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THE LAW OF THE APEX—ANOTHER DECISION.

We noted, November 7th, the progress of the suit at Provo, Utah, before Judge POWERS of the United States District Court, between the Beck, Bullion & Champion Mining Company, plaintiff, and the Eureka Hill Mining Company, defendant. This suit was begun in January last by a complaint in trespass. The defendant answered the allegations of the complaint, and filed a cross-complaint, alleging its own title and possession of the ground in dispute, and praying that the principal action be dismissed, and the title of the defendant in that action be quieted. The original plaintiff answered the allegations of the cross-complaint, and the issues thus formed upon the pleadings of the cross-action were brought to trial before the principal action. The Eureka Hill Company thus became plaintiff instead of defendant, and at the conclusion of the plaintiff's testimony, the defendant moved for a non-suit of the cross-action. The decision of Judge POWERS on this motion is now before us.

Evidently this decision is not conclusive as to the whole case. The other side has still to be heard on the facts. But the facts are of greater importance to the immediate parties than they can be to us, or to the mining community at large. The decision of Judge POWERS is an application of the law to a state of facts conceded, for the sake of the argument, to exist; and certain portions of it constitute an important construction of the mining law.

The only ground of the motion for non-suit which concerns us was that, upon the showing of the Eureka Hill Company's own witnesses, that company's location and patent had been taken upon a large lode, the apex of which is, for a part, at least, of the length of the claim, wider than the location. No doubt, the unity of this lode is disputed; but on the case as it stood when this decision was made, that fact was in proof, together with the fact of the priority in title of the Eureka Hill party. The contention of the defendant was, that the apex, not being wholly within the surface-lines of the property, neither location nor patent could give title to the whole width of the vein. This point has been discussed in several important cases, which will be found in Dr. RAYMOND'S paper on the Law of the Apex.

Judge POWERS, in opposition to Judge HALLETT, in *Hall vs. the Equator Mining Company*, and also in opposition to Judge MILLER (though he is not mentioned), in the second trial of the same case, decides this point in favor of the prior locator—a view which we certainly hope will prevail, as it seems to us to be the most equitable and reasonable construction of the law.

It is but fair to add, however, that the case now under consideration did not present the issue with absolute simplicity. So far as we can judge from the document before us, the lode as established by the testimony was not everywhere so wide that the apex was not covered by the location. The language of the court seems to cover even that contingency; but in the case actually at bar, it was possible to consider the local widening of the lode in one part of the claim as an unforeseen irregularity of nature, and thus bring it within the observation of the United States Supreme Court in the Flagstaff case, that "slight deviations of the outcropping lode from the location of the claim would probably not affect the right of the locator to appropriate the continuous vein; but if it should make a material departure from his location, and run off in a different direction and not return to it, it certainly could not be said that the location was on that lode or vein." (The italics are ours.) Judge POWERS makes a strong *a fortiori* argument on this passage, showing that, if a man could follow his lode when the whole of the apex slightly deviated from his location, he certainly should have the same right when the "deviation" was so much slighter that it carried only a part of the apex over the line. He does not openly declare that a location which at no point includes the whole width of the apex is good, against any later location, for the full width of the lode and the extra-lateral right in depth. But his frank dissent from Judge HALLETT'S view, and the general implication of his argument, carry that meaning.

Another element peculiar to this case is, that the Eureka Hill location was made under the Act of 1866, which undoubtedly laid more weight on the lode itself, and less on the apex and its relation to surface surveys, than did the Act of 1872. Under the latter act, as now incorporated in the Revised Statutes, there is some doubt, and there have been conflicting decisions on the point before us. Under the former, we do not see any room for doubt. And the rights which the Eureka Hill Company, or its grantors, had acquired under the earlier statutes are expressly reserved to them under the later one. So says Judge POWERS, and extends the application of the principle so far as to hold, apparently, that a patent under the later statute granted to a locator under the earlier one has a wider force than if location and patent were both prior to 1872. To this extent, we can not follow him. Parties who wanted patents under the law of 1866 should have applied for them while that law was in force. If they preferred to remain in the attitude of free tenants on the public lands until the United States changed the terms of its patents, they can not claim, under the law of 1872, a patent of the old form and force. But we will not discuss this point further. With the main tenor and result

If employers in any part of the world who desire the services of superintendents, mining or civil engineers, metallurgists, chemists, mine or furnace foremen, or other assistance of this character, will send us particulars of what they need, their wants will be advertised in the **ENGINEERING AND MINING JOURNAL**, WITHOUT CHARGE, and answers will be forwarded to them.

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of Judge POWERS's decision we are in accord; and we can only regret that the case presented any features to obscure the important issue which we suppose must be carried, sooner or later, to the Supreme Court.

Judge POWERS decided all other points in favor of the Eureka Hill party, and overruled the motion for non-suit. We await with interest the result of the trial, when the testimony on the other side shall have been taken; and we infer that the effect of this interlocutory decision will be to throw the weight of the case more decidedly than ever upon the question of the unity of the alleged lode, and thus to bring into greater prominence the distinguished experts on both sides. *

THE HELL GATE IMPROVEMENTS.

On another page, we give copious extracts from Lieutenant DERBY's letter on the Hell Gate improvements, for advance-proofs of which we are indebted to the courtesy of the *Sanitary Engineer*. As Lieutenant DERBY's interesting letter gives some figures of the cost of the work, we would refer our readers to the *ENGINEERING AND MINING JOURNAL* for October 24th, in which will be found the figures of cost of this work as given in the reports of the Chief of Engineers. Lieutenant DERBY does not give us the data on which he bases some of his statements; it is consequently impossible to discuss them fully; but there are some points in his letter that appear to call for some explanation, even in advance of the full figures of cost, for which we must wait.

Lieutenant DERBY mentions that the galleries at Flood Rock were driven on the stratification and at right angles to it, "so as to reduce the amount of timbering to a minimum," and that "the average thickness of the roof was 18'8 feet, far more than was desirable; but as the penalty for cutting it too thin was the probable loss of all hands and work worth nearly \$1,000,000, no unnecessary risks were taken." But is it not probable that it would have been safer and would have required less timber had the galleries run diagonally across the stratification? And was not the Hallett's Point work, where the average thickness of the roof was, we believe, about half that at Flood Rock, in precisely similar strata?

The large quantity of explosive used, 2'3 pounds, and the great number of feet of holes drilled, 11'97 feet per cubic yard excavated, at Flood Rock, are some of the facts that lead those experienced in mining to think that possibly a change in the direction of the galleries and better judgment in pitching the holes would have secured better results.

Every engineer will make large allowance for the difficulties of heavy water, and some also for the natural disinclination to take any risks, and will give full credit for the evident care for the safety of those employed with which the work was conducted. Lieutenant DERBY says that, owing to the great improvements made in mining machinery and in explosives since the Hallett's Point work, "the cost of preparing the mine for the reception of the final charge was reduced from \$7.92 to \$2.69 per cubic yard to be broken, as compared with the work at Hallett's Point;" but it should have been added that the preliminary work at Hallett's Point removed over 51 per cent of the rock, leaving less than 49 per cent to be dredged, and at Flood Rock the preliminary work removed less than 23 per cent of the rock, leaving more than 77 per cent to be dredged. Nor is it questioned that the rock is far less broken up at Flood Rock than it was at Hallett's Point.

Still, Lieutenant DERBY tells us that the total cost of removing Flood Rock will be at least 30 per cent less per cubic yard than was the cost of removing Hallett's Point—a result which would about correspond with the general reduction of cost in most of the supplies used and in doing such work elsewhere since 1877. In the absence of the figures on which this estimate is based, it is, of course, impossible to judge of its probable fulfillment; but we shall be greatly pleased should it be realized.

The items of the cost of the underground work in Flood Rock, as given in the Chief Engineer's reports, and the information obtained concerning the condition of the reef after the explosion, we confess do not appear to lead to such figures, and we shall be scarcely less surprised than pleased if Lieutenant DERBY be not mistaken. If the cost of dredging with the divers is actually less than \$6.38 per cubic yard, the improvement in that work since we last visited the rock and saw the scow at work is simply marvelous.

As we stated in our notice of the work done, Lieutenant DERBY is an exceptionally efficient officer, and undoubtedly deserves much credit for the care with which the work has been done, and for the economy said to have been attained.

It is to be regretted that the full details of cost of the work had not been furnished at the time the blast called attention to it; for the figures given in the Chief Engineer's reports are apparently calculated to lead to erroneous conclusions.

Some other points of Lieutenant DERBY's letter, connected with the charging of the holes, we shall refer to on another occasion.

Prussian Amber.—Since 1880, when diggings for amber were commenced under the Smaland Peninsula in East Prussia, the yield of the veins here has greatly increased. In 1864, the revenue was \$8500, against \$125,000 in 1883.

CORRESPONDENCE.

[We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested. All letters should be addressed to the MANAGING EDITOR. We do not hold ourselves responsible for the opinions expressed by correspondents.]

The Lower California Copper Mines.

EDITOR *ENGINEERING AND MINING JOURNAL*:

SIR: In reply to the letter of Mr. Derré, in your issue of November 28th, and in the absence of my friend, Dr. Trippel, I have to contradict emphatically the assertion that his report agrees in every particular with that of the late examiners, or with Mr. Derré's; for it adopts actually Mr. Brunton's report.

Besides, Dr. Trippel's estimate for a complete plant for a large business with all improvements, docks, steamboats, and dead-work, was 1,250,000 francs, and not 6,000,000 francs.

Mr. Brunton's report of results was made when ingots were at £73 sterling and Chili Bars at £67; and Dr. Trippel's report when ingots were at £66 and Chili Bars at £60; while in 1885, they have declined to £50, £45, and £40. So that no comparison must be made between reports of results of either party with that of the present reports.

NEW YORK, Nov. 30.

Yours truly, A. HARNICKELL.

EDITOR *ENGINEERING AND MINING JOURNAL*:

SIR: On behalf of my partner, Mr. D. W. Brunton, now in Leadville, I desire to correct several statements made in Mr. A. Derré's letter, published in the *JOURNAL* of November 28th.

It was in December of 1882 (not 1881) that Mr. Brunton visited the Lower California copper mines, and his report thereon, dated February, 1883, did not in any particular corroborate Mr. Derré's previous report. Neither did Mr. Brunton at that time or subsequently state that these mines "could safely be ranked among the largest producers in the world"—a statement which the development of the mines did not warrant, even with ingot copper at £72. Prof. A. Trippel examined the mines at least six months later than did Mr. Brunton.

There are other inaccuracies in the letter referred to; but such as I could correct would not sufficiently interest your readers to deserve space in your columns.

To any interested parties who have been led to believe that Mr. Brunton's report corroborated Mr. Derré's, I will with pleasure submit copies of both reports, which will speak for themselves. I am, dear sir, very truly yours,

No. 140 EAST THIRTY-SEVENTH STREET, NEW YORK, NOV. 30.

F. M. TAYLOR.

Alleged Improvements in Ore-Crushing Machinery.

EDITOR *ENGINEERING AND MINING JOURNAL*:

SIR: My letter published in your issue of October 31st was not intended to secure free advertising or to provoke a prolonged controversy that would enable Mr. Krom to obtain it. It was simply a brief statement in opposition to his claims for so-called improvements in crushing machinery, written to dissipate the impression he had conveyed in his paper before the Institute of Mining Engineers, and subsequently in the partial reprint of the same in the *ENGINEERING AND MINING JOURNAL*.

If Mr. Krom fancies that he is going to escape with any such mild criticisms on that paper as those contained in that letter, he is wholly mistaken. The columns of your paper are certainly not the place for the discussion of the validity of patent rights.

The first of the five improvements in stone crushers that he claimed as his is the use of "tie-bolts" to take the strain due to crushing, and the use of breaking-cups to relieve the machine in case of excessive strains. In his rejoinder, November 21st, he gives an illustration of the Patent-Office sketch of the A. W. F. Partz machine, showing the sectional framing and very tie-bolts that he claimed in his paper as his improvement. The date of the Partz patent, owned by the Blake Crusher Company, is September 27th, 1864. He also gives the Patent-Office sketch of the Varney & Rix machine, in which the strain due to crushing is taken by the tie-rods and bolts, the date of which is December 4th, 1866. The illustration of either one of these machines, the one antedating his patent by eleven years, the other by nine, is sufficient to annihilate any claim of his for originality in the use of sectional framing and tie-bolts taking the strain due to crushing. In fact, every essential element of his patent of 1875 is found in both of them.

He states: "When I made my improvements, I knew nothing of the Partz patent" (evidently not); but Mr. Krom was fully informed in regard to both the Partz and Varney & Rix patents before his paper before the Institute of Mining Engineers was written. In such a paper, before a scientific society, intended for publication, honesty and professional courtesy demanded mention of the fact that sectional framing and the use of tie-bolts for crushers were not only not new, but were in fact devices that were many years old, and for which he is not entitled to the credit, if there be any.

The second improvement consists in dispensing with one pair of long tension-rods or tie-bolts, and replacing them with short bolts, the mechanical equivalent of the clamps in the Challenge crusher. This so-called improvement was not made by Mr. Krom until some years after the Challenge was made and sold in all parts of the country, and in fact, so recent that I doubt whether Mr. Krom can point to a single machine so constructed in actual use; indeed, I doubt if he has ever made one.

The third improvement Mr. Krom kindly admits may not be new. The fourth improvement he does not acknowledge is old, and still virtually claims as his, although referred to the original Blake patent showing a movable jaw pivoted at the bottom, and although he has full knowledge of other crushers with jaw hung on axis below the crushing-faces; for example, the Dodge crusher, patented December 4th, 1866, and others.

The fifth improvement, toggles with rolling ends, was considered years before the date of his 1875 patent, reissued in 1882; in fact, I have no doubt such a device was fully considered at the time of the adoption of

the toggle-joint as a means of actuating the jaw, when the Blake machine was first introduced. It could hardly have been otherwise.

To Mr. Krom's personal allusions I forbear to reply. He forgets that patent rights are not on trial in this discussion; but that the simple question is, Is Mr. Krom entitled to the credit of being the original inventor of the five improvements he claims in his paper before the Institute, subsequently reprinted in part in your JOURNAL?

Respectfully yours,
THEODORE A. BLAKE.
NEW HAVEN, CONN., Nov. 23, 1885.

ON THE UTILIZATION OF WASTE ANTHRACITE.*

Prepared for the Engineering and Mining Journal by L. N. Lukens.

(Concluded from page 369.)

The Wootten locomotive is the only attempt known to me to burn culm in locomotives. It seems, however, to have had a very great success.

Its description, as given by Mr. Bell, is as follows:

"The distinguishing characteristic of the Wootten locomotive is a fire-box that is extended laterally over the driving-wheels without materially elevating the body of the boiler. The undue elevation of the boiler is avoided by the use of a fire-bridge placed at the back of the fire-box, the height of the bridge being equal to the depth of the front water-leg in an ordinary anthracite coal-burner.

"The grates are a combination of water-tubes and cast-iron bars, the tubes being two inches apart and the bars placed between them.

"Back of the bridge is a combustion-chamber, extending to the tube-sheet, having 32 square feet of heating surface. The exhaust has a variable nozzle from 4 to 5 inches in diameter."

Dr. C. M. Cresson made an investigation as to the Wootten locomotive, from which the following results are taken. Without going into details of tests that have been published, we give the following summary of the tests with anthracite coal:

Test A. Freight consolidation engine, Wootten boiler.
Test B. Passenger Wootten boiler.
Test C. Passenger ordinary boiler.

