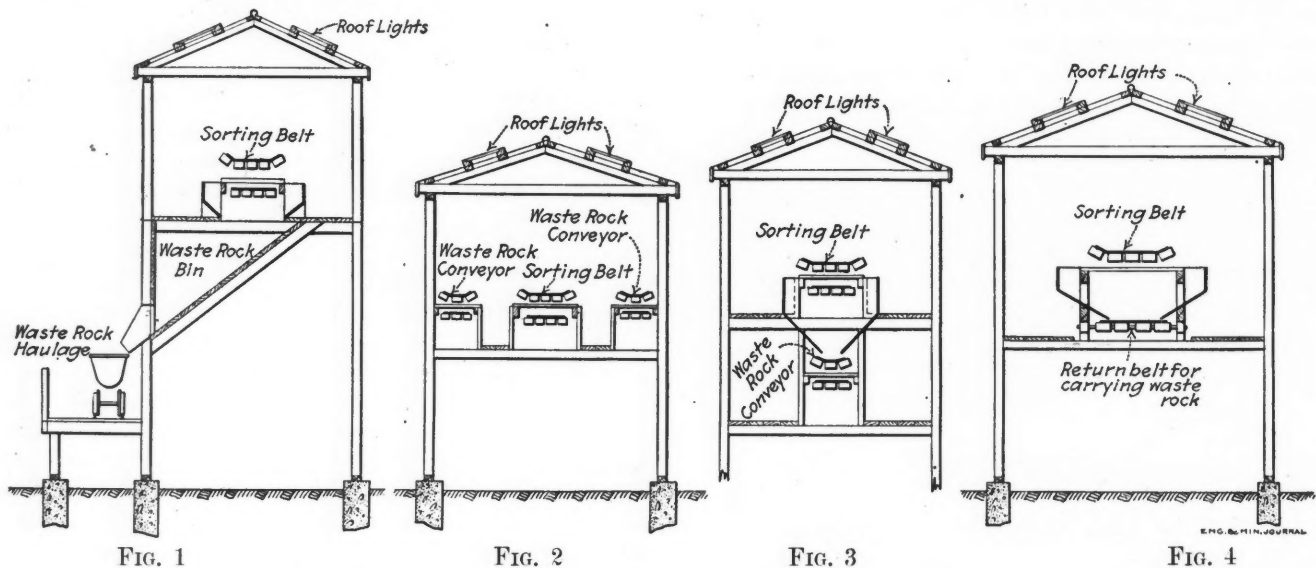


FIG. 1 FIG. 2 FIG. 3 FIG. 4
FOUR METHODS OF DISPOSING OF WASTE FROM SORTING BELTS

tons; a 42-in. belt, 78 tons, and a 48-in. belt, 90 tons per hour. Temporarily these capacities can be largely exceeded at the expense of efficient sorting, as the ore will then be packed in too deep a layer to permit of efficient work.

The length of the sorting belt is limited by the tensile strength of the material used for the belt, as has already been stated, and also by the number of operators needed to remove the waste. Assuming a case where 1200 tons of ore and waste is supplied from the shift of 10 hr., of which one-sixth or 200 tons, is waste; and further, that 33%, or 400 tons, will disappear when passing over the screening arrangements, so that 800 tons will pass over the sorting belt, equal to 80 tons per hour, a 42-in. sorting belt will be required. To remove the 200 tons of waste, from 67 to 80 sorters will be required, for whom up to 240 ft. of sorting space must be provided, or 120 ft. on each side of the belt. Adding to this 15 ft. for washing purposes, the total length of the belt becomes 135 ft., which is well within the limit enforced by the tensile strength of the belt.

impracticable, and in the Homestake mills, at Lead, S. D., solid copper nails or spikes have been long in use, the heads becoming amalgamated at once, like the plate itself (A. J. Clark and W. J. Sharwood, *Bull.* 98, I. M. M.)

These, however, are difficult to draw when replating becomes necessary, so that plates are often bent in the process of removal. Steel screws were therefore electroplated with copper, starting with a cyanide solution and then using the sulphate as electrolyte. The heads of these become amalgamated in the mill, but the metal is protected, so that they can be unscrewed after over two years' use. They promise to be a cheap and effective substitute for the copper nails.

❖

In Bending a Manila Rope over a sheave, the strands and the yarns of these strands slide a small distance upon each other, causing friction, and wearing the rope internally. If a worn-out rope be opened by untwisting the strands, a fine powder will be found, says a recent catalog, published by the C. W. Hunt Co., of New York. This shows that the strands in sliding on each other when in use ground some of the fibers to powder. To obviate this difficulty special brands of rope are made by lubricating the fibers with plum-bago, mixed with sufficient tallow to hold it in place.

THE COST OF DOING THINGS

Consolidated Mercur Costs

The Consolidated Mercur Gold Mines Co. in the fiscal year ended June 30, 1912, mined 187,592 tons of ore. The itemized mining costs are as follows:

CONSOLIDATED MERCUR MINING COSTS

	Amount	Per ton
Ore breaking.....	\$141,242	\$0.753
Tramming.....	17,009	0.091
Timbering.....	25,264	0.135
Hoisting.....	15,503	0.083
Blasting.....	5,504	0.029
Pipe and track work.....	2,060	0.011
Blacksmithing.....	4,066	0.021
Sampling.....	1,046	0.006
Assaying.....	3,034	0.016
Surveying.....	734	0.004
Supervision.....	10,086	0.054
Tramway.....	4,920	0.026
Prospecting.....	17,098	0.093
General expense.....	15,695	0.084
Total.....	\$263,659	\$1.406

In regard to the tramway cost, this is figured against total tonnage. As a matter of fact the tramway only handles the ore from the Mercur mine, and the cost per ton of ore actually hauled was \$0.043. General expense includes insurance, taxes, legal expense, salaries, office expense, bullion expense, etc., most of these items being divided half and half between mine and mill. There was a total of 3657 ft. of dead work done under the head of prospecting, at a cost of \$17,498, or a cost of \$4.78 per ft. of dead work.

The milling costs of the Consolidated Mercur Gold Mines Co. are given with unusual detail.

CONSOLIDATED MERCUR TREATMENT COSTS

Department	Tonnage	Cost per Ton
Crushing.....	201,652	\$0.114 per ton crushed
Roasting.....	67,816	0.857 per ton roasted
Classifying and settling.....	159,403	0.051 per ton classified
Filtering.....	49,377	0.180 per ton filtered
Leaching.....	152,275	0.545 per ton leached
Precipitating.....	.....	0.072 per ton treated
Refining.....	.....	0.046 per ton treated
Assaying.....	.....	0.015 per ton treated
General expense.....	.....	0.065 per ton treated
Total.....	.....	\$1.097 per ton treated

General expense includes bullion expense, taxes, insurance, salaries, legal expenses, office expenses, etc., the mill being charged one-half of these items.

CONSOLIDATED MERCUR DETAIL MILLING COSTS

Department	Crushing	Roasting	Classifying	Filtering	Leaching	Precipitating	Refining
Tonnage.....	201,652	67,816	159,403	49,377	152,275	.....	.....
Total spent.....	\$22,973	\$58,120	\$8,177	\$8,904	\$83,060	\$14,498	\$9,302
Costs per ton							
Labor.....	\$ 0.047	\$0.227	\$0.024	\$0.111	\$0.188	\$0.022	\$0.019
Misc. supplies.....	0.031	0.081	0.010	0.032	0.031	0.005	0.024
Coal.....	.....	0.497	.....	.....	.....	.....	.....
Cyanide.....	.....	.....	.....	.....	0.184	.....	.....
Lime.....	.....	.....	.....	.....	0.029	.....	.....
Zinc.....	.....	.....	.....	.....	.....	0.039	.....
Power.....	0.035	0.044	0.014	0.026	0.017	0.005	0.002
Water.....	0.001	0.008	0.003	0.011	0.025	0.001	0.001
Total.....	\$0.114	\$0.857	\$0.051	\$0.180	\$0.474	\$0.072	\$0.046

In the roasting department the average daily roaster duty was 96.9 tons per furnace, a much higher duty than has ever been obtained here before, which materially reduced the roasting expense although at times it adversely affected the slime tailings and caused some trouble.

In the slime plant the tonnage classified during the year was made up as follows: Base sand, 48,172 tons; oxidized sand, 61,854; total sand, 110,026; base slime, 16,134; oxidized slime, 33,243; total slime, 49,377 tons.

In the leaching, the consumption of chemicals was as follows: Cyanide, 0.73 lb. per ton; lime, 15.27 lb. per ton. The lime is burned by the company and is, low grade; hence the above does not mean a consumption of 15.27 lb. of CaO per ton of ore treated. In the precipitating department the consumption of zinc dust was 100,648 lb., or 0.50 lb. per ton. This is an increase over that formerly used, because the ore tonnage was reduced without proportionately decreasing the tonnage precipitated.



Unit Costs North Star Mines

The following article was written from data supplied by W. H. Hague, managing director of the North Star Mines Co., Grass Valley, Calif., and represents approximately the standard of work at this property. The record given herewith covers a 27 working-day month unless otherwise stated. American labor only is employed. The average hoisting depth is 1600 ft. The rock mined consists of diabase and granite and all ore is extracted by stull stoping. During the period covered by this article, 10,097 tons of rock were mined, consisting of 9204 tons of ore and 893 tons of waste; of the ore mined, 8268 tons came from stopes and 936 tons from development. No waste was hoisted from stopes. The development work consisted of 270 ft. of drifts and crosscuts and 147 ft. of raises, a total of 417 lin.ft. The underground labor is shown in the following table.

DISTRIBUTION OF UNDERGROUND LABOR, NORTH STAR MINES

Stopes:	8-hr. Shifts
Breaking ore.....	1533
Shoveling ore to chutes.....	1125
Tramming to shaft.....	303
Filling stopes.....	468.5
Timbering.....	273
Total shifts stoping.....	3702.5
Development:	
Advancing.....	204
Mucking and tramming.....	372.5
Timbering.....	7
Total shifts in development.....	583.5
Miscellaneous men underground.....	975
Total shifts underground.....	5261

According to these figures, 89% of the ore is produced by stopes and about one ton of waste is hoisted for every 10.3 tons of ore. Based upon the shifts as reported, 1.75 tons of ore are secured per shift per man employed underground. In stopes the rate is about 2.24 tons per man per shift; one man apparently breaks about 6.2 tons per shift, shovels 7.35 tons of ore to chutes or trams about 27.2 tons to shaft during a shift. In filling one man is employed for every 17.7 tons of ore stoped and in timbering one man for every 30.2 tons of ore.

In development work the average advance per shift per man employed in development was about 0.715 lin.ft., consisting of drifts, crosscuts and raises in the proportion mentioned. For men advancing the rate is about 2.4 ft. per man per shift. One trammer was employed for every 1.12 ft. advanced per shift and one timberman for every 59.5 ft. While it was not stated that any

timbering in development was confined to raises, such is probably the case, in this event the timberman rate would be one man for every 21 ft. of raise per shift. On the surface at the mine and in the mill, including all departments, about 100 men are employed per day, which, together with the average, 195, underground men, as reported, makes a total daily average of 295 men, indicating about 1.15 tons per man per day.

As stated, the average hoisting depth is 1600 ft. Hoisting from this depth, it requires about 100 hp. per day on an output of 10,000 tons of ore and waste per month. The average time required to lower and raise men is approximately 50 min. On an average of eight piston and 45 hammer drills are worked a day; it requires 118 cu.ft. of free air per minute per drill shift, including ventilation. During a shift of eight hours, two men, using a Numa drill sharpener, usually sharpen 310 drills per shift. Forges are supplied with compressed air and burn crude oil; one forge will consume 0.4 bbl. of oil per eight-hour shift.

In drifts it requires $1\frac{3}{4}$ hr. to set up machines on vertical bars, including time required to clean out face, and 35 min. to rig a machine on a horizontal bar. One set-up is made, and, using a No. 8 Leyner water drill, 43 ft. is about the average drilling rate per eight-hour shift. In stopes 12-A Waughs are used, and usually drill 25 ft. of holes in $5\frac{1}{2}$ hr. actual drilling time. The drill-steel consumption averages about 1000 lb. of Leyner and 3000 lb. of cross steel per month. During the period mentioned, 1469 machine-drill shifts were worked in stopes and 174.5 in. drifts; according to this, 5.64 tons of ore are secured in stopes and about 2.4 lin.ft. of advance in development per machine shift. In stopes 1.33 lb. of dynamite is consumed per ton mined, and in development 13.5 lb. per ft. advanced. Timber consumption in stopes is equal to about one linear foot of round stull per ton. All main drifts and stations are lighted by electricity, and candles are used by men in working faces; the candle consumption is four per man per shift of eight hours.

In drifting through hard granite, one man will advance a 6x8-ft. drift 3.5 ft. in eight hours. This is equal to approximately 0.437 lin.ft., or 21 cu.ft. of drift per man-hour. In raising through granite, one driller and two shovelers advanced a 6x10-ft. raise 118 ft. in 52 shifts of eight hours each, drilling approximately seven hours per shift and consuming 15 lb. of dynamite per foot. This is equivalent to 2.27 lin.ft. per shift, 0.095 lin.ft., or 5.66 cu.ft. of raise per man-hour.

In sinking an 18x9-ft. shaft on a 45° slope through hard diabase, four men per eight-hour shift, three shifts per day, for 29 days sunk 80 lin.ft., drilling four hours per shift and using 27 lb. of dynamite per linear foot. This is equal to 0.92 lin.ft. per shift, 0.0288 lin.ft., or 5.22 cu.ft. of shaft per man-hour. Comparing dynamite consumption, these figures show one pound broke four cubic feet of raise against six cubic feet of shaft. A summary of tramping records shows that one man pushes an 18-cu.ft. car 150 ft. per minute, loads off a plat into a car at the rate of three tons per hour and off a rock bottom at the rate of two tons an hour. Loading the same size car from a chute requires three minutes. These figures were obtained from several observations, but due allowance should be made for loss of time during a shift.

Notes on Dynamite Consumption

The following data were extracted from articles previously published in the "Cost of Doing Things," and for that reason no attempt has been made to give details of working conditions. On the Ready Bullion and 700-ft. claims of the Alaska United the average cost of explosives per ton of rock broken is 8.9c. and 9.8c., respectively. The Alaska-Mexican report shows 27.8 tons per machine shift at a cost of \$2.34 for explosives, or 8.1c. per ton broken, while the figures given in the Alaska-Treadwell, 32.74 tons per machine shift at \$2.62 for explosives, show a cost of 8c. per ton broken.

In Goldfield, Nev., the cost of explosives, including development, has ranged from 13c. to 33c. per ton of ore produced, and an average of about 22c. per ton. The average at the Tonopah-Belmont during 1911 was reported at 29c. per ton of ore produced. The Tigre Mining Co., Mexico, reported a cost of 35.2c. per ton of ore for all explosives, and the Daly-Judge, Park City, Utah, gives 8c. as the cost for explosives per ton of ore extracted from stopes. The Timiskaming Mining Co., Cobalt, Canada, reported a total cost of 33.7c. per ton for explosives in 1911. The following gives the approximate average consumption of dynamite, per ton of ore produced, by underground mining in Alaska: Alaska-Mexican, 700-Ft. Claim, 1.15 lb.; Ready Bullion Claim, 1 lb.; Alaska-Treadwell, 1.73 lb.; Alaska United, 1.1 lb. A short record at the Combination mine, Goldfield, Nev., gives a consumption of 1.46 lb. per ton of ore produced and reports of the Oriental Consolidated, Chosen, Asia, show an average of 3.02 tons of ore produced per pound of dynamite, while a detailed statement of its mines indicates that from two to 4.09 tons are secured per pound. The stoping figures for several mines, given in the accompanying table, show the consumption per ton of ore from stopes.

DYNAMITE CONSUMPTION PER TON OF ORE FROM STOPES.

	Lb.
Goldfield Nevada mines.....	0.446
Erie Consolidated, Calif.....	0.78
Pittsburg-Silver Peak, Nev.....	0.676
Cananea Consolidated, Mex.....	0.814
Ohio Copper Co., Utah.....	0.22
Mammoth Copper Co., Calif.....	0.45
Mother Lode Mine, British Columbia.....	0.67
North Star Mines, Calif.....	1.33

The average consumption of dynamite in development at various mines, expressed in pounds per linear foot of advance, as follows: Erie Consolidated, Calif., 4 lb.; Pittsburgh-Silver Peak, Nev., 7.67 lb.; Cananea Consolidated, Mexico, 8.7 lb.; Mammoth Copper Co., Calif., 18 lb.; North Star Mines, Calif., 13.5 lb.

The following figures show the amount of dynamite that was required for one cubic foot of raise or drift:

	Lb.
North Star Mines, 6x10-ft. raise in granite.....	0.25
Mammoth Copper Co., 6x12-ft. raise in porphyry.....	0.234
7x9-drift in porphyry.....	0.328
Cananea Consolidated, 6x11-ft. raise in hard quartz.....	0.126
4.5x6.5-ft. drift in hard quartz.....	0.26
Pittsburg-Silver Peak, 5x4.5-ft. raise medium hard quartz.....	0.40
Erie Consolidated, 5x7-ft. raise, slate and quartz.....	0.126

In shaft sinking at the Consolidated Merger Mines Co., Goldfield, Nev., the consumption in a 7x16-ft. shaft averaged from eight to 11.68 lb. per lin.ft. of shaft, or 0.0714 to 0.096 lb. per cu.ft. of rock removed. At the Cananea Consolidated, a 7x15.5-ft. shaft was sunk through hard limestone with a dynamite consumption of 0.1 lb. per cu.ft. of rock, and at the North Star Mines a 9x10-ft. shaft in hard diabase 0.16 lb. per cu.ft. of rock.

Hoisting Practice in Wisconsin Zinc Fields

By W. F. BOERICKE*

SYNOPSIS—In the shallow zinc mines of southwestern Wisconsin, the muckers load the ore directly into buckets which they tram to the shaft on low, flat trucks. The bottom man snaps the hoisting rope on the bucket, which is raised to the surface without guides and dumped by the hoistman. The bottom man and the hoistman work together so well that no signals are used.

