

THE ENGINEERING AND MINING JOURNAL



Entered at the Post-Office of New York, N. Y., as Second-Class Matter.

VOL. XXXVII. JANUARY 12, 1884. No. 2.

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THE SCIENTIFIC PUBLISHING CO., Publishers.

R. P. ROTHWELL, Pres. HENRY M. GEER, Sec. and General Manager,
P.O. Box 1833. 27 Park Place, New York.

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MR. FREDERICK PRIME, Jr., of Philadelphia, President of the Allentown Iron Company, has been nominated for the secretaryship of the American Institute of Mining Engineers, and has accepted the nomination.

ON the fourth page of our last number, second column, last paragraph of the review of Mr. D'INVILLIERS'S book, read, "Red hematite occurs in Berks County, in the Potsdam sandstone; but it has never become the object of extensive exploration or exploitation."

WITH commendable enterprise, the leading newspapers in mining sections of the Rocky Mountain States and territories have collected very

valuable data on the output of their respective districts during the year 1883. Among them, the Leadville *Herald*, under the able editorial management of Mr. WUENSCH, the Salt Lake *Tribune*, the Denver *Republican*, the Tombstone *Epitaph*, and the Butte papers are prominent. We print elsewhere abstracts from the returns thus gathered, and must refer to them for details. The general result of these inquiries confirms the impression obtained during the course of the year, that 1883 has witnessed a very substantial increase in the product of the West, in spite of many drawbacks. The *Herald* credits Lake County with a product of \$17,459,940, including the additions of stock of ore at the smelters. The smelters of Leadville turned out 86,870 tons of lead, with the mills, 5,313,638 ounces of silver, and 239,195 ounces of gold, of a total value of \$9,439,600. Of the outside works, the Grant leads with receipts of 18,023 tons of lead, 3,566,667 ounces of silver, and 3867 ounces of gold, having a total value of \$6,348,878.38, of which \$5,696,638.50 is credited to Colorado, Lake County leading with \$3,688,392.27. Among the other reduction-works whose returns have been published, the Boston & Colorado, at Argo, leads with a total business of \$3,907,000, of which \$2,576,000 in value was silver, \$969,000 gold, and \$362,000 copper, the bulk of it from Colorado. The Golden Smelting Company returns \$734,190, the Miners' Smelting-Works \$349,420, and the Royal Gorge Smelting-Works, \$177,602. Utah, according to the statement compiled by Messrs. WELLS, FARGO & Co., turned out from its smelters 1615 tons of refined lead, 27,237 tons of base bullion, containing 2,163,960 ounces of silver and 3925 ounces of gold, shipped ores carrying 4479 tons of lead, 140,390 ounces of silver, and 557 ounces of gold, and matte carrying 557,875 pounds of copper, 41,840 ounces of silver, and 1105 ounces of gold. The Ontario, Silver Reef mines, Tintic mines, and miscellaneous mills sent away 2,180,573 ounces of silver and 1394 ounces of gold, the whole valued at \$6,872,085.

THE ANTHRAHITE AND BITUMINOUS COAL TRADE DURING THE YEAR 1883.

Bituminous.

The year 1883 was an eventful one to the bituminous coal trade of the country. Turning first to the districts which supply the markets east of the Alleghanies, their development during the year has been remarkable in the face of adverse circumstances. It might be expected that, in sympathy with all manufacturing industries, the bituminous coal trade would have found a shrinking demand to contend with, forcing a corresponding restriction of the output. A glance at the figures for the production of the different districts promptly dispels this notion. Turning first to the Cumberland region, we have the following series of figures for the production of the past eleven years :

PRODUCTION OF THE CUMBERLAND REGION.

| Year | Gross tons. |
|-----------|-------------|
| 1873..... | 2,674,101 |
| 1874..... | 2,410,885 |
| 1875..... | 2,342,773 |
| 1876..... | 1,835,081 |
| 1877..... | 1,574,339 |
| 1878..... | 1,679,322 |
| 1879..... | 1,730,709 |
| 1880..... | 2,136,160 |
| 1881..... | 2,261,918 |
| 1882..... | 1,540,466 |
| 1883..... | 2,482,200 |

With the exception of the year 1873, last year witnessed the heaviest output in the history of the Cumberland region. The record of the Clearfield region is as follows :

PRODUCTION OF THE CLEARFIELD REGION.

| Year | Net tons. |
|-----------|-----------|
| 1877..... | 1,340,743 |
| 1878..... | 1,270,282 |
| 1879..... | 1,561,476 |
| 1880..... | 1,721,261 |
| 1881..... | 2,382,621 |
| 1882..... | 2,743,313 |
| 1883..... | 2,836,362 |

Owing to the long strike in the Cumberland region in 1882, that year is not fairly comparable with 1883, and 1881 is therefore better chosen to note the increase in the consumption. When it is considered that 1881 was a year of exceptional activity in manufacturing and shipping, the contrast will be acknowledged to be all the more remarkable. In 1881, the combined output of the Clearfield and Cumberland districts was 4,915,968 net tons; in 1883, it was 5,616,406 net tons, an increase of 700,438 net tons. It is safe to assume that a very large share of this increase is due to the use of bituminous coal in place of anthracite. This, of course, has been encouraged by the very low prices at which bituminous coal has been freely offered during almost the entire year; but making due allowance for this fact, we are convinced that it is a movement which is sure to gain in volume in the future. The fact that this increase has taken place in the face of a general depression of the manufacturing industries of the entire Atlantic coast, is an encouraging sign for the future of the bituminous coal interests. It is an interesting matter, there-

fore, to inquire into the capacity of the fields now accessible to furnish increased supplies.

In the Cumberland region, there are five companies possessing properties now nearly worked out, or so near that point that within two years they will disappear from the list of shippers. There are three others which are approaching an exhaustion of a part of their property, worked by openings distant from other parts of their lands. Altogether, these mines represent an aggregate production of very close upon 500,000 tons annually. It is true that the remaining companies are either capable of increasing or are actually preparing to increase their output to an extent which will fully compensate for this loss; but it is believed by those who have closely followed the capacity of the region that its maximum will not be beyond 3,500,000 net tons of big vein coal. The changes that are going on in the Cumberland region will have an important effect. They will, by the reduction in the number represented in the councils of the trade, enable the companies in the region to reach more promptly and with less friction an agreement upon points affecting common interests. This prospect of greater unity of action is one which all who have followed the history of the region will fully appreciate. It is true that the adjacent Elk Garden region is to some extent booming up as a competitor; but we believe that there is no question that the quality of the coal it produces does not equal that of the big vein in the Cumberland region, being softer and more sulphurous.

So far as the Clearfield region is concerned, it is capable of little expansion, the Pennsylvania Railroad not being able to handle more than it is doing at present. It is true that new roads are pushing toward the field; but it is not, in our opinion, safe to place the maximum for the present higher than 3,500,000 tons. The Snow-Shoe field, credited in 1883 with an output of 256,950 tons of coal and 18,624 tons of coke, will probably witness the most striking advance toward a maximum of 1,000,000 tons. The Blossburg region has already reached its maximum of about 1,200,000 tons, while the Barclay region has passed it, and is not likely to go beyond 300,000 tons per annum. Nor will the McIntyre District carry its total higher than 250,000 tons. Among the new-comers in our markets is first the Chesapeake & Ohio, with Newport News as its shipping point. Its long haul from the mines is, however, against it. A second competitor in this market is the Rochester & Pittsburg, which has begun to ship coal from Punxsutawney to Rochester and thence by Erie Canal to New York. In one or two instances, coal has also been shipped East from the Connells-ville coke region, though only under exceptional circumstances. In this case, also, it is likely that distance is against the shippers. Summing up the data thus obtained, we have the following table:

PRODUCTION OF BITUMINOUS REGIONS TRIBUTARY TO MARKETS OF THE ATLANTIC COAST STATES, NET TONS.

| Region. | 1882. | 1883. | Maximum. |
|------------------------|-----------|-----------|------------|
| Cumberland (1881)..... | 2,533,348 | 2,780,064 | 3,700,000 |
| Clearfield..... | 2,741,313 | 2,836,362 | 3,500,000 |
| Snow-Shoe..... | 233,000 | 256,950 | 1,000,000 |
| Blossburg..... | 1,305,678 | 1,460,000 | 1,350,000 |
| Barclay..... | 415,625 | 379,193 | 350,000 |
| Broad Top..... | 271,216 | 233,645 | 200,000 |
| McIntyre..... | 235,041 | 252,000 | 280,000 |
| Total..... | 7,737,219 | 7,963,214 | 10,210,000 |

We have, it will be noticed, placed in our table the production of the Cumberland field in 1881, which was 808,026 tons greater than that of 1882, when the long strike interfered with the product. In reality, therefore, fully one million tons more of bituminous coal were marketed in 1883 than in 1882, without counting the fact that fully 125,000 tons more of bituminous coal were shipped by the Chesapeake & Ohio Company from Newport News than last year, and that the receipts of Nova Scotia and English coals have been a little greater. This remarkable increase in the consumption is undoubtedly chargeable in part to the low prices which have been ruling during the year, and have widened the field of this class of coals at the expense of the anthracite producers. We are inclined to believe that the natural growth in the consumptive demand, due to the expansion and diversification of our seaboard industries, has been checked and fully counterbalanced this year by the general depression. The probability of a revival, therefore, makes it prudent to face the question whether the sources of supply now accessible can be relied upon, when the wheels of our industry are again revolving at a high speed, to furnish the necessary fuel at a reasonable cost. Our estimates of the maximum product attainable at short notice put any fears on this score at rest. They do not, on the other hand, discourage the well-founded hopes of those engaged in mining bituminous coal that, when these times do come, they can look forward with reasonable certainty to a fair profit. There is nothing in the outlook, so far as it is possible now to peer into the future, to warrant the expectations of any very high figures; but the data submitted will, we believe, bear the interpretation that the business is on a much sounder basis than most are willing to believe, after the experience of the past year. This is particularly the case with the best grades of bituminous coal, the supply of which is comparatively limited.

One of the elements of cost in placing coal on the market shows a decided tendency toward lower figures. During the past year, coasting freights have been low, and these are likely to continue so, on a general average, for a number of reasons. There has been a remarkable increase in the area which can draw its supplies by rail where formerly buyers were dependent upon sea freights. The controlling influence of the latter has, therefore, weakened to some extent. Besides, new vessels built are generally of much greater tonnage than formerly, going as high as 1200 and even 1500 tons, and the first step has been taken in bituminous circles to follow the example initiated in the anthracite trade by the Reading Railroad—the building of steam colliers for the coast trade. The Consolidation Coal Company is having two of these colliers built with a carrying capacity of 1500 tons, or 50,000 tons for the season.

THE CUMBERLAND AND CLEARFIELD REGIONS.

So far as the markets of the seaboard were concerned, the year opened quietly, as is usual at this season of the year, with Cumberland and Clearfield coals nominally worth \$4.60@4.80 f. o. b., and values slightly falling off, until at the beginning of February they stood \$4.55@4.70 for Clearfield and \$4.65@4.80 for Cumberland. In the beginning of February, began the first conferences between the managers of the

Pennsylvania and Baltimore & Ohio railroads, which were to develop into such a series of startling tactics. At the outset, there appeared to be every prospect of an amicable adjustment of the freights from the two regions on coal to tide-water points. It was understood that an agreement had been reached, when it was learned that the Baltimore & Ohio Company had sought to gain an undue advantage, by computing its rates from Piedmont instead of from Cumberland, a difference of 23 cents per ton. The Pennsylvania Company, evidently believing any measures justified under the circumstances, put Clearfield operators into the position of carrying off the first large contract, 62,000 tons for the Eastern Railroad. In the first days of March, both Cumberland and Clearfield shippers were freely offering coal at figures inconsistent with the freight rates established. A company mining George's Creek Cumberland succeeded in getting the 10,000-ton contract with the Fitchburg Railroad, which followed its usual policy of not providing for the entire year's requirements. Meanwhile, the quotations of coal for the general market had of course steadily drooped, buyers being confident of a decline in values, owing to the underhand contest between the carrying companies, and April opened with Cumberland selling freely at \$4.40@4.60 and Clearfield at \$4.40@4.50. This hesitation did much toward retarding the awarding of contracts. In April, the New York Central closed a contract for 120,000 tons; the New York & New England, 100,000 tons; the Boston & Lowell, 40,000 tons; and the Boston & Providence, 70,000 tons. The great bulk of this trade went to Cumberland and Clearfield parties shipping over the Pennsylvania Railroad, which also put its operators, by special rates, into a position where they were enabled to control the situation. This rate, it is true, was withdrawn on the first of May. On all of the contracts, the prices were known to be low. The market quotations had meanwhile fallen off to \$4.15@4.35 alongside for Clearfield, and \$4.25@4.45 for Cumberland coal. As instances to what point competition, backed by unknown powers, carried sellers, it may be stated that a Clearfield firm closed a contract with a railroad at \$3.70, delivered on Long Island Sound, and that the East Boston ferries were able to get 8000 tons delivered at \$4.34. In the middle of May, the contest was practically over, and a survey of the field demonstrated how badly that part of the Cumberland trade dependent upon the Baltimore & Ohio Railroad had been beaten. It was estimated that the contracts secured by the Cumberland region did not aggregate more than 500,000 tons, a good share of which was taken by companies having an outlet via the Pennsylvania Railroad, while the Clearfield region had carried off contracts aggregating 1,500,000 tons. It was only toward the end of the season that the Baltimore & Ohio Company appeared to realize the gravity of the situation. May opened with the market quoted \$4@4.25 for Clearfield and \$4.20@4.40 for Cumberland coal. June brought a lull after the exciting period preceding it, but did not witness any rallying in the prices, which, on the contrary, continued weak, the market being in the buyer's favor, with quotations of Clearfield coal going under \$4. In July, we may state, as proving how low prices had reached, the Fitchburg Railroad bought 10,000 tons of Cumberland coal at \$4.35, delivered at Boston. July closed with prices as low as \$3.75@4 for Clearfield and \$4@4.30 for Cumberland. August dragged along without any feature of interest beyond a further weakening of Clearfield coal, which in some instances sold as low as \$3.50. September, too, proved a quiet month, although with some gleams of hope for the Cumberland shippers, by reason of the scarcity of cars in the Clearfield District, while in the East a long-continued drought forced the mills to use steam-power almost exclusively. The principal cause of low prices had not, however, disappeared, as was proved by the closing of a 10,000-ton contract with the Fitchburg Railroad on the basis of \$2.70 f. o. b. at Baltimore. October, November, and December were exceedingly uneventful months, being characterized by a moderate demand and a continued sharp competition, with a gradual slight rallying of values.

The experience of the past year is one that should not be lost on those who have so controlling an influence upon the future of the trade. The uncertainty of the relations between the two greatest carrying companies led to a scramble in which no one knew whether and to what extent his neighbor was more favored than he. It unsettled the trade, and created a distrust which had a very pernicious influence.

OTHER PENNSYLVANIA FIELDS.