Fuel.	A. Anthracite waste.	B. Marketable Anthracite.	C. Anthracite.
Total heat-units in fuel used	11,275	11,913	11,275
Heat-units utilized in generating steam	7,823	7,813	5,647
Total equivalent in pounds of water evaporated from and at 212 degrees	8'09	8'08	5'84
Percentage of total heat utilized	69'4	65'5	50'0

A test of locomotive 169, Central Railroad of New Jersey, made by Messrs. Abbey & Baldwin, of the Stevens Institute, gave an evaporation of 8.7 pounds of water per pound of lump coal.

Locomotive No. 169 and several of the Wootten locomotives, may be regarded as among the best of American passenger locomotives. Their economy is about equal. They are both capable of sustaining a speed of over 60 miles an hour. The Wootten locomotive is capable of sustaining this speed, as shown by Mr. Dudley, with a fuel costing about one third of the price of that demanded by engine 169.

USE OF ANTHRACITE WASTE IN MINOR METALLURGICAL PROCESSES.

Mr. Durfee, of Bridgeport, Conn., reports great success in using anthracite culm in Siemens gas generators. In using a very rich bituminous coal, he had great trouble from the coal-tar choking up the pipes. By making up the charge with one quarter anthracite culm, this trouble was entirely obviated, and a great saving effected. The generator was managed exactly as usual. He did not open the gas-pipes for two years, and when he did so, only drew off a couple of buckets of tar. The anthracite coal was converted into CO, which gas worked very well with the gas from the bituminous coal. As he was able to get coal-yard screenings for less than one tenth of the cost of the bituminous coal he was using, a very great saving was effected. Anthracite culm has also been used in roasting ores with good success.

COMPARISON WITH COAL AS REGARDS COST.

It is difficult to decide upon the value to be assigned to culm. A few years ago, it had no money value at the mines, and could be had for the cost of hauling. As the consumption increases, the cost of the culm will increase, until a figure is reached about equal to its value. At present, it has no real market price, sales being made according to the conditions of each sale. Seventy-five cents a ton at the mines, and \$2.50 a ton at New York, have been taken as a fair value, allowing some increase over present figures.

COMPARATIVE COST OF COKES.

The cost of making 80 tons will be:

British anthracite.			American anthracite.	
	£	s. d.		
Culm, 60 tons	10	10 0	Culm, 50 tons	\$212.50
British slack, 35 tons	7	17 6	Connellsville coal, 50 tons	87.50
Coal-tar pitch, 5 tons	8	15 0	Manufacturing	88.00
Disintegrating 100 tons	2	10 0		
Washing 100 tons	2	10 0		\$388.00
Superintendent	2	10 0		
Labor, at 1s.	5	0 0		
Interest, etc.	1	6		
Royalties on 80 tons	2	0 0		
	41	14 0		\$4.85 a ton.

Connellsville furnace coke at Pittsburg, \$1.10 a ton. Foundry coke at Pittsburg, \$2.25 a ton. The items for the American coke are on the following authority: Anthracite culm and anthracite freight, the general freight agent of the Pennsylvania Railroad. Bituminous coal and freight, Connellsville Coke and Iron Company, Philadelphia. This high price, \$4.85 a ton, is in a great measure due to the freight on the anthracite coal. This freight is from the Shamokin districts via the Northern Central Railroad and the Philadelphia Railroad to Johnstown, Pa. Some

*The material contained in the following article was collected for my graduating theses, Stevens Institute of Technology, etc.

other point might be arranged to bring the two coals together cheaper; but I do not see just where.

THE HOWE GRATE.

The price charged for the Howe grate is \$4 a square foot, and \$10 for the blower. This includes setting ready to run. The grate surface used was 34 square feet, making in all about \$150 as the cost of the alteration. The interest on this, at 6 per cent, is \$9, an amount too small to need to be considered.

The evaporation, after all reductions, was shown to be, for one pound of chestnut coal, 8.262 pounds of water; for one pound of culm, 6.864 pounds of water. The value of the chestnut coal at Scranton may be taken at \$2.50 a ton. One dollar's worth of coal would, therefore, evaporate 6804.8 pounds of water.

The comparative value of the culm would be $x : 2.50 :: 6.864 : 8.262$. $x = \$2.07$. The actual value is 75 cents. The saving by using culm is therefore \$1.32 a ton.

One dollar's worth of culm would evaporate 18,304 pounds of water, a gain by the use of culm of 11,699.2 pounds of water, or over 100 per cent. This is at Scranton. An addition of say \$2 a ton on the coal and \$1.75 on the culm must be made for freight to New York, the railroad companies carrying culm slightly cheaper. This would make the prices at New York for coal, \$4.50 a ton; for culm, \$2.50 a ton.

The comparative value of culm in New York would be $x : 4.5 :: 6.864 : 8.262$. $x = \$3.74$. The saving by using culm would therefore be \$1.24.

The evaporation for one dollar's worth of coal would be 3672 pounds of water. For one dollar's worth of culm, 5491 pounds of water.

In using culm, at a distance from the mines, long contracts should be made with the railroad companies, as they are not always willing to carry it.

No comparison of costs need be made of the Whelpley & Storer process, the data not being definite enough as to an increase of efficiency in metallurgical operations, and it not being worth while to figure on the loss as shown by Mr. Isherwood's report.

The saving to be made by using culm by any of the direct-burning processes is so great as to require no comment or elaboration.

GENERAL CONCLUSIONS.

We now wish to compare the various processes with each other, and to draw our conclusions as to the results. In making comparisons of this kind, it is impossible to say that any one process or machine is unqualifiedly the best. We can only see that it is the best under the particular conditions assigned.

Fuel is used in three main ways:

- I. For domestic purposes.
- II. For steam purposes.
- III. For metallurgical purposes.

In metallurgical work, there are two classes:

1. Where the fuel is mixed with the material, as in the cupola and blast-furnace.

2. Where the fuel is in a separate chamber, as in the reverberatory furnace, etc. Examining the results as to the anthracite coke, we find that the cost is more than twice that of ordinary coke. This high cost would effectually exclude the anthracite coke from competition with bituminous coke for metallurgical purposes. Supposing it to equal anthracite coal in evaporation and convenience, it would not be used for steam purposes, as some of the other processes much more than equal it. Crushed, however, to convenient sizes, I should think it would make a very convenient fuel for domestic purposes, in districts where bituminous coal is now used with great inconvenience as regards smoke.

Artificial fuel proper, as made by Mr. Loiseau, would be handled very much as a soft anthracite coal. When new, it would bear the burden of a small blast-furnace, but has not been made in large enough sizes to be profitably so used. For steam purposes, the results are shown to be about equal to coal. It would seem, however, to be especially adapted to domestic uses. It ignites somewhat more readily than anthracite coal, burns with a hot, clear fire, does not smoke or crumble, and does not require the constant attention that a very soft coal fire does. It would have a large field for this purpose, if once introduced.

The Crampton method and the Whelpley & Storer method are especially adapted to the reverberatory furnace, and have attained their practical success with it, at the armories of Woolwich and Springfield respectively. The Whelpley & Storer process is claimed to have lately attained great economy in steam generation; but I have no personal knowledge as to it.

The direct-burning method, on either the Wootten, Howe, or McClave grate, is only adapted to steam generation, but possesses advantages as to economy and convenience in this respect that should probably exclude competition from the other types. The economy has already been shown. The alterations required are small. The method of firing is very much like the usual one, and could soon be acquired by any fireman. The saving in loss and trouble by the renewing of the grate-bars is something of an item. The general advantages are such that it has been extensively used in Scranton and the surrounding region by the Lackawanna Iron and Coal Company, the Dickson Manufacturing Company, and many other concerns, almost to the exclusion of any thing else.

For domestic purposes, then, the anthracite coke and the Loiseau fuel seem best adapted.

For steam purposes, the direct-burning process is far superior to any thing else as far as known, the Whelpley & Storer people not being able to prove the claims as to its steam-raising efficiency.

For reverberatory heating furnaces, the Whelpley & Storer process is shown to have great merits, and should be used for that purpose.

In conclusion, I have only to say that, having shown the importance of the subject and the advantages to be gained by the consumption of culm, I hope I may have done something toward stopping this enormous waste of our coal supply.

[Mr. Lukens has omitted considering the use of anthracite waste in the generation of water-gas, which is probably its most important future use. It has been proposed to make the water-gas at the mines, and pump it through mains to the large cities, New York, Philadelphia, etc.—EDITOR ENGINEERING AND MINING JOURNAL.]

THE HELL GATE IMPROVEMENTS.

By George MoC. Derby, First Lieutenant, Corps of Engineers, United States Army.

After referring to the earlier efforts to remove the Hell Gate obstructions, Lieutenant Derby says:

After these costly failures, the contract system was abandoned, and the work proceeded on General Newton's plans under his own management. He proposed to remove the larger reefs by tunneling under them, and for use on the smaller reefs he designed a large scow, built to withstand collisions, carrying heavy drop-drills working through pipes to avoid the current, and operated by means of flexible connections by engines on the scow. This machine has succeeded in accomplishing its work, though not at figures comparable with the cost of such work under ordinary circumstances.

Work was commenced on this project in July, 1869, and according to the estimate it should have completed in ten years at a cost of \$5,139,120. Sixteen years have now elapsed, and there is still three years' work to be done, all progress having been repeatedly cut short by the failure of appropriations, and the funds having at no time been furnished by Congress with sufficient liberality to admit of the work being prosecuted regularly, rapidly, and economically. The cost of the work has been largely increased by this policy; but thanks to the improvements in machinery and explosives, and to rigid economy in expenditures, the original estimate is not likely to be exceeded.

The methods pursued by General Newton at Flood Rock were substantially those that he had tested with such success, though on a comparatively small scale, at Hallett's Point. Two shafts were sunk on the ridge of the reef, and from them two sets of parallel galleries were run at right angles to each other, undermining the whole nine acres of reef and leaving it standing on pillars about fifteen feet square and about twenty-five feet apart from center to center. The roof in the cross-galleries was then blasted down, leaving it as thin as the character of the rock and the location under the river-bed would permit, as shown in section. The cross-galleries were run at right angles to the stratification, so as to reduce the amount of timbering to a minimum; accidents from falling rock being inadmissible on account of uncertainty as to the character of the roof above and the proximity of the river. The average thickness of the roof was 18.8 feet—far more than was desirable; but as the penalty for cutting it too thin was the probable loss of all hands and work worth nearly \$1,000,000, no unnecessary risks were taken. The least thickness was ten feet. Though the soundings on the reef were very close and taken with great care, they would not distinguish between solid rock and loose boulders bedded together and overgrown with shells. On this account, and the danger of breaking into large seams, the galleries had to be carried forward with great caution, only small charges being used and generally only one drill-hole at a time being fired. The effect of this is, that 2.3 pounds of explosive and 11.97 feet of drilling were required per cubic yard excavated; the galleries averaging 10 feet by 10 feet in cross-section. Far cheaper work could have been done had it been considered desirable to fire larger charges and several at the same time. One seam broken into was over ten inches wide and over 100 feet long, with nothing but mud and sand in it to keep the river out. Such seams were always walled up solid with Portland cement as fast as they were opened out. Another seam, from one inch to four inches wide, was found to extend from one side of the reef to the other, a distance of over 400 feet. By tapping it with drill-holes, the stream of water in it was found to be 350 gallons a minute. It being impossible to go around it or under it, it was decided to cut through it. As it was large enough to carry thousands of gallons, means had to be taken for protecting the completed part of the work in the event of the water coming in with a rush when the blasts were fired, breaking into the seam. This was accomplished by building across the gallery where the experiment was to be tried a heavy door capable of standing the pressure of the river, and of being closed by a long line leading to higher ground. After crossing this seam, a succession of others was encountered that gave constant trouble until the whole work was finished.

The precautions necessary and the delays to all hands caused by so much water combine to make this class of work far more costly than ordinary tunneling; but one of the fruits of the precautions is found in the fact that at Flood Rock 21,669 feet of tunnels were driven, 80,232 cubic yards of rock excavated, and about 480,000 pounds of high explosives consumed, with the loss of only one man.

After the completion of the galleries, the roof and the pillars to a depth of thirty-three feet, mean low water, were drilled with holes enough to contain 0.79 of a pound of No. 1 dynamite for every cubic yard of rock and every 7000 pounds of water overhead, amounting to 1.04 pounds per cubic yard of rock broken. The holes slanted upward at angles of 60 degrees and 45 degrees; the former, along the center of the gallery, were eight feet deep; the latter, ten feet, to reach as far over the pillars as possible. These lengths were often reduced by the drill cutting into seams open to the river. The holes were of such a diameter as to receive a rigid 2½-inch cartridge throughout their entire length; 113,102 feet of such holes were required, and, owing to their unusual size and their upward inclination, they were only drilled efficiently after radical improvements were made in the best rock-drills in use elsewhere. The average charge per hole was 22.5 pounds, which permitted a reduction in the amount of drilling required from 0.93 of a foot per cubic yard broken at Hallett's Point to 0.42 of a foot. Drill-holes of such large caliber are not generally used in this country; probably because the rock-drills in use are not adapted to drilling them. Most remarkable results were, however, obtained at the Arlberg Tunnel with holes of this diameter.

By taking advantage of progress made in mining machinery and explosives, and making the improvements in methods outlined above, General Newton had been able to reduce the cost of preparing the mine for the reception of the final charge from \$7.92 to \$2.69 per cubic yard to be broken, as compared with his work at Hallett's Point. To secure an equally satisfactory result on the cost of the blast itself, an elaborate set of experiments was planned and carried out in the early spring, to obtain more simple methods for firing the mine and to extend the list of available explosives, which was then practically limited to dynamite or other nitro-glycerine compounds.

These experiments resulted in proving beyond question that all the electrical connections between the drill-holes and the battery could be entirely dispensed with, as the explosion of a ten-pound charge of dynamite would fire with absolute certainty under water another charge of dynamite packed in a thin elastic envelope at a distance of twenty-seven feet. They also proved the efficacy of means previously discovered at Flood Rock, of firing long, narrow charges of rackarock, an explosive so inert (but consequently so safe to handle) that a pistol-bullet may be forced into it at short range with impunity.

This explosive was afterward adopted for the great blast, its strength under water being somewhat greater than that of No. 1 dynamite, its cost but little more than half, and it having the very great advantage that any quantity could be kept in store without danger to New York City, as it need only be made explosive just before being taken into the mine.

The total cost of the final blast at Hallett's Point was \$81,092.24; at Flood Rock, it was only \$106,509.93, though the blast was 5.6 times as large.

The explosive, rackarock, consisting of 79 parts of finely ground chlorate of potash and 21 parts of dinitrobenzole, was mixed in small batches in a leaden trough and packed at once into cartridge-cases 2½ inches in diameter and 24 inches long, made of copper 0.005 of an inch thick. In each cartridge was inserted a small exploder containing 30 grains of fulminate reinforced by one ounce of dynamite. The dynamite was not essential, and was only used on account of the hesitancy of the manufacturers to produce a larger primer of fulminate of mercury, this latter doing all the work of maintaining and transmitting the detonation.

The cartridge being loaded, its lid was securely soldered on by a method devised at Flood Rock, using an alloy melting at 160 degrees Fahr., and a soldering-iron heated by blowing through it a jet of wet steam; 42,528 cartridges were thus soldered without accident.

All the loading in the mine was done by a gang of twenty picked men, who worked from eight to twelve hours a day, from July 30th to October 9th, putting the cartridges into the drill-holes. They showed no timidity, and did not become reckless; their caution and steadiness were most commendable, as the accidental explosion of a single cartridge would certainly have resulted in the drowning of all who were not blown up. They only dropped one cartridge, which is very much to their credit, as the galleries varied in height from four to thirty-three feet, upward of 9000 feet requiring scaffolding to reach the holes. The scaffolds used were made in sections that could be bolted together and built to any height; they were mounted on the mine cars, and moved along on a portable track.