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Most of the mines in the Wisconsin zinc district are shallow, it being rare to find a shaft over 150 ft. deep, while the great majority are 100 ft. or less. In nearly every case only one level is worked and all tramping and hoisting is done from it. Consequently elaborate hoists and headframes are unnecessary. The problem has been to find the cheapest, simplest method for handling a fair tonnage per shift, involving small capital outlay for first cost. This latter is often important, as much of the mining is done by small leasing companies of limited resources.

EARLY SHAFTS WERE SMALL

The shafts sunk by the early lead miners were small and adapted only for handling a small output in the most primitive fashion. They were never sunk below water level, and therefore stopped at the bottom of the lead and drybone zone, and on top of the blende, which generally lay below the water. The shafts were rarely larger than 4x4 ft. in the clear. Most of the ore was handpicked and cobbled underground, and then carried in tubs or candleboxes to the shaft where it was hoisted by a windlass. There was no attempt at any economic tramping, and it was considered cheaper to sink a new shaft than to handle the dirt any distance underground.

With the coming of the larger companies in recent years, and the working of the jack deposits below the water level, such methods were, of course, abandoned along with the old hand jigs. Shafts were made larger, 5x9 ft. in the clear, being a usual size. This leaves a 5x5-ft. hoisting compartment, and a 5x4-ft. compartment for ladderway, pump-column pipe, etc. Double-compartment shafts are not often seen. The ground stands well with scarcely any timbering outside of an occasional stull and the usual cribbing around the soft ground at the top.

LOCAL CONDITIONS FAVORABLE FOR BUCKET HOISTING

With the single exception of one large company, which uses the car and single-deck cage in all of its mines, bucket hoisting is nearly universal throughout the district in all the vertical shafts. Except in Joplin it would be difficult to find conditions better adapted for the use of this crude but serviceable means of getting out the ore. Skips are not used, though in some incline shafts where cars are used underground, the latter are hoisted and dumped automatically on top.

The buckets are usually of uniform size, though where hand tramping is used over long distances, it is customary to use a lighter bucket for the longer tram, and a heavier for the shorter. The usual size is 28x30 in., containing approximately 10.5 cu.ft., or about 1000 lb.

*Mining engineer, Mineral Point, Wis.

of broken ore. No. 12 steel is used on the sides, and No. 10 on the bottom. Its weight is about 250 lb.; 500-lb., 750- and 1200-lb. buckets are also used, depending on local conditions. The handle of the bucket is loose so as to be out of the way while the men are shoveling into the "can," as the bucket is called. At the bottom a ring is riveted, and the bottom dished, or the ring countersunk, so the can will sit firmly on the car. This ring is used for attaching the dumping rope.

On account of the simplicity of the operations, and the short distance the dirt is hoisted, the headframes are of the simplest type. The hoist is usually placed on the top of the headframe, 40 or 50 ft. above the collar of the shaft, and within a few feet of the shaft itself, so that the hoistman can be near the shaft and control the engine at the same time.

Double-engine upright hoists are used in these mines, with cylinders 8x8 in., rated at 30 hp. There are a few first-motion hoists in use but generally the lift is too short to employ any high speed. With the engine usually employed the drum turns loose on the shaft, and is driven with an end wood friction, the clutch being thrown in and out by a double screw. As the load is unbalanced, there is no need of any link motion, as the bucket alone will pull itself back and unwind the engine. Band brakes, both foot and lever, are used. The usual hoisting speed is about 500 ft. per min., with a load of 1200 lb. Wire cable, 5/8 in. in diameter, is employed; it should be non-spinning, and if properly treated, lasts about six months.

Recently electric motors have been substituted for steam at many of the larger mines. These are usually constant-speed induction motors of the ordinary type, and are rated at 37 and 57 hp. Drum controllers are used. Hoisting speeds are 500 to 700 ft. per min. The excess power takes care of the frequent overloads to which they are subject, and they have given good satisfaction.

SIMPLE ARRANGEMENTS AT TOP AND BOTTOM

The hoistman not only attends to hoisting and lowering the buckets, but dumps them as well, thus saving the cost of a top man. He stands directly above the shaft, which is built up so as to be safe, and when the can is attached at the bottom, which he usually tells by the tension of the rope and long experience rather than by a signal, he starts the engine. When within a few inches of the top, the current or steam is shut off, and the bucket held stationary by the brakes. The door over the top of the shaft, which is so counterbalanced as to move easily, and which is within reach of his hand, is then closed to prevent possible accident to the men below, the dumping hook attached to the ring at the bottom, and the brake released. The bucket is consequently overturned and dumped on the grizzly. The engine is then started, the hook detached, and the bucket lowered with the brake alone.

Arrangements at the bottom are likewise simple, though here, as at the top, an experienced man is needed to handle a large number of cars. The buckets are trammed on light cars, which are run directly to the

bottom of the shaft. As soon as an empty comes down, it is steered dextrously to an empty car—a square platform of wood on wheels—the hoistman slacks off sufficiently to detach the hook, which is immediately snapped to a loaded car, and without further signaling the bucket is pulled to the top, the bottom man stepping under the shaft an instant to steady the can to prevent swinging on the way up. Immediately the empty can is hustled out of the way, and another loaded one brought near the shaft ready for the next trip. It is strenuous work while it lasts with no delays. It usually happens that 10 or 12 cans will come in all at once and these are got out as speedily as possible without a let-up. The system has the advantage that with all men working at top speed there is less likely to be delays at the bottom, and signaling will not be needed, as the hoistman knows exactly the interval to allow between cans.

Besides attending to the buckets at the bottom, the bottom man also keeps track of the cans, and credits each shoveler, who incidentally trams his own cans to the shaft. Each shoveler has a number given him, and places a wooden block containing it on top of the loaded bucket. By a system of pegs under each number the bottom man keeps tally. This is important, as the shoveling is generally done on contract. The hoistman at the top likewise keeps a separate tally of the total, and the two must check at the end of the shift.

From 400 to 500 cans is the usual number hoisted from one shaft per shift of eight hours for the ordinary mill. Much more could be handled with the same labor if the dirt could be got to the shaft and if the mill could handle it. The record hoisting for the district is, I believe, 1019 cans hoisted from one shaft in one shift in nine hours.

ADVANTAGES OF BUCKET HOISTING

The advantages of bucket hoisting, under the peculiar local conditions of Wisconsin, may be briefly indicated. The first cost is small, buckets being cheap and easily obtainable. No elaborate hoists are necessary. No timbering in the shaft is needed, though, of course, the walls should be smooth and there should be no projecting stulls to catch the lips of the buckets. Crossheads and their accompanying guides are rarely seen, as the shafts are so shallow that the bucket has little time to swing before reaching the top.

There is no handling of the ore underground, the rock not being dumped from the bucket until it reaches the top. The minimum amount of labor is needed throughout. Any other system would require an extra man.

The system has great flexibility. The tracks may be brought to the shaft from any direction, the only consideration being that a sufficiently strong pillar or pillars are left to support the shaft. With a cage, on the other hand, the tracks must be so arranged that the car is run on the cage from one direction only, in order to conform with dumping arrangements at the top. There is the further advantage with buckets that short curves may be used without much trouble, and hence there is considerable saving in bottom room around the shaft, which may be important where the roof is bad. Likewise at the top, no elaborate headframe and dumping arrangements are needed; there need be but one sheave wheel, and the designing is of the simplest.

Finally, the native miners are used to buckets, and the

clumsiness and added trouble of loading and tramping them are taken as a matter of course. They have never been used to anything better, and it must be confessed they are superior to candle boxes as a means of conveying ore. They are the approved means of making contracts with men for shoveling. The usual rate paid is seven cents per can—"tram your own dirt." This assumes, of course, that the tram is reasonably short, not over 500 ft., and generally down grade.

DISADVANTAGE OF BUCKET HOISTING

The chief disadvantage of buckets in underground work is the impossibility of getting out any large tonnage with them where the dirt has to be conveyed over 1000 ft. from the face to the shaft. Likewise, if any grade is encountered, it is quite impossible for one man to push the loaded bucket alone and another man is needed, thus making the system expensive. It is unadapted to any system of haulage, either mules or motors, on account of the profane ease with which the buckets are overturned, the center of gravity being so much higher than with a car. Considerably more labor is needed to fill the bucket with ore than a car of like capacity, as the dirt must be lifted considerably higher, and the area into which it is thrown is so much smaller that more care and time are needed to avoid spilling. Hence the net results of the shovelers' labor are less. This is especially the case in low headings, where there is no room to lift the shovel. The company also loses out in contract work from the fact that the shift boss cannot be everywhere at once, and advantage is taken of his absence to build "windy" buckets, by artistically piling a stockwork of irregular rocks at the bottom of the can, and covering the top with a nice smooth layer of dirt.

The unbalanced bucket hoists consume somewhat more power than those needed for counterbalanced cages. It is difficult to get good men at short notice to take the place of the hoistman or the bottom man, and with inexperienced substitutes, the efficiency of the system is much impaired. These men, of course, get good wages. With a cage, however, the wages are lower, as less expertness is needed, and men are more easily replaced.

COUNTERBALANCED CAGES USED AT LARGER MINES

Outside of bucket hoisting, the counterbalanced cage is used at some of the larger mines. The cage is of the ordinary mine type, four feet between guide timbers, and takes an end-dump mine car of 14-cu.ft. capacity, estimated to contain 1500 lb. of dirt. The counterbalance is so weighted as to balance the cage and the empty car, and slides up and down in special guides, placed at right angles behind one of the cage guides. Steel cable $\frac{3}{4}$ in. in diameter is used for cage and counterweight, and with proper dressing will last over a year. At one mine the rope is still in good condition after 28 months of active use. Cages are of course safer than buckets for transporting men, but there have been comparatively few accidents due to this cause.

A hoist of 25 hp. is sufficient for one of these cages. The drum is positively geared to the engine, and so differs from the bucket hoists in that it does not revolve free on the shaft. A link motion is therefore needed to lower the empty cage and car. The hoisting speed is low, not over 350 ft. per minute.

THE MINING INDEX

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language, for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for \$1, 33 for \$5, and 100 for \$15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COAL AND COKE

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CORRESPONDENCE AND DISCUSSION

Southern Pacific Geologist not in Government Employ

My attention has been called to a statement by the director of the U. S. Geological Survey appearing under the above title in the *JOURNAL* of Dec. 14, 1912, p. 1118, to the effect that I misrepresented myself while in private work as still being connected with the Survey. This does me an injustice. In fact, I was for some time a member of the Survey, and am proud, perhaps foolishly so, of the connection. Since leaving the Survey I have used a limited number of cards, usually in a social way, upon which I was designated as a member of the Survey.

In every case where such cards were used I explained verbally that I was now in private work. It was my usual practice to mark out the offending line. In no case were cards used with the purpose, or, as I believe, the result of deceiving the recipient. In the particular instance causing the trouble an unmarked card fell into the hands of one who, knowing the facts in the case thoroughly, none the less used it to injure me in retaliation for criticism I had passed upon wildcat drilling for which he was responsible. From this small basis of fact the large burden of criticism has grown.

I was careless and indiscreet, but I was not dishonest. Nothing was further from my thought than to injure the Survey or to obtain information under false pretenses. Such a practice is neither expected nor tolerated by the company for which I am working.

LEON J. PEPPERBERG.

San Francisco, Calif., Dec. 20, 1912.

✽

College Men Underground

In his discussion in the *JOURNAL* of Nov. 16, 1912, regarding the relative merits of college men and practical miners for positions of authority underground, Capt. Theodore V. K. Swift summarizes the advantages and disadvantages of the two as follows:

(1) Ability of college men to learn fast, to be systematic, to reason clearly and to adapt themselves and their work to changing conditions; (2) the ability of college men to calculate and to realize the value of figures; (3) the possibility of a college man's developing himself into a "practical technical man"; (4) the lack of ability in a college man to direct work for others which he has never done himself; (5) the better judgment of the old timer in details which can be gained only by long experience; (6) the superior faithfulness of the old timer to his employers.

Accepting the summary as it stands, one would conclude that the capabilities of the two types are about equal or that the chances of a college man and a miner developing into a good underground boss are about equal. As a college man and as a miner I beg to disagree with Captain Swift in some of these conclusions.

Bearing in mind that underground work is being discussed, is the first conclusion justifiable? As I understand it this means that a college man will learn to be a miner more rapidly than an uneducated man who has never worked underground. He will not do it for sev-

eral reasons, all of which are usually overlooked by the college man, the first of which is lack of familiarity and practice with tools. This knowledge of the use of tools is essential to the miner and it is almost entirely a matter of practice. The uneducated man has been acquiring this familiarity with tools all of his life, usually going to work with them, for wages, at the age of 15 or 16, or at such time as he is capable of making a living therewith. The college man seldom goes underground at an earlier age than 23 except as a visitor or for short spells during vacations. At that age he is usually possessed of only such familiarity with tools and work as is gained by looking at them. Those of us who have become familiar with both know that it requires much patient effort in addition to observation.

When the college man goes underground he comes in contact with men of his own age who have spent, in many cases, five or 10 years at underground work, many of whom are his mental inferiors in training only. Then, too, they have the physical training which he has not. It must be remembered that bosses are selected from the most intelligent and ambitious miners, not from the "average" and that it is against these that the college man must compete.

It was my fortune, some years ago, to have charge of a small mine which was operated by the head of the school of mines of one of our large institutions of learning in order, chiefly, to give some of the graduates a course of training in practical mining. The result was unsatisfactory from every angle and to those interested it was clearly demonstrated that college men make unsatisfactory miners and that it is a waste of time for them to try to become such. In three months' time not one of them acquired sufficient knowledge of machine work to hold a job in a mine where a "shift's work" is exacted from every man therein, and we all know that running a machine is about the simplest operation that will give a man any claim to being a miner.

It was through no fault of these young men that they did not learn to be miners in so short a time. No one ever became a miner in two or three months. To acquire the knowledge usually demanded of underground bosses will take six or seven years' work in several different mines. This statement may not be believed by the young graduate, but is not likely to be disputed by the bosses.

It is not to the advantage of the young college man to attempt to learn to be a miner, because it is his expectation eventually to hold a higher position than shift boss or fireman and to be able to superintend operations of any kind. He does not know whether he will be called upon to manage a gold mine or an iron mine, a cyanide plant or a smeltery. Should he become fairly proficient at copper mining in a large mine where improved methods are used, it will benefit him but little should he attempt to run a small gold mine, and a knowledge of both may be of little assistance to him in an iron mine.

Furthermore, the superintendent has other duties than directly supervising the underground work and a future superintendent must learn the milling or smelting as well as the still more important business end of his business. If the young graduate spends too much time as a miner he will be deficient in many other things which are probably of more importance to him. The one who thinks he can acquire this other knowledge while working in the mine will learn that mining companies do not encourage a miscellaneous investigation of mill and office by the miner. Besides, if he does what is expected of him in such mines as those in which it has been my fortune to work, he will learn that his time is pretty well occupied in doing one shift's work and preparing for the next one.

Another reason why college men seldom become thorough miners is because after a little experience they usually realize all of this and, too, they consider the emoluments of the underground jobs.

Shift bosses seldom get more than \$150 a month, while foremen may get \$200. This is above the average, however, as many mining companies pay less for these positions. The college man has an investment of five or 10 years' work and \$5000 or \$10,000 in his education, and he justly thinks himself entitled to more pay than that of a man with no such investment, and he will never be satisfied with a position for which he will find plenty of thoroughly competent men, no older than himself and with no college training.

THE COLLEGE MAN'S REAL ADVANTAGE

College men undoubtedly are better able to systematize their work and reason clearly. As to adapting themselves and their work to changing conditions, that is probably true, but unless their attention is attracted by an "old timer," they frequently fail to recognize these conditions. In this connection a case in California is recalled where it was extremely difficult to explain to an educated man that it was impossible to work at a profit an orebody 15 ft. wide averaging about \$1.25 per ton, but with bunches aggregating about one-twentieth of the whole and scattered miscellaneous through it, which averaged about \$5 per ton, the cost of mining and milling this ore being about \$3 per ton. He said that he knew it could be done because "in a silver mine in Mexico they mined the high-grade ore and left the poorer material to be mined when the price of silver went up." Too often the college man cannot recognize the fact that the methods applicable and results obtained under one condition may not hold in another case, especially if there is any similarity in the nature of the ore deposit.

As to the ability of the college man to calculate and realize the importance of figures there is no room for argument. In fact, it is likely that this is about the only advantage he has over the "old timer," though he is usually more flexible in his opinions and methods and is constantly striving for improvement in his work. The old timer is much more likely to become "set in his ways."

If by "a practical technical man" Captain Swift means a thoroughly practical miner as well as a technical man, it is extremely unlikely that the college man will ever develop into one. In an experience which includes an intimate knowledge of the miners and bosses of about 30 or 40 Western mines and some Eastern ones, I have

never known one who attained the degree of proficiency of the "old timers" who take pride in being "all around men." They sometimes become proficient enough to hold a job in one locality, especially where two-men machines are used, but they seldom do more than this.

As to the lack of "ability of college men to direct work for others which they have never done themselves," it seems that this should be self-evident. Unfortunately it is not, and we frequently see the young college man looking for a job as shift boss, a position for which he is never fitted and which it may be added, he never gets where ability is the chief qualification.

The better judgment of the old timer in details which can be gained only from long experience includes practically all of underground work. The man who is familiar with the details of the practice in the greatest number of places, "other things being equal," is best able to apply the most advantageous of them to any particular piece of work. It is an impossibility to acquire sufficient knowledge of those details to apply them without doing the actual work.

As to "the superior faithfulness of the old timer to his employer," there is a chance for argument. It is not true in the Western mines, or only to the extent that they are true to their jobs rather than to the employer. It seems rather unjust to the college man to say that his sense of responsibility is less than that of the miner, and the fact that a college man quits an underground job because he can get something better is but natural and does not indicate unfaithfulness.

On the whole it appears that Captain Swift is too favorable to the college man in his conclusions. In substantiation of this view, attention is called to the extreme rarity of the cases where they are at present employed in positions of authority underground. The observation that "the ideal operating man for the efficient mining of today is the one who has good, sound common sense, good practical experience and education and brains enough to handle the technical problems which come before him" is undoubtedly true, but I cannot agree with Captain Swift that this is, or will ever be, the college man. The fact that college men themselves as superintendents and managers seldom employ other college men for underground bosses is evidence that they realize the greater ability of the "old timer" at this work.