The great bituminous fields tributary to Pittsburg have been subject to many vicissitudes during the year, labor being a disturbing element, and the falling off in the demand for iron manufacturing and kindred industries telling heavily on their prosperity. The year began with a general strike in the river pits against a reduction from 4 to 3½ cents per bushel for mining; but toward the close of January, some of the miners had accepted the rate. A run in the beginning of February took out twelve millions of bushels from the overstocked market; and on the 17th, the miners had accepted the situation and resumed work. The market weakened correspondingly, falling to 5@5½ cents per bushel for screened coal, and 3½ cents for nut, at landings. During March, wages weakened in some cases to 3½ cents, and, with the pits working full, six millions of bushels were sent out to overstocked lower markets, followed by 200,000 tons in the beginning of April. A temporary trouble in the fourth pool was quickly settled, and the month passed by with great activity in the river pits, and heavy shipments, the only drawback being the low prices at lower points: while in Cincinnati and Louisville, there was an advance in May caused by a break in Lock No. 3. The prompt repairing of the lock, however, caused a reaction, and lump float fell to 5@5½ cents in June. The water continued favorable during that month, the ninth consecutive month of navigable water for coal craft. When the works began to close up in July, they had ended a season such as they had not enjoyed for a decade, the three largest firms out of twenty having, since the beginning of the year, sent out together nearly fifty millions of bushels of coal, or 1,900,000 tons, the probable total of the river pits being 90,000,000 bushels, or 3,420,000 tons. The middle of July witnessed another small run. There was favorable water in the beginning of August, but the shipments were small, nearly all the river pits being closed, except in the fourth pool, where, however, there were some local labor troubles. The beginning of October

witnessed a general resumption of work in the river pits. Empty craft were able to return, and the first shipments were made; but it was only in the beginning of November that a good run was made, followed by growing activity, until, in the middle of December, the markets were so overstocked that the operators began to close down some of the mines. Differences between masters and men as to the price of mining in the fourth pool were, after some hesitation on the part of the masters, submitted for arbitration to Mr. J. D. Weeks, who decided in favor of three cents per bushel, or half a cent less than the price at the other pools. Fourth pool coal, while inferior in quality, is cheaper to mine.

In the railroad pits of the Pittsburg District, trade, restricted to the local demand, opened quietly. In January, the men proposed the adoption of a sliding-scale to govern prices for mining, based on the price of coal at the yards of the Union Depot. Toward the close of February, the Pennsylvania Railroad reduced harbor rates to Cleveland and Ashtabula to \$1.25, thus enabling the river operators to meet competition for the lake trade on a more equal footing. The arbitration agreed upon between the miners and operators was repeatedly postponed because the representatives of the former could not show satisfactorily that they came fully empowered to act. Prices meanwhile were steadily receding until they touched 6 cents per bushel or \$1.50 at Union yards—a price which the operators claimed left them no profit. They urged, too, that in Cleveland, Hocking coal was selling at \$2.32 loaded on vessels. In spite of these arguments, the miners struck on the 1st of May against a reduction from 3½¢. After two weeks of almost complete cessation of mining, during which the lake trade was steadily slipping away, a compromise was reached, under which arbitration was accepted by both parties, Mr. J. R. McCune being retained as umpire. The trade was in a very unsatisfactory shape, both the "home" demand, for Pittsburg's great industries being slack, while in the lake trade, the competition of Ohio and West Virginia coals was severe. Meanwhile, the questions before the arbitration committee were so numerous, and its inquiries so extended, that the award was delayed until the 3d of July, the decision of Mr. McCune being that the price of mining be 3½ cents per bushel of 76 pounds of lump coal, a compromise verdict. Coal on the wall was quoted at the time 5½@5½ cents. The object of the arbitration was, however, temporarily defeated by the action of ten pits on the Pan-Handle, the men of which agreed to mine for 8 cents, but in the third week of July the majority of the recalcitrant miners stood out for the figure of the umpire. August witnessed some symptoms of a revival, and there was a growing activity, reaching into September, though values did not show any improvement until the close of the month. The beginning of October brought the award of the umpire, Mr. McCune, for winter work, the prices being 3½ cents for mining coal run over a 1½-inch screen. A corresponding advance in the market followed; and with the pits fairly active, the month closed with a satisfactory record. The cessation of the lake shipments in the beginning of November caused weakness, and the trade relapsed into dullness, sales being made at 5½ cents on the wall. The closing months of the year passed in extreme quietness, the demand on the part of railroads, mills, and for domestic purposes being comparatively restricted.

THE CONNELLSVILLE COKE TRADE.

The year 1883 is one that will long remain vivid in the memories of all interested in this great industry. It has been a year of exceptional depression and of important movements which have tended to concentrate the control of the business. The heavy falling off in the demand, the steady increase in the productive capacity, and the contest of the different railroads for a maximum share of the business have resulted in a remarkable decline of values. The year opened with coke selling at \$1.30 per ton in cars; but toward the close of January, with an ample car supply, and a declining volume of orders, fell off to \$1.15@ \$1.25. In the middle of February, the price was \$1, and only an average of 300 cars daily were sent out, against 800 cars in the beginning of the year, the embarrassments in the Western iron trade having a very depressing effect. There was a slight improvement in March, so far as the volume of business was concerned, the prices ranging from \$1.05@ \$1.15. In the middle of April, relief came to the producers by a reduction of freights to \$1 from the ovens to Pittsburg, but without stimulating orders. The supply continued in excess in May, and values receded to \$1, with occasional sales at less; and toward the closing days, demoralization spread, and 90@95 cents became the ruling rate for furnace coke. There was some inclination on the part of the "shaft" operators to urge a restriction of the output, a plan that was wrecked by the indifference of the "drift" mines, secure in an advantage over their fellows. Meetings were repeatedly held in June, and the owners of 4000 out of 10,000 ovens signed a paper favoring a limitation of the output by one half, but they did not result in any practical move. Prices declined to 85 cents, an unusually low figure, but they rallied slightly in July, holding at 95@ \$1, and closing at 95@ \$1.05 under an improved demand. A good deal of sensational talk was indulged in as to the formation of a "syndicate," but carefully conducted inquiries indicated that the reports did not rest on a good foundation. September saw a gradual rise in values, closing at \$1.05@ \$1.10 for furnace and \$1.15@ \$1.25 for foundry and selected coke free on board at ovens. In October, a weaker feeling developed, due to the fear that the efforts of the railroads to form a "pool" might lead to war. Another movement of great significance was the rapid extension of the influence of the leading coke-making firm, Messrs. Frick & Co., who, by purchase, absorbed a number of plants, until now they control more than one third of the capacity. November opened with coke at \$1@ \$1.05 and a fair demand, but prices did not mend during the month, and it was finally decided, toward the middle of December, to restrict production by 15 per cent, or 3600 cars per week. The end of the year, too, saw a settlement of the freight question, the railroads, after innumerable conferences, agreeing to the following allotment; Pennsylvania Railroad, 55 per cent; Baltimore & Ohio, 25 per cent; and the new-comer, the Pittsburg, McKeesport & Younghiogheny, 20 per cent. The year closed with prices at \$1 at the ovens. Except by annoying local disturbances, there was no serious disagreement between the makers and their men. The low prices current during the year have undoubtedly done much to extend the sphere of coke, while at the same time throwing the control of the business into firmer hands.

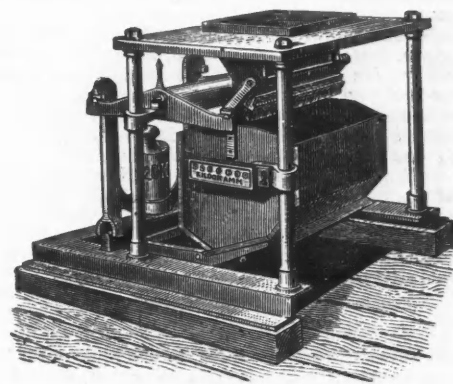
THE FOREIGN EXHIBITION AT BOSTON.

Special Correspondence of the Engineering and Mining Journal.

Although the Foreign Exhibition now in progress here contains many objects of interest to the metallurgist, the mineralogist, and the industrial chemist, yet the dearth of detailed and trustworthy information necessarily limits my description to a few things.

Self-Registering Automatic Grain-Weighing Machine.—This ingenious machine seems worthy of especial attention in this country, where the handling of grain is done on such an enormous scale and at such a vast number of points. It is made by the Hennefer Maschinen-Fabrik, at Hennefer-on-the-Sieg, in Germany, in which country it is said to have been already largely introduced into breweries, grain elevators, etc. We are also told that it is the only automatic machine for this purpose, and that it is recognized, approved, and stamped by the Prussian government. It is stated that in 500 test trials the greatest variation was only 67 grams in 60,000 kilograms, or only 0.00011 per cent—certainly a surprisingly insignificant proportion. The machine that is in operation at the Exhibition certainly seems most delicate and accurate, readily adjustable, and easily controlled. In its present form, it appears at first sight as if there was rather a complication of moving parts which might advantageously be simplified, although of course prolonged study of the design might remove this impression.

The apparatus consists essentially of an automatically recording beam-balance, with a counterpoise of known weight at one end and a box-shaped pan at the other, into which the grain is run, provided with ingenious automatic arrangements by which, as the weight of the grain in the pan approaches that of the counterpoise, the stream of grain is first checked, then stopped completely, and again admitted into the pan after the latter has automatically emptied itself. In the accompanying cut, the counterpoise is shown at the left side, marked 20 K, and the box-shaped grain-pan at the right side. The grain is delivered by an elevator or other suitable means into a hopper above the grain-pan. The spout



through which the grain runs from the hopper into the pan is controlled by two valves, which are actuated by the motions of the beam and pans. When the pan is empty, the counterpoise raises it into its highest position, thereby opening both valves of the hopper, allowing the grain to run at full speed into the pan. In this position, the weight of the pan is temporarily increased by that of a part of the mechanism which rests on it, and which we may call *W*. Now, as soon as the weight of the pan, plus the grain in it, plus *W*, equals the weight of the counterpoise, the pan begins to descend. In doing so, it shuts one of the two valves that control the stream of grain, and by the same motion, the weight *W* is removed from the pan, which therefore ceases to descend, the weight of grain, plus pan, being still less than that of the counterpoise. This first valve which has been thus closed does not completely stop the fall of grain, but allows a very narrow stream still to flow into the pan through a small notch in the valve itself. This stream runs on until the weight of pan, plus grain, barely exceeds that of the counterpoise, when the pan descends farther, closing the second valve, which completely stops the flow of grain. As the pan descends, it strikes a catch that opens a flap-valve in its bottom, through which the grain is almost instantaneously discharged. The counterpoise now draws the light and empty grain-pan up into its original position, automatically closing the flap-valve in its bottom, and at the same time opening the two valves which control the spout of the hopper. The grain again runs into the pan, and every thing goes on as before. We have thus allowed an exactly known weight of grain to pass the machine, which has meanwhile, by the motion of the pan, automatically registered on a dial one complete cycle of motions, by means of the arrangement familiar to us all as employed for registering the revolutions of marine engines.

The hopper-valves, which are none too clearly shown in the cut, may be described as about 60 degree arcs of concentric cylinders, each suspended at and rotating about a little shaft at the axis of those cylinders, which runs parallel with the length of the hopper spout at its right-hand side. When they are open, they are swung up to the left, out of the way of the stream of grain, in the position in which the cut represents them. They close by simply swinging downward to the left, cutting into the stream of grain just below the end of the spout. The grain simply piles itself up on the inner valve and chokes itself in the spout, its angle of repose being too steep to allow it to run over the edges of the valve.

Ordinarily the machine is inclosed in a locked iron box, and is entirely inaccessible, so that the holder of the key may be sure that there is no tampering with it during his absence. Its dial is, however, visible at all times, so that a workman may shut off the stream of the hopper when a given number of panfuls has been weighed out. Indeed, by applying some such arrangement as the Geneva stop (Rankine's Machinery and

Millwork, page 288), the machine could be easily set so that it would automatically stop itself after passing any desired number of panfuls of grain.

To test the working of the machine, the little stop or catch that opens the flap-valve in the bottom of the grain-pan on its descent, and thus empties it, is turned a little, when it will no longer open the flap-valve, but will simply arrest the descent of the pan. You can then see whether the full grain-pan and the counterpoise just balance each other, as they now swing freely, the accuracy with which they balance each other being indicated by an index attached to the balance-beam, just like the index-rod on an ordinary analytical or apothecary's balance.

The advantages of such a machine are so obvious as to hardly need to be pointed out. Not only is there a considerable saving in the labor of attendance in weighing out the grain, but the agent of the delivering or receiving party, the transporter or consignee, need only be present at the beginning and at the conclusion of the passage of a given lot of grain through the weighing-machine to be perfectly sure of what has gone in in the interim, provided, of course, that he assures himself that the spouts, trunks, etc., which carry the grain to and from the weighing-machine have remained undisturbed. For instance, if grain be delivered into a steamer, and the agent of a steamer can assure himself that all the grain which passes the weighing-machine enters his steamer, he need only be at the machine at the beginning and at the end of the delivery, even of a whole steamer-load of grain, to know exactly how much grain has passed into his vessel.

Leaf-Metals and Metallic Powders.—These are exhibited in most attractive form by J. F. Meier, of Furth, Bavaria, and of No. 135 William street, New York, and by J. Dannhauser, of Furth. We have here the greatest variety of colors of leaf-metals, many of them remarkably beautiful and wonderfully brilliant. Of the bronze powders, no less than nineteen beautiful shades are shown, including, besides such ordinary colors as white, red, golden, and orange, most attractive shades of green, blue, and violet. Perhaps the leaf aluminium is the most interesting of all to the metallurgist. All the aluminium used in leaf shape in this country is said to be imported from Paris, partly in blocks that are rolled down and reduced to leaves here, and partly as leaves. Among others, Messrs. Schultz & Co., of St. Mark's place, New York, roll their own leaf aluminium. It is estimated that about 6000 ounces are annually imported for this purpose.

The block aluminium is reduced to leaves in the same way that gold and silver are, but, owing to its being much less malleable, its leaves are much thicker. On account of its not tarnishing, it has a great advantage over silver-leaf, and has replaced it to a great extent for outside sign-work, for book-binders' purposes, and for hat-tip printers. On account of its great thickness, it does not adhere to glass so well as silver-leaf does, and the latter is therefore still probably exclusively used for lettering the interior of glass windows. Here the glass protects the side of the leaf nearest the street from tarnishing. The thickness of aluminium leaf renders it less desirable for book-binders than gold-leaf, although here, as in the case of outside sign-work, the ornamenting of leather for furniture, etc., the fact that it does not tarnish has enabled it to supersede silver-leaf.

Ozokerite.—On account of our deposits of this valuable substance in Utah, which, though important, have not yet been extensively developed, I believe, the display of Franz Wilhelm & Co., of Vienna, is particularly interesting. We have, in the first place, large blocks of the crude ozokerite displayed, having a color and general appearance much like the Utah mineral. Next we have a crude orange-colored wax made from it, with a fracture and translucency not unlike bees-wax, not soiling the fingers, and in every way decidedly waxy instead of greasy. It is said to be largely used in Europe for polishing wood and especially the beautiful floors whose extreme slipperiness gives the inexperienced such pangs of terror.

Next comes a still more refined product, of a fine pale-yellow color, with a rich polish, called crude cerasine, and finally, the highly refined, beautiful snow-white cerasine, with a charming waxy luster.

These refined products have a faint and agreeable wax-like odor, just enough to make them rather attractive, and by no means strong enough to annoy the most sensitive.

Beautiful tapers, or candles, are also shown, made from ozokerite, of various agreeable colors. They are hard, firm, and strong. I have taken the trouble to compare them carefully with the ordinary wax tapers (technically called Christmas candles) of the same size, and find that the ozokerite candles give a slightly less powerful light, say about three quarters as strong as that of the wax candle, but, on the other hand, burn much more slowly, a given length of ozokerite candle lasting nearly 60 per cent longer than the same length of wax candle of the same diameter. The ozokerite candle also remained quite hard at a temperature at which the wax candles bent rapidly under their own weight. The wax candles with which I have compared the ozokerite ones may not have been of the best and hardest. Still, the latter seem undoubtedly to be eminently fitted for mining purposes, where a slow burning and hard candle is to be sought, rather than one with a brilliant flame.

Central America sends quite a mineral display from Salvador and Guatemala. Among the Salvador minerals, are many ores of gold and silver, and some large and attractive lumps of moss-silver. From Guatemala, come several handsome marbles and alabasters from Sacatepequez and other places. Besides these, we find asbestos with very long and fine fiber, fair-looking plumbago, sulphur, and some lignite of fair quality. The display of Guatemala woods is very attractive, there being a large number of most beautiful polished ornamental woods, among which the rosewood and the mosaic ebony deserve particular admiration.

From *Ceylon* is sent what few of us have seen: A large, beautiful stick of ebony, so black as to remind one of the scriptural darkness which might be felt (hence the expression of Thothmes, "as black as your hat"). This stick is about six feet long and one foot in diameter.