Every dynamite cartridge contained a thirty-grain fulminate exploder, experiment having shown the value of such an exploder in preventing an explosion of the second order.

The copper cartridges were only 0.005 of an inch thick, tinned on the inside. They had been tested by submersion in the river for three months, and by standing for a like period loaded with rackarock in a warm room. Nevertheless, a considerable number of cartridges in the mine showed signs of corrosion some weeks before the blast. Fortunately, where this occurred, the odor of the rackarock and other indications made it known at once. The cause was soon found to be sulphur in the water running in certain drill-holes, which in a few cases was so strong as to completely destroy the copper in a couple of weeks.

The number of pounds of rackarock put in drill-holes was 240,399; of dynamite, 42,331; total, 282,730 pounds. There were 11,789 drill-holes in the roof, and 772 in the pillars. The total amount of rock to be broken by the final blast was 270,717 cubic yards, covering an area of about nine acres.

The primary charges, whose office was to fire those in the drill-holes, were placed along the galleries at intervals of 25 feet. They consisted of two 24 by 2½-inch thin copper cartridges filled with No. 1 dynamite, solidly packed, lashed upon a horizontal timber at a height above the floor varying from 3 to 12 feet, according to the height of the gallery. On top of these, was lashed a rigid brass shell, 8 by 2 inches, containing about one half-pound of dynamite put in loose, and a platinum fuse connected by wires with the battery on the surface at the head of the shaft. In the first case, the dynamite was packed tight, so that it should explode by sympathy in the event of its own fuse failing; and in the second, put in loose, so as not to be affected by water should the brass shell be imperfectly corked.

As far as practicable, in all cases, adjacent charges were put on different circuits, so that if any circuit failed from any fault in the connections, its charges would still explode, both of the adjoining charges being within sympathetic range and on two different circuits.

There were 591 of these primary charges arranged in 21 circuits of 25 each and three circuits of 22 each, all coming together at the poles of the battery. Some of these circuits were nearly a mile long.

The fuses made especially for Flood Rock had a resistance of 1.73 ohms cold, and 2.76 ohms at explosion. They only required 0.205 ampères to fire a single fuse, or 0.615 ampères to fire a series. A factor of safety of two was used, and double this current was sent through every fuse at the final blast.

The battery was a most excellent one. Each cell had an electro-motive force of 1.95 volts and an internal resistance of only 0.01 ohm. The plates were six inches by nine inches—four carbon and three zinc in each cell, separated by only one quarter of an inch. The ordinary bichromate solution was used.

There were sixty cells, all coupled in one series, two large mercury cups constituting the poles. The twenty-four lead wires were dipped into one of these cups, and the twenty-four return wires terminated in a third.

Between this third cup and the remaining pole of the battery stood the circuit-closer. It consisted of a stout iron cup containing mercury, in which sat a thin glass tumbler, also partially filled with mercury. Two large strips of copper connected the mercury in the iron cup with one pole of the battery and that in the glass with the cup containing the return wires. It is evident that, to close the circuit through the fuses, it would only be necessary to break the tumbler so as to let the mercury in it mix with that in the iron cup. To do this at the proper moment, a ½-inch iron rod four feet long, terminating at the top in a small round

disk, stood with its point in the bottom of the glass. It was long enough to pass through the roof of the battery-house. An ordinary 30-grain platinum fuse connected with a small battery at Astoria was laid on the disk and stuck on with a lump of wax. It had been previously determined by experiment that the blow struck by this fuse on exploding and transmitted by the iron rod was so sharp as to reduce the tumbler to dust without splashing the mercury so as to risk closing the circuit imperfectly.

This disk being a foot or more above the roof, there was no danger of the explosion of the fuse cracking the battery-jars or doing other damage to the connections inside the battery-house.

The mine was flooded by two siphons, one twelve inches and the other sixteen inches. They were started at noon October 9th, and the mine was full at half-past three A.M., October 10th. . . . When the water subsided, the surface of the river was covered with a thin mist of reddish fumes. It has been suggested that these fumes indicated an explosion of the second order. The writer has, however, often observed them on a small scale when firing either dynamite or rackarock under water, when there was no reason whatever for suspecting anything but a complete detonation. If they are not properly one of the products of the reaction in an explosion of the first order ordinarily, it is probable that they are caused by the action of some of these products at a high temperature on the finely divided water.

A diver was put down on the reef as soon after the explosion as possible. Wherever examined, it was found scattered and cracked; the surface-blocks very large, but in good shape to be dredged with a reasonable amount of surface-blasting. More could not have been expected.

Proposals were advertised for at once, and a contract let October 21st

thus removed daily, at an expense to the government of a little less than the amount paid the contractor.

The contractor has two large grapples at work, and is averaging about 120 tons a day.

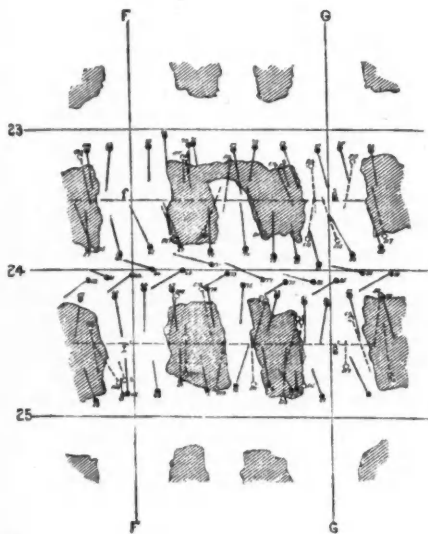
In all, about 2700 tons have been removed up to date (November 28th).

THE NEW BLAST-FURNACES AND STEEL PLANT OF THE TROY STEEL AND IRON COMPANY.

The Troy Times gives an interesting account of these works, gained in a recent visit to them under the guidance of Captain Robert W. Hunt, the distinguished metallurgist, Superintendent of the Troy Steel and Iron Company. From this report, we glean the following particulars:

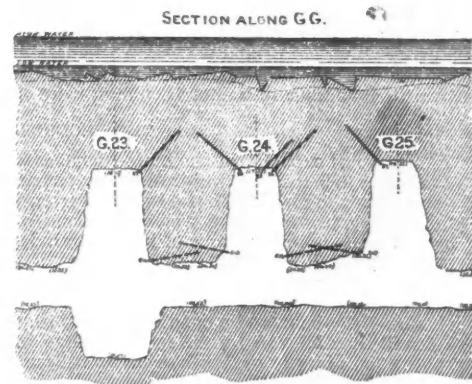
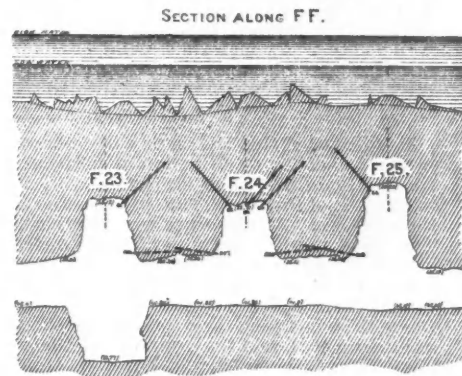
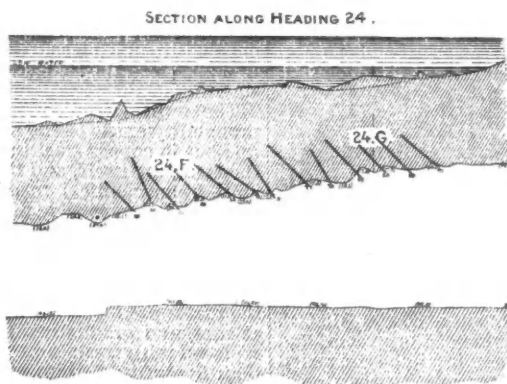
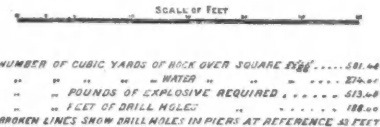
The company is building three magnificent blast-furnaces on a property of about 100 acres on Breaker Island, opposite the steel-works in South Troy. These furnaces are 80 feet high, 18 feet bosh, and each will be connected with four Whitwell hot-blast stoves; each 60 feet high and 20 feet diameter. The draught-stacks for the stoves and boilers will be 200 feet high and twelve feet six inches in clear diameter. There will be seven blowing-engines, with steam-cylinders of forty-two inches diameter, blowing-cylinders of eighty-four inches diameter, and eighty four inches stroke. Each engine will discharge at the ordinary working speed 12,000 cubic feet of air a minute, at a pressure of from ten to fifteen pounds.

The engines will be built by the Dickson Manufacturing Company, of Scranton, Pa. Steam for the engines will be supplied by sixteen Heine patent safety boilers of 2400 horse-power capacity. These boilers are of



PLAN

SKETCH
SHOWING DISTRIBUTION OF
DRILL HOLES AND EXPLOSIVES IN THE MINE



for the removal of 30,000 tons, at \$3.19 per ton, the contractor to do his own surface-blasting. The first contracts on Hallett's Point were let at \$2.40 and \$2.29, but the government agreed to break up the large blocks. When the third contract was let, on the same terms as to surface-blasting as the Flood Rock contract, the price was \$3.39. It is considered therefore that \$3.19 for Flood Rock is, on the whole, a very satisfactory price for the first contract, as the removal of the top layer is by far the most difficult part of the work.

As before stated, the cost of running tunnels under a river-bed, keeping as close to the water as possible, can not be compared with that of tunneling under ordinary circumstances, particularly when the engineer is required by law to pay the same wages for eight hours' work as a contractor would pay for ten, and the same munificent government supplies the funds at such a rate that only two years in ten can he work his whole plant, and three of the remaining years must stop altogether, while such items as pumping, superintendence, and care of plant run on, work or no work.

Comparing the results at Flood Rock with those at Hallett's Point, however, where the circumstances were much the same, we find the cost of mining a cubic yard of rock has been reduced 34 1/2 per cent; showing at least as much improvement in such work during the last decade as has occurred in tunneling generally.

The total cost of the work so far done on Flood Rock amounts to \$2.99 per cubic yard of the total amount of rock broken, \$5.66 less than the cost of breaking Hallett's Point. A considerable portion of this gain will, however, be expended on the proportionately larger amount of dredging to be done. The net result, however, will show an improvement of not less than thirty per cent, and probably more.

Pending the awarding of the contract for dredging, a large scow belonging to the government was set to work removing the broken stone as soon after the explosion as possible. The big blocks are slung with chains by divers, and hoisted out. From fifteen to thirty tons of rock are

recent invention, and are believed to represent the highest effectiveness and economy of service. It is designed that not more than six of the engines shall be in operation simultaneously, the seventh being held in reserve against any contingency that may arise.

Connected with each furnace will be a casting-house 150 feet long, built of brick, with an iron roof of fifty feet span. The engine-house, which will stand north of the furnaces, will be of brick, 150 feet long by 40 feet wide, and roofed with slate. The boiler-house, adjoining the engine-house, will be 153 feet long by 45 feet wide, of brick, with iron roof.

To supply water for the plant, there will be three steam-pumps, any two of which will have ample capacity to meet the requirements in this direction, and the same statement will apply to three pumps provided for feeding the boilers. The water-supply pumps will deliver into an iron water-tank standing upon cast-iron columns of thirty feet high, thus giving a head never less than thirty feet.

There will also be a stock-house, 300 feet long by 100 feet wide, constructed of iron, through which an elevated track will run over pockets into which the material will be dumped from the cars. A substantial dock will be constructed along the river front, 500 feet of which is already under way.

THE FOUNDATIONS.

The work thus far accomplished at Breaker Island, while very great in itself, has been merely preliminary. It consists mainly of building the foundations for the substantial superstructures yet to arise and for the massive furnaces and their appurtenances necessary for the equipment of the plant. In constructing these foundations, which has been done by the company itself, excavations were made to a bed of gravel overlying slate-rock. This deposit was found at an average depth of fifteen feet below the surface of the island. The excavations were cribbed with timber and filled with concrete to the surface level. The general level of the plant will be thirteen feet above the surface of the

ground; hence the foundations have been carried to that height. In order to insure the necessary solidity, a superficial wall of stone about eighteen inches thick was built up to the required level, and the inclosed space will be filled in with concrete. The hearth level of the furnaces proper will be six feet above the general level. The total quantity of concrete used amounts to about 15,000 cubic yards, the largest single mass of which forms the foundations for the Whitwell hot-blast stoves and their draught-stack, the former being thirty-two feet square and the latter 333 feet long, twenty-seven feet wide, and thirty-three feet high. Through the center of this mass and connecting with the draught-stack is a flue, lined with fire-brick, 310 feet long, eight feet wide, and ten feet six inches high.

The cement used in making this concrete was manufactured by the New York & Rosendale and the Norton cement companies of Ulster County, and the Rose & Ramsey cement companies of Howe's Cave, New York. All the cement used has been carefully tested by the Fairbanks cement-testing scales, the result showing highly satisfactory tensile strength. Much of the sand found in excavating and additional sand and gravel dredged from the river-bed have been found available and convenient for the same purpose, while the broken stone needed has come from other localities. The total number of yards of foundation is about 22,000. The entire plant, including railroad tracks, cars, and locomotives, docks and ferry-boats, etc., will cost \$750,000. The contract requires the three furnaces to be completed by the first of October, November, and December, 1886, respectively. James Ostrander & Son, of Troy, furnish the fire-brick used at the furnaces.

RAILROAD CONVENIENCES.

The company is building the furnaces expecting to use the ores mined by the Chateaugay Iron and Ore Company in Clinton County and by the Hudson Iron and Ore Company in Columbia County. All the ores, as well as other raw materials, will be delivered into the stock-house of the blast-furnaces by the Delaware & Hudson Canal Company over a branch track now building.

A MODEL ESTABLISHMENT.

It is expected that the plant will embrace all the improvements known in the art of iron production up to the present time, and that it will be the best and finest of its size in the world. It was designed by James P. Witherow, of Pittsburg, Pa., who has the contract for the construction of the furnaces. All the other work has been done by the engineers of the Troy Steel and Iron Company, S. Norton being in charge of the excavation and the building of the foundations; David H. Thomas, who will direct operations at the furnaces upon their completion, assisting him. Mr. Thomas comes of an ancestry noted among iron men, being a grandson of David Thomas, the first person to successfully make pig-iron with anthracite coal, and the founder of the now celebrated Thomas Iron Company of Hokendauqua, Pa. The Hon. Thomas Dickson had immediate charge of the teams and laborers.

The entire work has been under the supervision of Captain Hunt, the general superintendent of the company, a gentleman whose knowledge of every thing connected with iron and steel making seems all-embracing.

Ground was broken on the first day of September last, from which time until November 16th about 300 men were employed.

THE PRODUCT.

The total capacity of the blast-furnaces will be large. Each is expected to make 150 tons of pig-iron every twenty-four hours, or 3150 tons a week for the plant. To produce this iron, will require about 900 tons of ore a day, or 6300 tons a week; 550 tons of fuel a day, or 3850 tons a week; and about 200 tons of limestone a day, or 1400 tons a week. Thus, the works will consume daily 1650 tons of raw material, or 11,550 tons a week. A force of about 300 men will be ordinarily employed. The pig-iron produced will be taken across the river in narrow-gauge cars on a steam ferry-boat, to be constructed for that purpose at a cost of \$15,000. It will then be transferred to the tracks on this side of the stream, and conveyed directly to the Bessemer steel-works, where it will be converted into steel. The product is expected to be of better quality than most pig-iron used for making Bessemer steel, and as good as any now produced in the United States for that purpose.