H. F. DAVIS.

St. Louis, Mo., Nov. 30, 1912.

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Separation of Barite and Sphalerite

Since the appearance of the article "The Separation of Barite and Sphalerite," I have been asked if the same treatment would apply to other separations. I should like to reply through your columns that the same process would separate fluorite and sphalerite, and also smithsonite (or calamine) and sphalerite, as effectively as in the case of barite and sphalerite. These last named separations have been desired many times. The mineral to be separated from sphalerite in this manner must be a nonconductor to begin with and must not be made a good conductor by sulphating. Perhaps other separations than those named might be solved by this treatment.

C. C. CONOVER.

Cuba, Wis., Dec. 16, 1912.

EDITORIALS

The Public Land Controversy

At the recent meeting of the California Miners' Association in San Francisco the leading theme was the manner of the public land administration, papers reflecting the popular idea of injustice and the Washington idea of a merely faithful execution of the laws being presented and discussed. The same difference of opinion has been ventilated freely in the press, including our own columns. There does not seem to be any common ground upon which agreement can be reached, yet undoubtedly there ought to be.

We do not think that the Government at Washington wants to impede legitimate development of the mineral resources of the country. The statements of W. C. Mendenhall at San Francisco, as the mouthpiece of Secretary Fisher, are a logical presentation of the policy of the Interior department, and certainly this is fair and reasonable. Briefly, this department aims to execute the laws standing on the statute books; if the laws be unsatisfactory, let the people change them.

The root of the trouble is clearly the antiquated and imperfect mining laws under which we are still trying to get along, laws that were framed nearly two generations ago when there was no broad knowledge of the nature of ore deposits and the conditions of modern exploitation. There is no complete classification of the public lands, mineral, agricultural, etc. Oil and gas may be acquired only under the anachronistic placer law. No law provides for the acquisition of water powers. No means have existed whereby great industrial companies could simply acquire the resources of coal needed in their business, for their own supply. It is impossible by the letter of the law to make a valid location upon land supposed to contain an unexposed deposit of mineral, either a deep-lying bed or mass of ore, or an alluvial deep lead. These matters are all apart from the absurd and troublesome law of the apex, which in many districts has already been discarded by common consent, and Congress has neglected to adjust conditions although it has excellent precedents to follow in the laws and experiences of other countries.

Being without adequate laws we fell into the habit of getting along in any old way. The discretionary powers of the agents of the bureaus were exercised to the utmost. Fraudulent acquisition of natural resources was permitted with calm acquiescence simply in order that the development of the country might go on. Of course there were many abuses of this administrative nodding. With the awakening of the public conscience a few years ago there developed a policy to enforce the old laws and put a stop to easy going, just as the laws against the trusts and other old laws that were supposed not to mean anything were brushed up, the officers of the government considering this to be their duty.

It is this new policy that has aroused the storm of protest in the mining industry, but this is perhaps directed not so much against the policy itself as against the way of its execution. If Secretary Fisher himself, or his sub-

ordinates down to the second or third rank, could settle all cases of dispute in the interpretation of laws, etc., no doubt things would go on very well, but that being manifestly impossible, grievances respecting the actions of his sub-licutenants and orderly sergeants naturally arise, and it is these that generally cause the trouble. Very often, we think, they are well-founded.

We have before us now the correspondence in the case of W. J. Graham, of Groveland, Tuolumne County, Calif. Mr. Graham has been prospecting an ancient river channel near Groveland, which is shown as such on a map of the Geological Survey. A forest ranger, one Miller, cut out 160 acres of this channel to let V. D. Bunce, a ranchman, homestead in spite of Mr. Graham's protest that it was mineral land, shown as such by the U. S. Geological Survey. The forest ranger said that he had not been furnished with any such map. Mr. Graham reported these facts to H. S. Graves, chief forester, and protested. After the interchange of some characteristic bureaucratic correspondence, A. F. Potter, acting forester, informed Mr. Graham that the tract of land in question "was covered by a mining location on which no development work had been done and no discovery made." Also "that an auriferous channel was indicated on the Geological Survey maps to pass under this area. But these indications relative to the possible mineral character of this area were not deemed sufficient to" exclude the homesteader. Mr. Potter, with sublime bureaucratic nonchalance proceeded to inform Mr. Graham that if he did not like the status of things, of course, he was entitled to his day in court, etc.

Mr. Graham replied to Mr. Potter that the tract in question had been held for 40 years as a mineral claim, that gold had been discovered on it and many thousands of dollars worth taken from it. He further stated that he himself had done hundreds of dollars worth of assessment work on the tract every year and that he had bought and paid for a majority part of this piece of land as a mining claim, had made a discovery upon it, and was now prevented from selling it because of the Bunce location. In the remainder of his letter Mr. Graham expressed his opinion of Mr. Potter and the Forest Service generally. Mr. Potter favored him with another bureaucratic reply, the gist of which was that he regarded the action of the Forest Service as "being in all respects proper," bureau's docket all in correct order, nothing further to be done, day in court, etc.

Here we have some simple questions of fact. The forest officials admit the existence of the mining claim, but say that no discovery had ever been made and no regular assessment work done. Mr. Graham on the other hand says that he had done assessment work, and had taken gold from the property. If his statements are true it was certainly the duty of the forest ranger to find out about them before letting in the homesteader. As to these matters of fact Mr. Graham must be failing to tell the truth; or else the forest officials are failing to

tell the truth or were grossly ignorant and having made a mistake refuse to correct it. It ought not to be difficult to determine these things and manifestly it was the duty of the bureau so to do.

There is, however, another matter upon which both parties agree. Mr. Graham was prospecting for a deep lead (which he found subsequently) and the U. S. Geological Survey had called this mineral land and showed on a map the supposed extension of the lead through the tract of land in question. Yet the Forest Service did not consider this to be of any consequence. But if this does not constitute fair presumptive evidence of mineral land open to a mineral location we should like to know what does? As it is, Mr. Graham finds himself in the position of having his claim jumped with the aid and abettal of the Forest Service and the responsible head thereof tells him carelessly that he can have his day in court. We should think it ought to be the other fellow, if anybody, who should be directed thus to redress a grievance.

It is just exactly this sort of thing that creates the irritation against the bureaus and departments at Washington and so long as it continues there is nothing that can be said or done by the foresters or by Secretary Fisher and his subordinates that will cure it. The land laws and the mining laws ought to be improved; and popular sentiment in the mining states ought to be so aroused as to compel a supine Congress to do so. But this is likely to take a long time yet, and in the meanwhile there would doubtless be an improvement if the secretaries of the interior and of agriculture would give their personal attention to some of the flagrant cases of bureaucratic maladministration and summarily dismiss some of the Millers and Potters.

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Copper Freight Rates

The ruling of the Interstate Commerce Commission, on Dec. 27, that there is an improper discrimination between the freight rates on copper from Lake Superior to Detroit and New York, and ordering an increase in the latter rate, will probably have an important effect upon the net earnings of the Michigan mining companies. At present the rate to Detroit is 32½c. per 100 lb., and the all-rail rate to New York is only 35½c. Complaint alleging discrimination was made by certain copper manufacturers in the vicinity of Detroit. The Interstate Commerce Commission decided that the rate to Detroit is reasonable, but that the differential in favor of that place should be at least 10c. per 100 lb. instead of only 3c. This indicates that an advance of at least 7c. per 100 lb. in the rate to New York must be made.

This will leave the situation in the interior markets just as at present, the competition in them being in the main confined to the electrolytic copper coming from the refineries to the west of them and the copper coming from the Lake Superior refineries. The bulk of the electrolytic copper is refined in the vicinity of New York and ordinarily it is uneconomical to pay the back-freight on this which is necessary if it be sold in Detroit, Chicago, etc. In the Eastern market, on the contrary, there is a wide competition, and anything short of a general increase in freight rates would hardly influence prices. Thus, during 1912 there was a large increase in ocean freights, the result of which was that American producers selling their copper in Europe had to pay a larger expense for de-

livery out of their own pockets, or what is the same thing, had to sell their copper for a relatively lower price on the dock at New York.

The Lake producers have sought to maintain the old premium in favor of their copper and to a certain extent have succeeded inasmuch as their supply is relatively small, is more largely consumed at home than is electrolytic and is still demanded in some quarters where old prejudices continue to prevail. In fact, certain brands of Lake copper continue to fetch a special premium. The consumers who are willing to pay that may be willing to pay for the coming increase in freight rate, but in the case of the ordinary Lake copper we fancy that any additional charge for it would tend to divert customers to electrolytic, and probably the increment in freight rates will have to come out of the pockets of the sellers.

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Ocean Freights

A notable feature in the year just closed has been the strong advance in ocean freight rates, which has in many cases seriously affected the metal and mineral trades. This advance has been almost continuous throughout the year; the current level of charters is now from 35 to 45% higher than it was in 1911 on all heavy freights. The great activity in business and trade in almost all the commercial nations has contributed to the advance, and has made a demand for tonnage that is quite unprecedented in commercial history. In 1911 this demand was heavy and rates advanced, after a period of depression which had lasted for several years; but 1912 has been probably the best year on record for ship owners.

The minerals furnishing the greatest tonnage for ocean transportation are coal and iron ore. The coal exports of the more important nations are from Great Britain, about 70,000,000 tons; from Germany, 27,500,000; from the United States, 17,500,000; and from Japan and Australia, together, 6,000,000 tons. These exports are necessary, and will not be stopped by high freights, the only effect being to advance prices in the purchasing countries. Iron ore requires about 15,000,000 tons yearly, and this trade has been seriously affected by high rates. Thus, for instance, furnaces in the Eastern United States which have been using large quantities of Swedish and Spanish ores, are finding present rates almost prohibitive.

In the case of the metals, where the freight rates bear a much smaller proportion to the value than with coal and iron ore, the effect has been quite perceptible, though it has been to some extent lost sight of in the general advance of prices. A special case of a bulky mineral is found in the nitrates exported from the West Coast of South America. Here the effect on the prices realized by producers has been considerable, since the trade would probably have been checked had the higher freight rates been thrown entirely on the consumers.

In the present condition of trade there is no prospect of an early decrease in ocean freights. Shipbuilding will doubtless continue on a large scale. The general expectation is that the opening of the Panama Canal will increase the demand for tonnage, though this may be offset to some extent by the shortening of voyages—to the west coast of America for instance—enabling a steamer to carry a larger tonnage in a year. The high freight rates and the demand for tonnage are, at any rate, established facts, the effects of which will run through 1913.

BY THE WAY

It is an old English adage that every man is entitled to his day in court, but the experience of the Scheftels, Hawthorne and Wisner trials goes to show that in American legal practice every man is entitled not merely to his day but to his three months.

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A successful mine manager gives this advice to young engineers: 'Don't hesitate to assume responsibility. Don't be afraid of making mistakes. Everybody makes mistakes. There are so many ways of making mistakes that it is a wonder that we ever avoid them. But don't make the same mistake twice over.' Apropos of this advice, Marcus Daly, according to an old story which may or may not be true, said that the kind of a mine manager for him was one who had lost a million dollars for someone else. Presumably Mr. Daly considered that such a one had made all the possible mistakes, and would be unlikely to try to repeat all of them.

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There are some mining fatalities so unusual in their character that they cannot be guarded against in the most perfect code of rules. Thus, in a lead mine in southeastern Missouri, a man in the bottom of the shaft was killed by a dog leaping over the collar of the shaft and falling upon him. In the same district a headframe was struck by lightning and a round of shots to be fired electrically underground was exploded prematurely, killing a man. To such extraordinary accidents may be added the case of the miner in Tennessee who plugged and loaded a diamond-drill hole, ran 125 ft. to a supposed place of safety, but in fact opposite the other end of the hole, and was shot by his own plug as if from a gun, fortunately without any great damage to himself.

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We quote the following from the *Chicago Record-Herald* of Oct. 31, 1912, which is not given to the telling of Munchausen tales, so far as we are aware:

FINDS WONDER METAL

CHICAGO INVENTOR CLAIMS DISCOVERY WILL SEPARATE
GOLD HELD IN SOLUTION
Renders Whisky Harmless

Through his recent discovery of a new metal, a derivative of alumina obtained by a secret hardening process, John M. Murphy claims he is able to remove foreign, harmful and impure substances from all liquids, including water, cane syrup, milk, liquors, etc., and to separate gold and other previous metals held in solution.

Wine treated in this manner, Mr. Murphy claims, makes the nectar (*sic*) into which the Queen of Egypt dropped the priceless pearl seem but common vinegar; beer becomes ambrosia, with a foam that clings to the last drop; and whisky loses its headache and its poisonous quality.

Mr. Murphy demonstrated what his electrode is able to accomplish before a small body of scientists and business men gathered in the offices of Robert T. Brewer and William G. Chapman, 1325 First National Bank Building.

The metal of which the electrode is composed, the

inventor declares, has been the dream of chemists for many ages. It has been sought chiefly for use in the electrolysis method of purification. Mr. Murphy simply turns on the electricity, places the electrode, having insulating material between the metal plates, into the liquid to be purified, keeps it there for a few moments, then drains the liquid.

"It ages and purifies whisky and other liquors without removing the fusel oil," Mr. Murphy said in his demonstration last night. He proved the presence of fusel oil in the treated liquor by means of common table salt. "It changes the color, taste and effects of whisky."

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The above clipping was communicated to us by a gentleman in Chicago, who wrote that "the metal is made by a secret process and defies analysis," adding that "it is lighter and harder than aluminum." In another letter he said "that the metal is admittedly closely related to aluminum, being a derivative of aluminum, and differs only in the added elements, the identity of which is a secret." We were interested in a metal that "defies analysis," considering that we know chemists who cannot be defied. So, at our request, our correspondent favored us with a sample of the "wonder metal," and we handed it to Ledoux & Co., of New York, for analysis. Ledoux & Co. reported to us that the sample was 2.71 sp.gr. and contained 0.22% silicon, 0.29% iron, 0.02% copper, a trace of carbon, and 99.40% aluminum, these constituents adding up to 99.93%. Ledoux & Co. added, "the sample seems to be commercially pure, high-grade sheet aluminum. We cannot detect the presence of any elements other than those given above. Although a much larger sample might permit the detection of small traces of impurities, yet there are no ponderable amounts of other elements that could affect the qualities of the metal. We cannot see that the chemical or physical properties of the sample differ in any way from those of good sheet aluminum." Having full confidence in the report of Ledoux & Co., we don't think that this "wonder metal" will put an end to the prohibition movement; and, anyway, who wants to change the color, taste and effects of whisky?

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Parcels post, which went into effect on Jan. 1, should prove of considerable value to mining communities, but some of the new regulations are likely to prove irritating until experience has accustomed us to them. Up to 4 oz., parcels are to go at the present rate of 1c. per oz., but must bear the new parcels-post stamps, not the stamps now in use. Above 4 oz. the rate is figured on a zone basis, and requires a special mathematical training to compute it. The text book can be obtained for 25c. from the department at Washington. Parcels will be accepted up to 11 lb., and may measure, in combined length and girth, a maximum of 72 in. They must bear the new parcels-post stamps or be detained for postage, they will not be accepted without the address of the sender, and must be mailed at a post office or substation. If you put the old stamps on parcels-post packages, you may not even get your stamps back, so look out. With rectangular boxes, the maximum cubic contents will be reached with a box 12x12x24 in.; with a cylindrical package the maximum cubic contents will be reached at 24 in. long by approximately 15.3 in. diameter $\left(\frac{48}{\pi}\right)$.

December Mining Dividends

The mining industry closed a generally prosperous year by the announcement of December dividends by United States mining companies of \$8,744,479, by metallurgical, coal, iron and holding companies of \$13,541,564, and by Canadian and Mexican companies of \$2,845,388.

As might be expected, the copper companies are the largest dividend payers. Calumet & Arizona increased its dividend to \$1.25 quarterly, Nevada Consolidated paid an extra dividend of 50c., Quincy increased to \$1.50,

DECEMBER MINING DIVIDENDS.