Crucibles.—The Gebrüder Bessel, of Dresden, send some fine-looking crucibles, of which one is two feet one inch high and one foot seven inches in diameter at the top, or considerably larger than any ordinarily made in this country, the largest made by the Joseph Dixon Crucible Company being 21 inches high and 15½ inches in diameter at the top. We are told that in five heats 350 centners of silver alloy were melted in this crucible at the royal mint in Dresden.

ON GAS-FIRING FOR STEAM-BOILERS.*

By F. J. Rowan.

The quantities of fuel consumed each day in boiler-furnaces are considerable, and the expenditure occasioned in all industries by the production of motive power is too great not to attract our attention and to cause us to seek diligently for means of applying to boilers gas-firing, with all its advantages.

Great advance has been made in the design of boilers in the direction of utilizing more perfectly the heat of the gaseous products of combustion, and in that of reducing the diameters which are subject to pressure, so that thinner material can be used for a large portion of the heating surface; and thus the transmission of heat as well as the cooling of the gases is facilitated. But a similar advance has only recently been made in perfecting the means of combustion and in the application of the fuel, so that still, in spite of police regulations about the production of smoke, the chimneys of many works and factories send forth great volumes of dense, black smoke, polluting the surrounding atmosphere.

In order to have complete combustion, it is necessary to have an intimate mixture and contact between the particles of the combustible and the oxygen of the air, and to maintain, during the whole period of combustion, a temperature sufficiently high to permit of the free action of chemical affinity.

The employment of solid fuel, although in small pieces, prevents the realization of the one because it is only the surface of the pieces which can be in contact with the air; and the employment of methods of combustion which necessitate the use of excess of air interferes with the other by the inevitable lowering of the temperature.

Mere alterations of the form of the grate and of the methods of charging the fuel upon it do not suffice to meet the problem; and thus mechanical stokers must fail to be permanently adopted, since they only deal with the evil of irregular charging. On the other hand, the mere prevention of the appearance of smoke is not all. Analysis of the escaping gases is required to show whether there is an excess of oxygen in them, and thus whether too much air is admitted to the fire, and also to prove whether the invisible gases do not contain carbonic oxide instead of carbonic acid, showing that fuel is wasting. This test is especially needed to expose the fallacy of those so-called "smoke-consumers" that propose to give completeness of combustion by the introduction of steam into the furnaces in which coal is burning.

A furnace approaches perfection in proportion as the fuel is burned in it completely and with the minimum quantity of air in excess. Smoke escaping from the chimney is the best proof that combustion is incomplete; and if we could tell by sight the composition of the gaseous mixture in which the smoke is suspended, we should see that air is nearly always present in great excess. This excess of air is detrimental, because it lowers the temperature of the gases of combustion at the expense of which it is heated, and renders it necessary to increase the heating surface of any apparatus designed to utilize the heat of such gases. It also involves the construction of larger grates than are theoretically necessary, thus causing increased cost of construction; and as the gases which escape from the chimney must possess a certain temperature, the quantity of heat lost in this way is proportional to the quantity of gas passing away.

To apply this to the case of steam-boilers, it is plain that the excess of air admitted to the furnace cools the flame, lessens the production of steam per square foot of heating surface, and necessitates an increase of surface in the boiler, in order to obtain a given production of steam and reduction of the temperature of the hot gases. Moreover, if we admit a temperature of chimney of 200 degrees C. (= 392 degrees Fahr.) for a medium draught, then, if we employ two or three times the quantity of air theoretically required by the fuel, the loss of heat in this direction is double or treble the normal or proper loss. The chimney itself, so as to discharge more gas than would be necessary with furnaces constructed to work without excess of air, must have larger dimensions; and as that happens only too often, we are led to cool the gases less and lose them at 300 degrees or 400 degrees C. (500 degrees or 700 degrees Fahr.), in order to get sufficient draught with these larger chimneys.

The evils inherent in furnaces using solid fuel are not to be overcome by the management of the draught or alteration of the speed of combustion; for a comparison of the different rates of combustion per standard area of grate surface with ordinary appliances shows that, with slow combustion on large grates with feeble draught, no greater useful effect is obtained than with smaller grates on which a larger quantity of fuel is incompletely burned with a strong draught.

Again, with imperfect combustion such as is common to all boiler-furnaces using solid fuel, we are exposed to the evil of the formation of a deposit of soot on the heating surfaces of the boilers (and feed-water heaters where these are used), which entails a considerable loss of their efficiency. And the use of solid fuel also causes additional wear to the boilers by the alternate heating and cooling which result from the operations of charging where solid fuel must first be volatilized and then burned in the same chamber, and even of combustion itself.

Gas-firing is the easy remedy for all these evils, and it fulfills in a remarkable degree the conditions necessary for obtaining the best result from the combustion of fuel. By no other means can that intimate mixture and contact between the particles of the combustible and the supporter of combustion be obtained which are essential to complete combustion. The formation of smoke and soot is prevented, and, in the case of boilers, the destructive alternations of high and low temperature are replaced by an even temperature which the steady stream or flame supplies.

In carrying out the application of gas to boiler-firing, some simple precautions are desirable. For instance, in consequence of the rapid cooling of the products of combustion that results from contact with the surfaces of boilers which continually abstract heat, it is necessary, in firing them with gas, to allow the gas and air to mix in a combustion-chamber previous to their entrance into boiler-flues, so that only flame and highly heated products of combustion come in contact with the heating surface.

Heating the supply of air for combustion by means of the waste

* A paper read before the Mining Institute of Scotland.

heat carried by the escaping gases insures a higher temperature of combustion; but with gas-firing, even without such an addition, it is possible not only to insure the use of the minimum quantity of air in excess, but also to obtain a higher calorific intensity than with solid fuel. The reason of this is clearly explained by Galloway in his *Treatise on Fuel*, where he says (p. 46): "For every 1 part by weight of oxygen contained in air, there are 3.35 of nitrogen; now, 8 parts of oxygen are required to convert 3 parts of carbon into carbonic acid: there are associated with the 8 parts of oxygen in the air 26.8 parts of nitrogen, and the specific heat of nitrogen is 0.244 at constant pressure. We find the calorific intensity when carbon is burned in air to be 2717.6 degrees C.; thus:

$$3 \times 8080 = 2717.6^\circ \text{C.}$$

$$11 \times 0.2164 + 26.8 \times 0.244$$

Paradoxical as it might at first appear, the calorific intensity of carbonic oxide is greater than that of carbon when burnt in air. It will be seen that this is due to the lesser amount of air the carbonic oxide requires for its combustion; thus:

$$2408 = 2982^\circ \text{C.}$$

$$1.57 \times 0.2164 + 1.91 \times 0.244$$

The subject of firing boilers by gas has been studied on the continent for a number of years; and in the year 1873, after numerous trials, very satisfactory results were realized in actual working in France.

These results were obtained in the works of M. E. Muller at Ivry, and are recorded in an excellent paper by M. Fichet in the *Mémoires de la Société des Ingénieurs Civils*, the information of which paper has been freely made use of for the purposes of this communication. Two boilers were employed of the French type, having the cylindrical portion 1 m. 10 (= 3 feet 7 inches) diameter, with heaters or accessory chambers 60 centim. (= 24 inches) diameter, and the heating surface was 52 square meters (= 560 square feet) not reckoning the surface of feed-water heaters.

A producer (or gazogène) of a modification of the Siemens type was employed, placed close to the boiler setting—in fact, the arrangement required a producer grate to each boiler—and the setting contained elaborate passages for dividing and heating the air used for combustion. The performance of the gas-fired boiler was compared with that of the one fired by hand, and with similar boilers fired by hand, using the same coal and the same water, and numerous analyses were made of the producer-gas and escaping gases after combustion.

It was found that, whereas the ordinary rate of evaporation in hand-fired boilers—using the coal of the north of France and of Belgium—was about 6 pounds of water per pound of coal (although the Industrial Society of Mulhouse recorded in July, 1873, several results varying from 6.018 to 6.448 pounds), with the gas-fired boiler an evaporation of 8.60 and 9.20, or a mean of 8.90 pounds, was obtained. This showed an increase of evaporative efficiency of 48 per cent in the boiler fired by gas, or an economy of fuel of 38 per cent for equal quantities of water evaporated.

Great stress is laid by M. Fichet upon the importance of having a supply of heated air under a slight pressure (due to the ascensional force acquired by its being heated), so that there should be no suction from chimney draught, which, he found, invariably caused an excess of air to find its way in through cracks in the brick-work, and even through the pores of the bricks themselves, even when all air-valves were closed. It is to be remarked, however, that the arrangement of gasogène and boiler setting which he adopted necessitated a large amount of brick-work.

He has not given the temperature to which the air for combustion was heated; but other observations, extending over a week's working, are given in tables of which the following are translations:

RESULTS OF THE WORKING OF GAS-FIRED BOILERS.

Description of coal used, Grand Hornu. Moisture in coal (in the rough), 2.21 per cent. Analysis of coal (dry)—gas, 27.72; coke, 72.28—100. Ash, 9.36 per cent. Heating surface of boiler, 52 square meters = 559.74 square feet. Average pressure of steam, 5 atmospheres = 75 pounds per square inch. Weight of coal burned in 11 hours, 820 kilograms = 1808 pounds. Weight of water evaporated in 11 hours, 6900 kilograms = 15,224 pounds. Weight of water evaporated per pound fuel, 8.40 pounds. Weight of water at 0 degree C (= 32 degrees F.), 8.80 pounds. Weight of water evaporated per square meter of surface, 12.0 kilograms. Weight of ashes (dry) in 11 hours, 72 kilograms = 158.7 pounds.

| Hour of observation. | Temperature of feed-water in tank. | ANALYSES OF GASES. | | | Temperatures observed. Degrees Centigrade. | | | | |
|----------------------|------------------------------------|-------------------------|-----------------|---------|--|-----------------------------|-----------------------|--------------------------------|-------------------------------|
| | | Place where sampled. | CO ₂ | N, etc. | Total. | Between boiler and heaters. | At the end of boiler. | In front of feed-water heater. | Behind the feed-water heater. |
| 6 A.M. | Deg. Cent. 21 | Gasogène..... | 16.0 | 100.0 | 100 | 625 | | | |
| 7 A.M. | (75.2 F.) | Combustion-chamber..... | 17.5 | 83.5 | 100 | | | | |
| | | End of boiler..... | 17.0 | 83.0 | 100 | | | | |
| 8 A.M. | | Gasogène..... | 1.0 | 99.0 | 100 | 336 | 332 | 262 | |
| | | Combustion-chamber..... | 17.0 | 83.0 | 100 | | | | |
| | | End of boiler..... | 16.5 | 83.5 | 100 | | | | |
| 10 A.M. | | Gasogène..... | 16.0 | 100.0 | 100 | 626 | | | |
| | | Combustion-chamber..... | 16.0 | 84.0 | 100 | | | | |
| | | End of boiler..... | 16.5 | 83.5 | 100 | | | | |
| 12 noon. | 24 | Gasogène..... | 1.0 | 99.0 | 100 | 490 | | | |
| 2 P.M. | | Combustion-chamber..... | 18.5 | 81.5 | 100 | | | | |
| | | End of boiler..... | 16.5 | 83.5 | 100 | | 398 | 358 | |
| 4 P.M. | | Gasogène..... | 100.0 | 100 | 100 | | | | 263 |
| | | Combustion-chamber..... | 16.0 | 84.0 | 100 | 708 | | | |
| | | End of boiler..... | 15.0 | 85.0 | 100 | | | | |
| 6 P.M. | 29 (84.2 F.) | | | | | | | | |

Description of coal used, Grand Hornu. Moisture in coal (in the rough),

2.21 per cent. Analysis of coal (dry)—gas, 27.72; coke, 72.28—100 per cent. Ash, 9.36 per cent. Heating surface of boiler, 52 square meters = 559.74 square feet. Average pressure of steam, 4.5 atmospheres = 66 pounds per square inch. Weight of coal burned in 11 hours, 818 kilograms = 1803 pounds. Weight of water evaporated in 11 hours, 6845 kilograms = 15,086 pounds. Weight of water evaporated per pound fuel, 8.37 pounds. Weight of water at 32 degrees F., 8.83 pounds. Weight of water evaporated per square meter of surface, 12.0 kilograms. Weight of ashes (dry) in 11 hours, 76.5 kilograms = 168.6 pounds.

| Hour of observation. | Temperature of feed-water in tank. | ANALYSES OF GASES. | | | | Temperatures observed. Degrees Centigrade. | | | |
|----------------------|------------------------------------|-------------------------|-----------------|---------|--------|--|-----------------------|--------------------------------|-------------------------------|
| | | Place where sampled. | CO ₂ | N, etc. | Total. | Between boiler and heaters. | At the end of boiler. | In front of feed-water heater. | At back of feed-water heater. |
| 6 A.M. | Deg. Cent. 27 | Gasogène..... | 0.5 | 99.5 | 100 | | | | |
| 7 A.M. | (80.6 F.) | Combustion-chamber..... | 16.5 | 83.5 | 100 | | | | |
| | | End of boiler..... | 17.0 | 83.0 | 100 | 610 | 375 | | |
| 9 A.M. | | Gasogène..... | 100.0 | 100 | 100 | | | 401 | |
| | | Combustion-chamber..... | 17.0 | 83.0 | 100 | | | | |
| | | End of boiler..... | 15.0 | 85.0 | 100 | 626 | 352 | 342 | |
| 12 noon. | | Gasogène..... | 0.5 | 99.5 | 100 | | | | 300 |
| | | Combustion-chamber..... | 13.0 | 87.0 | 100 | | | | |
| | | End of boiler..... | 13.5 | 86.5 | 100 | | | | |
| 1 P.M. | 25 | | | | | 629 | 368 | 342 | |
| 3 P.M. | (77.0 F.) | Gasogène..... | 0.5 | 99.5 | 100 | | | | |
| | | Combustion-chamber..... | 14.5 | 85.5 | 100 | | | | |
| | | End of boiler..... | 16.0 | 84.0 | 100 | 682 | 370 | | 329 |
| 5 P.M. | | | | | | | | | |

Description of coal used, Grand Hornu. Moisture in coal (in the rough), 2.21 per cent. Analysis of coal (dry)—gas, 27.72; coke, 72.28—100 per cent. Ash, 9.36 per cent. Heating surface of boiler, 52 square meters = 559.74 square feet. Average pressure of steam, 5 atmospheres = 75 pounds per square inch. Weight of coal burned in 11 hours, 911 kilograms = 2007 pounds. Weight of water evaporated in 11 hours, 7850 kilograms = 17,301 pounds. Weight of water evaporated per pound fuel, 8.61 pounds. Weight of water at 32 degrees F., 9.08 pounds. Weight of water evaporated per square meter of surface, 13.72 kilograms. Weight of ashes (dry) in 11 hours, 89 kilograms = 196 pounds.

| Hour of observation. | Temperature of feed-water in tank. | ANALYSES OF GASES. | | | | | Temperatures observed. Degrees Centigrade. | | | | |
|----------------------|------------------------------------|-----------------------|-----------------|-----|------|---------|--|-----------------------------|-----------------------|--------------------------------|-------------------------------|
| | | Place where sampled. | CO ₂ | O. | CO. | N, etc. | Total. | Between boiler and heaters. | At the end of boiler. | In front of feed-water heater. | At back of feed-water heater. |
| 6 A.M. | Deg. Cent. 24 | Gasogène..... | 0.5 | | | 99.5 | 100 | 648 | | | |
| 8 A.M. | (75.2 F.) | Combust. chamber..... | 17.0 | | | 83.0 | 100 | | | | |
| | | End of boiler..... | 16.0 | | | 84.0 | 100 | | | | |
| 10 A.M. | | Gasogène..... | 0.0 | | 31.0 | 79.0 | 100 | | 365 | 356 | |
| 3 P.M. | | Combust. chamber..... | 9.0 | 9.0 | 1.0 | 81.0 | 100 | | | | |
| 5 P.M. | | End of boiler..... | 14.5 | 4.0 | 1.0 | 80.5 | 100 | 577 | | | |
| 6 P.M. | 31 (87.8 F.) | | | | | | | | 410 | 417 | |