It is believed by the gentlemen engaged in this vast enterprise that, owing to the favorable situation of the new furnaces as to ore, the advantages claimed by other localities in low-priced coal and cheap transportation will be overcome.

In addition to the large investment made in the plant, the company is actively engaged in altering and improving the Bessemer steel-works and other mills. In the converting department of the steel-works, very radical changes are to be made, which, when completed, will place them in the very first rank, both as to quantity and facility of production. These expenditures will amount to over \$100,000. When running at full capacity, the company's works will furnish work for about 3000 men, and the monthly pay-roll will be close to \$100,000.

November Work of the South Chicago Furnaces.

WEEK ENDED	No. 5.		No. 6.		No. 7.		Total.	
	Iron.	Coke.	Iron.	Coke.	Iron.	Coke.	Iron.	Coke.
November 7	1290	2040	1381	2004	1407	1984	4078	1988
" 14	1339	1952	1530	1952	1450	1903	4319	1936
" 21	1427	1958	1444	1964	1569	1836	4440	1921
" 28	1382	1871	1414	1942	1382	1840	4178	1884
Last two days	358	.....	357	.....	434	.....	1149	.....
Totals	5796	1954	6126	1966	6242	1877	18164	1932

These furnaces still improve their work in an astonishing manner, as shown in this record.—[EDITOR ENGINEERING AND MINING JOURNAL.

MODERN AMERICAN METHODS OF COPPER SMELTING.*

By Edward D. Peters, Jr., M.E., M.D.

CHAPTER X.

BLAST-FURNACES CONSTRUCTED OF BRICK.

The extreme length of time that a large furnace may stand in this way without injury is unknown to the author. Much depends on the fusibility of the charge, the character of the fuel, the more or less perfect exclusion of all air, and probably also upon the quality and amount of sulphide compounds present, whose gradual oxidation may sustain the vitality of the charge for a much greater length of time than if absent. The following instances, from personal experience, show that a considerable delay is permissible.

A furnace running on a fusible charge of calcined pyritic ore was shut down Friday noon, on account of an accident to the engine. Further examination showed the accident to be of such a nature as to cause a delay until the succeeding Wednesday night—5½ days—at the end of which time, a light blast was applied without much hope of a favorable result, although the coke on top of the charge was hot and glowing.

There seemed a good deal of obstruction to the blast at first; but in twenty minutes, a cold, thick slag began to run, which gradually improved, until the furnace resumed its normal condition and capacity in about eight hours. The charge had sunk about two feet in the furnace during this period of repose. The grade of the first tap of matte (the siphon-tap being impracticable in this condition of affairs) was 46 per cent, the ordinary average being from 28 to 29 per cent. The succeeding tapings gradually decreased—going successively 42, 37, and 34 per cent, the normal grade being reached soon after the furnace had regained its usual capacity.

Periods of 4 days, 3½, 3¼, 3, and of less time, appear in the writer's notes, the only serious accident occurring during one of the shorter periods, from the falling out of two of the tuyere-plugs, whereby a current of air entered the furnace for twelve hours before being discovered. The coke was completely burned out of the lower portion of the charge for about two thirds of that part of the shaft nearest the opening; but the furnace was eventually saved by blowing lightly into three tuyeres at the opposite end, which were still supplied with fuel, and little by little smelting out the entire half-fused block of charge. Much benefit was derived by introducing coke into the furnace through such tuyeres as seemed to warrant the trouble. Owing to the great size of the tuyere openings (6 inches) this was easily effected, and the smelting much facilitated. In fact, if any cavity in the semi-fused mass could have been found at any point accessible to the blast, nothing would have been simpler than to break a hole through one of the brick panels and fill the opening with coke. The author has done this in later instances with very satisfactory results, a cavity opposite the tuyeres having been formed by dragging out a lot of the stock, from which the coke had burned so gradually as not to fuse it.

Space is wanting for a description of the use of petroleum, gas, and other concentrated fuels for similar purposes, as the writer's own experience with such measures has been entirely unsatisfactory, nor can he find any record of successful cases in the annals of American copper smelting.

The most Herculean efforts are warrantable when any reasonable probability exists of the saving of an iron furnace from complete chilling up; but in copper smelting, the comparative cheapness and simplicity of the structure itself, and the certainty of being able to remove the worst chill by mechanical means in a comparatively short time render such unusual and expensive measures less important.

The oxidation of the sulphides in the charge during the period of repose is an element of some importance, although seldom so striking as in the case just mentioned. Still, the closing down of the cupola over night is invariably accompanied with a perceptible rise in the grade of the matte produced during a certain period succeeding; being greatest at first, and gradually diminishing as the contents of the furnace are replaced with fresh ore. This increase in richness is at first seldom less than 5 per cent, diminishing rapidly, however, as the ore nearest the bottom of the charge seems to have experienced the most thorough oxidation.

Though apparently a trivial matter, this enrichment of the matte is a direct pecuniary gain, and, according to a rough estimate, will offset the cost of the capital necessary for the double plant several times over in the course of a year.

Another useful and frequently applied remedy for various irregularities in cupola smelting is the so-called "running-down" of the furnace, by which is meant a mere cessation of charging until the column of ore and fuel has sunk to a point far below its normal limits. The shaft is then rapidly filled with the usual alternate charges of ore and fuel, and every thing goes on as before.

Without attempting to explain the reasons therefor, it is certain that this practice is sometimes of great advantage, obstinate irregularities often being conquered thereby, and the normal condition of things resumed. It is especially useful when it is desired to create a sudden and profound lowering of temperature at some point where a serious localized burning is taking place; for the exposure of the naked inclosing walls of the shaft renders it possible to deposit the batch of ore that is used to cool the walls in the exact spot where it is needed; and it is possible to use for this purpose, under such circumstances, an easily fusible ore or slag, instead of the highly siliceous material that is usually selected when this process of cooling down is undertaken blindly from above.

Wall accretions may also be reached and removed in this manner, the charge being allowed to settle until they are exposed, whereupon they may be reached by a long bent steel bar introduced through one of the charging-doors, the glowing interior being cooled down, if necessary, by sprinkling with water.

Still another means of remedying the cutting-down of the furnace bottom has been mentioned in a former section, but is sometimes useful in connection with the large brick furnace. This is, the introduction of ore or sand through the tuyere openings, which, being both cold and the

latter infusible, will not combine with the slag, as it is already below the smelting zone; but will simply remain in place and assist in building up a new bottom. By this means, even the molten masses present may be partially solidified and a great advantage gained in a short time. The author has occasionally tried the introduction of water in the same manner and for the same purpose, taking as a guide the very decided local chilling produced by a leaky water-jacket; but the results, though locally satisfactory, are not sufficiently extended, while the operation itself, especially in connection with a low-grade copper matte, can not be recommended to any who object to certain and frequent explosions of considerable force.

In connection with the measures already detailed for keeping the furnace in proper condition, may be mentioned the external repairs that it is feasible to execute while the furnace is still in blast. Not all smelters are aware of the very extensive repairs that may be carried out without stopping the blast more than a few hours; the length of the campaign often being doubled by the construction of a new panel, the repairing of a pillar, and other familiar and inexpensive operations. These are of too extensive and varied a nature to be enumerated in detail; but a few of the teachings of experience will throw some light on the practice in general.

The replacement of one or more panels that have become so thin as to threaten a constant breaking through of the charge is a simple though very hot and laborious task.

All needful material for the renewal being prepared and collected on the spot, the blast is shut off, the fore-hearth tapped, and the condemned brick-work at once broken in with sledge and bar. So much of the glowing charge as is necessary is at once dragged out of the opening with long hoes and rakes, and sprinkled with water so that the men can stand on it to work.

When the bricks have been removed to the extent deemed necessary, the cavity left in the column of stock is quickly filled with dampened coke, a few wooden slats being wedged across the opening, to keep the fuel from falling out.

The most important measure is to obtain a solid foundation for the new wall, and to accomplish this, all accretions of slag and metal of which the old wall largely consisted, must be chiseled away until sound brick-work is reached, which, being leveled with thick fire-clay, offers a proper starting-point. The work must proceed with great rapidity, as the passage of air through the opening will soon consume the fuel in the charge. Little attention is paid to neatness or even regularity so long as strength and tightness are obtained. If the work promises to occupy more than two or three hours, the opening should be closed at the beginning by a thin plate of sheet-iron tightly cemented at the edges with clay, outside of which the new wall is raised. When all is completed, the sheet-iron—unless already consumed—is cut away opposite the tuyere openings, and the blast is put on at once, there being no necessity of waiting for the work to dry, as the heat from the furnace will evaporate all moisture quite as soon as is desirable.

By this means, extensive repairs may be executed on any portion of the furnace, it being even possible to put in a new bottom or repair the foundation walls, by suspending the charge on bars driven transversely through the furnace. When possible, the ashes of the rapidly consumed fuel should be cleared out before starting again; but there are but few instances where it will not be found better to blow out the furnace when such radical repairs are required.

The water-jacket furnace may also be allowed to stand idle much longer than is usually supposed, as the absence of air prevents the combustion of the fuel; but the rapid conduction of heat through its cold metallic walls prevents any such liberties as may be taken with the brick furnace, and renders it unsafe to leave the furnace more than twelve hours.

In fact, it is better to run the charge down to the very bottom, throw in a few baskets of coke, and, after stopping all the air-holes, leave the jacket in this condition, by which all danger of chilling is avoided, and the bottom being kept hot, smelting may be resumed in a very short time.

The final blowing out of the large furnace presents no peculiar features. The blast should be lessened as the charge sinks, and as soon as slag stops running, the breast-wall, and, if expensive repairs are imminent, some of the rear and end panels, should be knocked in, and all stock and fuel dragged out, until a tolerably even bottom is reached, which needs no preparation for the succeeding campaign.

Any burning out of the brick pillars that form the main support of this furnace should be carefully watched and repaired before it has proceeded to a dangerous extent. This burning is sometimes so obstinate that when it is important not to stop the furnace or blow out, it is necessary to support the superincumbent brick-work with props and braces, which should remain in place until the pillars have been restored to their former strength.

The cost of building and running a furnace of this type is given in the following pages, and may be studied in connection with the accompanying cuts.

Further details regarding blast-furnace smelting will be found in a succeeding chapter, which is devoted to the general consideration of the subject, the foregoing section pertaining principally to the Orford type of cupola.

(TO BE CONTINUED.)

The Invention of the Incandescent Lamp.—This is now claimed for Belgium. In 1838, Jobard, of Brussels, proposed as a source of light a small carbon in an exhausted receiver, and rendered luminous by means of an electric current. De Chanzy, in 1844, repeated these experiments, and patented the divisibility of the electric light. About the same time, Starr, of Cincinnati, constructed a lamp with a platinum wire, which King afterward replaced by a filament of carbon. Staité employed iridium in 1848; and in 1859, Du Moncel indicated the different tissues that, when carbonized, gave the best effects of incandescence. Finally, M. Sonzée, on November 5th, 1879, obtained a patent in which it is claimed are given all the essential conditions for the glow lamp as now known, as to the kind of carbon employed, the form and section of conductor, the means for its preservation, and the nature of the receiver or globe.

Mining Lectures Inaugurated by the New Zealand Government.—The New Zealand government recently sent Prof. James G. Blacke, of the Otago University, on a mission to lecture on mining subjects throughout the mining districts. His lectures were well attended wherever he went, and it is said will prove of great benefit to the mining community by instructing miners in some important though generally neglected branches of their education.

Dynamite at Flood Rock.—There were used 48,331 pounds of dynamite in the great Flood Rock blast; 6000 pounds in the primary charges, which exploded by concussion; and 42,331 pounds placed in the 12,561 holes, to explode the rack-rock, as described in the *ENGINEERING AND MINING JOURNAL*, October 24th. This dynamite was all supplied by the Hancock Chemical Company, whose works, at Hancock, Michigan, make the dynamite used at most of the copper mines, and which has aided in bringing about the wonderfully rapid and economical work done in that region. Mr. R. W. Warren, the President of the Hancock Chemical Company, who is one of the most experienced and successful manufacturers of high explosives in this country, also supplied the Vulcan powder used in most of the excavations at Hallett's Point, and about 12,000 pounds was used in the final explosion there.

Saponification by Electricity.—In 1882, Professor Rotondi presented to the Academy of Sciences in Turin a communication in which he recommended for commercial purposes the use of electricity for the decomposition of concentrated salt solution into caustic soda and chlorine gas. The experiments were confirmed by MM. Raudin and Bidet, and recently Professor Rotondi has renewed and completed his researches, which appear to be of eminently practical importance. With a dynamo machine and diaphragms, the saponification process is easily effected by means of sodium chloride (ordinary salt) and fat. The separation of the resultant products, glycerine, soap, and chlorine gas, offers no difficulty. No caustic soda or potash is thus required for saponification, and the process would be particularly applicable in cases where the chlorine could be at once used for bleaching textile fiber, and where sufficient water-power is at disposal. In such works, bleaching and saponification operations might be carried on at night while the motive power is not otherwise required. Professor Rotondi is further engaged in very interesting experiments on the extraction of metals directly from the ores by means of electricity.

The New Croton Aqueduct.—Mr. W. S. Church, Engineer of the aqueduct, in a paper read before the Engineers' Club of Philadelphia, says: "The 'ground' through which the tunnel is advancing is largely gneiss, with considerable limestone, feldspar, and occasional quartz seams. The dips are so vertical that much roof rock comes away. This trouble is increased by the too free use of high explosives near the perimeter of the vertical section, so that the area excavated runs from 25 to 50 per cent in excess."

"A most careful system of measuring and recording just what is excavated is carried out. A vertical dial, which the boys call 'the Sun-flower,' is set up every 10 feet, and oftener if necessary, and radial measurements taken to all the inequalities of the section; these measures are plotted on the diagrams, and the areas estimated with the planimeter."

"The principal difficulty that the line has yet encountered is the Gould Swamp. It has finally been decided to under-run this in solid rock with a siphon, making a blow-off below grade and draining by an adit out into the Hudson River."

"In Vol. V., No. 1, page 13, in a discussion of Mr. A. Harvey Tyson's paper on Pollution in Storage Reservoirs, I notice that Mr. Charles G. Darrach says: 'I would call attention to the fact that, in the proposed Quaker Bridge Dam for the New Croton Aqueduct, no provision seems to have been made, as far as can be learned from published plans, for draining off the water for the lower levels. As this dam will be of almost unprecedented depth, the same trouble may be expected as in Baltimore and Reading, unless this precaution is taken.' The Club will observe from the drawing sent, that this criticism is fully met, and that the big reservoir of the Croton will, when constructed according to present designs, have the best circulation of any reservoir in the world."

PATENTS GRANTED BY THE UNITED STATES PATENT-OFFICE.

The following is a list of the patents relating to mining, metallurgy, and kindred subjects, issued by the United States Patent-Office.

GRANTED NOVEMBER 24TH, 1885.