United States Mining Companies	Situation	Per Share	Total
Baltic, c.	Mich.	7.00	700,000
Bunker Hill & Sull., l. s.	Ida.	0.20	65,400
Bunker Hill Con., g.	Cal.	0.05	10,000
Calumet & Ariz. c.	Ariz.	1.25	745,441
Calumet & Hecla, c.	Mich.	12.00	1,200,000
Camp Bird, s. g.	Colo.	0.24	267,300
Champion, c.	Mich.	1.00	100,000
Chief Con., l. s. g.	Utah	0.10	87,138
Colorado, l. s. g.	Utah	0.03	30,000
Daly Judge, s. l.	Utah	0.30	90,000
Doe Run, l.	Mo.	1.50	98,673
Federal M. & S., l. s.	Ida.	1.50	187,283
Fremont, g.	Cal.	0.04	4,000
Frontier, z.	Wis.	2.00	2,500
Gold Dollar, g.	Colo.	0.004	12,500
Golden Cycle, g.	Colo.	0.02	30,000
Gold Chain, g.	Utah	0.03	30,000
Hecla, l. s.	Ida.	0.05	50,000
Homestake, g.	S. D.	0.50	109,200
Klar-Piquette, z.	Wis.	0.50	10,000
Montana-Tonopah, g. s.	Nev.	0.10	100,000
Nevada Con., c.	Nev.	0.874	999,712
New Idria, q.	Cal.	0.30	30,000
North Star, g.	Cal.	0.50	125,000
Quincy, c.	Mich.	1.50	165,000
Silver King Coalition, l. s.	Utah	0.25	312,500
St. Joseph, l.	Mo.	0.014	150,000
Success, z.	Ida.	0.15	15,000
Superior & Pittsburgh, c.	Ariz.	0.38	569,922
Tomboy, g. s.	Col.	0.24	75,330
Tom Reed, g.	Ariz.	0.07	63,668
Tri-Mountain, c.	Mich.	3.00	300,000
Utah Con., c.	Utah	1.00	300,000
Utah, c.	Utah	0.75	1,182,412
United, c.	Wash.	0.01	10,000
United Verde, c.	Ariz.	0.75	225,000
Wasp No. 2, g.	S. D.	0.02	10,000
Yellow Pine, z. l. s.	Nev.	0.02	19,000
Yukon Gold, g.	Alas.	0.074	262,500

Coal, Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Sm. & Ref. Co.	U.S.-Mex.	\$1.00	\$500,000
Am. Sm. & Ref. pfd.	U.S.-Mex.	1.75	875,000
Crucible Steel	U. S.	1.75	427,688
Gen. Asphalt, pfd.	U. S.	1.25	164,120
General Chemical, com.	U. S.	1.50	122,269
Great Northern Ore.	U. S.	0.50	750,000
Harbison-Walker, com.	U. S.	0.50	90,000
Inter. Nickel, com.	U. S.	2.50	758,609
Nat'l Lead, com.	U. S.	0.75	154,914
Nat'l Lead, pfd.	U. S.	1.75	426,433
North Star, g.	Cal.	0.50	125,000
Phelps Dodge & Co.	U.S.-Mex.	5.50	2,475,000
Pittsburgh Steel, pfd.	U. S.	1.75	218,750
St. Mary's Min. Land	Mich.	1.00	100,000
U. S. Steel, com.	U. S.	1.25	6,353,781

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Alacran, g. s.	Mex.	\$2.00	\$19,200
Beaver Con., s.	Ont.	0.03	59,989
Crown Reserve, s.	Ont.	0.05	88,440
Dos Estrellas, g. s.	Mex.	2.50	750,000
El Oro, g. s.	Mex.	0.24	278,843
Esperanza, s. g.	Mex.	0.36	165,847
Encino y Anexas, g. s.	Mex.	1.00	16,000
Hedley, g.	B. C.	1.50	180,000
Hollinger, g.	Ont.	0.03	82,500
Kerr Lake, s.	Ont.	0.25	150,000
Lucky Tiger, g.	Mex.	0.05	50,074
Norias de Baján, g. s.	Mex.	0.50	1,000
N. Y. & Hond. Ros., s.	C. A.	0.20	30,000
Pefioles, l. s. g.	Mex.	1.25	150,000
Santa Gertrudis, s.	Mex.	0.48	664,862
Santa Maria de la Paz, l. s. g. c.	Mex.	2.50	24,000
San Toy, g. s.	Mex.	0.10	60,000
Standard, s. l.	B. C.	0.024	50,000
Timiseaming & H. B., s.	Ont.	3.00	23,383
Victoria, l. s. g.	Mex.	0.50	1,250

Baltic to \$7 yearly, Superior & Pittsburgh to 38c., Utah Consolidated paid \$1, and Tri-Mountain paid \$3, after having paid nothing for two years.

In the Mexican field, no less than 11 companies paid dividends in December, despite the disturbed state of the country. In next week's JOURNAL an extended table will

be given of dividends paid in 1911 and 1912, and a full comparison of the years will be made at that time.

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Filling Mine Stopes with Mill Tailings*

The quartz mine owners and operators of California have suddenly been confronted with what is to them a new and serious problem, that of disposing in some manner of the tailings from their mills. They must prevent the tailings from flowing away from their mills into the creeks of the vicinity, where the sand will be carried along by the stream to the farming lands below and cause damage to the farmer and to the small gardener.

To the stranger this seems perfectly natural; nothing, so it appears to him, could be more so. A stream will carry along sand coming into it, so long as the volume of water and the grade of the stream are sufficient to move the material, which will be deposited in the beds and along the banks of the streams wherever the grade is sufficiently low, and in flood time this deposited sand is likely to be carried along in the much larger volume of water and spread out over the low lands of the valleys in the foothills. This is a perfectly rational theory and is, in fact, exactly what occurs. There is absolutely nothing new in it, unless it be the recent attitude of hostility on the part of the farmers and vegetable gardeners, against the quartz miners.

TAILINGS HAVE BEEN VALUABLE TO AGRICULTURISTS IN MAKING LEVEL LAND

The matter of real surprise is, that as this thing has been going on for 60 years—since 1851, when the first quartz mills were built—the farmers and gardeners have apparently just found out that this perfectly natural process has been in operation and is injuring them. There are many acres of gardens, fields of grain, and of alfalfa, that have been actually made by the agriculturists, who have built retaining walls of rock at the side of cañons, and filling the area behind the walls with tailings by turning the creeks aside, thus making fine level pieces of land. These tracts are intensively cultivated with good profit to the vegetable gardener. In other instances series of rock dams have been built across depressions, and tailings carried in by means of ditches, for the purpose of making level areas that might be cultivated. I have seen many acres of this "made land."

Recently, however, it appears that some of the agriculturists of Amador County, where tailings have been utilized as above described, have observed that the quartz miners of that county seem to be prosperous and they have concluded that the time is ripe to demand that the owners of quartz mines shall restrain the tailings from their mills, because of the damage the sand will do or has done, to the lands of the valley. As a result of the recent agitation the farmers have organized what they style a protective association for the purpose of carrying the matter of damage from mill tailings into the courts, and a number of suits have been filed in which all of the mining companies operating on the Mother Lode in Amador County are made defendants. As this example set by the farmers is likely to prove contagious, and the

*Excerpts from a paper read by W. H. Storms before the Sixteenth Annual Convention of the California Miners' Association.

farmers elsewhere are likely to sue or attempt to enjoin the quartz miners of other counties, the problem promises to become one of large economic importance to the mine owners.

There are two ways in which mill tailings may be disposed of. The first is by impounding the sand behind suitable dams; the second is by storing the sand in the stopes of the mine. All mining men are more or less familiar with the first expedient, and that it may be satisfactorily accomplished in various ways, but there may be many who possibly doubt that mill tailings can safely and economically be stored in the stopes of the mines. This can, no doubt, be done in California, as it is satisfactorily accomplished in a number of mining districts abroad¹, notably in the gold mines of Western Australia; on the Rand, in South Africa; in Belgain coal mines, and in several other European countries.

As many of the mills of California gold quartz mines are situated in cañons, or at places where suitable areas for the permanent impounding of tailings are not obtainable, at least, not without great expense, the method of storing mill tailings in underground workings becomes a matter of much interest to mine operators.

SAND FILLING PRACTICABLE AND SAFE

Notwithstanding that sand filling of mine stopes has been demonstrated to be a safe and economical method of holding up the roof and walls of underground excavations, while at the same time disposing of the waste product of gold mining, it has not, as far as I am aware, been attempted in the Western United States, if in America at all. There is nothing in the scheme that is impracticable, although it may seem to some at first glance to be so, and to possess an element of danger. When properly introduced it has been found to be not only safe but a better method than any other that has been tried, as well as less expensive.

At the mines of Amador County, Calif., something must be done to dispose cheaply and permanently of the large amount of tailings from the mills, and the filling of the stopes with sand seem to offer a remedy. Therefore what has been accomplished abroad in this direction must prove of interest to those most vitally concerned, as well as to others, who may, ere long, find themselves in the same unfortunate predicament. The principal objections I have ever hear urged against the idea of sand filling are due to the fact that it is such a radical departure from methods which have been in use for years.

It goes without saying, that all of the tailings resulting from milling a given block of ore cannot be replaced in the mine in the stope from which the ore originally came. This becomes apparent when it is considered that a cubic foot of solid quartz weighs 165 lb., whereas a cubic foot of quartz sand weighs about 106 to 110 lb. This indicates that only about two-thirds of the tailings can be replaced in the stope from which the ore came. This, however, in California mines would, in most cases, be no great disadvantage, as almost every mine has already extensive open workings into which the extra one-third of the sand could be stored, so that it would, generally speaking, be a long time before the excess output of the mill would become additionally troublesome.

¹"Filling Mine Stopes with Sand," W. H. Storms, Eng. and Min. Journ., Sept. 23, 1911.

Hollinger Gold Mines, Ltd.

The report of General Manager Robbins, of the Hollinger Gold Mines, Ltd., is of special interest, as it is the first since the new mill went into commission.

The plant was practically all completed at the date of the report, Oct. 5, 1912, the only expenditures contemplated being for additional boilers and for blast and cupe¹ furnaces in the refinery. The first stamps dropped in the mill on June 15, but no attempt was made to treat ore until July 1, and for two weeks only low-grade ore was handled. The mill was expected to treat about 300 tons per day, but operations have shown that with 40 stamps dropping, a capacity of 450 or 500 tons per day can be reached. Stamp capacity has been tested up to 12 tons per stamp per day and the cyanide plant up to the equivalent of 600 tons per day. At present an average of 300 tons is handled daily with an extraction of 97% on \$30 ore.

TOTAL DEVELOPMENT AT HOLLINGER GOLD MINES, LTD., TO OCT. 5, 1912.

100-ft. Level	Length	Av. Width	Av. Value
No. 1 Vein.....	1000 ft.	8 ft.	\$31.54
No. 2 Vein.....	665 "	5.2 "	12.50
No. 3 Vein.....	136 "	4.4 "	5.60
No. 4 Vein.....	485 "	8.2 "	12.91
No. 8 Vein.....	56 "	5.2 "	4.90
No. 37 Vein.....	70 "	4.6 "	11.60
No. 38 Vein.....	66 "	3.8 "	15.30
200-Ft. Level			
No. 1 Vein.....	839 ft.	6.7 ft.	45.74
No. 2 Vein.....	42 "	6.2 "	10.60
No. 4 Vein.....	125 "	5 "	9.20
No. 37 Vein.....	155 "	4.2 "	10.80
No. 41 Vein.....	57 "	4.5 "	15.10
300-Ft. Level			
No. 1 Vein.....	63 ft.	5.7 ft.	8.40
No. 2 Vein.....	*	13 "	16.00
No. 37 Vein.....	*	4 "	20.00

* Exposed by crosscuts.

A total of 3759 ft. of development work has been done on the property, of which 2279 ft. was done from Jan. 1 to Oct. 5, 1912. The accompanying table shows the character of the ore exposed. Development has yielded 20,444 tons of ore, in which some waste rock was inadvertently included; on milling, this has shown an average value of \$19.70 per ton. The stopes have yielded 5777 tons of ore, showing an average value of \$37.89 per ton. The average value of ore removed from the mine to Oct. 5, 1912, was \$23.69 per ton, as established by treating the 26,221 tons in the original test mill and in the new mill.



California Oil in November

The net production in all California oil fields in November was 7,176,192 bbl., a decrease from October of 445,511. November daily average was 39,206, a decrease of 6654 bbl. from October. In all fields except Coalinga the daily average decreased or remained stationary in November. Coalinga increased in daily average 1033 bbl. Field consumption in November totaled 419,859, making the total gross production 7,596,051 barrels.

November shipments totaled 6,897,609 bbl., a decrease of 310,534. The losses amounted to 122,930, making the total outgo 7,020,539 bbl. Stocks on hand at the end of November, 47,170,909 bbl., an increase of 204,481 over the October stocks.

Field operation and development in November showed 46 new rigs, 62 completed wells, 5796 producing wells active, 826 wells capable of producing but idle, 60 wells being deepened, 7 wells abandoned; of the 62 wells completed one was a water well.

PERSONALS

H. H. Knox has gone to Europe on professional business. H. E. Jackman is now manager of the York property in Cobalt, Ont., formerly the King Edward mine.

Hervey Gulick, recently of Cuzco, Peru, reached Tacoma, Wash., about Jan. 1, where he will have offices with W. V. Gulick.

John J. Kane, engineer of the Tiro General mine at Charcos, San Luis Potosi, Mexico, will be in New York until early in January.

Joseph Houston, formerly manager of the St. Anthony mine, has been appointed superintendent of the Schumacher mine at Cobalt, Ontario.

Walter C. Richards has returned to American Fluorspar Mining Co., of Crittenden County, Ky., after spending a year prospecting in Colorado.

R. B. Stanford has been appointed manager for the Bonanza mine, Cape Gracias, Nicaragua, and started from San Francisco this week.

A. H. Hale, who recently returned from the Belgian Congo, has just returned to New York from a trip to British Guiana on mining business.

Hon. William Loeb, Jr., collector of the port of New York, is to join the Guggenheim Exploration Co. in an executive capacity soon after Mar. 4, 1913.

George H. Garrey, chief geologist for the American Smelting & Refining Co., who has been at mines in the Southwest for several months, has been in New York the past week.

E. P. Merrill has gone to Salt Lake City to visit mines in Utah. He will go from Utah to the Northwest and will return to Williamson, W. Va., about the middle of January.

O. B. Monahan, of Allentown, Penn., who for some time past has been general superintendent of quarries for the Lehigh Portland Cement Co., has tendered his resignation to engage in business for himself as an efficiency expert in drilling and blasting. Mr. Monahan will maintain offices in Allentown and New York.

Erroneous press dispatches in connection with the Hawthorne trial have confounded the identities of Dr. Robert Bell, late acting director of the Geological Survey, and J. McIntosh Bell, mining geologist and engineer to Messrs. Ehrlich & Co., London, England. J. McIntosh Bell had no connection whatever, either directly or indirectly, with the Hawthorne matter.

OBITUARY

Roswell E. Sampson, assistant professor of metallurgy in the State College of Washington, at Pullman, was struck and instantly killed by a Northern Pacific train on the morning of Dec. 12. Mr. Sampson was a native of Medford, Mass., and a graduate of Massachusetts Institute of Technology, class of 1907. His first professional work was that of assayer and surveyor for the Marietta Mines Co., near Mina, Nev., after which he was engaged in ore-testing work for the Huff Electrostatic Separator Co., of Boston. He next joined the engineering staff of the Quincy mine at Hancock, Mich., and later became assistant to his former teacher, Dr. Richards, in adapting the Richards classifiers to Quincy mill conditions. He joined the mining faculty of the State College of Washington in the fall of 1911.

Alfred Wartenweiler, who died Dec. 13 at San Francisco, was one of the pioneer mining engineers of the West. Born at Kradolf, Switzerland, in 1848, he was educated at the Ecole des Mines in Paris and went to California in 1869. He was at first employed by the Giant Powder Co., but in the early seventies moved to Utah, where he took a prominent part in the development of mining and smelting. One of the first trained metallurgists in the region, he contributed greatly to improvement of the crude smelting methods then in vogue. In 1879 he moved to Butte, where he became manager at the Lexington mine, and at that and other properties in the district passed the next 10 years. He is best known through the West by reason of his connection with the Exploration Co. and his activity in placing large American mines with English and other foreign investors. In this work he was associated with Henry Bratnober. Working in connection with M. Ranvey, S. de la Bouglise, and Professor Cumenge, he sold the Boleo mines, in Mexico, in France, and his name is associated with many other profitable ventures. An excellent judge of mines, he was conscientious

and honest in his opinions and made few mistakes. He was of a genial, kindly disposition, and is widely remembered for his charitable acts. He joined the American Institute of Mining Engineers in 1875, but never found time to contribute to the "Transactions." Mr. Wartenweiler's health broke down some months since, and his active career ended over a year ago.

SOCIETIES

Old Freibergers in America—On Dec. 20, at the Hofbrauhaus, New York, a number of old students of the Freiberg Bergakademie sat down to dinner. This meeting was called for the purpose of forming an association in America to be known as the "Old Freibergers in America." After the dinner a business meeting was held and the following officers were elected: President, R. W. Raymond, vice-president, Gardner F. Williams, and secretary-treasurer, C. L. Bryden. It was decided to hold two meetings a year, one on Mar. 25, the anniversary of the founding of the Akademie, in 1765, and the other on Dec. 20, this to be the annual meeting. The following members were present: Dr. R. W. Raymond, 1861; Gardner F. Williams, 1868; P. J. Oettinger, 1867; Stuart M. Buck, 1868; T. Wain Morgan Draper, 1876; Baron Alfred von der Ropp, 1882; Franklin Guiterman, 1877; F. G. Corning, 1879; R. Boice, 1908; Albert Meyer, 1908; R. M. Payne, 1909; Dr. E. E. Lungwitz, 1886; F. H. Sistermans, 1885; George M. M. Godly, 1900; Walter V. Rohlfs, 1903; H. H. Knox, 1886; H. A. Wilkens, 1889, and C. L. Bryden, 1907. All old Freibergers who have not already done so, are requested to send in their names and addresses to the secretary, C. L. Bryden, 1015 Myrtle St., Scranton, Pennsylvania.

NEW PATENTS

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

REVERBERATORY FURNACE for Refining Copper. John B. F. Herreshoff, New York, assignor to Nichols Copper Co. (U. S. No. 1,047,521; Dec. 17, 1912.)

CYANIDING—Automatic Filter Press. Robert Lemmon and Robert Patrick Holmes, Boulder City, Western Australia. (U. S. No. 1,047,093; Dec. 10, 1912.)

CRUSHING—Feeding Means for Tube Mills and Like Grinding Apparatus. James Edward Thomas, Germiston, Transvaal. (U. S. No. 1,045,342; Nov. 26, 1912.)

STAMP MILLING—Ore Feeder. Hans Charles Behr, Johannesburg, Transvaal. (U. S. No. 1,047,369; Dec. 17, 1912.)

ALUMINUM—Manufacture of Alkali Aluminates. Dmitry Alexandrowitch Penlakoff, Brussels, Belgium. (U. S. No. 1,045,097; Nov. 19, 1912.)

NICKEL-COPPER MATTES, Method or Process of Treating. Alexander McKechnie, Birmingham, and Frederic George Beasley, Smethwick, Birmingham, England. (U. S. No. 1,047,825; Dec. 17, 1912.)

SEPARATION—Process of Separating Zinc and Lead from Mixed Sulphides. C. A. L. W. Witter, Hamburg, Germany. (U. S. No. 1,047,360; Dec. 17, 1912.)

DRILLING APPARATUS. William H. French, Seattle, Wash. (U. S. No. 1,047,625; Dec. 17, 1912.)

EXCAVATOR. Alvah D. Hadsel, Philadelphia, Penn., assignor to Cable Excavator Co., Philadelphia, Penn. (U. S. No. 1,046,180; Dec. 3, 1912.)

PROPS—Improvements in or Relating to Mining Props. F. Nelles, Essen-Bredene, Germany. (Brit. No. 1876 of 1912.)

CONCENTRATING TABLE. Frank H. Braeckel and Frederick J. Ehlerding, Joplin, Mo., assignors to Braeckel Concentrator Co., Joplin, Mo. (U. S. No. 1,047,161; Dec. 17, 1912.)

CONCENTRATION—Hydraulic Concentrating and Amalgamating Apparatus. William Fitzcharles Mason McCarty, New York, N. Y. (U. S. No. 1,047,673; Dec. 17, 1912.)