Description of coal used, Nœux, Pit No. 4. Moisture in coal (in the rough), 2.01 per cent. Analysis of coal (dry)—gas, 28.87; coke, 71.13—100 per cent. Ash, 6.42 per cent. Heating surface of boiler, 52 square meters = 559.74 square feet. Average pressure of steam, 4.75 atmospheres = 69.85 pounds. Weight of coal burned in 11 hours, 1081 kilograms = 2272 pounds. Weight of water evaporated in 11 hours, 8810 kilograms = 19,417 pounds. Weight of water evaporated per pound fuel, 8.54 pounds. Weight of water at 32 degrees F., 9.23 pounds. Weight of water evaporated per square meter of surface, 15.40 kilograms. Weight of ashes (dry), in 11 hours, 126 kilograms = 277.7 pounds.

| Hour of observation. | Temperature of feed-water in tank. | ANALYSES OF GASES. | | | | | Temperatures observed. Degrees Centigrade. | | | | |
|----------------------|------------------------------------|-----------------------|-----------------|-----|------|---------|--|-----------------------------|-----------------------|--------------------------------|-------------------------------|
| | | Place where sampled. | CO ₂ | O. | CO. | N, etc. | Total. | Between boiler and heaters. | At the end of boiler. | In front of feed-water heater. | At back of feed-water heater. |
| 6 A.M. | Deg. Cent. 28 | Gasogène..... | 1.0 | | 20.0 | 79.0 | 100 | | | | |
| 8 A.M. | (82.4 F.) | Combust. chamber..... | 8.5 | 5.5 | 2.5 | 83.5 | 100 | | | | |
| | | End of boiler..... | 11.0 | 9.0 | 5.0 | 80.0 | 100 | 613 | | | |
| 9 A.M. | | Gasogène..... | 11.0 | 2.0 | 5.0 | 82.0 | 100 | | | 384 | |
| 10 A.M. | | Combust. chamber..... | 14.0 | 5.0 | 0.5 | 80.5 | 100 | | | | 356 |
| 11 A.M. | | Gasogène..... | 0.5 | 0.0 | 20.0 | 79.0 | 100 | | | | |
| 3 P.M. | 26 (78.8 F.) | Combust. chamber..... | 13.0 | 5.5 | 0.5 | 81.0 | 100 | 676 | | | |
| | | End of boiler..... | 6.5 | 9.5 | 0.5 | 83.5 | 100 | | 351 | | |
| 5 P.M. | | Combust. chamber..... | 15.0 | 3.5 | 0.0 | 81.0 | 100 | | | 349 | 193 |
| 6 P.M. | 30 (86 F.) | | | | | | | | | | |

Description of coal used, Nœux, Pit No. 4. Moisture in coal (in the rough), 2.01 per cent. Analysis of coal (dry)—gas, 28.87; coke, 71.13—100 per cent. Ash, 6.42 per cent. Heating surface of boiler, 52 square

meters = 559.74 square feet. Average pressure of steam, 5 atmospheres = 75 pounds per square inch. Weight of coal burned in 11 hours, 1127 kilograms = 2483.9 pounds. Weight of water evaporated in 11 hours, 11,858 kilograms = 26,135 pounds. Weight of water evaporated per pound fuel, 10.52 pounds. Weight of water at 32 degrees F. per pound fuel, 11.89 pounds. Weight of water evaporated per square meter of surface, 20.73 kilograms. Weight of ashes (dry) in 11 hours, 101 kilograms = 222.6 pounds.

| Hour of observation. | Temperature of feed-water in tank. | Place where sampled. | ANALYSES OF GASES. | | | | | Temperatures observed. | | | | |
|----------------------|------------------------------------|-----------------------|--------------------|-----|------|---------------------|--------|-----------------------------|-----------------------|--------------------------------|-------------------------------|--|
| | | | CO ₂ | O. | CO. | N ₂ etc. | Total. | Between boiler and heaters. | At the end of boiler. | In front of feed-water heater. | At back of feed-water heater. | |
| 6 A.M. | 25 (77 F.) | | | | | | | | | | | |
| 8 A.M. | | Gasogene..... | 1.0 | 0.0 | 20.0 | 79 | 100 | | | | | |
| | | End of boiler..... | 15.0 | 2.0 | 2.0 | 81 | 100 | | | | | |
| 9 A.M. | | Combust. chamber..... | 19.5 | 1.0 | 0.5 | 79 | 100 | 751 | | | | |
| 10 A.M. | | " | 16.0 | 0.0 | 2.0 | 82 | 100 | | 396 | 350 | 244 | |
| 11 A.M. | | End of boiler..... | 16.0 | 2.0 | 0.0 | 82 | 100 | | | | | |
| 12 noon | 32 (89.6 F.) | | | | | | | | | | | |
| 3 P.M. | | Combust. chamber..... | 16.0 | 0.5 | 0.5 | 83 | 100 | | | | | |
| | | Gasogene..... | 5.0 | 0.0 | 16.0 | 79 | 100 | | | | | |
| | | End of boiler..... | 14.0 | 4.0 | 0.0 | 82 | 100 | | | | | |
| 4 P.M. | | Gasogene..... | 6.0 | 0.0 | 21.0 | 70 | 100 | 686 | | | | |
| 5 P.M. | | | | | | | | | 397 | 376 | 219 | |
| 6 P.M. | 31 (87.8 F.) | | | | | | | | | | | |

Description of coal used, No. 4. Moisture in coal (in the rough), 2.01 per cent. Analysis of coal (dry)—gas, 28.87; coke, 71.13—100 per cent. Ash, 6.42 per cent. Heating surface of boiler, 52 square meters = 559.74 square feet. Average pressure of steam, 5 atmospheres = 75 pounds per square inch. Weight of coal burned in 11 hours, 833 kilograms = 1829.9 pounds. Weight of water evaporated in 11 hours, 7815 kilograms = 17,246 pounds. Weight of water evaporated per pound fuel, 9.39 pounds. Weight of water at 32 degrees F., 10.12 pounds. Weight of water evaporated per square meter of surface, 13.70 kilograms. Weight of ashes (dry) in 11 hours, 99 kilograms = 218 pounds.

| Hour of observation. | Temperature of feed-water in tank. | Place where sampled. | ANALYSES OF GASES. | | | | | Temperatures observed. | | | | |
|----------------------|------------------------------------|-----------------------|--------------------|-----|------|---------------------|--------|-----------------------------|-----------------------|--------------------------------|-------------------------------|--|
| | | | CO ₂ | O. | CO. | N ₂ etc. | Total. | Between boiler and heaters. | At the end of boiler. | In front of feed-water heater. | At back of feed-water heater. | |
| 8 A.M. | 26 (78.8 F.) | | | | | | | | | | | |
| 9 A.M. | | Gasogene..... | 15.0 | 1.0 | 20.0 | 80.0 | 100 | | | | | |
| | | Combust. chamber..... | 15.0 | 1.0 | 0.5 | 83.5 | 100 | 610 | | | | |
| 10 A.M. | | End of boiler..... | 15.0 | 4.0 | 0.0 | 81.0 | 100 | | 355 | 305 | 210 | |
| 1 P.M. | 28 (82.4 F.) | Gasogene..... | 0.5 | 0.0 | 20.5 | 79.0 | 100 | | | | | |
| | | Combust. chamber..... | 13.0 | 1.0 | 4.0 | 82.0 | 100 | | | | | |
| 2 P.M. | | End of boiler..... | 15.0 | 1.0 | 3.0 | 81.0 | 100 | 659 | | | | |
| 3 P.M. | | | | | | | | | 406 | 381 | 191 | |
| 4 P.M. | | Combust. chamber..... | 13.0 | 1.0 | 4.0 | 82.0 | 100 | | | | | |
| | | Gasogene..... | 1.0 | 0.0 | 19.0 | 80.0 | 100 | | | | | |
| 5 P.M. | | Combust. chamber..... | 17.0 | 1.0 | 0.0 | 82.0 | 100 | | | | | |
| 6 P.M. | 30 (80.0 F.) | | | | | | | | | | | |

Recently, a very carefully conducted series of comparative trials of gas and hand-firing has been made in this country by Mr. J. H. Darby, engineer to the Plas Power Colliery at Wrexham, whose report I am enabled to quote in full. He employed two boilers of the Lancashire pattern of identical design and dimensions, one (illustrated on Figs. 1 and 2) being fired by gas from a Wilson producer with the arrangement of furnaces, gas-valves, etc., as shown in the figures, but without any elaborate arrangement of boiler setting as in the French experiments, and with the minimum of brick-work in the combustion arrangements. The other was fired by hand in the usual way. Measurements of the water and coal used, and analyses of all gases from the producer and in chimney flues* were made, and the *modus operandi* was slightly altered in the experiments, in order to ascertain the best way of working. The result he has stated to be an average economy of 27 per cent in favor of the gas-fired boiler.

REPORT of Trials conducted at Plas Power Colliery of the Comparative Economy of Firing Boilers by Gas and Hand.

The two boilers selected for the experiments were set side by side, and of the following size and dimensions: Length, 27 feet; diameter, 7 feet; with internal flues of the Lancashire pattern, seven diagonal tubes being placed in each flue. Effective heating surface in each boiler, 443 square feet. No. 1 was heated by gas from a Wilson producer. No. 2 was hand-fired by the usual method. The feed-water was supplied from two iron tanks by a pump:

- No. 1 tank supplying No. 1 boiler, measuring 15' 11 1/2" x 7' 0".
 - No. 2 tank supplying No. 2 boiler, measuring 15' 11 1/2" x 6' 11 1/2".
- The gauge of the tanks was then: No. 1, 561 pounds water per inch depth. No. 2, 576 do.

The draught caused the burnt gases to pass first along the internal flues, then back along the bottom of the boiler, splitting at the front into a flue on each side, and along these to the main flue.

In trial No. 1, the hand-fired boiler was worked as is usual at the colliery, with

* Examinations of the waste gases from two boilers similarly fired by gas from Wilson producers at Messrs. Tangye's Steel-Works, Birmingham, have been made by Pattinson & Stead, who certify that the average of six analyses gave 13.20 per cent of carbonic acid, precautions having been taken to remove sulphur dioxide before treating the gases with potash. This result shows a completeness of combustion equal to that shown by the analyses in Mr. Darby's trials.

the damper open, and a draught of 16 to 20 millimeters (5/8 to 7/8 of an inch) of water, so as to burn the inferior fuel.

In trials Nos. 2 and 3, with the same boiler, the draught was regulated to 9 millimeters (3/4 tenths of an inch), the fires being so worked that the red fuel was pushed forward toward the bridge, while the green fuel was being coked near the dead-plate. There was, however, much trouble in burning the inferior fuel by this method of firing the boiler taking the entire attention of one stoker.

Description of coal used: Refuse.

TRIAL No. 1.—Nos. 1 and 2 Boilers.

Duration of trial, 11 hours. Draught, 16 to 20 millimeters (5/8 to nearly 7/8ths of an inch). Pressure of steam 50 pounds per square inch.

No. 1 BOILER (PRODUCER).

Used 8260 pounds of fuel. Used 47,932 pounds of water—4357 pounds per hour. One pound of fuel evaporated 5.8 pounds of water. Fuel gave clinker and refuse 13.5 per cent. Temperature of water for feed, 40 degrees Centigrade (= 104 degrees F.). Pressure of gas in producer, 20 millimeters = nearly 3/8ths of an inch. Carbonic acid in gases issuing from the end of internal flues, 8.2 per cent. Sample of gas from producer gave an analysis:

| | Per cent. |
|---------------------|-----------|
| Carbonic acid..... | 7.14 |
| Oxygen..... | 0.00 |
| Hydrogen..... | 12.15 |
| Carbonic oxide..... | 19.83 |
| Marsh-gas..... | 3.61 |
| Nitrogen..... | 57.24 |
| | 99.97 |

Temperature in annular flue of producer, 960 degrees C. (= 1760 degrees Fahr.). Temperature above gas-valve under boiler, 740 degrees C. (= 1364 degrees Fahr.). Temperature in fuel of producer, 1300 degrees C. (= 2372 degrees Fahr.).

No. 2 BOILER—(HAND-FIRED).

Used 6160 pounds of fuel. Used 32,616 pounds of water—2965 pounds per hour. One pound of fuel evaporated 5.3 pounds of water. Fuel gave 16.6 per cent of clinker and refuse. Temperature of feed-water, 40 degrees C. (= 104 degrees F.).

In the foregoing trials, the fuel burnt as gas in No. 1 boiler gives a better duty by 9.4 per cent than the same class of fuel burnt under No. 2 boiler by hand-firing, the duty done by each boiler per hour being in favor of the gas-fired boiler.

Gas-fired boiler, 4357 pounds of water evaporated per hour. Hand-fired boiler, 2965 pounds of water evaporated per hour. With the temperature of the feed-water at 100 degrees C. (= 212 degrees Fahr.) and the steam at atmospheric pressure, the duty per pound of fuel would be as calculated:

No. 1 gas-fired boiler, 6.86 pounds of water evaporated per pound of fuel. No. 2 hand-fired boiler, 6.26 pounds of water evaporated per pound of fuel. Before making Trial No. 2, various tests were taken to ascertain what conditions of draught were most favorable to a high percentage of carbonic acid in the burnt gases.

TRIAL No. 2.—Nos. 1 and 2 Boilers.

Description of Fuel: Refuse from Screens. Duration of trial, 9 1/2 hours. Draught, 9 millimeters of water (3/4 tenths of an inch). Pressure of steam, 50 pounds per square inch.

No. 1 BOILER (PRODUCER).

Used 6104 pounds of fuel. Used 39,943 pounds of water—4204 pounds per hour. One pound of fuel evaporated 6.5 pounds of water. Fuel gave 12.6 per cent of clinker and refuse. Temperature of feed-water, 30 degrees C. (= 86 degrees Fahr.). Pressure of gas in producer, about 20 millimeters (nearly 1/2ths of an inch). Carbonic acid gas, in gases issuing from end of internal flues, 13.4 per cent. With slightly redder flame, carbonic acid, 16.2 per cent. Oxygen, 1.4 per cent. Carbonic oxide, 0.8 per cent. Temperature of gases in annular ring of producer, 750 degrees C. (= 1382 degrees Fahr.). Temperature of gases in valve below boiler, 570 degrees C. (= 1058 degrees Fahr.). Temperature of waste gases in flue to chimney, 320 degrees C. (= 608 degrees Fahr.). Temperature of air heated by waste gases before combustion, 120 degrees C. (= 248 degrees Fahr.).

In this trial, the level of the fuel in the producer was about 4 feet from the ground.

No. 2 BOILER (HAND-FIRED).

Used 4704 pounds of fuel. Used 29,880 pounds of water—3145 pounds per hour. One pound of fuel evaporated 6.3 pounds of water. Fuel gave 13.6 per cent of clinker and refuse. Temperature of feed-water, 30 degrees C. (= 86 degrees Fahr.). Carbonic acid in end of internal flues, 10 per cent. Oxygen, 8.9 per cent. With slightly redder flame—carbonic acid in end of internal flues, 14.2 per cent. With slightly redder flame—oxygen, 4.6 per cent.

In No. 2 Trial, the fuel burnt as gas in No. 1 boiler gives a better duty by 3.2 per cent than the same class of fuel burnt under No. 2 boiler by hand-firing. But contrasting the duty done by No. 1 boiler during No. 2 Trial, with the duty done by No. 2 boiler in No. 1 Trial, there is a better duty given by No. 1 boiler over No. 2 boiler of 22.6 per cent. With the temperature of the feed-water at 100 degrees C. (= 212 degrees Fahr.), and the steam at atmospheric pressure, the duty per pound of fuel would be as calculated:

No. 1 boiler (gas-fired), 7.8 pounds of water evaporated per pound of fuel. No. 2 boiler (hand-fired), 7.5 pounds of water evaporated per pound of fuel. The duty done by each boiler per hour is in favor of the gas-fired boiler, as under:

Gas-fired boiler, 4204 pounds of water evaporated per hour. Hand-fired boiler, 3145 pounds of water evaporated per hour.