- 330,895. Fluid-Metal Press. William R. Hinsdale, Brooklyn, New York, Assignor to the Compressed Steel Company, Cleveland, Ohio.
- 330,901. Macblue for Forging Bolt-Blanks. Henry J. Johnson, Providence, R. I., Assignor to Plumb, Burdick & Barnard, Buffalo, New York.
- 330,915. Metallic Ceiling. Albert Northrop, Pittsburg, Pa.
- 330,916. Metallic Ceiling. Albert Northrop, Pittsburg, Pa.
- 330,917. Metallic Ceiling. Albert Northrop, Pittsburg, Pa.
- 330,932. Device for Mixing Natural Gas and Cold Air. John H. Sheffer, Pittsburg, Pa.
- 330,953. Brick-Machine. Abel B. Woodward, Nashville, Tenn.
- 330,961. Metallurgical Apparatus. Joshua E. Clayton and Simon F. Mackie, Salt Lake City, Utah.
- 330,973. Means for Pumping Oil- Wells. Henry Forbes, Franklin, Pa.
- 330,981. Rock-Drill. Sylvanus Hussey, Buffalo, New York.
- 330,997. Rolls for Rolling Girder-Rails. Arthur J. Moxham, Johnstown, Pa.
- 330,998. Rolls for Rolling Car-Rails. Arthur J. Moxham, Johnstown, Pa.
- 331,000. Gas-Regulator. Alonzo F. Olds, New York City, Assignor to the Equity Gas Saving Company, same place.
- 331,017. Ore-Crushing machine. William E. Wild, San Francisco, Cal., Assignor of one half to George E. Ames, same place.
- 331,024. Relief-Valve for Gas-Generators. William T. Bate, Conshohocken, Pa.
- 331,051. Gate for Turbine-Wheels. Emilie C. Geyelin, Philadelphia, Pa.
- 331,056. Metal Packing. Nathan Hemenway, Parma, Ohio.
- 331,059. Manufacture of Beta-Naphthol Sulphuric Acid. Meinhard Hoffmann, Mainkur, near Frankfurt-on-the-Main, Assignor to Leopold Cassella & Co., Frankfurt-on-the-Main, Germany.
- 331,071. Ore-Concentrating Jigger. John S. Loder, Leadville, Colo.
- 331,080. Method of Operating Gas-Engines. Lewis H. Nash, Brooklyn, Assignor to the National Meter Company, New York City.
- 331,119. Apparatus for Detecting the Presence of Gas. George H. Eaton, North Middleborough, Mass.
- 331,161. Petroleum Heating Apparatus. Robert Schulz, Dresden, Saxony, Germany.
- 331,197. Apparatus for Firing Furnaces. Charles Holland, Jr., Boston, Mass., Assignor to Frederick L. Houghton, Trustee, same place.
- 331,249. Process of Making Zinc-Sulphide Pigment. Thomas Macfarlane, Montreal, Quebec, Can.
- 331,267. Apparatus for the Manufacture of Iron and Steel. Thomas Williamson, Wishaw, County of Lanark, Scotland.

FURNACE, MILL, AND FACTORY.

The Union Drop Forge Company has been incorporated at Chicago, Ill., to manufacture and sell iron and steel forgings; capital stock, \$20,000; incorporators, Henry J. Russell, Edgar F. Russell, and Rufus C. Hall.

Until December 12th, proposals will be received at the Treasury Department, Office Supervising Architect, Washington, D. C., for furnishing and putting in place, complete, the iron columns, beams, etc., required for the Post-Office, etc., building at Council Bluffs, Iowa.

The Agawam Nail-Works, owned by the Central Manufacturing Company, at Wareham, Mass., were destroyed by an incendiary fire on the 30th ult. The loss is estimated at \$20,000; uninsured.

The Virginia Iron and Steel Company's plant and works at Buffalo Gap, Virginia, has changed hands and passed into the possession of New York and Philadelphia parties, who will put them in full blast at once.

At the office of Building for State, War, and Navy Departments, Washington, D. C., proposals will be received until December 17th for furnishing and delivering complete the materials, fittings, etc., required for the construction of the heating and steam apparatus as follows: Class 1. Boilers, tanks, safety-pans, smoke-stacks, etc. Class 2. Cast-iron flange-pipe, coils, dampers, etc. Class 3. Pipe fittings, valves, wrought-iron coils, registers, etc. Class 4. Wrought-iron pipe.

The large furnace of the Leesport Iron Company, at Leesport, Pa., which has been idle for the past ten months, resumed on the 30th ult.

Proposals will be received by William K. Park, Chief-Engineer of the Philadelphia, Pa., Gas-Works, until December 10th for the purchase and removal of all the ammoniacal liquor produced at all the works of the Trust during the period of five years, beginning January 1st, 1886, and ending December 31st, 1890. The contractor to furnish and erect at his own expense all the apparatus and machinery (also labor and fuel) necessary for the proper scrubbing of the gas, collection and removal of the liquor.

Mr. Frederick C. Prime, of Philadelphia, has been appointed receiver of the Everett Iron Company. The property is one of the most extensive in Pennsylvania, including valuable ore franchises in Bedford County and in Maryland, as well as collieries in the Broad Top region. Its plant consists of a furnace said to be one of the largest in the State, equipped with all modern appliances, together with an extensive coke plant at Kearney. The whole was completed about a year ago, and operations then began. It is thought that the unfavorable state of the iron trade, coupled with certain defects of construction, have brought the company into its present embarrassment, which, it is expected, will be but temporary. The assets are nearly \$1,000,000, and the liabilities less than \$200,000.

The Parker-Russell Mining and Manufacturing Company, of St. Louis, Mo., has so extended its trade in its "sunlight" carbons that it now reaches nearly 100,000 carbons a week.

The nail plate mill and factory of the Calumet Iron and Steel Company, at Cummings, Ill., resumed operations on the 1st inst. The nail factory is the largest in the West, running 128 machines.

According to our Pittsburg exchanges, all the stockholders of the Westinghouse Machine Company save one or two have signed the agreement to surrender 50 per cent of their stock rather than stand an assessment of 50 per cent in cash on their holdings, as proposed, under the act of 1874. Mr. George H. Westinghouse, it is further stated, will take the stock thus surrendered, at par and pay for it in cash, thus relieving the company from its present burdens and putting it on a solvent basis. Mr. Westinghouse will also turn over to the Machine Company all the work required for the Stanley Electric Light Company, assuring a large increase in profitable business and work for many additional skilled men.

The E. & G. Brooke Iron Company, at Birdsboro', Pa., is going to an expense of \$60,000 to improve its plant.

The works of the Pottstown Iron Company, at Pottstown, Pa., are running night and day. The demand for nails far exceeds the capacity of the mill. There are ninety-five machines in operation in the

Pottstown mill, turning out 1700 kegs of nails daily. The new and extensive steel-works of this company, which are in course of erection by Mr. J. P. Withrow, of Pittsburg, Pa., will, it is believed, be ready to put in operation in February next. Preparations are making to put the furnace of the company in blast, it having been idle some time.

The Phoenix Bridge Company, Pittsburg, Pa., has received the contract for the iron and steel work in fitting up warehouses in "Block B" of the New York approach of the Brooklyn Bridge. The bid of this company, \$17,577.45, was the lowest of thirteen.

The cylinder of a 650 horse-power Corliss engine blew out on the 30th ult., at the Worcester Steel-Works, Mass., and George Ryder, the engineer, was thrown through a partition and instantly killed. Another employé was severely cut about the head by flying fragments, and several others were slightly injured.

A number of capitalists, including Mayor Jonathan Scoville, of Buffalo, N. Y., N. C. Scoville and George W. Miller, of the Buffalo Car Manufacturing Company and Buffalo Car-Wheel Works, and one of the water commissioners, will organize a stock company, and on February 1st they will take possession of works that have been leased, and begin the manufacture of cast-iron water-pipe and special castings. It is stated that these works will not belong to the pool organized by the manufacturers of water-mains.

The Lechner Manufacturing Company, of Columbus, Ohio, reports orders for 27 of its Legg undercutting machines, four of which are to go into the Hocking Valley, three into Illinois, and the rest in districts west of the Mississippi. The Legg machines have a capacity to undercut, with proper handling, from 800 to 1000 square feet of floor in ten hours. These machines are used in many new mines of the West, and in the Central, Southern, and Eastern States. The company is also manufacturing the Legg rotary power-drill, which is rapidly taking the place of the common hand-drill wherever power can be applied. The roller chain belting is also a specialty with this company, and the style and quality being superior, it meets with growing favor for use in mines, mills, and establishments where strength and certainty of mechanical motion are required to be transmitted.

The Barnum Wire-Works, at Detroit, Mich., were destroyed by fire on the 3d inst. It is reported that the works are almost a total loss.

Messrs Bonfield & McCabe, of Belleville, Ill., representatives of the co-operative nailers of Belleville, have been in Pittsburg, for the purpose of purchasing machinery for a new co-operative nail mill of 60 machines.

LABOR AND WAGES.

The strike among the miners in the Monongahela Valley, Pa., is said to be nearing an end. Great distress in the families of many of the men is reported.

Several of the twelve coal mines in the Massillon District of Ohio have resumed operations, the men submitting to the operators' terms.

The coal miners of Des Moines, Iowa, and vicinity held a conference on the 1st inst. Several questions relating to the pooling of the interests of the operators and miners were discussed, and resolutions were adopted sustaining the past action of the Committee on Legislation, pledging renewed support thereto, and commending the protection afforded by the Knights of Labor.

The wages of the nailers' helpers, and mill laborers in the Wareham Nail-Works at South Wareham, Mass., have been increased 10 per cent. The wages of nailers in this mill were advanced the same amount three weeks ago.

The trouble at the coal mines at Bevier, Mo., between the white and black miners is over, and quiet has been restored for the present, many of the men returning to work.

TRANSPORTATION NOTES.

The first successful public trial of the electric railroad on Ridge avenue, Philadelphia, was made last week. A car was run over the road several times, making the trip without interruption, and attaining a speed of seven miles an hour. This was accomplished

with a loss of electrical power ranging from three to five per cent.

It is stated that the trains of the Chicago and Great Southern Railroad will be running over the extension into Brazil, Ind., by February 1st. Contracts are letting for 500 coal-cars and twelve engines. It is expected that the new line will do an immense traffic, especially in coal, live stock, and lumber. The ultimate destination of the Great Southern is Charleston, S. C.

A charter has been issued at Harrisburg, Pa., to the Philadelphia, Newton Square & Chester Railroad Company, the line of which will run from Philadelphia to West Chester, and will be thirty miles in length. The capital stock is \$2,500,000. It is intimated that the new road is in the interest of the Baltimore & Ohio Railroad, and is part of the scheme to reach New York by a short route.

The Norfolk & Western Railroad reports its gross earnings for the month of October as \$285,964, the expenses \$142,257, and the net earnings \$143,707, a decrease of \$12,061, as compared with the same month last year. For the ten months to October 31st, the net earnings were \$895,248, a decrease of \$68,362, as compared with the same period of 1884.

COAL TRADE NOTES.

CANADA.

NOVA SCOTIA.

Messrs. Edwin Gilpin, Inspector of Mines, W. B. Moore, and T. Turnbull have made a test of blowing coal with dynamite at the Vale colliery, and think it will work well. It is thought that too much powder is used in the bottom lift of the McBean seam, and that dynamite will be much safer.

COLORADO.

The Marshall Consolidated Coal Mining Company has purchased 3360 acres of land in Boulder County. The property is advantageously located, and extensive preparations for large shipments will be made at once.

ILLINOIS.

Colonel John S. Lord, Secretary of the State Bureau of Labor Statistics, has prepared a supplemental report of the coal-producing interests of Illinois for 1885. There are now employed in the mines in this State 25,446 employes. Capital employed, \$9,898,950; number of mines of all kinds, 786. Forty-six more openings are reported this year than last, although nine mines have been abandoned. The counties now producing coal are 49.

OUTPUT OF COAL IN ILLINOIS.

1884	10,101,005 net tons.
1885	9,791,874 " "
Decrease	309,131 net tons.

This decrease was due to strikes involving 1700 men, and the loss to them was \$213,300.39, or about \$125.48 each.

Secretary Lord gives, as one of the reasons why there has not been an increase in the output of the mines of Illinois, that "there has been a diversion of unusual quantities of coal from Pennsylvania to Western markets, occasioned by the utilization of natural gas as a fuel."

Secretary Lord estimates that the working time of the best class of miners is 225 days. The State average for 655 mines during the year was 191 days, and the average for the total number of mines of all kinds is but 174 days for the year.

"The practice of blasting coal down prevails in this State almost universally, except where the coal is worked by the long-wall system. . . . There are only forty-one long-wall mines in the State. . . . The powder is paid for by the miner, and used at his discretion. It requires one keg of powder—25 pounds—for every 50 tons of coal made, costing \$2.37 a keg. The powder, fuses, oil, and repairs of tools constitute no inconsiderable elements in the expense account of the miner. The use of powder in mining is attended with great danger and discomfort." A table gives 10,683 miners at work in 415 mines, producing 6,736,652 tons of coal, and consuming 134,547 kegs of powder, of 25 pounds each.

There were 39 persons killed during the year, and 176 disabled. Twenty men were killed from fall of roof or rock, 2 from gas, 1 from premature discharge,

7 from falling down shafts, 2 from falling cages, 2 from pit-cars, 1 from boiler explosion, 3 struck by timbers, 1 drowned in swamp.

An interesting feature in this report is the "truck store," as the coal company store is called. The report shows seventy-five of these institutions in this State. Of these, twenty-seven are free from competition or the surveillance of rival dealers, and can fix prices to suit themselves. The implied understanding exists that the miners must patronize these stores, and as a rule this custom is enforced.

PENNSYLVANIA.

ANTHRACITE.

It is reported that the Maltby colliery, near Wyoming, is to be worked again about January 1st.

At Wilkes-Barre, an explosion of gas on the 27th ult. in the Conyngham shaft, operated by the Delaware & Hudson Canal Company, while 175 men and boys were at work, merely knocked down three men by the concussion.

David Potts, a miner, has a novel suit against the proprietors of Tresckow colliery, near Hazleton, for the purpose of compelling them to recover the body of his father-in-law, Evans Owens, a miner, who was drowned in this colliery on August 13th last, the body being still in the mine. Mr. Potts is endeavoring to secure the co-operation of his fellow-workmen throughout the State. Since the year 1869, about eight bodies have been left in the collieries of the Hazleton region, and should Mr. Potts succeed in his suit against the owners of the Tresckow colliery, it would undoubtedly lead to other lawsuits on the part of the friends of those who have been lost in the mines.

The decision of the coroner's jury inculpating the Delaware & Hudson Canal Company in the explosion of gas at their mine in Plymouth has been filed with the commissioners, and suit for the violation of the new mine law will at once be instituted against the company by the district-attorney. Relatives of the deceased miners and laborers will also begin joint suit against the company for damages, making a claim for \$10,000 in each fatal case. The injured men, who have not fully recovered, are also considering the matter of claiming damages.

BITUMINOUS.

Application has been made for a charter to the Berwind-White Coal Mining Company of Philadelphia; capital, \$200,000. Charles F. Berwind is President, and Frederick McOwen, Treasurer. The company will mine bituminous coal in the Clearfield region.

COKE.

The Cambria Iron Company paid \$85,000 for the Mahoning Coke-Works at Dunbar, the sale of which was reported in our issue of last week.

The Loyalhanna Coal and Coke Company, of Latrobe, will do away with mule-power, and haul its coal to the mouth of the pit by cables. The company is placing proper machinery in the mine.

It is stated that J. W. Moore, Dr. David Hostetter, and Ralph Bagaley, all of whom own coal lands in the Pleasant Unity District, will erect a large number of ovens in this district. This will make a formidable rival to the Frick Syndicate. The Texas branch of the Pennsylvania Railroad, which has been partially graded, will probably be built in the spring. This road will be run from Everson to Latrobe, passing directly through the undeveloped coal-fields that are owned by these parties.

SOUTH AMERICA.

CHILI.

The only sources from which fuel can be obtained in all South America are, it is said, the coal mines that lie at the extreme southern limit of the populated district of Chili. Taicahuano is the nearest port of importance; but the towns at the mines are Lota and Coronel. The mines are entered by shafts that are immediately over the water of Lota Bay, so that the coal is drawn on trucks to the mouth of the mines, and dumped into launches and lighters, which are towed out to the anchorage of ships. It is said that it costs \$1.35 a ton to mine and deliver this coal on ship-board, and that the owner, Donna Isadora Cousino, of Santiago who is said to be the Crossus of South America, will not sell at less than \$7.50 a ton, just a shade less than the cost of imported Cardiff coal.