CRUSHER—Gyratory Crusher. Bruce W. Traylor, New York, N. Y., assignor to Traylor Engineering & Manufacturing Co. (U. S. No. 1,047,859; Dec. 17, 1912.)

CRUSHING—Improvements in Crushing and Grinding Mills. J. Mohs, Dessau, Germany. (Brit. No. 6399 of 1912.)

CRUSHER. Frank O. Whiting, Columbus, Ohio, assignor to Jeffrey Manufacturing Co. (U. S. No. 1,045,763; Nov. 26, 1912.)

ORE CRUSHER. Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,047,356; Dec. 17, 1912.)

ROCK CRUSHER. Ross M. G. Phillips, Minneapolis, Minn., assignor to Ideal Rock Crusher & Manufacturing Co., Minneapolis, Minn. (U. S. No. 1,047,835; Dec. 17, 1912.)

ORE FEEDER. Thomas Sutton, Sonora, Calif. (U. S. No. 1,047,589; Dec. 17, 1912.)

SLAG—Process of Disintegrating Molten Slag. John G. Bergquist, Chicago, Ill. (U. S. No. 1,047,370; Dec. 17, 1912.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Dec. 23

The Report of the State Board of Control covering the appropriations recommended for the needs of the state departments and institutions for the fiscal two years beginning July 1, 1913, reduces the estimate made by the state mineralogist for all purposes of the State Mining Bureau from \$135,000 to \$40,000. The only item not reduced or eliminated is the salary of the state mineralogist, which is fixed by statute. The estimate for support of the bureau is reduced from \$40,000 to \$30,000; the printing fund from \$10,000 to \$4000. The \$39,000 asked for geological survey and general report, the \$15,000 asked for special work on the Mother Lode, iron deposits, mining methods, metallurgy, ancient channels, and the \$25,000 for exposition purposes were ignored. The amount recommended for support of the bureau is \$10,000 less than was allowed for the two preceding years and other like periods during the incumbency of Mr. Storms' predecessor. Should the legislature approve amounts recommended by the board, the result will be to destroy the practical efficiency of the mining bureau and reduce the state mineralogist to the necessity of disregarding the demands of the statute creating the office, for the appropriation recommended is barely sufficient to keep the bureau open to the public and perform the necessary routine work. Mr. Storms' estimate of the needs of the bureau was approved by the board of trustees, which is composed of men of reputation and influence in the state and who are fully cognizant of the requirements of the institution from the viewpoint of men engaged in the practice of mining. The work planned by the state mineralogist is in strict accord with the statutory requirements and in response to the demands of the industry. So far as the amounts estimated for the needs of the specific branches of the work may be considered in advance of the undertaking, they are so conservative as to suggest the necessity for strictest economy. Unless the special work required by the statute may be permitted by an adequate appropriation the bureau can serve no other purpose than that of a public library and museum of mining and minerals. This would be inconsistent with the purpose for which the bureau was created.

California offers a broad field for mining investment, and the State Mining Bureau is not only the proper official channel of information, but it offers through the publication of timely bulletins the character of information most sought. The demand for these bulletins has been constant, and since a price covering the cost of production has been established, they have gone only into the hands of men who can make practical use of them. The general reports, which Mr. Storms seeks to revive, are of great value as they contain a complete and concise history of the progress of the mining industry embracing all its branches, and a brief record of every mining property in the state, whether operative or idle. There is probably no single contribution to the practice of mining more important to bona fide investors. These reports have long been discontinued, chiefly for the reason that the appropriations were not sufficient to include them with the bulletins that have been published. The publication of the bulletins suggested in the estimate approved by the board of trustees of the mining bureau is of vast importance, as the bulletins would provide scientific and technical knowledge essential to the continued development of new ground and the reopening of properties abandoned for lack of such knowledge. One fact of importance not generally known in connection with the industry is that 55 of the 58 counties in California are producers of minerals, so the proper maintenance of the bureau is of value not merely to a few counties embracing certain well known mining districts or famous mines, but is of direct value to practically every county in the state. It is to be expected that when the matter is presented to the legislature as it should be by leading men in the mining industry, and other men of prominence in other and kindred industries, an adequate appropriation will be allowed to make the state-mining bureau the valuable institution which the statute contemplates and the mining industry deserves. Mineral discovery created, and for many years the industry entirely supported the state; and it has a value beyond the mere dollars it represents, in placing California in the front rank of mineral producers. The total value of all mineral substances produced in the state in 1912 was approximately \$95,000,000. California has

invited the world to be its guests in 1915, and if the legislature will make the necessary appropriation there will be proper official representation of the mining industry in the exposition to confirm the individual and associate representations of the mineral products and the mechanical methods employed in mining.

DENVER—Dec. 26

The El Paso Preliminary Report has been made and forwarded to Allen L. Burris at New York by T. R. Countryman, designer of the Roosevelt tunnel and engineer for the El Paso and Elkton companies, who recently made an examination of the El Paso mine to measure the low-grade orebodies. Upon this report depends the construction of a low-grade mill which will have a capacity of 500 tons per day, planned to be built in the gulch below the main shaft of the El Paso mine. That there is much low-grade ore in sight which can be mined cheaply and that it will warrant the construction of a mill is the belief of those working at the property.

BUTTE—Dec. 24

The Great Falls Power Co. is making preparations to begin the construction of the power dam across the Missouri River at Great Falls, about 12 miles below the city of that name. Fifty men are engaged in reconstructing the buildings of the camp which has been maintained for several years, and preparing it for the large force of men soon to be put to work. The erection of a temporary bridge just above the damsite has also been started. This will be a frame structure 750 ft. long, 20 ft. above the water, and will be used for the transportation of construction material from one side of the river to the other by a dinky engine and train of cars. Supporting piers in the form of rock cribs, will be placed in the river.

The "Rustling Card" system, installed a short time ago by the Anaconda company, was subjected to a referendum vote of the members of the Butte miners' union, Dec. 20, 1912. Sentiment against the innovation was manifested by a majority of 229 votes out of a total of 3483 votes cast. Less than half of the members voted, there being approximately 7083 eligible voters in the organization at present, and it has been generally conceded that the entire strength of the radical element, voting against the measure, was represented, whereas the 3600 not voting were practically all conservative members. Officers of the Anaconda company have stated that there were good and sufficient reasons for the adoption of the card system; that it was done for the benefit and protection of the miners and community, as well as for the company itself, and that it will not recede from the policy as adopted. The result of the vote will be reported at the next regular meeting, when a decision will be made as to the future proceedings.

SALT LAKE CITY—Dec. 26

The Utah Society of Engineers has been devoting its monthly meetings to particular subjects. At the November meeting hydro-electric power was discussed, and at the meeting held Dec. 20, the subject was mining, and operations at Bingham, Park City, and Tintic were described. Bingham was reviewed by J. Fewson Smith, of the engineering staff of the United States Smelting, Refining & Mining Co., who traced development from the period of the wagon-haul to the early railroad, tramway, and finally the introduction of electric power, steam-shovel mining, etc. From 1870 to 1900, the camp produced more than \$75,000,000 worth of ore, which was prior to the big porphyry operations. At present, annual dividends of \$5,000,000 are being paid. There are enormous quantities of low-grade ore available, the present tonnage being estimated at something over 200,000,000 tons.

The Park City District was reviewed in a paper by George D. Blood, superintendent of the Silver King Coalition Mines Co. Mr. Blood gave an account of the geology of the camp, the metallurgical practices obtaining, and its record of production, describing also the character of the ores at the different large mines. Regarding new metallurgical processes evolved at Park City, the Stetefeldt furnace was introduced to treat the siliceous ores of the Ontario, increasing the efficiency of pan amalgamation; the Daly ores were treated by the Russell process of hyposulphite-lixiviation,

which superseded amalgamation, and a special practice for treating complex silver sulphides was evolved at the Marsac mill. At present, the Silver King Coalition, Daly West and Daly-Judge have concentrating plants of an approximate daily capacity of 400 tons each, and these are kept up to date by the addition of new crushing and other machinery, as needed.

The Ontario-Daly Drainage System or the Ontario 1500 drain tunnel was described. This has a depth of 2500 ft. below the collar of the Daly-Judge Anchor shaft, and extends through the underlying fractured Ontario quartzite, discharging 9000 to 10,000 gal. of water per minute, and releases much of the surplus water of the district. The Daly-Judge Anchor tunnel and the Alliance tunnel of the Silver King Coalition each carry about 1000 gal. of water per minute.

The Production of Park City mines to date has been 100,000,000 oz. silver, 175,000 oz. gold, 300,000 tons lead, 90,000 tons copper, and 30,000 tons zinc, selling for \$85,000,000, of which \$35,000,000 was paid in dividends, and \$50,000,000 for operating expenses, labor and supplies.

The Geology of Tintic was the subject of an extemporaneous talk by Walter Fitch. In discussing the orebodies, Mr. Fitch pointed out that several single orebodies had produced as much as \$1,000,000 each. Carried on with the judgment exercised in ordinary business, mining, he said, was not a gamble, and a careful study of the geology of Tintic gave an index to be followed with confidence and safety, citing as an example his own property, the Chief Consolidated, developed into a dividend payer on discarded ground, the geology of which was not fully understood.

NEGAUNEE—Dec. 27

A Conference of 25 Mine Owners of Michigan was held at the Blackstone Hotel, at Chicago, Dec. 16, in response to a call issued by W. J. Olcott, president of the Oliver Iron Mining Co. The purpose was to formulate plans for conforming to the new Michigan compensation act. This law provides that in case of accident the mining company shall provide three weeks' medical care and attention for the injured person. The method heretofore in vogue was to deduct \$1 per month from each man's wages, this amount to cover the cost of medical care for the man and his family. The question, therefore, to be determined was for what part of the amount paid previously by the miner should the company be held responsible, according to the compensation act. It was demonstrated upon examination of records that the proportion of medical care needed for mine accidents is much less than for sickness in the family of the miner. It was therefore decided that, pending the report of a committee of investigation appointed by Mr. Olcott, the men will pay 90c. per month instead of \$1. The regulations decided upon will probably apply to Wisconsin mines, although there is a small technical difference in the state compensation laws. At the conclusion of the meeting the mining men were entertained at luncheon as guests of the Oliver Iron Mining Company.

JUNEAU, ALASKA—Dec. 23

The Bureau of Mines, Alaskan Expedition, which went north Sept. 6, 1912, to make an examination of the Bering coal fields to determine the availability of the coal for use on American battleships, was in charge of R. Y. Williams, of the Pittsburgh, Penn., station of the Bureau of Mines, assisted by W. A. Selvig, W. R. Reese and G. T. Powell, also of the Pittsburgh station, and R. V. Ageton, surveyor, of Pullman, Wash. The expedition was organized in this state in August and was composed of about 40 miners, guides and camp helpers. S. S. Smith, mine inspector for Alaska, joined the party later. Prospecting in all parts of the Bering coal field was done on an extensive scale, but the principal work of taking out samples and proving up seams was done on Trout Creek, 26 miles inland from Chilkat; 20 days were spent in actual mining during which time 855 tons of coal were taken out. This will be brought out during the winter and will be taken on board one of the battleships and given a trial.

COBALT—Dec. 26

Under the Terms of the Cobalt Lake Property Transfer to an English corporation, it is proposed to organize an English company with a capital of £3,000,000 in £1 shares, Sir Henry Pellatt has deposited 1,000,000 shares of Cobalt Lake with the British & Colonial Land & Securities Co., Ltd., of Toronto, under option to the syndicate, and the syndicate has deposited \$250,000 to bind the agreement. The syndicate proposes to buy for cash at 45c. per share, one-fifth of all the stock deposited under the option agreement, and to exchange shares of the English company for the remaining four-fifths, at the rate of £1 per share for 10 shares

of Cobalt Lake stock. The syndicate then takes an option on these English shares, giving them the privilege of purchasing them in monthly installments, at prices ranging from £1 6½d. to £2 3s. 7½d., the option on the final block to mature Jan. 15, 1914. All optional blocks are independent of each other and the failure to take up any one, does not affect the remaining blocks. The average price per share received for Cobalt Lake stock under this agreement is about 75c., to be paid in monthly installments over a year. The privilege of depositing stock under this proposal, must be exercised by Jan. 10, 1913. While this appears to be a favorable basis for the purchase of the Cobalt Lake mine, it is impossible to say what the outcome will be for those shareholders who do not wish to sell. While they can, of course, remain in the old company, it is altogether probable that the market for the shares will be confined largely to England.

The First Outbreak Among the Strikers since the Provincial police took charge of the situation in Porcupine occurred a few days ago upon the arrival of the Toronto train. About 200 strikers were at the station and when the train stopped, they attempted to board the Pullman cars to get at the strike breakers. A number of Provincial policemen were on duty and they attacked the mob. Sticks and stones were used freely, but fortunately, no one was seriously hurt. The Provincial police kept their heads and did not make use of their guns. As a consequence of this outbreak several arrests were made.

The Rea Property Has Been Leased to John Reddington for five years with an option of renewal for a further period. Mr. Reddington pays for the lease, \$6000 cash, which is to be used to pay the company's debts. He will erect a 25-ton mill, which becomes the property of the company at the end of the lease. Mr. Reddington is to pay the company 25% of the net profits of operation. He has agreed to incorporate a company to work the lease, and shareholders of the Rea will have the right to subscribe for shares in the new company, which is to be known as the Mines Leasing & Development Co., Ltd., to the extent of 99,900 shares of \$1 each. The capital of the leasing company is to be limited to \$200,000, and subscriptions and payments for stock must be made before Jan. 14, 1913.

TORONTO—Dec. 27

On the Grand Trunk Pacific Ry.—500 men are at work completing the last 30-mile section of the coal branch from Bickerdike, Alberta, to the Mountain Park collieries in the foothills of the Rocky Mountains. It is expected that the branch will be completed by March, giving connection with the new coal areas, including the Mountain Park, Pacific Pass and Yellowhead mines, rendering the output available for consumers in central Alberta and Western points. The Yellowhead mines are already shipping from 150 to 200 tons daily and the plant at Pacific Pass is ready for operations as soon as a few miles more of the road is completed.

CHIHUAHUA—Dec. 22

The Chihuahua Smeltery of the American Smelting & Refining Co., which was inoperative during the first half of December on account of lack of coke, has had two furnaces in blast for the last week. The plant received a sufficient supply of coke Dec. 21, to insure restricted operations being carried on until the early days of January. Large consignments of coke are en route over the line of the Northwestern Ry. Coke is also en route over the National line from El Paso, but this service is not only uncertain and slow, but may be discontinued any day on account of the rebel activities.

At a Strike at Mapimi, in the state of Durango, the entire mine force of about 5000 went out, demanding higher wages, during the last week, and at this writing no settlement is in sight. The Peñoles Mining Co. is said to have given notice to the strikers that unless they return to work immediately the mine and smeltery will shut down for a period of six months or longer should the present abnormal conditions prevail in the country.

The Rio Plata Mining Co., operating at Guazapares in the western part of the state, lately shipped via Alamos, Sonora, silver bullion worth 180,000 pesos. About 25,000 pesos worth of concentrates were also shipped to the Torreon smeltery. Arrangements have been made for the continuation of development work even after the suspension of milling operations.

Activities at Cusihuiriachic continue unabated. During the last month development work has been started or increased in scope at a number of properties, while the producing mines have increased their output on securing needed ore cars.

THE MINING NEWS

ALASKA

THE LEMON CREEK lode claims and the Hallum properties, near Juneau, have been consolidated to develop a free-milling gold property. George R. Noble has charge of the work.

MINERAL CREEK—This company reports a strike of rich ore on the Millionaire claim, at Valdez. B. F. Millard has charge of the work.

MANSFIELD MINING CO.—This company plans considerable development work in the spring and will start crews at work repairing flumes and sluice boxes at once on their property near Juneau. John W. Dudley, who is in charge of the work, states that the company plans to strip the surface of the property as was done at the Treadwell, in the early days. The tunnel, now 600 ft. long, will be extended 1000 ft. along the vein and considerable crosscutting will be done.

MOHAWK ASSOCIATION—It is reported that the Guggenheims have purchased the property owned by this company, including Nos. 1, 3 and 5, below on Flat Creek, the Glen Association and a small interest on Otter Creek at the mouth of Flat Creek. On the Mohawk the pay streak is known to be 1000 ft. wide.

ALASKA-TREADWELL—During November, 74,816 tons of ore were crushed, which yielded \$193,552 worth of gold in bullion and concentrate, or \$2.61 per ton, at an estimated net profit of \$114,557.

ARIZONA

Maricopa County

IN THE PIKE'S PEAK district, G. E. Tuttle and Juan Borjques have recently found a 10-in. streak of high-grade gold ore on one of their claims, 35 miles northwest of Phoenix.

THE SMELTER AT SWANSEA has received a carload of tailings from the old dump near the site of one of the old Vulture mills on the Hassayampa River, one mile above Wick- enburg, which are to be used in lining converters. If they prove satisfactory, shipments of the tailings will continue for some time as it is estimated that the dump contains 80,000 tons. The mill which was formerly at this place was removed to "Smith's mill" and also to Seymour below Wick- enburg on the Hassayampa, and finally to the Vulture mine, where it did service until about three years ago. It has now been replaced by a modern mill.

VIA MINING & SMELTING CO.—This company, operating near Roger's Springs, north of Phoenix, will resume work at an early date. Copper matte was recently shipped to the Douglas smeltery.

Mohave County

THE PROPERTY IN THE SECRET PASS DISTRICT, owned by the late J. D. Jordan and others, has been taken under bond and lease by a company formed by Frank Wilhelm, of Los Angeles. The assessment work for this year is being done by Mr. Wilhelm and it is expected that development work will be started soon. As a result of the new miner's-lien law, Mr. Wilhelm's company has protected the owners of the property against attachment for debts incurred in its development, by filing an indemnity bond. Richard Lloyd has been making an examination of the property of J. F. Withers and associates in the same district.

MIDNIGHT—Kean, and John St. Charles are rapidly assembling the machinery for the new mill at this mine, at Chloride. They expect to have the mill in operation about the middle of January. Some ore has been blocked out and some is on the dump. A portion of the water supply for the mill will be secured from the Pinkham mine, which adjoins the Midnight.