TRIAL No. 3.

It was resolved to try the fuel in the producer at a higher level, in order, if possible, to reduce the temperature of the gases on leaving the producer, and also to reduce the percentage of carbonic acid in the gases.

Nos. 1 AND 2 BOILERS.

Duration of trial, 9 hours. Draught, 9 millimeters of water (= 3/4 tenths of an inch). Pressure, 50 pounds. Description of fuel, best coal.

No. 1 BOILER (PRODUCER).

Used 3948 pounds of fuel. Used 33,916 pounds of water—3768 pounds per hour. Fuel gave 12.5 per cent of clinker and refuse. Temperature of feed-water 30 degrees C. (= 86 degrees Fahr.). Pressure of gas in producer, about 22 millimeters (= 8/10 tenths of an inch). Carbonic acid in gases issuing from end of internal flues, 14 per cent. Oxygen, 2.8 per cent.

An analysis of the gases, taken when the producer seemed to be at its best,

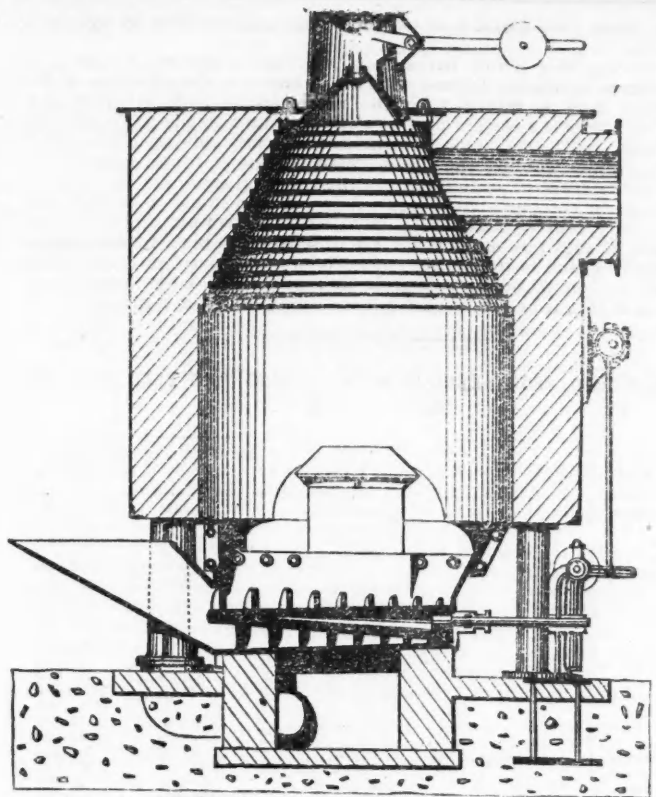


FIG. 2.—SECTION OF WILSON PRODUCER.

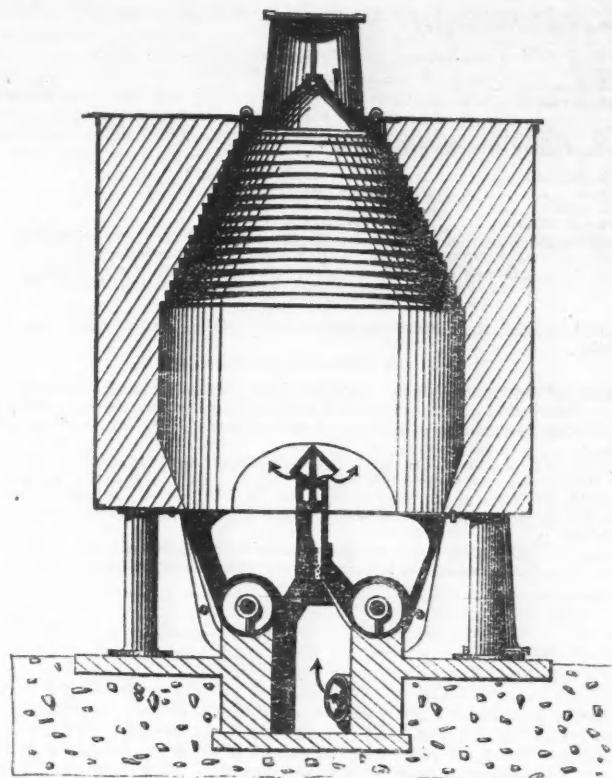


FIG. 3.—SECTION OF WILSON PRODUCER.

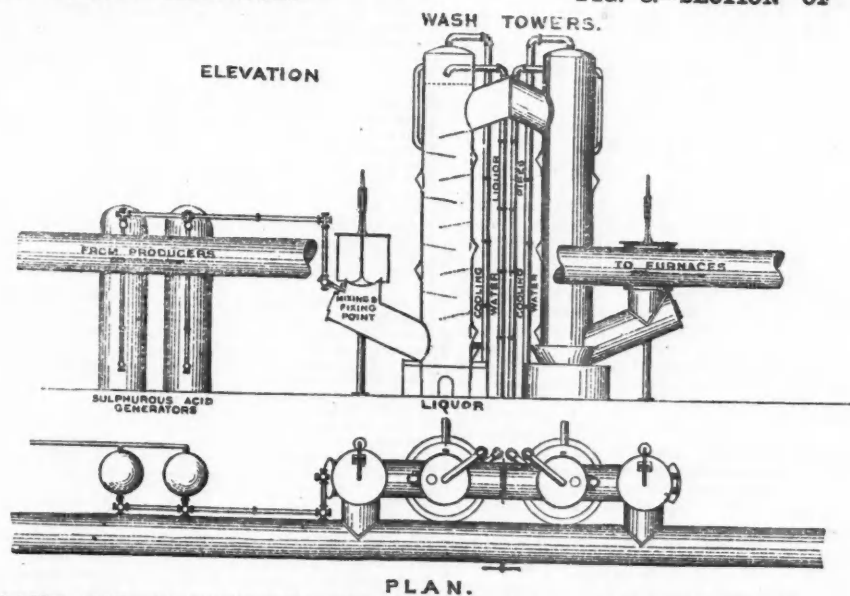
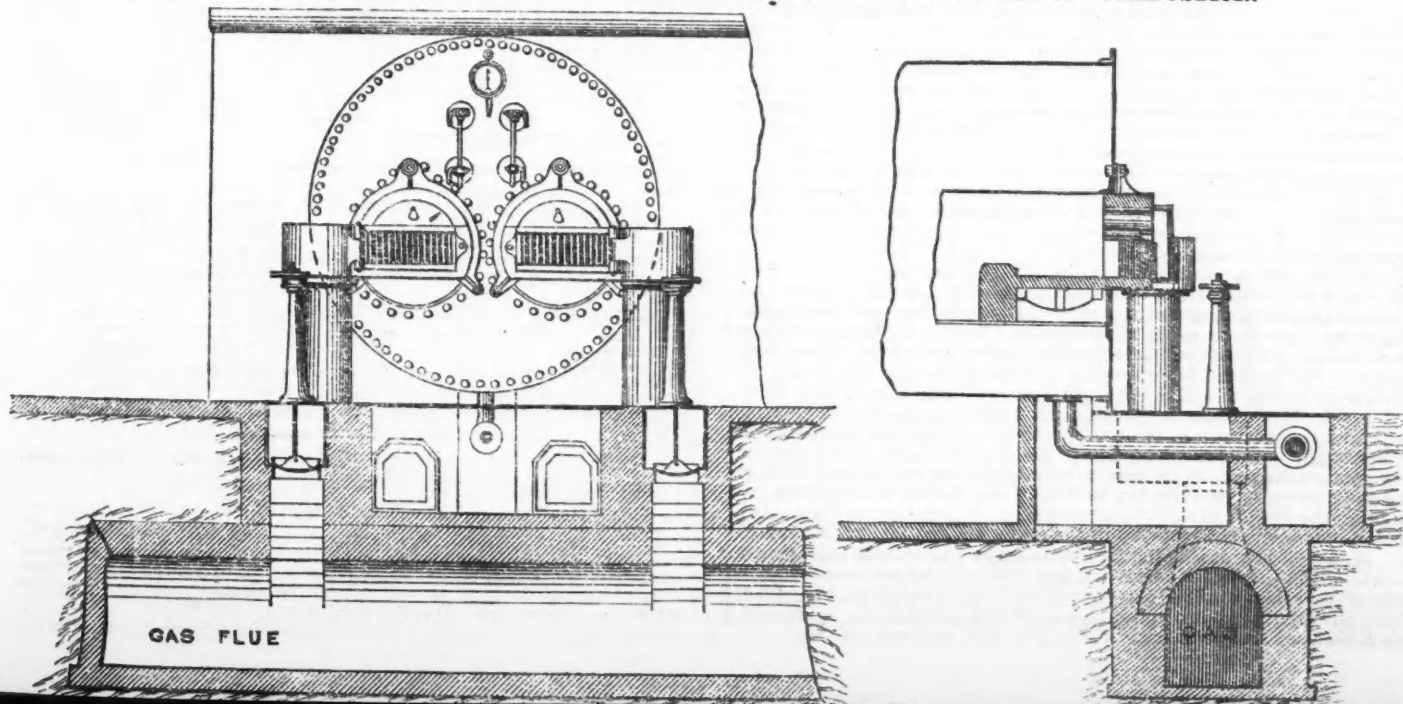


FIG. 4.—PLANT FOR RECOVERING WASTE PRODUCTS FROM GASES OF COMBUSTION.



GAS FLUE

and a larger quantity of steam entering by steam jet, at a lower velocity than in the former trials, gave :

| | | | |
|---------------------|----------------|----------------|-----------------|
| Carbonic acid..... | 4.11 per cent. | Marsh-gas..... | 5.91 per cent. |
| Oxygen..... | 0.00 " | Nitrogen..... | 51.06 " |
| Hydrogen..... | 12.42 " | | |
| Carbonic oxide..... | 26.48 " | | 99.98 per cent. |

An analysis of the average of three samples, which may be taken as a fair average analysis of the gases, gave :

| | | | |
|---------------------|-------|----------------|--------|
| Carbonic acid..... | 6.26 | Marsh gas..... | 4.72 |
| Oxygen..... | 0.00 | Nitrogen..... | 50.36 |
| Hydrogen..... | 14.68 | | |
| Carbonic oxide..... | 23.98 | | 100.00 |

Temperature in annular flue of producer, 600 degrees C. (= 1112 degrees Fahr.)
 " valve below boiler, 450 degrees C. (= 842 degrees Fahr.)
 " of waste gases in flue to chimney, 290 degrees C. (= 554 degrees Fahr.)
 " air heated by waste gases before combustion, about 120 degrees C. (= 248 degrees Fahr.)

In No. 3 trial, the level of the fuel in the producer was about 6 feet from the ground.

No. 2 BOILER (HAND-FIRED.)

Used 3724 pounds of fuel. Used 29,520 pounds of water—3280 pounds per hour. One pound of fuel evaporated 7.9 pounds of water. Fuel gave 11.6 per cent of clinker and refuse. Temperature of feed-water, 30 degrees C. (= 86 degrees Fahr.)

In No. 3 trial, the fuel burnt as gas in No. 1 boiler gives a better duty by 8.86 per cent than the same class of fuel burnt under No. 2 boiler by hand-firing. With the temperature of the feed-water at 100 degrees C. (= 212 degrees Fahr.) and the steam at atmospheric pressure, the duty per pound of fuel would be as calculated :

No. 1 boiler (gas-fired), 10.33 pounds of water evaporated per pound of fuel.
 No. 2 boiler (hand-fired), 9.49 pounds of water evaporated per pound of fuel.

| | No. 1 TRIAL. | | | No. 2 TRIAL. | | | No. 3 TRIAL. | | |
|-------------------------|---|--|--------------------------------------|---|--|--------------------------------------|---|--|--------------------------------------|
| | Pounds of water evaporated by 1 pound of fuel, feed-water at 100 degrees C., steam at atmospheric pressure. | Pounds of water evaporated by 1 pound of fuel. | Water evaporated per hour in pounds. | Pounds of water evaporated by 1 pound of fuel, feed-water at 100 degrees C., steam at atmospheric pressure. | Pounds of water evaporated by 1 pound of fuel. | Water evaporated per hour in pounds. | Pounds of water evaporated by 1 pound of fuel, feed-water at 100 degrees C., steam at atmospheric pressure. | Pounds of water evaporated by 1 pound of fuel. | Water evaporated per hour in pounds. |
| No. 1 boiler (gas)..... | 6.86 | 5.8 | 4357 | 7.8 | 6.5 | 4204 | 10.33 | 8.6 | 3768 |
| No. 2 boiler..... | 6.26 | 5.3 | 2965 | 7.5 | 6.3 | 3145 | 9.49 | 7.9 | 3280 |

In summing up the results of the foregoing tests, I must remark that the No. 1 or gas-fired boiler was under considerable disadvantage through all the trials, owing to only one producer being at work to supply it: the quantity and composition of the gases vary so much from one addition of fuel to another that it is almost impossible to regulate the supply of air for combustion to the adequate amount. If we had several producers working together, the duty done by the fuel would have been better. On the other hand, I do not think that the hand-firing in the Nos. 2 and 3 trials could be improved, as the greatest care was taken.

With our bituminous coal, it does not answer to run the producer as high as in trial No. 3. A large quantity of tar was formed in the flues and around the valves, and would have quickly obstructed the passage of the gas.

As regards labor costs in each method, if all our boilers (seven in number) were fired by gas, we should require six producers of the 4 cwt. per hour size, one to be always off for cleaning, but this would generate more steam than we require. The gas-fired boiler making 32 per cent more steam than the hand-fired boilers in a given time, or after deducting the steam used by the steam jet (to 170 pounds of water per hour) gives 28.9 per cent more duty. Therefore, I think that five producers, four working and one off for cleaning, would make all the steam we require, and would take six men to work them. Six men are at present required to fire the seven boilers as in trial No. 1, but to fire them as in trials No. 2 and 3 it would require eight men. (Signed) JOHN H. DARBY, Engineer to the Plas Power Colliery.

With reference to the concluding paragraph in this report, it must be remarked that Mr. Darby estimated the number of men required to work five gas-producers by simply multiplying the labor required for one. This, however, is an erroneous estimate, for it is found in practice that four men are enough to work seven or eight such producers. This refers to the design of producer illustrated in the author's paper to this Institute on "Gas-Firing" (*Transactions*, vol. iii., part 7, October 13th, 1881), which requires to be cleaned out periodically by hand labor. The new design, which has recently been worked out, removes the necessity for this labor by the introduction of mechanical appliances for automatically cleaning out the ash and clinker from the producers continually. The design of producer is illustrated in Figs. 2 and 3, being vertical sections at right angles to one another.

The two discharging-worms work in a cast-iron trough filled with water which acts in several ways. It, of course, prevents the worms and bottom of the producer from being burnt, it cools the ash and clinker falling down from the zone of combustion, and thus acts as a recuperator of heat, because the heat which is usually lost in withdrawing ash and clinker at a full red heat is retained in this producer, the refuse passing out at a temperature not over 150 degrees Fahr. The steam rising from the water in the trough keeps the central tuyere or nozzle from being burned, and the steam itself is decomposed by the glowing carbon and adds hydrogen and carbonic oxide to the producer-gas. The producer works continuously at its maximum speed with the minimum of labor.

The paper recently read by Mr. Beilby to this Institute has shown an addition to the use of gaseous fuel which is now assuming an increasing importance, namely, the recovery of the ammonia and tar products from coal. And as it is probable that boiler-firing by gas on even a moderate scale will not in the future be carried out without the addition of such means of deriving profit from the use of coal as fuel, Fig. 4 is added, showing the arrangement of plant patented and carried out by Messrs. Addie & Sons, at Langloan Iron-Works, for the recovery of ammonia

and tar from blast-furnace or producer-gases, and applied by us to producer-gas.