WASHINGTON TERRITORY.

Mr. James T. Jones, of Seattle, a correspondent of

the *Shenandoah Mining Herald*, gives the following information concerning the coal trade:

COAL TONNAGE IN WASHINGTON TERRITORY.

NAME OF MINE.	Shipments for year ended Dec. 31st, 1884.	Shipments for year ended June 30th, 1885.
Carbon Hill.....	125,759	135,926
South Prairie.....	29,469	34,313
Tacoma.....	2,432	5,431
Cedar Mountain.....	1,546	14,573
Black Diamond.....		10,562
Renton.....	32,709	30,397
New Castle.....	188,783	149,048
Total.....	280,698	380,250

The statement gives all of the present active mines excepting Franklin, which is opening.

A new coal mining law was passed, taking effect January, 1884, taxing coal four mills a ton, and compelling coal mining agents to make quarterly sworn statements of the mine product. The second column, and first in part, is from the agents' returns.

The Cedar Mountain and Black Diamond are new mines just opened. Tacoma was reopened in 1884, having been idle eight years—formerly called Wilkeson. The Renton is closed and under water. New Castle is undergoing robbing out with an extension of the slope under way. The Bellingham Bay, Talbot, and Vulcan have been abandoned; the former are under water. The shipments from Bellingham Bay are reported at 233,043 tons, say 250,000 tons for the entire output, including home consumption. The total output from the Talbot is estimated at 30,000 tons. From the available data at hand, Mr. Jones makes the total output in the territory to January 1st, 1885, to be about 2,200,000 tons.

The coal business of the territory is not aglow at present, yet it has more than held its own during the last year; and while some of the principal shippers and miners have lost much of their business through the depression, the others have gained more than was lost.

The foreign coal is the keenest rival, as it comes in ships bound for this coast for wheat and lumber cargoes. It is brought as ballast, and when it arrives must be sold. When it is sold to coast steamers for their own consumption, it is free of the seventy-five cents duty. The duty was lowered in 1872 from \$1.20 a ton to the present rate.

Coal is selling in the territory at the following prices: Domestic, \$3.50 to \$4 a ton; Cumberland (consumption only about 30 tons a month), from \$15 to \$17.50; anthracite (about 25 tons a month), \$20; domestic coke, from \$7 to \$12.

GAS AND PETROLEUM NOTES.

Exports of refined, crude, and naphtha from the following ports, from January 1st to November 28th:

	1885.	1884.
	Gallons.	Gallons.
From Boston.....	8,026,681	6,645,825
Philadelphia.....	139,245,870	102,887,626
Baltimore.....	10,520,087	13,781,275
New York.....	337,262,316	352,138,224
Total exports.....	495,054,954	475,452,950

DISTRICT OF COLUMBIA.

While boring artesian wells with the view of determining whether the foundation for a proposed sluice-gate could be sunk at a point about a thousand yards above the Long Bridge, near the Virginia channel, gas was struck last week at a depth of thirty-two feet below the river bottom. About fifty feet distant, another flow of gas was struck.

IOWA.

The Iowa Natural Gas and Manufacturing Company has been incorporated, with head-quarters at Des Moines. Capital stock, \$25,000. The intention is to prospect for natural gas, with the expectation of its utilization, if found, for manufacturing purposes.

OHIO.

A little more than a year ago, the Cleveland Rolling-Mill Company, at Cleveland, began sinking a well for gas on a lot near its wire mills. On the 1st inst., when the drill was down 3162 feet, a strong vein of gas was struck. It has been decided to drill the well deeper, in the hope of securing a better flow. Other wells will be started at once. The discovery is of immense importance to the iron interests of Cleveland, and local capitalists have already organized a company to transport gas through a pipe-line from the oil-fields,

PENNSYLVANIA.

A charter has been granted to the Independent Natural Gas Company of Pittsburg; capital stock, \$50,000.

The Manufacturers' Gas Company has made arrangements to begin laying its pipe from Washington County. The company has not yet obtained the right to enter Pittsburg.

The Borough Council of Sewickley has granted to the Ohio Valley Gas Company the exclusive right to lay pipes through the streets of the borough and to supply gas to the people. The Ohio Valley Company, it is believed, will operate in harmony with the Bridge-water Company, and secure a supply of fuel from the wells of the latter.

A bill in equity was filed in the United States Circuit Court, at Pittsburg, on the 28th ult., by Frederick Crocker, of New York, a stockholder in the Chartiers Natural Gas Company, for an injunction restraining it from selling stock to any who are not stockholders, or which will give them control of the company; also, from laying pipe along any route other than that named in charter of the company. No further action has yet been taken.

The Standard Oil Company has a scheme under way to pipe natural gas for heating and illuminating Buffalo. The plan is to lay a large trunk line from the Venango District to Corry, and from there to Buffalo. At Corry, there will be placed the pumping machinery necessary to force the gas to its destination. The machinery will be constructed on the principle of the Worthington duplex pumps used by the National Transit Company for pumping oil, modified in such a manner as to adapt them to their new uses.

GENERAL MINING NEWS.

AFRICA.

From Mr. William Coppenger's sixth annual paper prepared for the Baltimore *Sun*, we take the following: Gold mining in West Africa has not succeeded. The gold is there, but lack of capital and transportation and bad management have contributed to the ill fortune that has attended these enterprises, and even the best have had to contend with difficulties of climate and labor. There seems no end to the new discoveries of gold in South Africa. Information from the Transvaal is to the effect that a paying reef, yielding 1½ ounces to the ton, has been found in Matabeleland, and that a concession to work it has been granted by Lobangolo, chief of the Matabele natives, to a company that has started working with small plants of steam crushing machinery, through the use of which twelve bars of solid gold weighing one pound apiece have been secured from the first trial crushing. Rejoicings have taken place at Pretoria and Appolonia, owing to a display of gold discovered close to those places. Persevering men, with good health and capital, crushing machinery, and a supply of provisions for six months' stand a fair chance of becoming wealthy in time. South Africa enjoys a virtual monopoly of the diamond market of the world. A diamond has recently been found there weighing 475 carats, and said to be greatly superior in color and brilliancy to all the other famous diamonds known. It has passed into the hands of J. Metz & Co., of Amsterdam. Another large diamond from the De Beer mine was purchased on the spot by an agent of Messrs. H. Muhr & Sons, of Philadelphia, Pa. It weighs 128 carats in its rough state, and is of perfect octahedron shape. It is about an inch through in its longest and deepest parts, and in its present state is valued at about £15,000; but when cut, the price will be very much more. It is considered one of the most famous gems of the world, and is called "the President."

CALIFORNIA.

MONO COUNTY—BODIE DISTRICT.

Reports for the week ended November 23d:

BODIE.—Assays from the north drift 400 (Mono level averaged during the week \$24 a ton. Nineteen men are employed.

BULWER.—On the Ralston No. 2, south, they have connected the south uprise with the stopes, and are now extending the stopes south. The vein is 18 inches wide; good ore, looking very promising.

CONSOLIDATED PACIFIC.—During the past week, a severe storm has interfered some with the progress, rendering work in other directions necessary. Started drift north on No. 3 vein to connect with bottom of winze in upper tunnel. The drift is out 7 feet from

station. Vein looks well. Have also started drift south from bottom of winze No. 1 on the Fortuna vein.

MONO.—In the south drift from No. 1 winze 550 (Lent shaft) level, the last 58 feet show rich ore. Good ore is still in the face of the drift. An uprise from near the face of the drift is up above the top of the drift 10 feet in good ore.

STANDARD.—The ore-bodies hold strong, with indications of improvement. Ore shipped to mill, 384 tons. Bullion shipped on the 17th valued at \$9262.

NEVADA COUNTY.

EUREKA.—This mine has been leased. The lessee will erect a mill, and crushing will at first begin on the old dump of the Eureka, and when this ore is exhausted, then ore will be crushed from the mine. Work will begin in the old Mobile tunnel (the Richardson ground) and continue until the Eureka ground has been reached.

NORTH STAR.—During the last six weeks, four tributaries took out ore that yielded them \$1800.

SIERRA COUNTY.

CLEVELAND.—The ledge that was encountered on the lower tunnel, in about 300 feet, is said to show two and a half feet in width of good ore. The 8-stamp mill is completed, and has probably started up.

LEWIS CONSOLIDATED.—The company has made preparations to continue work during the winter.

CANADA.

Reports from Ottawa state that it has been discovered that a large proportion of the phosphates exported from Canada to England and Germany is reshipped to the United States as British and German phosphates. It is understood that the American Consul at Ottawa, in his next report, will point out the absurdity of forcing Canadian phosphates to make two trips across the Atlantic before entering the United States.

PROVINCE OF NOVA SCOTIA.

Mr. Van Slooten is reported to have said that he has succeeded in raising \$1,000,000 of capital in England and the United States for investment in Cape Breton mines, provided the concessions asked for last winter from the local legislature are granted. The matter will again be brought before the government at Halifax, at its approaching session.

EASTERN DEVELOPMENT COMPANY, LIMITED.—Work is to be resumed shortly at the Coxheath copper mines, Cape Breton, and will continue, it is stated, during the winter.

PROVINCE OF ONTARIO.

Reports from the mines in the vicinity of Port Arthur state that the prospects are satisfactory. The cost of operating the mines with the present want of proper roads and railroad facilities is the greatest obstacle. Development-work will continue during the winter at several properties. It is stated that American capitalists are negotiating for the purchase of mines in this district.

PROVINCE OF QUEBEC.

The erection of a large asbestos manufacturing mill at Thetford, Beauce, is talked of. The shipments of asbestos from Thetford, Colerain, and Broughton this year will, according to reports, aggregate 1500 tons, and it is said to be of the finest quality.

ST. ONGE.—This company, whose property is at St. George, Beauce, intends to sink another shaft in the center of the alluvial lead. The deposit is 165 feet below the surface of the ground.

COLORADO.

CLEAR CREEK COUNTY.

UNION SMELTING AND REFINING-WORKS.—It is stated that these works, at Idaho Springs, which used the Campbell patents for roasting, will not be started up again.

GILPIN COUNTY.

GREGORY-BOBTAIL.—The incline shaft has attained a depth of about 365 feet. It is thought that the vein of the Gregory will soon be reached.

RARA AVIS.—Instructions have been received at the mines to begin active operations.

LAKE COUNTY.

The Leadville *Herald* reports the following:

ADAMS.—The company will purchase an engine and other machinery for the new Adams shaft, and will sink the Brookland shaft to a greater depth.

MAID OF ERIN.—An important strike has occurred in this mine, on Carbonate Hill, fully five feet of sand carbonates having been exposed at a depth of 520 feet. It runs low in silver but well in lead, and can be

treated for less than \$3 a ton. The property is owned by Messrs. Moffat, Chaffee, Tabor, and Du Bois.

UNION PARK GOLD MINING COMPANY.—This company has obtained a judgment before Judge Lupke, at St. Louis, against H. C. Donnell and Patrick McCann, former directors of the company, for \$64,107.

PARK COUNTY.

SOVEREIGN.—It is stated that this company will soon double the capacity of its concentrating mill, which is already one of the largest in the State, and will add forty stamps to the Pioneer mill, which already contains twenty. The plant will then have a capacity for handling 250 tons of ore daily.

PITKIN COUNTY.

CONNEMARA.—An undivided eighth interest in this mine is said to have been purchased by John D. Morrissey, of Leadville, and Joseph Reynolds, of Chicago, for \$36,000.

PRIDE OF ASPEN.—A vein has been struck in this mine on Aspen Mountain at a point 300 feet from the mouth of the tunnel, and 240 feet from the surface.

OURAY COUNTY.

The Bona Hensel and Emma, two prospects at Camp Paquin, have been bonded to Leadville and Buena Vista parties for \$20,000.

SAN JUAN COUNTY.

SOUTHERN COLORADO BISMUTH SILVER MINING AND SMELTING COMPANY.—Owing to the financial embarrassment of this company, work has been suspended on its properties, of which the Sampson mine and stamp-mill, at Gladstone, are the only ones of any consequence. The heaviest creditor is A. J. Hamilton, of Cleveland, Ohio, where the principal office of the company is. Mr. Hamilton has a trust deed for a loan of \$30,000, which was made last winter, covering the entire property of the company. By a provision stipulated in the deed, Hamilton was permitted to name the manager of the properties, and thereupon he assumed the management himself. Several attachment suits have been brought, and these creditors, it is said, propose to test the validity of the trust deed. Most of these debts were contracted by Mr. Hamilton.

DAKOTA.

LAWRENCE COUNTY.

CALEDONIA.—Official advices, dated November 23d, state that 1264 tons of ore were produced during the week. They are working a face about 50 feet wide on the 425-foot level, in a northerly direction, where the ore-body shows up better and stronger as they advance. The bullion product for the first half of November was bar No. 46, \$12,130.68.

FATHER DE SMET.—The superintendent writes: Bar No. 220 contained 813.45 ounces of gold, the result of the run of the mill for the first half of November; valued at \$13,369.44. They are not working as much in the good ore in the bottom of Eureka cut as usual, being compelled to break down more from near the surface, which is of poorer quality. More active work has also been resumed in Golden Gate and Justice cuts, the grade of which is very low; consequently, the general average of the mine will be lighter this month. They will have to work more generally throughout the mine from this on, and carry a surplus of ore in the different stopes and chambers, in order to insure a steady supply for the mill during the winter and spring months. The heaviest part of the winter supplies are in, and paid for; consequently, the expenses will begin to get less at once. Altogether the outlook is favorable, and while perhaps the results may drop off some, the final outcome ought to average up pretty well. For the week ended November 22d, there were 2025 tons of ore extracted and milled.

IRON HILL.—The mill started up on the 19th ult. At the mine, the shaft is down 300 feet, and at least 1000 feet of tunneling, drifting, and cross-cutting has been done. It is stated that there is a large amount of ore in sight.

GEORGIA.

BARTON COUNTY.

About 100 tons of brown hematite ore a week are shipped from this county, where the deposit is said to be rich and valuable, to Birmingham, Ala., where it is used in making rolled iron.

IDAHO.

VIOLA MINING AND SMELTING COMPANY.—The smelter at Nicholia is running successfully. The furnaces have a daily capacity of forty tons; but, owing to the fineness of the Viola ore and its liability to clog up, the furnace has only been kept half full so far (and will be until enough coarse ore has been obtained to

mix with it), and twenty tons of ore a day are smelted, yielding from ten to twelve tons of bullion, which is shipped at once. Very little of the slag is resmelted, the lead being almost entirely extracted. The fuel used is coke and coal. The wages paid are from \$3 to \$4.

MEXICO.

CEDRAL.—Dispatches state that these silver mines, at the foot of San Marcos Mountains, near Santa Rosa, have just been denounced by Señor Ruben Castillo, a wealthy Mexican. The significance of this claim on the part of a native Mexican of wealth will be understood when it is stated that these mines were purchased several years ago by an American company organized at Mobile, Ala. This company has spent a large amount of money, said to be \$1,250,000, in putting up modern machinery and clearing the mines. This denouncement is made under an ancient Spanish-Mexican mining law, which obligated the owners of every mine to perform a stipulated amount of work within six months or forfeit their mine. This law has never been repealed.

The Mexican *Financier* reports the following: Mining supply stocks are very low at Pachuca, and there is likely soon to be a strong demand made on companies in the United States making a specialty of these goods. A regular mining boom is going on in this section of Mexico, and mining prospects have not, for years, looked brighter than to-day. Pachuca mines turn out more ore than the local reduction-works can take care of.