PINKHAM—Active development work is being carried on by the Joseph M. Qualey Co. under the direction of L. A. Dockery. One shaft has been sunk to a depth of 100 ft. and another is being started.

ALPHA—Peter McCardell, deputy mineral surveyor, is surveying for patent this group of claims at Layne Springs.

KINGMAN COPPER CO.—This company has recently taken under option the properties of the Southwestern Turquoise Co., the Aztec Turquoise Co. and adjacent claims belonging to Thomas McNeely and Mrs. John Kay. Last week a contract was let to W. W. Gates, of Kingman, for drilling prospect holes. The territory covered by the properties comprises a large portion of the Mineral Park district and it is expected that at least \$100,000 will be spent in prospecting it. Mr. Morgan, of Denver, has the contract for surveying the property and is engaged in the preliminary work of determining the locations of the churn-drill holes. The company has opened a boarding house.

METALLIC ACCIDENT—Development work is progressing rapidly on this property under the direction of Ross D. McCauseland, who has recently taken it under bond. He has determined that extending the old Fairfield tunnel about 300 ft. will tap the Metallic Accident vein at a depth of about 450 ft. This tunnel was driven in about 1500 ft. in the early days to tap the Fairfield vein at a depth of 250 ft.

ARIZONA SOUTHWESTERN COPPER CO.—J. O. Davidson, representing the Orient Railway Co., C. L. Davidson, George Theiss and Walter Innis, of Wichita, Kan.; C. E. Foote, of Topeka; Frederick Hessel, of Kearney, Mo., president of the company; J. H. Hoffman, of Pueblo, Colo., secretary of the company, and C. J. Price, recently of the Trans-

vaal, recently visited this property at Copperville, where a new mill is in the course of erection. Mr. Price has been appointed consulting engineer for the company. Connection has recently been made in the drift driven to connect the two shafts on the property and the work of blocking out ore ready for stoping is progressing.

SILVER HILL—A strike of considerable interest has been made at this mine, at Chloride, by Mr. Reeves, who is working the property for an Eastern company. The ore is 5 ft. wide and assays \$80 per ton in gold and lead. The shaft is but a short distance from the recently extended Chloride branch of the Santa Fé R.R.

CALIFORNIA

Amador County

LINCOLN CONSOLIDATED—A large volume of water has been encountered in the 1950-ft. drift from the Lincoln shaft that extends under the old Wildman workings. The miners were obliged to quit work temporarily. The flow of water decreased the second day, and it was ascertained that the water in the old Wildman shaft had lowered about 20 ft. since the measurement made about three months ago, which may account for the flow in the Lincoln drift. It is said a survey of the drift will be made and the Wildman shaft water remeasured to ascertain if the source of the water is in the old shaft, in which case the unwatering may be done through the Lincoln. A. Noce, of Sutter Creek, is superintendent.

EAST EUREKA—After a temporary shut down for readjustment the mill has resumed crushing. A satisfactory cleanup of the previous run is reported. Mr. Davis has resigned and H. Drullard, of Sutter Creek, has been appointed superintendent.

Butte County

GOLD BANK—A 60-ton cyanide plant contemplated at the time of reopening of the mine has been ordered. It is being built by the L. G. Trent Engineering Co., of Los Angeles, and will be installed and in operation as soon as completed. The 20-stamp mill reconstructed from former mills is ready for crushing, and a large body of good ore has been blocked out ready for extraction. Forbestown Consolidated Mines is owner, M. J. Cooney, of Forbestown, manager.

Eldorado County

HILLSIDE—A 15-stamp mill is to be built at this mine in the Mud Springs district south of El Dorado. The stamps of the 5-stamp mill now in operation will be utilized in the new construction. Development has been in progress for about two years, and includes a 400-ft. tunnel and minor excavations. W. G. Busick is manager.

Humboldt County

HORSE MOUNTAIN COPPER—While the trails were open and just in advance of the recent heavy snowfall, a 21-mule pack train loaded with provisions was started to the mine. When the weather clears the train will be loaded with concentrates and hand-sorted ore to be delivered at Korbel on the Arcata & Mad River R.R. for shipment to tidewater; thence to be shipped by steamer to the Tacoma smeltery. The concentrates are reported to contain a high percentage of copper. David Wilson, of Eureka, is manager.

Kern County

LA CROSS—The mine has been leased to C. G. Illingworth, Roy Baker, and Jesse Jewett. Extensive development is contemplated. The mine is situated two miles southwest of Randsburg.

Merced County

MERCED DREDGING CO.—This company has been organized by Benjamin C. Warnick & Co., 131 South Fourth St., Philadelphia, to dredge a tract of land along the Merced River, about two miles east of Snelling. The company owns about 2000 acres, of which 947 acres have been drilled, the depth to bedrock being about 20 ft. The company claims an indicated gold content of \$3,741,000, and intends to build two 15-cu-ft. dredges.

Nevada County

CHAPMAN—R. G. Gillespie, owner of the Gillespie mine, formerly known as the Coan, has secured a bond on the Chapman which is an adjoining property, and which is to be developed through the Gillespie shaft. The mine is equipped with a 5-stamp mill. Daniel McGonigal is manager.

San Bernardino County

SEARLES LAKE—According to press dispatches, a U. S. deputy marshal has been dispatched to Searles Lake in response to a warning that armed claim jumpers might attempt to take possession of potash deposits there. The property involved is now in the hands of a federal court receiver pending the outcome of foreclosure proceedings.

Siskiyou County

BEAUDRY—The ditches, flumes and giants are being put in order for reopening this hydraulic mine, in the Callahan district. The sawmill, on Wildcat Creek, will furnish the lumber. Mr. Eberline is manager.

LANKY BOB—This quartz mine, in the Salmon River district, has been leased to William Baldwin and others, of Etna, and preparations are being made to operate the mine all winter.

BLACK BEAR—The building of the new stamp mill is progressing. An electric power plant will also be built. The mine was a large producer in the early days. John Daggett is owner. William Farish, Jr., lessee, is reopening the mine.

COLORADO**Clear Creek County**

BLACK EAGLE—A vein of rich silver ore has been opened on the fifth level. The ore shows native silver and is reported to assay over 100 oz. per ton.

BESSIE M.—This property, on Spirit Hill, is being developed under the direction of J. T. Mallalieu. The shaft is 160 ft. deep and a drift has been advanced westward 60 ft. The vein is three feet wide, composed of quartz containing small pockets of galena.

GOLD DIRT—Lessees have opened a small vein reported to assay 7 oz. gold per ton.

LUCANIA—This crosscut tunnel is now 6038 ft. long. To date it has intersected 23 veins, few of which have been systematically developed. It is reported that a promising streak of ore has been struck in vein No. 15. The tunnel is 5x8 ft. in the clear and is now being advanced at the rate of 4 ft. per day. Leyner No. 8 machines are used.

STEPHENS—Development has been resumed on this property, in the Banner district, under the management of Thomas Barnard.

TORPEDO—This mine, in Spring Gulch, has been reopened under the management of John C. Hull.

HOOSAC—A carload of machinery for the new concentrating mill at Fall River has been received. The mill building, new shaft house, blacksmith shop, ore house and transformer house are completed and the installation of machinery has been commenced.

Lake County—Leadville

THE SILICEOUS ORES OF FRYER HILL are in demand at the smelteries and a heavy tonnage is being mined. The last property on the hill to mine this class of ore is Dunkin No. 3 shaft and the lessees have a pretty fair body. The ore is of about the same grade as that which comes from the Matchless.

IRON MASK—This company, at Red Cliff, has planned considerable new work to be carried out in the near future. The capacity of the mill will be increased from 80 to 120 tons daily, and will be supplied with a complete set of new roasters, new magnetic separators and two new Wilfley tables. It is understood that the company has secured the old Belden property, which exceeds 200 acres of patented ground, and to develop it the old Newhouse tunnel, the portal of which is a short distance up the mountain from the mill, will be driven into the ground; the first contract let is for 500 feet.

ROCKEFELLER—The vein of zinc ore opened in this tunnel, toward the head of Big Evans Gulch, is now four feet wide.

JOLLY—Zinc-carbonate ore has been found in this shaft, at the head of East Fifth street, and a trial carload was sent out during a recent week. The lessees are of the opinion that this ore is richer than the usual mine production.

ROBERT E. LEE—Lessees while prospecting, found a streak that averaged better than the main oreshoot and during a recent week they sent a car of this ore to Bartlesville, Okla. Another carload will be prepared for shipment.

BABE—The lessees at this shaft, in California Gulch, are shipping on an average of six cars of a good grade of zinc-carbonate ore monthly, and are keeping development work ahead.

Mineral County

HAPPY THOUGHT—Through a connection with the adjoining Regent mine, after the removal of about 50 tons of debris by a force of volunteers, 35 men were rescued from this mine in which they were imprisoned by a fire in the Nelson tunnel. It is reported that the fire is under control.

Park County

SOUTH PARK PLACER CO.—This company, an Ohio corporation, closed a lease on the Stormy Jordan group of placer mines in the Tarryall district near Como. Other new companies are entering the field and extensive operations are being planned by some of the older mining companies in this immediate vicinity. Several carloads of machinery to be used in the work were on the track at Como before the final papers were signed.

Teller County—Cripple Creek

CLIMAX—Ore assaying \$7.41 per lb. has been found by John Anderson, a lessee on this claim, on the south side of Squaw Mountain. The vein in which this ore occurs is 3 ft. wide. The average of the entire vein is high. Many lessees have worked the claim during the last 10 to 12 years with indifferent success. The property is owned by the Little Puck Gold Mining Co., which, years ago, did a large amount of development work in an effort to locate a commercial oreshoot. The property is opened principally by a tunnel 500 ft. in length and also by a shaft about 300 ft. deep. The claim was equipped for several years with a first-class hoisting plant, but recently the buildings and machinery were removed.

UNITED GOLD MINING CO.—The number of cars sent from properties owned by this company, during November totaled 29, divided as follows: Montrose, 4; Damon, 7; Deadwood, 11; May B., 1; Wild Horse, 2; Silver Tip, 1; Trachyte, 1; and Damon dump, 2. The company has taken over the W. P. H., on Ironclad Hill, and has started in to remodel the hoist and erect a new headframe. Several blocks have been left for lessees.

IDAHO**Idaho County**

STRATTON—A strike of \$20 free-milling ore is reported in the tunnel level.

REVENUE—This property, formerly known as the California, is shipping ore taken out by the lessees.

BENGAL—Shipments to the Elk City reduction works are being made by M. F. Tytler, lessee.

DIAMOND HITCH—Work has been resumed on this property in the Oro Grande district.

LONE YELLOW PINE—A strike of 4 ft. of \$40 ore is reported in the 60-ft. crosscut from the lower tunnel on the French Pete group in the Ten-Mile district.

KNOB HILL—It is the intention of the management to begin shipping ore soon to the Twin Butte mill, which was purchased and overhauled recently.

Shoshone County

TAMARACK—The new tramway, having a maximum capacity of 200 tons daily, has been tested and put into commission.

JACK WAITE—Resumption of shipments was ordered at a recent special meeting of the directors.

SUCCESS—Additional development work has been begun, the chief feature of which is a deep shaft to reach the lower limits of the 30-ft. zinc ore.

NATIONAL—Crosscutting from the 1700-ft. level has shown the copper ore to be 30 ft. wide.

WHITMAN GROUP—Work has been resumed on this property in the Pine Creek district, and will be continued all winter.

SMALL HOPE—The lessees operating this portion of the Bunker Hill & Sullivan mine have begun to make shipments, taking the ore out through the old Reed tunnel.

SAN FRANCISCO—At the annual meeting of the stockholders it was voted to resume work under the direction of J. Fredericks. The property adjoins the Douglas group in the Pine Creek district.

INTERSTATE—The 300-ft. raise connecting the underground workings of the Interstate-Callahan and the Amazon groups has been broken through. The latter group will be operated by the Interstate company, using its own equipment.

ILLINOIS**Montgomery County**

AMERICAN ZINC CO. OF ILLINOIS—The third furnace has been put in commission at the Hillsboro zinc smeltery. The company had been producing at the rate of 20 tons per day. It is expected that at the end of February, five furnaces will be in operation.

MICHIGAN**Copper**

MAYFLOWER—No. 24 drill hole, which is farthest north of any of the present exploratory work, has encountered the lode at a depth of about 785 ft. The formation is uniform and nearly 50 ft. wide, with average mineralization. No. 23 drill hole, about 350 ft. south of No. 24, is down over 1000 ft., and may reach the formation at any time now. With the No. 24 hole completed, this company will have taken 12 drill cores, which, with those taken on the adjoining Old Colony property, show the formation continues for a distance of more than 2000 ft. along the strike.

FRANKLIN—This company is shipping about 1100 tons of ore to the mill daily, and the results on the lower levels are satisfactory. One-man drill machines are being adopted as fast as can consistently be done. A diamond drill has been started on the second level of No. 3 shaft, to test the formation in the direction of the Quincy property.

ALLOUEZ—No. 2 shaft is down to the 22d level, and in that section is developing ground above the average. The new equipment of this shaft is working satisfactorily. Shipments of about 2400 tons are being sent to the mill daily. This property is in good physical condition, and as the large construction accounts are practically closed, expenses will be materially reduced during the year.

LA SALLE—Shafts Nos. 1 and 2 are about unwatered, and the large surface equipment, which has been moved from shafts Nos. 5 and 6 of the Caldwell tract, are being rapidly assembled, so that the property will again enter the producing list in the near future. No. 1 shaft has a large amount of ground developed, and No. 2 shaft was bottomed in good ground at the time of the shutdown, so that the property will get results practically as soon as operations are resumed.

TAMARACK—Plans are being made toward the remodeling of No. 2 mill of this company, and as soon as the work in the Calumet & Hecla shops will permit, this work will be started.

NONESUCH—Operations have been resumed at this property. This property was held under option by the Calumet & Hecla, and considerable exploratory work was done, but the copper-bearing ground pinched out at the third level. The continued good results obtained at the adjoining White Pine tract has led to the resumption of operations with the hopes of picking up the good ground at greater depth.

SUPERIOR—No. 1 shaft is being sunk to the 21st level; No. 2 shaft is being sunk below the 14th level to the 17th level, where a station will be cut and the two shafts connected.

Iron

BRISTOL—The new four-compartment shaft, known as No. 2, is bottomed at 1000 ft. at which horizon most of the ore will be loaded. In the new steel shaft house erected by the Wisconsin Bridge & Iron Co., the skips discharge over round bar grizzlies to a No. 7½, style K, Gates crusher.

RAVENNA—This new mine of M. A. Hanna & Co., at Crystal Falls, was a small shipper during the season just closed, and will probably make a good-sized shipment next year.

MCDONALD—This exploration of the Huron Mining Co., in the Crystal Falls district, made a small shipment in the season just closed.

LADENBURG, THALLMAN & CO.—This company, controlling the old Florence mine at Florence, Wis., the Ernst mine, at Commonwealth, Wis., and the Bates mine, in the Iron River district, is hurrying work for a large shipment next year, following a visit of the general manager, Felix Vogel, of New York. The Ernst and Bates mines are in the development stage and have some ore blocked out; the Florence mine is believed to be practically exhausted.

MINNESOTA

Mesabi Range

THE MISSISSIPPI LAND CO. VS. WISCONSIN STEEL CO. case, involving \$1,000,000, is in the hands of Judge McClennahan in the district court. The Mississippi Land Co. is the fee owner of the Hawkins iron mine at Nashwauk and is seeking to restrain the operating company, the Wisconsin Steel Co., from mining and shipping what the plaintiff declares is ore below the merchantable grade. The Wisconsin Steel Co. is a subsidiary of the International Harvester Co. The Mississippi Land Co. is controlled by a number of large interests, including the Weyerhaeusers, S. C. Whitney, of Ottawa, and the O. D. Kinney and R. L. McCormick estates.

MONTANA

Butte District

EAST BUTTE—During the quarter ended Sept. 30, 1912, this company mined 19,135 tons of first-class ore containing an average of 7.13% copper, and 6633 tons of second-class ore, containing an average of 2.6% copper; a total of 25,768 tons of ore averaging 5.9% copper. From this tonnage was produced 3,929,000 lb. of copper, 3795 oz. of gold, and \$5,399 oz. of silver. An increase of 40% in copper production was made over the quarter ended Sept. 30, 1911.

Deer Lodge County

IN THE FROG POND basin, Frank Lutz has opened a vein of galena ore, and is planning to commence ore shipments in the spring.

ON FLINT CREEK, Andrew Nelson and Albert Ecklund, of Anaconda, are operating a property and expect soon to be in a position to ship ore.

BETWEEN GEORGETOWN AND SILVER LAKE, C. C. Gibson is operating a mine in which he recently struck a good vein of ore, which is increasing in value as drifting progresses.

VENEZUELA—Arthur Fortier and John Standahl, of Anaconda, are developing this property, in the Georgetown district. Recently a vein of ore was opened at a depth of 32 ft., a portion of which assays \$18 per ton, principally in gold. In preparation for active production, rails have been laid and the property equipped with ore cars.

BONANZA—As the result of a systematic course of development work, a wide vein of low-grade ore has been opened at this property. Thomas McGrath and associates, of Anaconda, the owners of the mine, are making plans for shipping in the near future.

ROYAL BASIN MINING & MILLING CO.—This company has just completed the installation at the North Star mine of a plant of approximately 400 tons daily capacity. The ore is leached in tanks, and the copper precipitated electrolytically from the solution by a current of 3000 amperes. The first lot of 20 tons of copper has already been shipped.

Silver Bow County

BUTTE & DULUTH—John D. Fields is installing a leaching plant for this company at Butte, and expects to have it in operation about Jan. 15.

NEVADA

Comstock Lode

OPHIR—The directors are considering the advisability of resuming work in the territory around the old stopes on the 1800-ft. level, going north from the Sutro tunnel and upward. At one place below the tunnel, the ore extended up to within 40 ft. of the 1600-ft. level, and appeared to turn over, as if there had been a fault, dipping 45° east and making the upper block take a downward throw. The matter is being carefully looked into by Superintendent McCormick and he will submit a report to the board.

MEXICAN—The incline winze below the 2500-ft. level has now been sunk 100 ft. below the sill floor of the stope. The winze is following the foot wall closely and the bottom is now in a formation of porphyry, clay and quartz of low assay. The mill for the week ended Dec. 21, 1912, crushed a total of 541 tons, of an average assay of \$20 per ton.