In working this plant, sulphurous acid gas is produced from some cheap source of sulphur burned with air in suitable chambers, and this sulphurous acid is mixed with the producer-gas while hot, before it enters the scrubbing-towers shown. The ammonia in the gas is fixed by combination with the sulphurous acid, and a very moderate amount of scrubbing and of cooling the gases subsequently is found sufficient to remove every trace of ammonia from the escaping gas.

This plant is comparatively inexpensive, and is found to be very successful, the patentees recovering from 30 to 35 pounds of sulphate of ammonia, of first-rate quality, per ton of coal from blast-furnace gases. From the fact that in the Wilson gas-producer combustion is carried on in an atmosphere of steam, it is probable that a much larger quantity of ammonia will in it be produced from the nitrogen of the coal.

DIVIDENDS PAID FROM AMERICAN MINES DURING THE YEAR 1883, AND TOTAL TO DATE

| NAME OF COMPANY. | Location of mines. | Amount paid in 1883. | Total amount paid to date. |
|---|--------------------|----------------------|----------------------------|
| Amie Consolidated, s..... | Colorado..... | \$25,000 | \$330,000 |
| Atlantic, c..... | Michigan..... | 80,000 | 220,000 |
| Bassic, s..... | Colorado..... | 300,000 | 300,000 |
| Black Bear, g..... | California..... | 6,000 | 895,000 |
| Bonanza Consolidated, e..... | Montana..... | 50,000 | 50,000 |
| Boston & Montana, g..... | California..... | 10,000 | 310,000 |
| Bulwer Consolidated, a..... | Colorado..... | 35,000 | 165,000 |
| California, g..... | Colorado..... | 65,000 | 65,000 |
| Calumet & Hecla, c..... | Michigan..... | 2,000,000 | 24,350,000 |
| Carbonate Hill, s..... | Colorado..... | 60,000 | 60,000 |
| Castle Creek, e..... | Idaho..... | 30,000 | 51,000 |
| Catalpa, s..... | Colorado..... | 30,000 | 240,000 |
| Central, c..... | Michigan..... | 60,000 | 1,670,000 |
| Christy, s. L..... | Utah..... | 6,000 | 90,000 |
| Colorado United, s..... | Colorado..... | 16,750 | 16,750 |
| Contention, s..... | Arizona..... | 437,500 | 2,525,000 |
| Consolidated Gold Mining Co. of Ga..... | Georgia..... | 24,000 | 108,000 |
| Copper Queen, c..... | Arizona..... | 500,000 | 1,225,000 |
| Cosmopolitan, s..... | Utah..... | 50,000 | 50,000 |
| Crescent, s. L..... | "..... | 150,000 | 150,000 |
| Deadwood-Terra, a..... | Dakota..... | 20,000 | 900,000 |
| Dunkin, s..... | Colorado..... | 10,000 | 210,000 |
| Evening Star, s. L..... | "..... | 75,000 | 1,300,000 |
| Father de Smet, e..... | Dakota..... | 120,000 | 650,000 |
| Gem, s..... | Colorado..... | 7,500 | 17,500 |
| Glen, s..... | "..... | 3,000 | 7,000 |
| Granite, s..... | "..... | 3,750 | 5,750 |
| Hecla, s..... | Montana..... | 180,000 | 537,500 |
| Henriette, s..... | Colorado..... | 27,000 | 27,000 |
| Holyoke, g..... | Idaho..... | 44,000 | 52,000 |
| Homestake, g..... | Dakota..... | 525,000 | 2,875,500 |
| Hope, s..... | Montana..... | 56,250 | 135,625 |
| Horn-Silver, s. L..... | Utah..... | 1,100,000 | 2,800,000 |
| Howell S. & M. Co., g. s. L..... | Arizona..... | 3,750 | 3,750 |
| Idaho, g..... | California..... | 34,100 | 3,299,150 |
| Indian Queen, s..... | Nevada..... | 3,750 | 368,750 |
| Indian Spring Drift..... | California..... | 1,000 | 1,000 |
| Iron Silver, s. L..... | Colorado..... | 300,000 | 1,200,000 |
| Juniper, g..... | Idaho..... | 2,000 | 2,000 |
| Kentuck, s..... | Nevada..... | 24,000 | 1,267,000 |
| Leadville Consolidated, s..... | Colorado..... | 80,000 | 330,000 |
| Lexington, s..... | Montana..... | 200,000 | 200,000 |
| Little Chief, s..... | Colorado..... | 20,000 | 720,000 |
| Morning Star, s. L..... | "..... | 50,000 | 615,000 |
| Mount Pleasant, g..... | California..... | 90,000 | 90,000 |
| Mount Diablo, s..... | Nevada..... | 49,500 | 49,500 |
| Navajo, g. s..... | "..... | 125,000 | 225,000 |
| Northern Belle, s..... | "..... | 100,000 | 2,400,000 |
| Ontario, s. L..... | Utah..... | 36,000 | 5,150,000 |
| Original, s..... | Montana..... | 36,000 | 26,000 |
| Osceola Consolidated, c..... | Michigan..... | 125,000 | 910,000 |
| Plymouth Consolidated, g..... | California..... | 350,000 | 350,000 |
| Prussian, s. L..... | Colorado..... | 15,000 | 132,000 |
| Quincy, c..... | Michigan..... | 380,000 | 3,584,000 |
| Richmond, s. L..... | Nevada..... | 270,000 | 4,042,587 |
| San Francisco, g..... | California..... | 2,500 | 20,000 |
| Shoshone, g..... | Idaho..... | 6,000 | 7,500 |
| Sierra Buttes, g..... | California..... | 11,250 | 1,450,933 |
| Sierra Grande, s..... | New Mexico..... | 500,000 | 700,000 |
| Silver Cord, g. s. L..... | Colorado..... | 225,000 | 225,000 |
| Silver King, s..... | Arizona..... | 175,000 | 1,300,000 |
| Smuggler, s..... | Colorado..... | 36,000 | 66,700 |
| Standard Consolidated, g..... | California..... | 325,000 | 4,600,000 |
| Total Wreck, s..... | Arizona..... | 50,000 | 50,000 |
| True Fissure, g. s. L..... | Utah..... | 75,000 | 75,000 |
| United Gregory, g..... | Colorado..... | 12,000 | 42,000 |
| | | \$10,083,600 | \$75,413,505 |

G., gold. S., silver. C., copper. L., lead.

Amounts paid by mines located in the States and territories are as follows :

| | In 1883. | Total to date. |
|-----------------|------------|----------------|
| Arizona..... | 1,166,250 | 5,103,750 |
| California..... | 904,850 | 11,021,083 |
| Colorado..... | 1,361,000 | 5,909,700 |
| Dakota..... | 665,000 | 3,837,500 |
| Georgia..... | 24,000 | 108,000 |
| Idaho..... | 82,000 | 112,500 |
| Michigan..... | 2,645,000 | 30,734,000 |
| Montana..... | 482,250 | 1,219,135 |
| Nevada..... | 572,250 | 8,352,837 |
| New Mexico..... | 500,000 | 700,000 |
| Utah..... | 1,681,000 | 8,315,000 |
| Total..... | 10,083,600 | 75,413,505 |

| | In 1883. | Total to date. |
|---------------------------------------|--------------|----------------|
| Total amount paid by gold mines..... | \$1,760,350 | \$15,476,083 |
| " " silver mines..... | 2,481,000 | 11,950,085 |
| " " gold, silver, and lead mines..... | 428,750 | 528,750 |
| " " silver and lead mines..... | 2,266,000 | 15,479,587 |
| " " copper mines..... | 3,147,500 | 31,978,000 |
| Total..... | \$10,083,600 | \$75,413,505 |

THE DESTRUCTIVE DISTILLATION OF COAL, AND THE TRANSFORMATION OF ITS NITROGEN INTO AMMONIA.

The following is an abstract made for the *Journal of the Society of Chemical Industry*, from a paper by M. Scheurer-Kestner, read before the Paris Academy of Sciences:

Many experiments, with the object of finding means for more completely utilizing the nitrogen contained in certain combustibles without impairing their calorific power, have been made. Good results have been achieved by M. Carvès in the manufacture of coke, and some English works have also succeeded in recovering the ammoniacal vapors produced in blast-furnaces fed with coal. The high value of ammonia has suggested the idea of replacing the use of coal by that of coke and gas for general heating purposes, in order to reduce the cost of fuel by the profit on the ammonium salt obtained. This subject has been recently treated of by Mr. Weldon at a meeting of the London section of the Society of Chemical Industry (see *Journ. Soc. Chem. Ind.*, vol. ii. [1], pp. 5 and 6). Still it remains an open question whether the profit arising from the recovery of the ammonia is not more than counterbalanced by a depreciation due to a corresponding decrease of calorific power in the carbonaceous material from which the ammonia has been abstracted. Mr. Davis has calculated the advantages which would result from a substitution of gas for coal for household heating purposes; and Morrison, discussing a similar question, called attention to Foster's statement in a paper published last February in the *Journal of the Chemical Society*, that coal, on destructive distillation, does not by any means give up a quantity of ammonia equivalent to the nitrogen contained in it. The numbers furnished by him admit of calculating the advantages of the condensation of the ammonia, since he gives the distribution of the nitrogen, such as takes place on subjecting coal to dry distillation in the preparation of illuminating gas. Out of 100 parts of the total nitrogen contained in the coal:

14.5 are given off as ammonia.
1.5 " " cyanogen.
35.5 " " free nitrogen.
49.0 remaining in the coke.

100.00

The author considers that, by using apparatus specially adapted, it would be possible to utilize separately the heats of combustion of the gas and coke produced, with as great advantage as if the coal itself had been burnt and used as fuel in the usual way. It is obvious that the decrease of the calorific value of the coal arising from its transformation into gas and coke must not exceed the profit from the ammonium salts obtained, if the process is to be really profitable. This condition is, however, not fulfilled, as will be seen from the following, unless the price of coal is sufficiently low. As far as at present known, it is only possible to base any calculations on approximate figures, but it is assumed that the composition of coal-gas is that given by Wurtz in his *Dictionnaire de Chimie*. The amount of coal-gas produced from 100 kilos. of coal is 28 cubic meters, the amount of coke being 70 kilos., including 20 of ashes. It is further assumed that the heat of combustion of coal containing 14 per cent of ashes is 7500 calories, that it retains 1½ per cent of nitrogen, and that the distribution of the same is in agreement with Foster's data. Given these conditions, the results obtained are those given in the subjoined table:

| | Percentage composition of gas. | Weight of one liter of gas at 0°. | Weight of 100 liters of gas at 0°. | Heat of combustion in cala. Favre and Silbermann. | Calories generated by the combustion of 100 liters. |
|---------------------|--------------------------------|-----------------------------------|------------------------------------|---|---|
| Ethylene..... | 3.8 | 1.25400 | 4.765 | 11,858 | 56,503 |
| Marsch-gas..... | 32.8 | 0.71600 | 23.485 | 13,063 | 306,784 |
| Carbonic oxide..... | 12.9 | 1.2400 | 18.176 | 2,403 | 38,870 |
| Carbonic acid..... | 0.3 | 1.97700 | 0.573 | ..... | ..... |
| Hydrogen..... | 50.3 | 0.08958 | 4.496 | 34,600 | 155,561 |
| | 100.00 | | 49.495 | | 557,718 |

Hence 100 liters of illuminating gas generate on combustion 557,718 calories, and 1 kilo. would consequently develop

$$\left(\frac{557,718 \times 1000}{49,495} \right) = 112,68 \text{ calories.}$$

Now, since 1 kilo. of coal produces 280 liters, or 138,586 grms. of gas, it follows that the gas from 1 kilo. of coal would, on combustion, develop 1561,587 calories, that is,

$$\left(138,586 \times \frac{112,68 \text{ calories}}{100} \right).$$

The same kilo. of coal would produce 700 grms. of coke, containing about 560 grms. of pure coke, of which the heat of combustion is 8080 calories, and 560 grms. of such pure coke, on combustion, would generate 4524 calories, that is (0.560 × 8080). Hence 1 kilo. of coal transformed into coke and gas loses 1415 calories, or 19.3 per cent of its calorific value, that is [7500 calories - (4524 + 1561) = 1415]. It now remains to be ascertained whether the ammonia that has been condensed during the distillation of the coal represents a value sufficient to compensate for the diminished value of the coal as a fuel, as well as to afford a margin of profit. It has been seen that, according to Foster, only about one seventh of the total nitrogen contained in the coal is converted into ammonia. According to Armour, one ton of Broomhill coal only yields 9,060 kilos. of ammonium sulphate, or 2,200 kilos. of nitrogen, in the coke-ovens; and according to Jameson, the yield is even smaller. These data agree pretty closely with those of Foster, although the figures in one case refer to coke-ovens, and in the other to gas-retorts. However, Armour and Jameson have not stated the amount of nitrogen contained in the coal used in the coke-ovens to which they refer, and hence assumption must be resorted to on this head in making any deductions. It would appear, from the numbers given, that coal never produces more than from two to three thousandths of ammonia. It is admitted with Mr. Foster that 14 per cent of its nitrogen is transformed into ammonia. According to the data given before, 1 kilo. of coal containing 15 grms. of nitrogen

will give up 2.1 grms. of this gas as ammonia, corresponding to 8.55 grms. of ammonium sulphate. The average price of 1 kilo. of this salt being 0.5f., the value of the ammonium sulphate obtained from 1 kilo. of coal would be 0.004275f., or 4.27f. per ton of coal. Consequently, there is a gain of 0.004275f. on one side, and a loss of 1415 calories on the other; or, in other words, since coal commands a price of 22.65f. per ton, the condensation of the ammonia affords no advantage whatever, as is clearly seen from the following calculation:

$$\frac{7500 \text{ cal.} \times 0.004275}{1415 \text{ cal.}} = 0.02265 \text{ per kilo.}$$

If the price of coal sinks as low as 15f. per ton, the manufacture of ammonium salt affords a profit of 1.44f. per ton, from which we have still to subtract the cost of the process, in order to get the next margin:

$$\frac{1415 \text{ cal.} \times 15f.}{1000} \times 7500 = 0.00283.$$

$$0.00427 - 0.00283 = 0.00144.$$

These results are by far lower than would be expected after such a modification in the heating materials, unless the price of fuel is very low; for the lower it is, the less considerable is the loss represented by the 1415 calories which have not been utilized. It is probable that the cost attending the transformation of the coal into coke and gas would not even admit of a profitable working of this process, in case fuel was as cheap as 10f. per ton. In fact, the advantage gained by the manufacture of ammonium salts would only average as much as 4f. per ton of coal, or hardly 1.5 centimes per cubic meter of gas. *A fortiori*, one can not expect to realize any profit in ordinary coke-ovens, where the number of calories lost is much more considerable. In Mr. Davis's calculations and those of Mr. Morrison—*loc. cit.*—the heat of combustion of the illuminating gas is found too high. Davis, instead of availing himself of the heat of combustion of the compound bodies, has added together the heats of combustion of the carbon and of the hydrogen. Thus he arrives at the number of 12,233 calories, while the calculations made with the figures obtained by Favre and Silbermann for the different compound gases show a difference of 783 calories, or 6.4 per cent. Morrison arbitrarily assumes 18,000 thermal units for illuminating gas, exceeding thereby the reality by more than 40 per cent. The conclusions derived consequently require modification *pro rata*.

THE ALMADEN QUICKSILVER MINES.