LA BLANCA.—The ore at this mine, Pachuca, which was thought to be very refractory, is turning out better than was anticipated since having been put into the patio.

REAL DE MONTE.—Dividends are paid and the shares are said to be in active demand.

ROSARIO VIEJO.—Reports credit this mine, at Pachuca, with having struck exceedingly rich ore.

SAN FELIPE DE JESUS.—This mine, at Zacatecas, has been bought by a St. Louis (United States) company, of which Judge W. B. Boyle is president and Mr. C. J. Wimple, of Zacatecas, resident manager. The mine is on the Central Railroad, four miles from the city of Zacatecas, and is a part of the Veta Grande vein, on which many good mines are situated. This vein has yielded \$796,000,000 in 284 years by official returns.

SAN RAFAEL.—This mine, at Pachuca, is rapidly paying off its indebtedness out of recent earnings.

MICHIGAN.

COPPER MINES.

TAMARACK.—This company has recently sold some \$26,000 of its holding of the bonds of the Hancock & Calumet Railroad.

IRON MINES.

The following statement, published by the *Marquette Mining Journal*, shows the amount of iron ore and pig-iron shipped from the lake ports of that district for the season, up to and including November 25th:

	Gross tons.
Marquette—Iron ore.....	746,710
L'Anse—Iron ore.....	20,027
Pig-iron.....	8,825
St. Ignace—Iron ore.....	93,679
Pig-iron.....	13,352
Escanaba—Iron ore.....	1,209,649
	2,092,242

MONTANA.

LEWIS & CLARKE COUNTY.

The Helena Mining and Stock Exchange was to be opened on the 1st of December.

KATIE PUTNAM.—A rich strike is reported in the company's tunnel near Red Mountain.

MEAGHER COUNTY.

The smelting-works at Toston, owned by W. L. Austin, are now reducing about twenty-five tons of ore a day. The works are on the line of the Northern Pacific Railroad, and are so situated that the handling of ore and shipments of bullion are reduced to the lowest possible cost.

SILVER BOW COUNTY.

Assistant General Superintendent Dickinson, of the Union Pacific Railroad, has visited Butte, and has had conferences with the leading mining and smelting men. It is thought the company will reduce the freight charges on salt to \$10 a ton, the reduction asked by the parties interested.

ALICE.—The company's works are now lit by electricity.

BLACK ROCK.—The company has made a contract with the Colorado smelter to ship to the latter 10,000 tons, more or less, of its ore, of a grade from 20 ounce

a ton upward. It will, on account of the manganese it contains, be used as a flux.

SILVER BOW COUNTY.

MOULTON.—Official advices state that considerable dead-work is doing in the mine. The shaft is going down 200 feet additional, which will increase its depth to 700 feet; so far, they have had unusually good sinking, and have already attained a depth of 650 feet. The water body has been small, but looks now as if they would have to begin pumping within a short time; it is the intention to connect the Cornish pump with the 700-foot station, and have every thing complete for future development in January.

NEVADA.

ESMERALDA COUNTY.

LAPANTA.—The vein on which this mine, in Hawthorne District, is located, has been prospected at different points by means of inclines for a length of 1000 feet. The deepest incline is down 80 below the surface, and assays of the ore run high.

STOREY COUNTY—COMSTOCK LODE.

CONSOLIDATED CALIFORNIA & VIRGINIA.—During the week ended November 21st, there were extracted from the 1750 level 870 tons of ore and 883 tons shipped to the Morgan mill. The value per ton of ore milled during the week was \$22.30, according to assays made from samples taken from the batteries. Under the Jones contract, 771 tons of ore were shipped to the Eureka mill. The value of ore milled during the week was \$28.40 a ton, according to assays made from battery samples.

JULIA.—At a meeting of the stockholders, at San Francisco, the case of George S. Mowser and others against the company's directors was discussed. The attorney for plaintiffs stated to the meeting that the shareholders must either pay assessments for carrying on the suit or relinquish their stock altogether.

WASHOE COUNTY.

A mill has been built at Peavine, near Reno, with a furnace and bath attached, for working refractory ores, by Messrs. Halleck and Griffin. By their process, it is claimed that the \$10 refractory ore now on the dumps at the mine in that district can be reduced to bullion and leave a margin for the owner. The ore is crushed, roasted, and subjected to a chemical bath.

NEW MEXICO.

GRANT COUNTY.

The McGregor Brothers have sold out the larger part of their interests in Georgetown to Messrs. Payne, Washington & Co. and John Spiller. The property transferred consisted of the mill, the McGregor and Grampan mines, and a half-interest in the Scottish mine. The price paid is said to be \$70,000. The new owners will continue work, but will let a number of new leases. The mill will be improved by the addition of a new boiler, amalgamating-pans, etc., and bullion will be shipped in future instead of concentrates. Mr. Payne will act as superintendent.

FLAGLER REDUCTION-WORKS.—Several shipments of sulphides have been made to the Grant Works at Omaha. It is stated that the company has abandoned the notion of erecting a refining plant in connection with its leaching-works, as the Omaha Works have offered it such favorable terms for its roasted sulphides that it is nearly as cheap to ship as to refine.

OREGON.

BAKER COUNTY.

BURNT RIVER MINING COMPANY.—A contract has been let for a tunnel 200 feet in length, to tap the Oriental ledge, and the work is already under way. The development of these mines will have a good effect on the business of the region.

PENNSYLVANIA.

ERIE COUNTY.

A company has been organized at Corry to work an alum deposit discovered there last summer.

NORTHAMPTON COUNTY.

NEW YORK SLATE COMPANY.—This company has been organized at Bangor, with a capital stock of \$150,000.

SOUTH AMERICA.

BOLIVIA.

The Bolivian chambers have ratified the increase of duties on silver.

UTAH.

BEAVER COUNTY.

CAMPBELL REDUCTION-WORKS.—The works have closed down for the winter.

COMET.—This company has not yet perfected

arrangements for reopening its Copper Gulch property, though plans are preparing for preliminary work.

SALT LAKE COUNTY.

In the case of W. H. H. Bowers vs. the London Bank of Utah, Judge Zane of Salt Lake City, on the 23d ult., allowed the plaintiff thirty days in which to file notice of a motion for a new trial. If the motion is denied, the case will be carried up to the Supreme Court of the territory, and if beaten there, the plaintiff will appeal to the Supreme Court of the United States. This will have the effect of tying up the bank funds for several years longer.

John A. Groesbeck has purchased the Darlington and Woodside mines, adjoining the Evergreen, in Little Cottonwood District. The amount paid is said to have been \$10,000 in cash and 10,000 shares of stock in a corporation to be formed, comprising both properties, and the total number of shares in which will be 100,000.

TOOELE COUNTY.

The Messrs. Niedringhaus, of St. Louis, have purchased the Muscatine and Silver King mines at Stockton. The litigation with the Bambergers over the Stanton and Monument is said to have been settled by Messrs. Niedringhaus paying \$17,000.

VERMONT.

We have received the following relating to the sale of property belonging to the estate of the late Smith Ely, as published in our issue of last week:

The claims of the late Smith Ely against Ely Goddard & Cazin, as specified by counsel for the estate, are explained as follows: The same counsel brought suit for Mr. Smith Ely for \$100,000; but when trial was ordered, the suit was withdrawn. There is a suit in chancery pending, in which Cazin is plaintiff and Smith Ely, Ely Goddard, the Vermont Copper and Mining Company, and the Vermont Copper Company are defendants, in which the whole matter between these parties is at issue. In this suit in chancery, the chancellor ordered the defendants to furnish bonds for \$50,000, that in their hands the rights and property of the plaintiff Cazin should be protected. They not being able to furnish this bond, the property was turned by chancellor's order into the hands of a receiver, where it is now. It includes the concentration mill, the property of Ely Goddard & Cazin exclusively.

WISCONSIN.

GREAT WESTERN.—Operations are to be resumed at this mine at Crystal Falls. A diamond drill has been employed there for the past six months, and is said to have cut valuable bodies of ore. It is also stated that the old workings are to be abandoned and the mine opened up anew in every particular.

LAKE MOUNTAIN.—This company has been organized under the laws of Wisconsin, with a capital of \$1,000,000, for the purpose of carrying on mining operations. The incorporators are C. A. Swineford, B. K. Cowles, and W. E. Clarke. The general offices are to be at Baraboo. It is thought that the company intends to prosecute its mining operations in Alaska.

MARKETS.

NEW YORK, Friday Evening, Dec. 4.

At the regular meeting of the Board of Managers of the Metal Exchange, on Thursday, several new members were elected, among them being Messrs. D. W. Richards and Morton B. Smith, of D. W. Richards & Co., No. 92 Mangin street, this city.

The most important action taken was the listing of Chili Bars; to do which, several additions were made to the copper rules, of which the principal ones read as follows:

Rule 14.

SEC. 2 (Exception to Rule 3, sec. 3). The minimum fluctuation on Chili Bars shall be two shillings and six pence per ton of 2240 pounds.

SEC. 3 (Exception to Rule 3, sec. 4). The minimum quantity of Chili Bars to be dealt in shall be 25 gross tons (56,000 pounds), with the privilege to deliver 5 per cent more or less, any such excess or deficiency to be settled for at the market price on day of delivery.

SEC. 5 (Exception to Rule 5, sec. 1). Deliveries of Chili Bars shall be made by English warrants, bearing the indorsement of the original importer of the warrant into New York; and no warrants shall be a good delivery unless the party so indorsing shall have

been approved by the New York Metal Exchange for this purpose.

SEC. 9. (Exception to Rule 8, sec. 1). The rate of original margin on contracts for Chili Bars shall be \$500 for each contract of 25 gross tons; and in determining the market price to which additional margins may be called, the conversion from the sterling price into United States currency shall be at the rate of five dollars for each pound sterling.

Rule 15.

SEC. 1. Dealings shall be in the coin of the realm of Great Britain, commonly known as sterling money.

SEC. 2. The calculation for conversion of the sterling price into the national currency of the United States of America (except as provided for margins, in foregoing section 9 of Rule 14) shall be at the rate of \$4.87½ per pound sterling.

The houses that the Exchange has named as qualified to indorse the warrants are Ladenburg, Thalmann & Co., and Lumsden Brothers.

Silver.

The "expectant" condition of the market, referred to in our previous reports, continues both abroad and here.

DATE.	LONDON.		N. Y.		
	Pence.	Cents.	Pence.	Cents.	
Nov. 28	47½	102½	Dec. 2	47½	102½
30	47½	102½	3	47½	103
Dec. 1	47½	102½	4	47½	103

United States Assay-Office at New York.—Statement of business for the month ended November 30th, 1885:

Deposits of Gold.

Foreign coin.....	\$390,000
Foreign bullion.....	100,000
United States bullion.....	584,000
United States bullion (re-deposits).....	268,000
Jewelers' bars.....	100,000
Refined gold.....	226,000—\$1,068,000

Deposits of Silver.

Jewelers' bars.....	\$22,500
Foreign coin.....	5,000
Foreign bullion.....	52,000
United States bullion (contained in gold).....	8,500
United States bullion, re-deposits.....	1,500
Arizona.....	1,000
California.....	100
Colorado.....	200
Dakota.....	.....
Idaho.....	.....
Lake Superior.....	700
Montana.....	193,000
Nevada.....	.....
New Mexico.....	27,000
Oregon.....	.....
Utah.....	.....
Vermont.....	.....
Refined silver.....	238,500— 550,000

Total deposits..... \$2,218,000
Gold bars stamped..... \$1,067,492
Silver bars stamped..... 435,188— 1,502,681

Foreign Bank Statements.—The governors of the Bank of England, at their regular weekly meeting yesterday, made no change in the bank's minimum rate of discount, and it remains at 3 per cent. During the week, the bank gained £369,024 bullion; and the proportion of its reserve to its liabilities was reduced from 46½ to 44½, against 38½ per cent at this date last year. On the 3d inst., the bank lost £112,000 bullion on balance. The weekly statement of the Bank of France shows gains of 3,102,000 francs gold and 1,834,000 francs silver.

Copper.—The advance of last week and the strong feeling then recorded have relaxed a little, and our copper market is now rather quiet, with prices firm and steady at 11·10@11·20c. for Lake; 10·10c. for Orford and Baltimore. Furnace material is very scarce indeed, and the price at which the large Montana sale mentioned in our last was made would require a figure about seven eighths of one cent a pound above the present quotations, to make the purchasers safe, or nearly £50 a ton for Chili Bars in London.

If a few of the producers of matte were to act in concert, the English works, which are dependent for a large part of their supply on this country, would have to advance their prices or close down, and those who control the output of our largest producers of matte are financially able to carry their product until they get their price. The Calumet & Hecla has not yet made sales for next year's delivery, and it could, in accord with the producers of matte, readily advance the price of copper 1 or 1½ cents a pound, and would obtain it. When such things are possible, and so greatly in the interest of the few persons who have the

power to bring this about, it would not be surprising if they were to take shape.

The London market for Chili Bars has declined during the week from £43 10s. a week ago, to £42 firm, at which it closes to-day. Best Selected remains at £47.

Tin.—The London market is cabled £94 for spot and £94 12s. 6d. to-day, the market having fluctuated between £93 10s. and £94 10s. during the week. Here the price remains wonderfully firm, considering the announcement that 1600 tons have been shipped to this country during November. We quote 20¼@21c. for spot, and 20'60@20'80c. futures. At these last figures, about 20 tons have been sold within two days at the Metal Exchange.

Lead.—The lead market is "booming," and prices for spot lead have advanced even beyond the price of importation. We may quote 4'50@4'60c. for January, and 4¾@4¾c. for spot, though we have heard of 5c. being named. The fact is, there is no spot domestic lead to be had in this or any of our other markets, and there is practically no foreign lead on hand. In London, Soft Spanish is quoted at £12 7s. 6d., which would lay down lead here at about 4'75c. And our market here is now likely to be controlled by the price of foreign, for it is evident that we are consuming at least as fast as we are making. Even the Richmond stock has ceased to act as a load on the market; for it can be sent here but very slowly, owing to the necessity for taking only low freights, and owing to the contract by the Richmond to deliver 200 tons a month to a San Francisco firm.

About 1200 tons of lead were sold here during the week, beginning at 4'36c. and up to 4'50c. for future. The Spanish exports of lead for the first eight months of this year were 79,440 tons; and in the corresponding months of 1884, 75,695; and in 1883, 83,324 tons.

The Committee of the New York Metal Exchange on Lead has adopted the following as the classification of the various brands of domestic: Corroding, deliverable also on contracts for prime desilverized or good ordinary, Pennsylvania Company refined, St. Louis, Aurora, Kansas City refined, Omaha refined, Pueblo refined. Prime desilverized, deliverable also on contracts for good ordinary, Omaha common, Pueblo common, Kansas City common, Pennsylvania Company common, Newark, Chicago S. & R. Company. Good ordinary, Richmond, Selby, St. Joe, Soft Missouri.

Messrs. John Wahl & Co., of St. Louis, telegraph to us as follows to-day:

We have to report an improved demand. Market is active, and the general tendency is in the ascendant, 4'25c. for both Common and Refined, but holders refuse to take it. The asking price is now 4'30@4'35c., according to the brand and delivery. Sales for the week sum up 500 tons, at 4'25@4'30c.

Messrs. Everett & Post, of Chicago, telegraph to us as follows to-day:

Market very firm. Shot lead in demand at 4'35c. Sales for the week sum up 600 tons, December, January, 4'25@4'35c. Lead very scarce.