CONSOLIDATED VIRGINIA—Advancing on the vein on the 2300-ft. level is underway from a west crosscut from the main north drift. The formation is all quartz, the full width of drift, giving low assays.

CROWN POINT—A railroad car of concentrate has been shipped to the smeltery from the Yellow Jacket mill, as a partial result of a run of ore now underway.

Lyon County

MASON VALLEY—This mine is now being opened below the tunnel level. This is ore that was prospected by drills and which showed the ore to be of about the same average value as that being mined and shipped to the smeltery from the upper workings. The smeltery manager states that two converters will be installed this year and shipments of blister will be made instead of matte that is now going to the Garfield smeltery in Utah.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended Dec. 21, are as follows:

Mines	Week	Year to Date
Tonopah Mining.....	3150	171,169
Tonopah Belmont.....	3031	130,391
Montana-Tonopah.....	1040	52,088
Tonopah Extension.....	1070	51,618
West End.....	1000	40,177
Midway.....	.....	910
MacNamara.....	560	19,902
North Star.....	45	446
Mispah Extension.....	.....	40
Jim Butler.....	300	5,600
Tonopah Merger.....	350	1,205
Totals.....	10,546	473,546
Estimated value.....		\$212,913

White Pine County

NEVADA CONSOLIDATED—Owing to the severe winter weather, 10° to 15° below zero, the production of ore from Eureka and Liberty pits has recently been somewhat curtailed.

GIROUX—Production from the Morris, and Bunker Hill shafts is gradually increasing above 500 tons per day. Quarters have been made underground for the mules and they have been lowered into the mine to become accustomed to conditions underground. As it now requires two men to handle an ordinary one-ton mining car, the haulage by mules should materially reduce costs. The management has recently purchased a number of air drills. Of the 450 men employed underground, about 80% are foreigners.

NEW MEXICO

Socorro County

ERNESTINE—The first 10-day cleanup in December yielded 9520 Troy oz. gold and silver bullion and 10,000 lb. high-grade concentrate; 1090 tons of ore were milled during the period.

OAKS CO.—The vein is becoming wider as the Pacific tunnel is driven south, and 90 tons were recently shipped from this mine to the Deadwood mill. High-grade assays were obtained from ore from the F. A. shaft on the Johnson group development.

McGOLLON GOLD & COPPER CO.—A first-class wagon road has been built to the Little Charlie, which mine continues to ship a large tonnage daily to the Socorro mill. A new office building has been built at the portal of the tunnel.

DEADWOOD—The mill treated 250 tons during a recent week. Mine development was advanced 40 ft., largely on the 500-ft. level.

SOCORRO—The various headings in the lower levels are being advanced in good ore.

NEW YORK

St. Lawrence County

THE ZINC MINE AT EDWARDS is preparing for active mining operations. Water power is supplied from the Oswegatchie River.

HINCKLEY FIBER CO.—This company, of Hinckley, N. Y., has taken a lease on a royalty basis of the pyrites mine on the Frank Cole farm, east of Gouverneur. The workings have been pumped out; the greatest depth is about 60 ft. Ladenburg, Thallman & Co., which operates pyrites mines at Hermon, at one time held the Cole mine, but did not operate. The concentrating mill was torn down several years ago.

TEXAS

THE TEXAS CO. has made a proposal to stockholders of Boston Osage Oil Co. to carry on further development of the latter's property in consideration of surrender of half its stock. The Osage company is a comparatively small producing company in the Osage region of Oklahoma. It owns some property not prospected; to explore fully that portion not yet drilled would require \$15,000 or \$20,000. Texas Co. directors will take under consideration the acquisition of Producers Oil Co., of Houston, through exchange of stocks and bonds. Consent of 80% of stockholders of the Producers company is required. Time for deposit of stocks and bonds of Producers Oil Co. was extended to June 1, 1913, but 95% of securities have been already deposited. Texas Co. is now closely affiliated with Producers Oil Co. and has preference in purchase of the latter's oil.

UTAH

Beaver County

MOSCOW—It has been decided to pay monthly dividends of 1c. per share in 1913.

HORN SILVER—This company has a bond and lease on the Lulu property, which is being developed through the 700- and 900-ft. levels.

BLACK JACK—This property is being developed, and some ore is reported about 25 ft. below the surface.

LOWER CAVE—This property, near the Cave mine, is under bond and lease for two years, with the understanding that work is to be carried on continuously.

Juab County

EAGLE & BLUE BELL—Twenty-one cars were shipped the week ended Dec. 20, the ore coming from the 700-, 1000- and 1350-ft. levels. Mining has been facilitated by connections recently completed between the 700- and 1000-ft. levels.

OPOHONGO—This company is prospecting below the 700 level, from which a winze has been sunk for a distance of 50 ft. The ore here is low-grade, with occasional bunches of high-grade.

GOLD CHAIN—The ore found by way of the 1500-ft. level of the Lower Mammoth is opening up satisfactorily, and drifting for the same orebody has been undertaken from the 1200-ft. level of the Lower Mammoth, which is sharing the expense, as the work is of importance to both properties.

LOWER MAMMOTH—A surplus is being accumulated from the sale of zinc ore, November shipments having brought in about \$4000. The ore comes from the 1500- and 1800-ft. levels, but chiefly from the former. A car of zinc ore of unusually high grade was shipped the week ended Dec. 20.

Summit County

PARK CITY SHIPMENTS for the week ended Dec. 21 were 2,884,130 pounds.

Utah County—Santaquin District

AT THE UNITED METALS, Santaquin Chief, and Santaquin King, work is now being done.

UNION CHIEF—A car of ore was recently marketed, the ore coming from a raise near the bottom of a 400-ft. incline shaft.

WASHINGTON**Ferry County**

SAN POIL—The capacity of this mill in the Republic district is to be increased from 50 tons to 100 tons, and other new machinery will be installed.

Stevens County

NELLIE S—New machinery is to be installed at this mine in the Chewelah district, owned by the Arcade Mining Co. F. R. Clark is president.

CLARK—Extensive development work is planned for this group near Metaline Falls, according to Lewis P. Larson, who has charge of the work.

Wheaton County

IN THE RUBY CREEK DISTRICT in the eastern part of the county, placer-gold claims are again being worked.

WISCONSIN**Platteville District**

MINERAL POINT ZINC CO.—This company has purchased all the lands of the Highland Mining Co., at Highland, embracing 500 acres. Lead ore was struck on this ground in 1841, and the land has been mined continuously for lead, "drybone," and black jack. The Black Jack-Marsden mine, three miles south of Galena, including 170 acres of ground, has passed into the hands of the Mineral Point Zinc Co.

WISCONSIN SEPARATING CO.—This company has completed a 50-ton mill on the Little Dad mine, at Hazel Green. An option has been taken on the Murray mine, three miles northwest of Benton. C. C. Mathey, of Galena, is general manager.

CANADA**British Columbia**

HEDLEY GOLD MINING CO.—A dividend of \$180,000 has been declared by this company, operating the Nickel Plate mine at Hedley. Dividends so far distributed by this company amount to \$863,520.

UTICA—A surplus of \$30,000 has been earned by this mine in the Ainsworth district. The gross earnings have been \$40,000, of which \$10,000 was absorbed by operating expenses.

TRILBY—Operations on this mine, in the Rosland district, which have been suspended for several years, are to be resumed by the owners, among whom are, Duncan McDonnell, William Costello, Samuel McDonald and David Murphy, of Rosland. Assays as high as \$40 in gold per ton are reported to have been obtained in a 30-ft. shaft, which will be unwatered by David Murphy with a view to exploring the vein.

McGILLIVRAY CREEK COAL & COKE CO.—Production from this company's mines at Carbondale aggregated 13,500 tons in November and would have been greater had the car supply been sufficient. The source is a seam dipping of about 30° and having a width of 11 ft. It is estimated that entries were extended 2000 ft. during the last eight months of development. Operations are directed by Lorne A. Campbell, manager of Rosland.

New Brunswick

NATURAL GAS is being installed throughout the Intercolonial Ry. offices and shops at Moncton. Natural gas is now largely in use for both industrial and domestic purposes in Moncton, with as yet comparatively little demand upon the supply available at the wells in Albert County.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Dec. 28, and for the year to date, were as follows:

	Week	Year
Bailey.....	20.00	41.57
Beaver.....		163.75
Buffalo.....	59.70	1,163.54
Casey Cobalt.....		255.15
Chambers-Ferland.....		90.93
City of Cobalt.....		914.99
Cobalt Lake.....	30.10	1,056.51
Cobalt Townsite.....	67.76	1,867.78
Colonial.....	13.33	76.47
Coniagas.....		1,997.90
Crown Reserve.....	19.99	457.83
Dominion Reduction Co.....		119.41
Drummond.....	30.07	449.84
Hargraves.....		17.35
Hudson Bay.....		662.85
Kerr Lake.....		743.05
La Rose.....	106.26	3,538.93
Lost and Found.....		27.80
McKinley-Darragh.....		2,509.16
Nipissing.....	27.86	1,803.62
O'Brien.....		411.43
Penn.-Canadian.....		97.90
Provincial.....		22.22
Peterson Lake (Seneca Superior).....	41.16	391.75
Right of Way.....		242.82
Silver Queen.....		31.25
Timiskaming.....		958.66
Trethewey.....	27.01	577.05
Wettlaufer.....	50.00	487.21
Totals.....	493.24	21,588.72

COCHRANE—A 4-in. vein of high-grade ore has been intercepted by the crosscut from the main shaft. This property was lately taken over by the General Assets, Ltd.

SILVER QUEEN—The stock of the English Leasing Co., which will operate this property, has been largely oversubscribed.

NIPISSING—During November, the gross mill and smelter returns amounted to \$343,000.

BEAVER—The financial statement shows that the net liquid assets, Dec. 1, amounted to \$141,873, showing considerable increase over the previous statement. Mine op-

erations are resulting satisfactorily, there being a good body of high-grade ore on the 600-ft. level. The main shaft is down 730 ft., with a level at 700 ft. An important fact is the discovery of silver in the diabase, underlying the Keewatin. The 50-ton mill is giving good results, and will soon be in a position to treat 100 tons per day.

CROWN RESERVE—A bonus of \$10,000 has been distributed among the employees, the average sum being \$75.

BUFFALO—A bonus of about 3% of their wages has been paid to all the employees.

ALEXANDRA—This claim, adjoining the McKinley-Darragh-Savage has been taken over by the recently organized Canadian Gold & Silver Mining Co., which has also secured a group of claims in the Swastika camp.

WALSH MINES CO.—This newly incorporated company will develop claims in Cobalt and Gowganda.

Ontario-Porcupine

CROWN CHARTERED—Complications may arise on account of this property having been restaked. The syndicate has raised sufficient money to finance operations.

FOSTER—A carload of gold ore has been shipped that will assay approximately \$500 per ton.

DOME—Fifty men are now at work on the pipe line to Porcupine Lake, and the installation will be completed in a few weeks, so that no serious shortage of water is anticipated.

McINTYRE—Sufficient carpenters have been obtained to carry on the work at the new mill, the construction of which is rapidly nearing completion.

McENANEY—Sufficient men for mill construction have been obtained, but underground work is as yet practically at a standstill.

MEXICO**Chihuahua**

THE SCARCITY OF ORE CARS has been slightly relieved, so that the mines of Cusihiuiriachic and those along the Mexico northwestern line are able to maintain reduced shipments at least. The line of the Kansas City, Mexico & Orient Ry. east of Chihuahua, is again in operation regularly, so that regular shipments from the several copper properties have been resumed.

COINCIDENT WITH THE RAISING OF DUTIES on importations into the country, it was circulated that mining taxes would also be raised to increase the federal revenues, but state officials claim that this will not be done and that the federal authorities have authorized the quieting of this erroneous report.

SAN TOY MINING CO.—This company, operating at Santa Eulalia, lately distributed \$60,000 in dividends, which may be considered satisfactory in view of the difficulties attendant on operations during a 12 months' period of revolution.

THE NAICA AND GIBRALTAR COMPANIES in the Naica district, south of Chihuahua, are maintaining regular shipments to the Torreon smelter. The latter company has lately added heavier machinery, as well as a modern assay office and laboratory to its equipment.

EL TAJO—This mine, at Parral, plans on resuming both mine and mill work in January.

CONCHENO MINING CO.—This company is operating its slimes plant and at the same time progress in the remodeling of the sands plant is being made, as rapidly as machinery is received.

THE KANSAS CITY, MEXICO & ORIENT RY., according to gossip, is going to pass into control of the Southern Pacific. The K. C. M. & O. road went into the hands of a receiver, because A. E. Stilwell, its president, was not able to secure enough money to complete the 1600-mile line from Kansas City to Topolobampo, Mex. The road is well laid out, and connects with the Southern Pacific's extensive Mexican system; it would also give the Southern Pacific a direct line from the middle of the grain-raising district to the gulf. Southern Pacific could probably bid Stilwell's road in cheaper than it could build one in the same territory.

Sonora

THE STRIKE AT CANANEA seems to have been promptly broken, for, according to press dispatches, a large number of men have returned to the mines, the smelter is operating with a full force, and it was expected that the concentrator would resume operations this week.

FREEMONT & MEXICO FUEL OIL CO.—This company has a well drilled which is producing at the rate of about 5000 bbl. per day. A second well is being drilled and it is expected to case through the first oil horizon to reach the more prolific area now being tapped by gushers on adjoining land.

CIA. MEXICANA DE PETROLEO EL AGUILA—This company has perfected plans for a large crude-oil refinery in three or four units, to be built on the Mexican National branch running to La Barra. The first unit, a topping plant, the only part to be built this year, will have a daily capacity of about 12,000 bbl. of crude oil. The refinery plans primarily to prepare a fuel oil meeting all Lloyd's requirements for marine use and also the requirements of the British Admiralty. This fuel oil will have a flash point over 150° F., and a viscosity under 1000. The equipment will be purchased partly in Europe and partly in the United States. Construction is to start in January and operations to start the latter part of the year.

AFRICA**Transvaal**

Gold production in November is reported at 757,337 oz., being 11,344 oz. less than in October, and 37,608 oz. more than in November, 1911. For the 11 months ended Nov. 30 the total was 7,527,815 oz. in 1911, and 8,347,893 oz.—or \$172,550,948 in 1912; an increase of 820,078 oz. The total number of negro laborers employed on Nov. 30 was 210,520, an increase of 4163 during the month.

THE MARKET REPORT

COAL TRADE REVIEW

NEW YORK—Dec. 31

A Week of Stormy and Inclement Weather has seriously interfered with the transportation of coal, delaying both the movement of loaded cars and the distribution of empties to the mines. This condition has prevailed both in the East and the Central West. The Seaboard bituminous trade has felt the shortage of supplies and prices are well maintained. The Coastwise trade has been practically at a standstill.

Anthracite deliveries have been slow. Work at the collieries has been delayed by the holidays, but to a less extent than usual. Demand continues urgent.

Coal and coke tonnage carried on all lines of the Pennsylvania R.R., east of Pittsburgh and Erie, 11 months ended Nov. 30, short tons:

	1911	1912	Changes
Anthracite.....	10,742,344	9,275,631	D 1,466,713
Bituminous.....	38,437,959	42,162,485	I. 3,724,526
Coke.....	9,728,136	12,128,463	I. 2,400,327
Total.....	58,908,439	63,566,579	I. 4,658,140

The total increase for the 11 months in 1912 was 7.9%. The decrease in anthracite was large.

United States Exports—Exports of fuel from the United States, with coal bunkered, or sold to steamships in foreign trade, 10 months ended Oct. 30, long tons:

	1911	1912	Changes
Anthracite.....	3,016,127	3,033,691	I. 17,564
Bituminous.....	11,643,931	12,395,776	I. 751,845
Coke.....	777,761	679,772	D 97,989
Total exports.....	15,437,819	16,109,239	I. 671,420
Steamer coal.....	5,583,497	6,151,280	I. 567,783
Total.....	21,021,316	22,260,519	I 1,239,203

The steamer coal is practically all bituminous. The larger part of the exports were to Canada.

United States Imports—Imports of coal and coke into the United States, 10 months ended Oct. 31, long tons:

	1911	1912	Changes
Anthracite.....	42	1,657	I. 1,615
Bituminous.....	998,753	1,337,891	I. 339,138
Coke.....	60,884	86,425	I. 25,541
Total.....	1,059,679	1,425,973	I. 366,294

Imports—chiefly from Canada—are principally to the Pacific Coast and the far Northwestern states.

IRON TRADE REVIEW

NEW YORK—Dec. 31

The Iron and Steel Trade last week of the year is generally expected to be dull, when buyers are making up stocks, closing their balance sheets and otherwise getting ready for the new year. This year is a notable exception. Seldom, if ever, has there been so much business done in the closing week of December. It is true that new orders have been rather less for two or three weeks past; but that has been mainly due to the fact that large buyers are generally covered for the first quarter of 1913, many for the first half.

The exceptional activity this week is in part due to railroad orders for equipment and bridge work. Orders for freight cars are large, and it must be remembered that these now involve a large quantity of steel. Nearly all the cars now ordered are steel framed, in the case of coal cars and gondolas all steel. The old-style wooden cars are very few in number. The equipment orders now placed need a heavy tonnage of shapes and plates. Structural-steel orders also include a number of contracts for spring work, placed now in order to secure needed deliveries.

Mills are busy in almost all lines, and the holiday stoppages have been made as brief as possible. Stormy weather has caused some delays in deliveries.

Pig iron has been quieter and more like usual holiday conditions than any other part of the market. The coke question continues a serious one, and furnaces are delayed in

blowing in owing to uncertainties about the fuel supply. Prices are generally firm.

BIRMINGHAM—Dec. 30

The Buying Movement during the next week or two will hold the center of attention. It is the opinion of some of the optimistic pig-iron men in the Southern territory that very little time is to be lost in opening up the trading and there will be quite a tonnage disposed of right from the start. As previously announced, there has been considerable iron sold ahead for delivery during the first half of the year. The quotations are firm around \$14 per ton, No. 2 foundry, as a minimum, with \$14.50 asked and \$16 per ton for special analysis and special-brand irons. Two furnaces are now being gotten ready for operation, one to be started up during the first month of the year and the other a little later.