The method of working these mines is described, from the *Preussische Zeitschrift*, in the recently issued volume of Mr. James Forest's, *Inst. C.E., Abstracts of Foreign Papers*. It differs little from that first introduced in 1803 by Larrañaga; in fact, some of the earlier descriptions of Almaden, especially that by Noeggerath, are in most cases adapted to the present condition. The formation and situation of the lodes have not, however, as yet been described. No traces of Roman workings having been found, it would appear that, although the Romans exported a good deal of cinnabar from the Spanish province Beatica, Almaden was unknown to them. The town of Almaden lies about 10 kilometers to the north of the Almadenejos station on the Ciudad Real-Badajoz line, and can be reached in two hours from the station. The town lies on a long chain of small hills, running from east to west, on the eastern slope of which, and quite near the town, are situated the shafts, the metallurgical works lying nearer the valley. The geological formation of the country is chiefly Silurian and Devonian; and principally on the north side of the town, many outcrops of Devonian can be traced in the Silurian formation of the Sierra Morena. This fact has been clearly established by many fossils belonging to the Devonian formation. The strata which most commonly occur round about the mines are as follows:

- 1st. A grayish-white sandstone, very finely grained.
- 2d. Quartzite, which darkens in color on contact with the schist.
- 3d. A foliated schist, which appears in close proximity to the mineral. Plutonic rocks are represented by a sort of dioritic porphyry, to be found in the north of San Nicolas shaft, and the typical Almaden rock, "Piedra Frailesca," composed of shining black grains, cemented together by a calcareous dolomitic mass. According to researches instituted by Helmacken, the former may be classed with the diabases, and the latter with the "Schalstein," or tabular spar.

Mining is carried on on three courses of ore, called respectively San Nicolas, San Francisco, and San Pedro y San Diego; the last, as the name indicates, was separated nearer the surface. The body of ore, east of the principal section at San Teodoro, is, however, still called San Diego; while that situated to the west is called San Pedro. Burat mentions a fourth body of ore, situated more to the south, called Santa Clara, in his *Theorie der Erzlagertätten*. This, however, disappears in lower levels. The run of the lodes is from east to west, the dip almost plumb; in some cases, however, they dip slightly to the north, and in San Pedro y San Diego sometimes to the south. Faults are only observable in three places; two of these throw the San Nicolas lode the one 2 meters to the north and the other one (situated 12 meters to the east of the former) 3 meters to the south. No disturbance is, however, noted in the San Francisco lode, which is only 10 meters south of these faults. The third fault pushes the western part of San Pedro 2 meters to the north, and afterward crosses the other two masses, without, however, altering their positions. In all three lodes, the ore is found as an impregnation of the original strata, with cinnabar and metallic quicksilver; they may, therefore, be looked upon neither as seams nor as veins, as the stratification of the original strata can still be observed within the limits of the impregnated parts.

San Pedro y San Diego is the largest as well as the richest course of ore in the mine. Its south wall is formed by a stratum of quartzite, from 3 meters to 5 meters thick; still farther south, comes black schist, while from 36 to 40 meters farther occurs the San Teodoro shaft, sunk in Piedra Frailesca. The north wall of the lode is formed by a band of schist, about 5 meters wide, extremely soft, and crumbling on contact with the mineral; this is again followed by quartzite. Between the schist and quartzite lies the ore, carrying strata of gray sandstone; varying very much in width, it attains its maximum width, from 8 to 8½ meters, on the tenth floor of the San Diego level. West of San Teodoro

shaft—that is to say, in the San Pedro level—the average width is 5 meters. In the upper floors, however, wider places may be observed; for instance, in the seventh floor at San Diego, the lode attains a width of 14 meters. The impregnation of the cinnabar gives the sandstone a lighter color, and is in some places quite uniform; in others, however, it is so irregular that, even in pieces the size of a fist, different grades of impregnation can be observed, noticeable on account of the dark and light shading. The average percentage of mercury varies between 19 and 25 per cent; but in many places, and particularly on the south wall, it gets a good deal poorer.

The best idea of the richness of cinnabar can be had after the smelting, by the brittleness or hardness of the residue, as the higher the percentage rises, the more porous and pulverizable is the residue. With rich ore, the only residue is a thin, loose sand; while very poor ore gives hard and solid sandstone. It is thus shown that, in the formation of these deposits, the impregnation matter has, so to speak, pushed asunder the sandstone, and in some cases even taken its place. In the cracks and druses, crystals of cinnabar are found, mostly small and ill-formed, together with iron pyrites and metallic mercury; in Pedro y Diego, however, the latter is found less than in the other lodes.

The walls of the lode, especially when in conjunction with quartzite, are not sharply defined; in fact, the sandstone gradually becomes quartzite, and the percentage in cinnabar gets poorer and poorer. The same thing occurs in the eastern and western ends of the deposit—the mineral-bearing stratum gets gradually poorer, till at last not a trace of cinnabar can be found. The length of Pedro y Diego is about 180 meters.

San Francisco y San Nicolas are only divided by a band of quartzite, and differ greatly in character from San Pedro y Diego. The impregnated stratum does not consist of sandstone, as in Pedro y Diego, but is composed of quartzite, blackish in color, and little stratified. This quartzite is traversed in all directions by small veins of cinnabar, only a few millimeters in width, often running parallel; so that in a small piece many of these veins can be described, only separated by a band of quartzite 0.01 meter in width; hence the impregnation can not be said to be equal in all places. In hollows and druses, many small cinnabar crystals are found, as well as copper and iron pyrites, and small drops of metallic mercury. The average percentage in the San Nicolas lode is between 8 and 13, and may be fixed at 10 per cent; in San Francisco, it is about 8 per cent, the poorest ores smelted having a percentage of 2. The length of the San Francisco lode is about 180 meters, and the lode may be said to have increased in width in lower levels; the average width attained on the tenth floor lies between 4 and 6 meters.

The San Nicolas lode is considerably longer in the lower levels than near the surface, having only a length of 50 meters; it gradually lengthens to 200 meters on the tenth floor. On the tenth floor, the width has increased toward the west to 15 meters, but the average is 6 meters, and in upper levels 8 meters. The north wall of the lode is formed of a thin stratum of schist, but after that dioritic porphyry.

The method of working these mines at the present time is almost the same as described by Larrañaga. The mining operations are divided into three periods: during the first, the lode is worked on its whole length, on a width of 2 meters, by overhead stoping down to the lowest floor, leaving thus a good deal of ore on each side. During the second period, the ore on one side is won from the bottom upward by perpendicular cuttings 4 meters wide, pillars of four meters being left standing, these cuttings being filled by masonry-walls, keeping step with the advance. In the third period, the reserves of ore between the two walls are worked from the top downward.

This method is very complicated and expensive on account of the walling; every year, 2500 cubic meters of wall are built, at a cost of from 13 to 12 francs per cubic meter. Besides this, from 10,000 to 15,000 francs' worth of wood is used yearly.

Some improvements have been introduced lately; for instance, the transport of ore is to take place in the next deepest floor, and not to be lifted in kibles to the next highest, as before. The gallery joining San Francisco to San Pedro has also been made the principal extraction gallery, so as to enable the ore to be hoisted with greater facility from all the shafts. At every 40 meters, cross-cuts are driven into the different lodes from this gallery, which is shown on plan. The transport on the tenth floor is now done by wagons running on rails, while before it was done by wheelbarrows. At the present moment, attention is directed to arranging the tenth floor, which San Nicolas and San Francisco have not yet reached, and San Diego only partly.

Lately, the mining operations have been limited to the removal of the mineral reserves left in the pillars. Of the three shafts, only two—Teodoro and Miguel—are sunk to the level of the tenth floor, which lies 285 meters under the surface. The principal extraction-shaft is San Teodoro, which has a 40 horse-power engine; after each shift, iron buckets holding one cubic meter are let down into the sump, each time lifting about 0.3 cubic meter. San Miguel has an engine of 20 horse-power, which is also used for the hoisting of water and ore. San Aquilino is principally used for bringing material into the mine and for the conveyance of men. The total extraction is 18,000 tons a year.

GENERAL ABBOT'S LATEST EXPERIMENTS ON EXPLOSIVES.

General Abbot has issued Addendum I. to the report on Submarine Mines, embodying the results obtained with tonite, California gun-cotton, and rackarock, the following abstract of which has been printed in *Notes on the Literature of Explosives*, by Prof. Charles E. Munroe, U.S.N.A.: The tonite had been manufactured in the United States for about a year by the Tonite Powder Company of San Francisco, under patents assigned by the Cotton Powder Company, Limited, of London, when, in the summer of 1882, samples were procured for trial at Willet's Point. The shipment was made on the Pacific Railroad. The works of the company, near Stege station on the Central Pacific, are reported to have a capacity of twenty tons monthly, and it is understood that similar works are to be erected in the East. The standard tonite made by the company consists of 52.5 parts of gun-cotton and 47.5 parts of nitrate of baryta; but for special purposes, and by request, a part of the latter is sometimes replaced by potassium or sodium nitrate.

Two varieties of the standard explosive were received—one dry in com-

packed cartridges, and the other damp in bulk. The damp as sent contained 18 per cent of moisture, but, when received, it held but 13.5 per cent. The uncompressed damp tonite was detonated with dry tonite or gun-cotton. The relative efficiency in a horizontal plane, as compared with dynamite No. 1, was found to be 0.81 for the dry compressed state and 0.85 for the other, giving as an average value 0.83. The explosive therefore takes rank just below gun-cotton (0.87). The result is not unlike what might be anticipated from the chemical composition of these two explosives, and it is evident that the substitution of a portion of nitrate of baryta tends rather to reduce than to increase the normal intensity of action of gun-cotton, found for pound, when fired under water.

The Tonite Powder Company of San Francisco, also manufactures gun-cotton by a process which differs from its circulars to be essentially that of Professor Abel—excluding the compression into cartridges. It was regarded as desirable to test this product at Willet's Point, in the usual manner, to learn how it compares in strength with that made in England. A sample was accordingly procured with the tonite in the summer of 1882. The explosive was delivered damp in the state of loose powder, which, when dry became a fine white dust. The following statement respecting it was received from Mr. W. L. Oliver, general manager of the company:

"Lot No. 3.—This is 120 pounds gun-cotton (pulverized) containing 24 per cent of moisture. This lot of gun-cotton gave by assay 89.60 per cent insoluble tri-nitro-cellulose and 10.40 per cent soluble gun-cotton. This is not quite up to our average, which is about 93 per cent, owing to the acid of late being rather inferior; but nevertheless, the gun-cotton good, and is 7 per cent above the standard required by the British government. The test for purity and acidity from two samples stood 246 degrees and 250 degrees Fabr. for 28 minutes, the British government standard being 150 degrees for 10; and these samples, subjected to a long and steadily increasing temperature, stood 358 degrees and 360 degrees before they flashed, and a fresh sample started at 200 degrees stood 364 degrees. Such gun-cotton will keep unaltered for many years in any climate."

This gun-cotton was shipped across the country packed in a barrel. To determine whether, when actually tested, the explosive retained the full 24 per cent of moisture, a sample of 400 grains was withdrawn from the bottom of the mass and desiccated to dryness. The loss proved to be 80.6 grains, or only 20 per cent. These figures were used in estimating the charges in preference to those furnished by the company, because some loss of moisture was to be expected under the circumstances. The firing-test showed this gun-cotton to be not inferior in explosive intensity to the best English manufacture; but in the form furnished it was so bulky that very solid packing was necessary to force 4.2 pounds into a No. 2 can, which will readily receive 10 pounds of dynamite in loose powder. This bulk would be a fatal objection for use in ground mines, but would be perhaps an advantage in buoyant torpedoes.

The rackarock, supplied by the Rendrock Powder Company of New York, was brought to General Abbot's notice in the winter of 1882, by one of the manufacturers. It consists of a solid, composed mainly of potassium chlorate, in fine powder, given a reddish tint by some coloring matter; and of an oily liquid, having the strong, bitter almond smell characteristic of nitro-benzol. These compounds, neither of which is explosive by itself, are combined before use by immersing the solid in the liquid for a few seconds until an increase in weight of about one third is effected by absorption. The solid is supplied in the form of loosely-packed cartridges of different sizes, put up in bags closed at each end. The combination of the ingredients is effected by means of an open basket of wire to receive the cartridges, which is suspended from a spring-balance and dipped in a galvanized iron pail containing the fluid. A little attention to the time of immersion renders the absorption fairly uniform. The explosive, when prepared in this manner, is a compact red solid, having a specific gravity of about 1.7. It decrepitates with difficulty when hammered on an anvil, but hardly ignites on wood. A fuse containing 24 grains of fulminating mercury fails to explode a cartridge unconfined or loosely confined. Even if it be compacted in an auger-hole in a log and tamped with mud, the explosion is only partial. A cartridge struck by a bullet from a Springfield rifle flashes but does not detonate. Ordinary friction seems to have little tendency to cause explosion. These facts show it to be quite safe to handle, even when ready for use, and it has given excellent results in rock-blasting under General Newton at Flood Rock. Its peculiar chemical composition gives rackarock the interest of novelty among modern high explosives, and it has accordingly been tested with special care to discover the intensity of action of which it is capable when fired under water. Two fluids were supplied for the trials—the usual one consisting essentially of nitro-benzol; and the other, of a special preparation, consisting of the same saturated with picric acid (from 12 to 16 per cent, according to the quality of the solvent). The explosives prepared by absorbing these fluids by the solid are designated as "rackarock" and "rackarock special."

The results of the firing-tests showed that rackarock, fired under water, gives a relative efficiency in the horizontal plane of 0.86, being nearly equivalent to gun-cotton, and a study of the results proved that there is no difference in the intensity of action between rackarock and rackarock special, which exceeds the range of variation with either of them, but there was a considerable variation with each of them. That this should be so in a mixture of which the ingredients are combined by the rough method described above is not surprising. Moreover, nitro-benzol itself (formed by treating crude benzine with fuming nitric acid) is certainly subject to important variations in chemical composition, due to its impurities; and the same is probably true of the solid as supplied in the trade cartridges.

The anomalous variations noted were confined to the firing of two days. It is to be regretted that the causes which produced the excessive pressures could not be detected; for if the peculiar conditions corresponding to the greatest intensities of action could always be fulfilled, this explosive would take rank with explosive gelatine itself instead of with gun-cotton for use under water.

General Abbot concludes that "rackarock possesses the merits of high intensity of action, unusual density, absolute safety in handling and storage (components unmixed), and little cost; on the other hand, under the conditions of my tests, an exceptionally strong detonating primer is essential to develop its full power. Experiment alone can determine

whether this defect be equally marked when the charges are confined in drill-holes in solid rock." It will be observed that rackarock belongs to the class of explosives invented by Dr. Sprengel, and noted on page 670, vol. viii., of the Proceedings of the Naval Institute.

For comparison of the relative efficiency of explosives, the following table, taken from General Abbot's *Submarine Mines*, page 110, is added :

RELATIVE STRENGTH OF EXPLOSIVE COMPOUNDS FIRED UNDER WATER.

| Explosive. | Percentage of nitro-glycerine. | Value of E. | Relative intensity of action. | | |
|---------------------|--------------------------------|-------------|-------------------------------|------------------------|-------------------|
| | | | Downward. S = 0. | Horizontally. S = 90°. | Upward. S = 180°. |
| Dynamite No. 1* | 75 | 186 | 100 | 100 | 100 |
| Gun-cotton | .. | 135 | 81 | 87 | 91 |
| Dualin | (?) | 232 | 116 | 111 | 108 |
| Rendrock | 20 | 101 | 67 | 78 | 84 |
| " | 40 | 160 | 91 | 94 | 95 |
| " | 60 | 166 | 93 | 95 | 96 |
| Dynamite No. 2 | 36 | 120 | 75 | 83 | 88 |
| Vulcan powder No. 1 | 30 | 99 | 66 | 78 | 86 |
| " No. 2 | 35 | 114 | 72 | 82 | 86 |
| Mica powder No. 1 | 52 | 119 | 74 | 83 | 87 |
| " No. 2 | 46 | 46 | 39 | 62 | 73 |
| Nitro-glycerine | 100 | 111 | 71 | 81 | 88 |
| Hercules No. 1 | 77 | 211 | 109 | 108 | 105 |
| " No. 2 | 42 | 118 | 74 | 83 | 87 |
| Electric No. 1 | 33 | 67 | 51 | 69 | 77 |
| " No. 2 | 28 | 43 | 38 | 62 | 72 |
| Designolle | 0 | 65 | 50 | 68 | 77 |
| Brugere | 0 | 110 | 71 | 81 | 86 |
| Explosive gelatine | 89 | 259 | 125 | 117 | 113 |

FURNACE, MILL, AND FACTORY.