Spelter.—This metal is still very lifeless, and we quote Domestic 4'40@4'60c., according to brand. New Jersey, 6¼@6½c. Foreign, 5c.

In London, Silesian Spelter is quoted £14. Sheet-Zinc has declined, and may now be quoted about 5'50 for Domestic.

The Committee of the New York Metal Exchange on Spelter has designated the following brands as good delivery on the regular contract for prime domestic: Glendale, Illinois, C. H. Lanyon & Brothers, Robert Lanyon & Co., W. & J. Lanyon, Cherokee, Rich Hill, Collinsville, Joplin, M. & H.

Antimony is quite dull and unchanged, at 8¼@9c. for Hallett's; 9½ Cookson's here, and £26 for Hallett's in London.

Nickel.—We quote nominally 70c., but this figure is shaded by foreign brands.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, Dec. 4.

Iron Ore.—The ore market is very active so far as orders are concerned, but importers are afraid to make prices on account of the difficulties in arranging for freights. Nominal quotations are 9@10c. per unit for Foreign; the prices of domestic Bessemer ores

are a matter of negotiation, depending on the works. We hear of further sales of Chateaugay and also of Mahopac Bessemer. The demand for any kind of good Bessemer ore is very brisk, and is likely to continue so for some time.

Pig-Iron.—The pig-iron market throughout the country, as advised by our correspondents, is, unquestionably, stronger, and has an advancing tendency, which has been "boomed up" in press dispatches into \$1 and \$1.50 per ton advance in prices. No such advance has actually taken place, but a better feeling prevails, and in some places slight advances in prices have been secured. In this market, the quotations of last week remain unaltered—namely, \$18@18.50 for No. 1 X; \$16@17 for No. 2 X; and \$15@15.50 for Forge, standard Lehigh brands. Chickies and a few extra brands command from 50c. to 75c. a ton above these prices, and there are some less esteemed brands that can be bought a good deal below our quotations. It is quite generally expected that an advance in prices will be made in January; but there is also a strong feeling that no great advance can long be maintained, on account of the large number of furnaces that have recently blown in, or are about to be blown in.

Bessemer iron, both Domestic and Foreign, is in very good demand, and prices have steadily increased, and are now quoted \$20@20.50 for foreign Bessemer, and \$18 for Cornwall Bessemer, which is looked upon as too high by the mills.

Spiegeleisen shares in the continued activity and advance in steel rails and Bessemer pig, and is now quoted \$28@28½ for 20 per cent English, and \$27@27½ for German, \$32 for 30 per cent, and \$67@68 for 80 per cent. Some important sales were made early in the week at our last week's quotations, but the advance is now held firmly, owing to uncertainties as to freights, and an advancing tendency in the foreign market, based upon exaggerated reports from this side.

Scotch Pig.—About 600 tons have arrived during the week; but the market is dull on account of high freights and the slight advance recently noted as having taken place in Scotland.

We quote: Coltness, at Glasgow, 50s.; at New York, \$19.50@20. Summerlee, at Glasgow, 49s.; at New York, \$19@19.50. Gartsherrie, at Glasgow, 46s.; at New York, \$19@19.50. Eglinton, at Ardrossan, 42s. 6d.; at New York, \$18.

Structural Iron and Steel.—More business has been reported during the week than for some time past, but prices remain unchanged. Angles, 1'90@2c. delivered; Tees, 2¼c.; Iron Beams and Channels, 3c.; American and Belgian, 2'60@2'75c.; Steel Angles, 2'30@2'40c.; 3-inch to 4-inch square steel billets under 10 carbon are quoted \$32.50 ex ship.

Plate Iron.—Unchanged. Quoted at 2@2½c., according to quality; Common Tank, 2c.; Refined, 2¼c.; Flange iron, 3¼@3½c.

Bar Iron.—We quote at 1'45@1'55c. for Common; 1'75@1'85c. Refined.

Steel Plates.—Quoted 3@3½c. for Boiler and Ship Plates; 3½@4c. for Flanges.

Merchant Steel.—We continue to quote American Tool Steel, 8@10c.; special qualities, 12@15c.; Crucible Machinery, 4¼@5½c.; Bessemer Machinery, 2@2½c.

Steel Rails.—The demand for steel rails continues very strong, though the fact that several mills have ceased to accept orders naturally gives a quieter air to the market. The price of \$35 at our Eastern mills is firmly held, and we hear of a single order having been booked within a day or two at that figure, for 15,000 tons. Western mills have sold at \$38, Chicago delivery, and there is understood to be some talk of advancing the price to \$40 Chicago. Unquestionably the market still remains strong, and we hear of no weakness in it. A number of the principal mills have already filled their quota on the 750,000 ton basis. It is proposed to increase the quota to 1,000,000 tons, in order that the railroads may be able to supply themselves. Some of the mills that have not filled their quota are not yet able to produce, and others are occupied in part with miscellaneous business.

On the 1st of December, the steel mills had taken orders for 529,000 tons on the quota of 750,000 tons. The recent order of 10,000 tons English steel rails by the Chicago, Burlington & Quincy Railroad at it is said, about \$45 a ton, creates much comment. The

reason given for sending the order to foreign works is, that the quality of the English rails is better than our own. It is not denied by many of our makers that the very low and unremunerative prices of last summer led to the production of inferior rails at some mills; but there can be but little doubt that, if any road is willing to pay extra for an extra quality, our American works would guarantee the quality equal to that of foreign mills, and we can see no reason for paying the extra price to foreign mills for what our own can produce.

The Canada Southern road has ordered 2000 tons of English rails; but that is natural, as they enter Canada, we believe, free of duty.

Old Rails are scarce and may be quoted nominally at \$19, at which price it is probable but small quantities could be obtained. We hear of sales at a shade below this figure, and some English rails, double heads, at \$20.25@20.50.

Scrap.—Wrought, \$18@18.50; car-wheels, \$15@16.

Philadelphia.

Dec. 4.

[From our Special Correspondent.]

The volume of business in pig-iron for the past week would have been larger but for the unwillingness of some makers of iron to sell at prices named by parties that are willing to purchase supplies for the first quarter of next year. Most of the business done in September was for material to last them to the end of this month. A few buyers bought enough to carry them for one or two months next year, and, in exceptional cases, one or two months longer. The forge iron market is stronger just now for reasons like these: A good many buyers have used up all they have, and are now coming into the market or will soon be forced to. The consumption of forge iron has considerably increased during the fall, and the increase in production has not been correspondingly large. Another reason is, that a good many requirements for finished iron have been presented in the market for a few days, and this is a pointer that forge iron people are not slow to make the best use of. The quotations can not be changed, and are \$18@19 for No. 1, according to quality; still there is plenty of iron to be had under \$18, though it is not reliable in quality. Sales of No. 2 iron have been made under \$17, although little can be said in its favor. Sales of forge have been made this week at \$16.50; and there are parties here that will take not a cent less. A few companies here are pretty well sold up, and are endeavoring to put prices a notch higher. There is still iron to be had at \$16, though less is offered at that low price. Cinder iron is to be had at almost any price. Some offerings of Virginia iron have been made on the market this week, and a few sales have been effected. Agents of Alabama iron are endeavoring to do some business, but no transactions have been heard of for delivery in this market. Some Eastern business has been closed at prices equaling about \$15 here.

Foreign Irons.—Spiegeleisen has been sold at \$26.50 for 20 per cent. There is quite a number of inquiries in the market for Bessemer. Some sales have been made, but the details have not been given. Quotations are \$19.50@20.50. Freights are against large sales.

Manufactured Iron.—More common iron has been sold this week than any other kind, and at a little firmer prices, owing to the difficulty of obtaining a sufficient supply of old rails. Sales of common iron, footing up several hundred tons, have been made at \$1.50. A good medium iron commands \$1.65. Refined iron, according to quality, runs from \$1.65@1.80. There are inquiries in for bars and plates, which the parties having the business in hand expect to place very soon. A few good contracts have already been secured, and others are under way. Store lots of refined iron readily command \$1.80. A little confidence would bring out a great many backward buyers, who are waiting to see what January will bring.

Nails.—A slight falling off in demand for nails for future delivery is shown. There are still enough buyers on the market to keep prices very firm. No weakness is likely to be developed for at least thirty days. The mills are crowded with orders, and, so far, buyers have been furnished with supplies actually necessary; \$2.50@2.60 are quoted.

Plate Iron.—A number of good-sized orders for plate iron have been placed, and there is more business in sight.

DIVIDEND-PAYING MINES.

NON-DIVIDEND-PAYING MINES.

Main table with columns for Name and Location of Company, Capital Stock, Shares, Assessments, Dividends, and Name and Location of Company, Capital Stock, Shares, Assessments. Includes entries for Adams, Alice, Amie, Atlantic, Argenta, Barbee & Walker, Basick, Belle Isle, Belcher, Big Bend Hydraulic, Black Bear, Bodie, Bonanza Development, Bonanza King, Boston & Mont, Breese, Calumet, Calumet & Hecla, Carbonate Hill, Caribou, Castle Creek, Catalpa, Central, Christy, Chrysolite, Colorado Central, Con. Gold Mining, Contentment, Crescent, Crown Point, Deadwood-Terra, Derbec, Dunkin, Eureka, Evening Star, Excelsior, Father de Smet, Franklin, Freedland, Grand Enterprise, Gem, Glen, Gould & Curry, Grand Central, Grand Prize, Granite, Granite Mountain, Green Mountain, He & Anderson, Hecla, Hecla & Red, Holyoke, Homestake, Honorius, Hope, Horn Silver, Idaho, Independence, Indian Queen, Inyo, Iron Silver, Jackson, Jucostita, Kentuck, La Plata, Leadville, Lexington, Little Chief, Little Pittsburg, Manhattan, Marguerite, Martin White, Minas Nevada, Montana, Morning Star, Mouto, Mount Pleasant, Mt. Diablo, Napa, Navajo, N. Hoover Hill, New York Hill, New York & Colo., Northern Belle, North Bull, Ontario, Ophir, Original, Osceola, Oxford, Paradise Valley, Pleasant Valley, Plymouth, Prussian, Quick Silver, Quincy, Richmond, Rising Sun, Robinson, Robert E. Lee, S. A. Co., San Francisco, Savage, Security, Shoshone, Sierra Buttes, Sierra Butte, Sierra Grande, Sierra Nevada, Silver Cord, Silver King, Small Hopes, Smuggler, Socorro, South Yuba, Spring Valley, St. Bernard, St. Joseph, Syndicate, Tip Top, Tombstone, True Fissure, United Gregory, United Verde, Valencia, Vista, Yellow Jacket.

G. Gold. S. Silver. L. Lead. C. Copper. * Non-assessable. † This company, as the Western, up to December 10th, 1881, paid \$1,400,000. ‡ Non-assessable for three years. § The Deadwood has previously paid \$275,000 in seven dividends, and the Terra \$75,000. ¶ Previous to the consolidation of the California and Consolidated Virginia in August, 1881, the California had paid \$31,330,000 in dividends, and the Consolidated Virginia \$42,993,000. ** Previous to the consolidation of the Copper Queen with the Atlanta, August, 1885, the Copper Queen had paid \$1,350,000 in dividends.

COAL STOCKS.

Table of coal stock quotations for various companies like Barclay Coal, Cameron Coal, Col. C & I, etc., showing prices for different dates from Nov. 28 to Dec. 4.

* Of the sales of this stock, 11,879 shares were in Philadelphia and 6,275 in New York. Total sales, 175,983. † The quotations for these stocks are not percentage, but actual price. ‡ Ex-dividend.

Coal Stocks.

The market has not been as active this week, and the transactions, as compared with last week, show a falling off of 124,861 shares, the total transactions aggregating 175,983 shares.

Philadelphia & Reading has been lower, selling between \$23 1/2 and \$22. Lackawanna ranged from \$120 @ \$121 1/2, closing at \$120 1/2; the sales were 107,823 shares. Delaware & Hudson was quiet at from \$97 1/2 @ \$96 1/2, closing at \$97, the sales only amounting to 2665 shares.

Meetings.

Meetings of the following companies will be held at the time mentioned:

New York, Honduras & Rosario Mining Company, Nos. 347 and 349 New York Produce Exchange, December 9th, at three P.M., annual meeting.

Passaic Zinc Company, Company's Works, Jersey City, N. J., January 5th, from twelve to one o'clock P.M., annual meeting.

Queen of the Hills Mining Company, Salt Lake City, Utah, December 18th, special meeting for the purpose of authorizing the sale of a portion of the company's properties in Tooele County, Utah.

Rappahannock Mining Company, Room 9, No. 61 Broadway, New York City, December 7th, at half past three P.M., annual meeting.

Dividends.

Alice Gold and Silver Mining Company, of Montana, has declared a dividend (No. 17) of 6 1/4 cents a share, payable at the Farmers' Loan and Trust Company, in this city, on the 10th inst.

Granite Mountain Mining Company, of Montana, has declared a dividend (No. 12) of 15 cents a share, r \$60,000, payable at St. Louis.

Iron Silver Mining Company, of Colorado, has declared a dividend (No. 15) of twenty cents a share, payable at the company's office, No. 23 Broad street, in this city, on the 23d inst.

The Philadelphia & Reading Railroad Receivers will purchase on December 10th the December, 1885, interest and coupons of the following divisional coal land mortgage bonds at the respective rates of interest named: Hartman & Meyer, Reed et al., tracts, 6 per cent; Forbes and Delano tracts, 5 per cent; and Richard Wood Estate tract, 4 per cent.

Pipe Line Certificates.

Messrs. Watson & Gibson, petroleum brokers, No. 49 Broadway, report for the week as follows:

The market on oil has been in a panicky condition for the past two weeks. The only adverse news is, that the Anchor wells at Kinzua are showing up better than many expected, but this is not especially significant. About eight miles southwest, at Kane, the Clemminger well has been worked as a mystery, and this is the real bear on the market.

The following table gives the quotations and sales at the Consolidated Stock and Petroleum Exchange:

Table showing opening, highest, lowest, closing, and sales for various dates from Nov. 28 to Dec. 4.

Total sales. 54,989,000

San Francisco Mining Stock Quotations.

Table of closing quotations for various mining companies like Albion, Alpha, Alta, etc., from Nov. 27 to Dec. 3.

Boston Copper and Silver Stocks.

[From our Special Correspondent.]

BOSTON, Dec. 3.

The market for mining stocks the past week has partaken of something like an old-time boom, especially in the early dealings, when the market was quite active, and the demand for good stocks buoyant; in the later dealings, the market fell off somewhat in point of activity, but prices were generally well sustained, and the dullness is only of a temporary character, as we look for higher prices in the near future.

shares, Pewabic advanced on sales of 650 shares from \$2 @ \$3 1/2, and is in good demand. We note sales of 800 shares of Ridge at 75 @ 87 1/2 c., and 300 shares Huron at \$1 1/2. Sales of copper stocks for the week, 8114 shares.

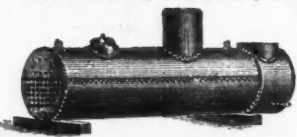
In silver stocks, Catalpa and Crescent have been the most active. The former advanced from 42 1/2 c. @ 47 1/2 c., declining later to 30c.; while the latter advanced from 15c. @ 17 1/2 c., and held steadily at that price; sales of these two stocks aggregate 15,250 shares. Dunkin sold at 30c. (300 shares). Breece, 25c. (500 shares). Total sales of mining shares for the week at the Boston Stock Exchange, 19,164 shares.

At the Mining Exchange, there is quite an active demand for the stocks dealt in, and we note sales of Bowman at 13c. @ 14c. Dunkin, at 25c. @ 27c. The prices for copper stocks did not vary much from the sales at the other Board.

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