Cast-iron pipe interests in announcing completing of big orders from the West say there are others in hand and in sight that will warrant steady operation. Pipe makers in the Eastern states are in the market for iron, indicating there are good orders in hand.

The new year starts in with a smaller amount of accumulated iron on the yards in Southern territory than in three years. The probable make will have to care for the open-market demand. Some inquiries have been received for iron for the entire year, but in only one or two offices is there any consideration being given to inquiries for that long ahead.

CHICAGO—Dec. 30

The Iron Market continues quiet as regards pig iron, but sales of finished products continue large. Prices remain firm in all lines except that Southern No. 2 foundry iron is said to be obtainable at \$13.50, Birmingham, if anyone really wishes any quantity at that price. Such sales as have been made in the last week, of small lots, have been made at \$14, Birmingham, or \$18.35, Chicago, this price applying to deliveries anywhere in the first half. Northern No. 2 foundry coke iron holds to \$18 at the furnace, or about \$18.50, delivered, and Lake Superior charcoal iron to \$18.75 minimum for Chicago delivery. The general situation is, of course, that the melters desire a small amount of iron on hand for the inventory time and that the holidays have limited business.

Railroad Buying continues large in the finished-products market and there is especial demand for track fastenings. The demand for structural material revolves around the question of deliveries; contracts for the second half are sought and any possibilities of first-half delivery are quickly made use of. In bars there is not so much activity, but the volume of business is still large and prices are firm. For plates and sheets there is much demand, with delivery the all-important question, and minor lines show activity. It is a strong

CLEVELAND—Dec. 30

So Active a Market as was experienced in the last week of the year has seldom occurred.

Pig Iron—The market is firm, though sales are mainly in small lots. There are many inquiries for second and third quarters of next year. Prices are unchanged, but strong.

Finished Material—Bars and structural steel are in strong request. Buyers seem willing to pay the higher prices, the main question being as to deliveries. Crude steel is scarce and is in urgent demand.

PITTSBURGH—Dec. 30

New Orders, as is naturally to be expected in a holiday week, have been few, but otherwise business has been quite as active as it had been all through December. There is no diminution in the activity of mills, except so far as the stormy weather has interfered with operations. Holiday stoppages are being reduced to a minimum, and work is being driven as fast as possible.

A fire at the Lindsay & McCutchen mill, of the Carnegie Steel Co., on Dec. 27, destroyed several buildings, causing a loss of \$35,000, and an interruption to work.

The "Railway Age-Gazette" reports a total of 235,000 new cars ordered in 1912, and 152,400 delivered. At this rate the car shops must have very nearly a year's orders on the books.

Pig Iron—The Youngstown Sheet & Tube Co. has closed for 50,000 tons basic and 36,000 tons bessemer iron for deliveries running through the first half of 1913, and a little beyond. For foundry iron the market has been quiet and quotations rather variable. Current quotations are: Bessemer, \$17.25@17.50; basic, \$16.50; No. 2 foundry, \$17.50@18; malleable, \$17@17.50; forge, \$17@17.50, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—Material is scarce and the market is not quotably changed: Prompt carloads, \$75@80; contracts, first half, \$70@75; second half, \$65, f.o.b. Baltimore.

Steel—The situation is unchanged and we repeat former quotations: Bessemer billets, \$27; sheet bars, \$27.50; open-hearth billets, \$28; sheet bars, \$28.50, f.o.b. maker's mill, Pittsburgh or Youngstown. Rods are quotable at \$30, Pittsburgh, but are not easy to secure at the price.

Sheets—There is no change in the market. We quote, depending on delivery: Black sheets, 28 gage, 2.25@2.40c.; galvanized, 28 gage, 3.40@3.60c.; blue annealed, 10 gage, 1.65@1.80c.; painted corrugated, 2.45@2.50c.; galvanized corrugated, 3.45@3.50c. per pound.

Connellsville Coke—Production was reduced this week by the holidays. Prices continue very firm, \$4.25 having been paid this week for prompt coke, and \$3.50 on a contract running over first half.

ST. LOUIS—Dec. 30

The Pig Iron Market remains firm and quiet. Naturally very little business is being transacted over the holidays, and as nobody needs any business, everyone is happy. Price on No. 2 Southern foundry iron is firm at \$14.50, Birmingham, or \$18.25, St. Louis. Quick-shipment iron is scarce. Everybody is entirely sold up for the first half. Third-quarter business has not opened up yet, but it is expected that a number of buyers will be in the market for that delivery shortly after the first of the year. Northern iron is quoted around \$19, St. Louis, for No. 2, and is in fair demand.

Coke Situation remains the same. Connellsville foundry is bringing around \$7, St. Louis, and byproduct \$6 for nut.

IRON-ORE MARKETS

Negotiations are active for Lake tonnage for next season. Quite a number of contracts have been closed at 45c. from Duluth to Lake Erie ports, an advance of 5c. on last season.

METAL MARKETS

Gold, Silver and Platinum

Gold—Prices on the open market in London remain at the bank level, 77s. 9d. per oz. for bars and 76s. 4d. for American coin. Germany was an active buyer, but the demand was not strong enough to force a premium.

Iridium—This metal continues in small supply, and \$70@75 per oz. is asked for pure metal.

Platinum—The market is still quiet and prices here are unchanged. Dealers ask \$45@46 per oz. for refined platinum, according to quantity; \$47.50@48.50 per oz. for hard metal, up to 10% iridium. Abroad there is no material change, although the large producers are reported to hold heavy stocks.

Silver—Since the holiday season has set in, the market, while absorbing all silver offered, does not show any special activity, but cables under date of Dec. 31 report China in the market. The close is at 29d. in London, with a steady tone.

Shipments of silver from London to the East, Jan. 1 to Dec. 19, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£8,702,500	£11,924,500	I. £3,222,000
China.....	990,300	1,796,000	I. 805,700
Total.....	£9,692,800	£13,720,500	I. £4,027,700

Exports of gold from London to India were £105,000 for the week.

Copper, Tin, Lead and Zinc

Copper—The market has experienced considerable improvement since Christmas with the buying of some domestic manufacturers, who needed to replenish their supplies, and the price advanced materially. Some sales to Europe also were made. The domestic business was done chiefly at 17½c.,

delivered, usual terms, and the foreign upon the basis of about 17.40@17.45c., cash, New York. In the aggregate this business amounted to several million pounds. Since Monday there have been rumors of a large sale by the principal agency to one large American consumer at 17.65@17.75c., New York, delivered, usual terms. Something of this sort seems to have happened, but the conditions have not been disclosed. Presumably they mean delivery at interior points, where competition is restricted, at prices figured to New York basis. It is certain that there has been no important buying movement in the New York market, where copper is still offered liberally by the outside agencies, at 17½c., delivered, without finding takers. While there have been some sales of round lots to Europe, there has not yet been any large demand from there. All of the agencies maintaining the pegged price seem to be willing to pocket all inequalities in freights, offering in European outposts on the same terms as in the regular ports. The business of the last week was principally for early delivery, no one now being interested in the later months. Not much business in Lake copper was reported.

Anyway, it is clear that there is a decidedly better tone to the market. It is evident that the stocks of refined copper abroad are becoming depleted and that the supplies in second hands have been absorbed. If in this country consumers have remained apathetic, influenced to a large extent by the dullness which has prevailed in the market for manufactured forms of copper since about a fortnight, that may be ascribed partly to the fact that we are now at the period of the year when stock taking and inventory is occupying the attention of consumers. It is expected that after the turn of the year a good demand will again make itself felt.

DAILY PRICES OF METALS

NEW YORK									
Dec.-Jan.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
26	4.8485	62½	@17.35	@17.35	50½	@4.25	4.10	@7.10	7.05
27	4.8465	62½	@17.40	@17.40	50½	@4.30	@4.15	@7.20	@7.10
28	4.8465	62½	@17.45	@17.45	50½	@4.30	@4.15	@7.20	@7.10
30	4.8480	62½	@17.40	@17.40	50½	@4.25	4.10	@7.10	7.05
31	4.8515	62½	@17.50	@17.50	50½	@4.32½	@4.17	@7.20	@7.10
1	.....	.....	.....	.....	.....	.....	.....	.....	.....

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 for 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Dec.-Jan.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
26	.....	.....	.....	.....	.....	.....	.....	.....
27	28½	76½	77½	81½	227½	227½	18	26½
28	28½	.....	.....	.....	.....	.....	.....	.....
30	28½	76½	77½	81½	229½	229½	18	26½
31	29	76½	77½	81½	229½	229	17½	26½
1	.....	.....	.....	.....	.....	.....	.....	.....

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = % 21½c.

At the close Lake copper is quoted at 17% @ 17 1/4 c., and electrolytic in cakes, wirebars or ingots 17.40 @ 17.50 c. Casting copper, which has been rather pressed for sale, is quoted nominally at 17% @ 17 1/4 c., as an average for the week.

Copper sheets are 23 @ 24 c. per lb., base for large lots; full extras are charged and higher prices for small quantities. Copper wire is 19 @ 19 1/4 c. base, carload lots at mill.

Exports of copper from New York for the week were 5730 long tons. Our special correspondent gives the exports from Baltimore at 216 tons.

The London market for standard copper has been strong and advancing. This has been due not only to covering by bears, but also to some renewed buying on the part of speculators, influenced principally by the dwindling European stocks. On Dec. 27, spot was £76 2s. 6d., and three months £77 2s. 6d.; on Dec. 30, spot was £76 5s., and three months £77 3s. 9d., and on Dec. 31, the market closed at £76 12s. 6d. for spot and £77 11s. 3d. for three months.

Tin—Domestic buying continued at a very satisfactory rate. Therefore all the London limits were accepted, with the result that the market has become very strong. Spot tin has also been in better demand and it is feared that a scarcity of the same may develop. At this time, both in the London and domestic markets, material actually on the spot is demanding a premium. The market closes firm at £229 10s. for spot and £229 for three months; and about 50% for January tin here.

Lead—The lower prices have attracted consumers and a large business has been consummated. At the close somewhat better prices have been realized. St. Louis is quoted 4.12 1/2 @ 4.17 1/2 c., and New York, 4.27 1/2 @ 4.32 1/2 cents.

The London market for lead is quiet, Spanish being quoted £17 17s. 6d. and English lead 7s. 6d. higher.

Spelter—There was very little demand during the last week. Plenty of spelter for early delivery now seems to be available. Apparently the recent importations from Europe have not yet been wholly disposed of. Offerings during the week at 7 1/2 c., St. Louis, consistently failed to develop business, cheaper sellers supplying what was wanted. We quote 7.05 @ 7.10 c., St. Louis, and 7.10 @ 7.20 c., New York.

The London market is slightly easier, good ordinaries being quoted £26 7s. 6d. and specials £27 per ton.

Zinc dust is quoted at 7 1/2 c. per lb., New York.

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

Other Metals

Aluminum—The market has been more active and firmer. Quotations are 26 @ 26 1/2 c. for No. 1 ingots, New York. The foreign market is firmer.

Antimony—Sales of antimony have been light, owing to the holiday season. Cookson's is unchanged, at 10 @ 10 1/4 c. per lb. The range in Hallett's is narrower, 9% @ 9 1/2 c. being quoted. Chinese, Hungarian and the outside brands are unchanged, 9 @ 9 1/4 c. per lb. being asked.

Quicksilver—Business has been quiet and prices remain about the same. The New York quotation is \$40 per flask of 75 lb., with 59c. per pound asked for retail lots. San Francisco, \$40 for domestic and \$37.50 for export orders. London price is £7 7s. 6d. per flask, with £7 5s. named from second hands.

Zinc and Lead Ore Markets

JOPLIN, MO., Dec. 28

The high price of zinc sulphide ore is \$59, and the base per ton of 60% zinc, \$52 @ 56. Zinc silicate sold at a price range of \$29 @ 35 per ton of 40% zinc. The average price, all grades of zinc, is \$52.88. Lead continues on a base of \$53 per ton of 80% metal contents and the average price for all grades is \$52.74 per ton.

SHIPMENTS, WEEK ENDED DEC. 28

	Blende	Calamine	Lead Ore	Value
Totals, week.....	10,966,430	456,190	1,636,920	\$345,179
Total, year.....	576,483,370	36,779,390	93,362,260	18,714,261

Zinc sulphide value, the week, \$294,833; the year, \$15,475,284. Zinc silicate value, the week, \$7,187; the year, \$586,222. Lead value, the week \$43,159; the year, \$2,652,755.

PLATTEVILLE, WIS.—Dec. 21

The Base Price paid this week for 60% zinc ore was \$55 per ton. The base price paid for 80% lead ore was \$51 @ 52 per ton.

SHIPMENTS, WEEK ENDED DEC. 21

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Total for week.....	3,278,230	207,900	1,146,540
Year to date.....	195,748,290	8,067,840	39,208,970

Shipped during week to separating plants, 1,727,430 lb. zinc ore.

CHEMICALS

The General Markets Have Been Quiet as is usual at this season. An active business is expected after the New Year.

Arsenic—The market is dull, and quotations are \$4.75 @ 5 per 100 lb. Small shipments are now coming regularly from domestic, Canadian and Mexican mines. Sellers rather anticipate a decline.

Nitrate of Soda—Trade in this article has been light. Quotations remain 2.60c. per lb. for spot and futures up to April 30. Futures are 2.57 1/2 @ 2.52 1/2 c., according to date.

The Price of Gulf Coast Crude Oil has passed \$1 per bbl. for the first time. The Gulf Pipe Line Co. has contracted to take the output of nine producing concerns in the Batson field for one year at \$1.07 1/2 per bbl. The production amounts to about 1000 bbl. per day.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the new cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	Sept.	Oct.	Nov.	Dec.
Alaska shipments.....	1,726,715	1,435,235		
Anacosta.....	24,500,000	25,250,000	24,250,000	
Arizona, Ltd.....	3,340,000	3,200,000	3,000,000	
Copper Queen.....	9,103,861	8,184,575	8,807,940	
Calumet & Ariz.....	4,462,000	4,404,000	4,918,000	
Chino.....	3,217,369	3,638,500	3,911,169	
Detroit.....	1,881,668	1,934,828	1,968,620	
East Butte.....	1,250,000			
Mammoth.....	1,834,937	1,883,283	1,805,860	
Gioux.....	1,005,208			
Mason Valley.....	1,200,000	1,563,700		
Nevada Con.....	5,607,578	850,741		
Ohio.....	635,000			
Old Dominion.....	2,204,000	2,523,000	2,758,000	
Ray.....	2,978,404		3,201,500	
Shannon.....	1,142,000	1,210,000	1,436,000	
South Utah.....	225,568			
United Verde*.....	2,750,000	2,750,000		
Utah Copper Co.....	6,616,887	2,022,352		
Lake Superior*.....	19,250,000	21,500,000	20,400,000	
Non-rep. mines*.....	8,094,792	8,250,000	8,250,000	
Total production.....	103,025,987			
Imports, bars, etc.....	25,149,329	28,205,270		
Total blister.....	128,175,316			
Imp. in ore and matte...	7,142,232	11,224,879		
Total American.....	135,317,548			
Miami.....	2,949,150	2,577,750	2,972,000	
Brit. Col. Cos.:				
British Col. Copper.....		1,022,904		
Granby.....	2,083,118	2,018,424	1,852,896	
Mexican Cos.:				
Boleof.....		2,612,400	2,315,040	
Cananea.....	3,500,000	4,428,000	5,064,000	
Moctezuma.....	771,844	3,045,667	2,112,377	
Other Foreign:				
Cape Cop., S. Africa....	678,720	757,120	907,200	
Kyshtim, Russia.....	1,750,000			
Spassky, Russia.....	981,120	974,000		
Tilt Cove, Newf'd.....		86,785		
Exports from:				
Chile.....	6,048,000	8,512,000	4,816,000	
Australia.....	7,616,000	9,520,000	10,752,000	
Arrivals in Europe\$....	8,518,720	13,771,520	12,976,320	

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

STATISTICS OF COPPER

Month	United States			Visible Stocks.		
	U.S. Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
XI.1911	111,876,601	68,039,776	67,049,279	134,997,642	176,825,600	311,823,242
XII.....	122,896,697	65,988,474	79,238,716	111,785,188	164,281,600	276,066,788
Year	1,431,938,338	709,611,605	754,902,233			
I, 1912.	119,337,753	62,343,901	80,167,904	89,454,695	158,323,200	247,777,895
II.....	116,035,809	56,228,368	63,148,096	66,280,643	154,851,200	221,131,843
III.....	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV.....	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V.....	126,737,836	72,702,277	69,485,945	65,066,029	134,176,000	199,242,029
VI.....	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII.....	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII.....	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX.....	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X.....	145,405,453	84,104,734	47,621,342	46,701,374	107,408,000	170,473,587
XI.....	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII.....				86,164,059	96,947,200	183,111,259

Assessments

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

Monthly Average Prices of Metals SILVER

Table with columns: Month, New York, London. Shows monthly average prices for silver.

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

COPPER

Table with columns: Month, New York (Electrolytic, Lake), London, Standard. Shows monthly average prices for copper.

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

TIN

Table with columns: Month, New York, London. Shows monthly average prices for tin.

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

LEAD

Table with columns: Month, New York, St. Louis, London. Shows monthly average prices for lead.

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

SPELTER

Table with columns: Month, New York, St. Louis, London. Shows monthly average prices for spelter.

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

PIG IRON AT PITTSBURG

Table with columns: Bessemer, Basic, No. 2 Foundry. Shows prices for pig iron at Pittsburgh.

STOCK QUOTATIONS

Table with columns: Name of Comp., Bid. Lists various stock quotations.

TORONTO

Table with columns: Name of Comp., Bid. Lists various stock quotations from Toronto.

Table with columns: Name of Comp., Clg., Bid. Lists various stock quotations.

N. Y. EXCH. Dec. 30

Table with columns: Name of Comp., Clg., Bid. Lists various stock quotations from N.Y. Exchange.

N. Y. CURB Dec. 30

Table with columns: Name of Comp., Clg., Bid. Lists various stock quotations from N.Y. Curb.

BOSTON CURB Dec. 30

Table with columns: Name of Comp., Last. Lists various stock quotations from Boston Curb.

LONDON Dec. 31

Table with columns: Name of Com., Clg., Bid. Lists various stock quotations from London.

†Last quotation.