The Buckeye Engine Company, of Salem, Ohio, has recently booked the following orders for engines, some of which have already been placed : One 26 by 36 for the Laird Norton Company, Winona, Minnesota ; a 16 by 32 for Elix Smith & Sons, Yonkers, N. Y. ; a 20 by 40 for Bodley Brothers, Wheeling, West Va. ; a 14 by 28 to Elgin, Ill. ; and one 11 by 22 for Merchants' Electric Light Company, of Moline, Ill. The company is building a 16 by 32 to go to Chippewa Falls, Wis. ; a 15 by 30 for the Owensboro' Wagon Company, Owensboro', Ky. ; and one 11 by 22 for the Sioux City Electric Light Company. Previous to the freeze-up, the company had completed a switch track to its works, with turn-table terminus, hoist-crane, etc., in the yard, which will facilitate shipments, especially in handling the heavy parts of the larger class of engines which it builds. It is now working full force and full-time.

Owing to the depression in the iron trade, the Coplay Iron Company, at Allentown, Pa., has blown out its last stack, and the works are now entirely idle.

A patent has been applied for on a natural-gas puddling furnace by William McKenna, of Wilson, Walker & Co.'s mill, Pittsburg. The furnace is now in use at the mill, does its work well, and uses less gas than any other kind of furnace.

Application has been made at the State Department for a charter for the Crawford Iron and Steel Company, of New Castle, Lawrence County, Pa., with a capital of \$1,500,000.

Work was resumed in all departments of the Reading Iron-Works January 8th. The works employ one thousand men. The steel mill puddlers have been reduced from \$3.50 to \$3.25 per ton. A number of other manufacturers are preparing to resume work, and the outlook in the iron trade at Reading is generally brighter.

A dispatch from McKeesport to the *Chronicle-Telegraph* states that work has been resumed at the National Rolling-Mill and Forge Company, the workmen accepting a reduction of wages ranging from 12 1/4 to 25 per cent. Wood's Iron-Works also started with a full blast, at the former wages. The National Tube-Works will also resume work to-morrow at the reduction.

The property of the Steubenville Furnace and Iron Company, consisting of coal mines, blast-furnaces, coke-ovens, engines, and other machinery, etc., has been sold at sheriff's sale for \$20,200, being bid in by L. Raney, of New Castle, Pa., one of the bondholders. The property originally cost four or five times that sum.

Messrs. Fraser & Chalmers, manufacturers of mining machinery, have opened a branch office at No. 11 Calle de Juarez, Chihuahua, Mexico, in charge of Mr. H. O. Reinhardt, formerly superintendent of the Santa Eulalia Company, at whose mines, it may be stated, Mr. Reinhardt put up a twenty-stamp mill, built by Fraser & Chalmers.

LABOR AND WAGES.

The number of idle men in this city, at present, says a dispatch from Pittsburg, Pa., is unusually large, owing to the glass-workers' strike, and the depression in the iron and coal trades. An advertisement in a labor paper on Wednesday for twenty coal miners, elicited 300 responses within twenty-four hours. A prominent labor leader, commenting upon the situation, said : "The reports, however, from the various iron mills in the city show a better condition of things than had been anticipated last month. Nearly all the iron and steel mills are now running, with fair prospects of an increase in business during the present month. There seems to be a growing demand for iron, and the manufacturers are daily growing more hopeful. Business is increasing, and the outlook is more encouraging."

John A. Roebing's Sons state that the average reduction of wages will be about 6 per cent. The reduction was because the price of wire is fully 10 per cent lower than ever before, owing to the decline in the demand. The increased demand caused by the barbed wire industry six years ago has fallen away, resulting in overproduction.

The Coal Screen Committee of Ohio will recommend that screens with smaller meshes be used, in order that the miners may receive pay for coal now classed as nut.

The Springfield Iron Company, Springfield, Ill., has reduced the wages of its employes 10 per cent.

At a meeting of the Penitentiary Board of Directors at Columbus, Ohio, recently, the firms employing convict labor, evidently by agreement among themselves, made bids at the extraordinarily low figure of fifty cents per day for the labor of able-bodied convicts, and even less was bid by some. The board thought it was a scheme of the contractors to increase their profits at the expense of the State, and rejected all bids. A few days later, the same contractors bid again, offering for able-bodied men 80 cents a day, or thereabouts, and maimed 60 cents. The bids were accepted.

The Amalgamated Trade and Labor Union met in New York City, January 6th, Kenneth McKenzie in the chair. The legislation committee reported that they had agreed on their bills to push through the Legislature, if possible, one for a new mechanics' lien law, one for the abolishment of the contract convict-labor system, and one for a ten-hour law.

The Trenton Times says that the Reading Railroad Company has notified all its employes holding public positions to resign their offices or leave the company's employ.

A State convention of coal miners met in Pittsburg recently, to effect an

* Standard of comparison.

organization. Delegates were present from all parts of the State, and the session will probably last several days. After perfecting an organization, a resolution was adopted levying a per capita tax of five cents per month to defray the expenses of the State officers. The question of giving two weeks' notice before taking any decided action in relation to the matters between operators and men was next considered, pending which the convention adjourned until the next day, when Mr. Flannery offered a series of resolutions, which were adopted, asking that a national bureau of statistics be established in Washington. The question of a uniform traveling card, to be given any member of the assembly, was left to the executive committee with power to obtain some convenient form and sell the cards to district presidents. Mr. Kelduff offered a resolution that Congress be petitioned to prohibit the bringing of foreign labor into this country under contract, as injurious to the interests of the workmen. The resolution was adopted and the district presidents were appointed to get up the petition, which is circulating among the workmen. President Harris made the closing address, urging earnest work as the only means of success. He said he came to the convention determined to offer his resignation as State President, but he had been so greatly encouraged that he had been strengthened to more earnestly push the work of organization in the State.

The miners of the fourth pool, at a meeting in Brownsville, Pa., resolved to establish camps near the mines in which men may work at less than the district rate.

Five shearmen in Bailey's Nail Works at Harrisburg, Pa., have refused to work because the company desired them to pay the wages of two helpers out of their own earnings. The works have been stopped in consequence, and 200 men will remain idle until new shearmen can be secured.

The miners in the employ of the Alden Coal Company, at Alden, Pa., are out on a strike, owing to the refusal of the company to pay for propping in the future. The company, however, offered to increase the rates of mining from 96 to 98 cents per car to make up the difference, but this the men refused, and the strike was ordered. At a meeting of the miners, a committee was appointed to wait upon the superintendent, and it is believed a compromise will be effected satisfactory to both sides.

The steel-smelters in the employ of Hussey, Howe & Co., at Pittsburg, have been notified that on and after Monday next they will be paid only \$5 per ton for their work, instead of \$6.25, the present price, the reason given being the depression in trade, and the necessity of a reduction to keep the works running. Should the reduction be accepted, it is thought the six or eight other firms in this line will also reduce wages. This being the case, the action of Hussey, Howe & Co. has caused great excitement among the crucible steel-workers of the city. The opinion of several disinterested persons is, that the reduction will be accepted without a strike. The reduction proposed is equal to 12 1/2 per cent. Steel smelters at present average, when at work, from \$8 to \$10 per day.

The finishers in Moorehead & Co.'s mill, at Pittsburg, have struck, giving as a reason for their action that the new steel they are using is so much harder to work than that formerly used that they could not make the same wages as when working the iron. This is one of the most important strikes that have taken place here, as it will probably settle the question whether the men shall work hard steel at the same price as iron. It is not known what action the Amalgamated Association will take, but it is intimated that the decision will be against the company. The process used by the firm is a new one, and is not popular with the men, as it does away with puddling and knobbling. Some of the workmen say the steel in working must be treated differently from ordinary iron, and that new rules will have to be made in order to govern the rate of wages fair to the men working in that department.

RAILROAD NEWS.

The agents of the Delaware, Lackawanna & Western Railroad express no fear that the order regarding their Buffalo connections will be carried out, and suggest that, if driven to the wall, President Sloan may order a cut on coal rates which would injure the New York Central's coal traffic.

The Board of Directors of the Lehigh Valley Railroad Company, at their recent meeting, resolved to increase the capital stock of the company outstanding 20 per cent, giving stockholders the privilege of subscribing to the new stock at par, in the proportion of one share for five held by them. This increase of capital amounts in all to \$5,526,639.

A charter was granted at Harrisburg, Pa., to the Pittsburg & Allegheny Central Railroad, with a capital of \$1,200,000, to run from Chartiers Creek, Allegheny County, to a point near New Salem, Westmoreland County, a distance of forty miles.

The comparative statement of the business of the Philadelphia & Reading Railroad and Coal and Iron companies for the month of and fiscal year ended November 30th, 1883, shows the following figures : Total gross receipts of the railroad company for November, \$3,654,916.21 ; total gross expenses, \$1,581,435.45 ; profit for the month, \$2,073,480.76 ; profit for the year to date, \$14,547,479.25 ; profit for the same month of 1882, \$1,104,564.49 ; for the year, \$9,859,064.98. Gross receipts of the Coal and Iron Company for the month, \$1,756,584.50 ; gross expenses, including interest, \$1,363,379.64 ; profit for the month, \$393,204.86 ; profit for the year to date, \$921,771.79 ; profit for the same month of 1882, \$303,121.24 ; for the year, \$1,200,173.91. From this deduct for the railroad company : Debit balance renewal fund, \$27,499.03 ; State tax on capital stock, \$55,909.36 ; all rentals and full interest on all outstanding obligations, including floating debt, \$12,101,666.89 [including full interest on the entire amount of convertible loan, a portion of which has been funded] ; for the Coal and Iron Company full interest on all outstanding obligations other than those held by the railroad company, \$1,126,942.70 ; total, \$13,312,017.98. Surplus of both companies, \$2,157,283.06 ; 7 per cent on preferred stock, \$108,626 ; 6 per cent on common stock, \$1,990,972.52 ; total, \$2,099,598.52. Balance applicable to interest on deferred income bonds, \$57,634.54. The above statement includes the working of the Central Railroad of New Jersey and branches for November and for six months from June 1st to November 30th, namely, profit for the month, \$124,407.51 ; for six months, \$633,482.57.

The coal report of the Tennessee Coal, Iron, and Railroad Company shows coal received directly from mines during December, 12,390 ; total from January 1st, 1883, 126,784 ; coke received directly from mines during December, 10,933 ; total from January 1st, 1883, 101,090 ; total transported during December, 23,313, total transported from January 1st, 1883, 227,874.

COAL TRADE NOTES.

ARKANSAS.

It is stated that a fine coal-bed has been discovered within two miles of the town of Bethesda Springs.

CANADA.

PROVINCE OF NOVA SCOTIA.

The produce of the coal mines of Nova Scotia during the first three quarters of 1883 amounted to 1,078,996 tons, an increase over the same period of the previous year of 97,468 tons. Sales during the same period aggregated 996,060 tons, an increase of 93,137 tons.

CUMBERLAND COAL AND RAILROAD COMPANY.—On January 1st, the property known as the Spring Hill mines and situated in Cumberland County, but which was largely developed by St. John capitalists, passed into the hands of its new proprietors, the above company. This new company was organized but recently, and is formed principally of Montreal capitalists. Their first strike was the purchase of the Spring Hill & Parrsboro' Mining and Railroad Company, an organization which came into existence some years ago, and built what was then known as the Spring Hill & Parrsboro' Railroad, a line 32 miles in length, running from Spring Hill Station to the Intercolonial Railroad, past the Spring Hill mines and into the promising town of Parrsboro', Nova Scotia. Besides the railroad, the company owned extensive mining privileges; but from one cause or another, these were never developed, the principal business being the management of the railroad, over which a considerable carrying trade was done, particularly from the mines to the junction with the Intercolonial. When this purchase was completed, the new company at once entered into negotiations for the purchase of the Spring Hill mines, which for years have been doing an extensive business, supplying not only a large number of local consumers in St. John, but also a number of the locomotives on the Intercolonial Railroad. At a meeting of the stockholders, held some time ago, the offer of the new company to purchase the mines was accepted, and, when the negotiations were completed, a portion of the purchase-money was paid down. The balance of \$600,000 is now on deposit in the Bank of Montreal, and will be paid stockholders on demand. This completes the contract, and the Cumberland Coal and Railroad Company will enter into the full possession of one of the best coal-mining properties in Canada. From the enterprise shown by the new organization since it obtained possession of the railroad, it is only fair to assume that the business will be largely increased, and Spring Hill become a large purchaser from St. John. The growth of the village at the mines this year has been really amazing, some 200 new houses having been erected.

Mr. R. G. Leckie, managing director of the company, stated to a *Telegraph* reporter that the company now controlled ten square miles of coal areas. The property first purchased had been explored, and the indications are extremely promising. Two shafts, one 1300 feet in depth, known as the west slope, and the other 800 feet, called the east slope, are now worked on the Spring Hill property. A new slope 1000 feet in depth has been sunk on this property, but it is not yet in full operation. As soon as they begin operations, it is the intention of the company to connect the present mines with those on the other property, which will give an underground tunnel of about two miles in length. This tunnel will of course follow the vein, which is of unusual richness. A large stationary hoisting-engine, manufactured by Messrs. Fleming & Sons, and exhibited by them at the Centennial Exhibition, has recently been put in position at the West Slope, the engine formerly in use having been transferred to the north or new slope. The coal is at present mined entirely by hand; but it is the intention of the company to adopt all the best and latest machinery in use in the mines of Scotland and elsewhere, which will largely increase the output of the mines. After it has been taken out of the seam underground, the coal is hoisted to the surface in cars which are dumped on large screens which allow all the finer coal or sluck to pass through. The round or large coal rolls over. It is then loaded on the cars for transportation either to Parrsboro', where it is sent by water to various places, or over the Intercolonial Railroad, which, in itself, is a large consumer of Spring Hill coal. Contracts have recently been made with the Grand Trunk Railroad for the supply of the eastern portion of the road. As worked at present, the monthly pay-roll of the company, including the railroad, amounts to about \$25,000.

The railroad, which had been greatly run down when the present management assumed control, has been much improved during the past summer, and when spring opens, still further improvements will be made to the road-bed. Since the opening of the road, a large passenger business has been developed and large quantities of lumber are carried from the various mills along the line to Parrsboro' for export; and now that the mine and railroad are under one management, the export of coal will no doubt be materially larger than it has been. The Spring Hill mines are in an excellent position to compete for the bunker trade of Portland and Boston, which is capable of still further development.

COLORADO.

Following is a summary of the coal output of Colorado for the year 1883:

| | Tons. | | Tons. |
|-----------------------------------|---------|--------------------------------|-----------|
| Mines near Erie and Canfield..... | 80,000 | Mines near El Moro..... | 277,341 |
| Mines at Louisville..... | 103,321 | Mines near Durango..... | 12,000 |
| Mines at Langford..... | 45,500 | Mines at Rico..... | 2,500 |
| Mines near Golden..... | 19,899 | Mines at Crested Butte..... | 75,983 |
| Mines at Franceville..... | 53,757 | Mines at Castleton..... | 14,846 |
| Mines at Sedalia..... | 1,500 | Other mines..... | 3,500 |
| Mines at Como..... | 58,391 | | |
| Mines near Cañon City..... | 272,163 | Total product of Colorado..... | 1,114,040 |
| Mines near Trinidad..... | 93,339 | | |

The value of the product, 1,114,040 tons, at \$2.25 per ton, is \$2,506,590.

COLORADO COAL AND IRON COMPANY.—During the year 1883, this company mined the following amount of ore from its various mines:

| | Tons. |
|--------------------------|--------|
| South Arkansas mine..... | 19,646 |
| Hot Springs mine..... | 25,938 |
| Placer mine..... | 1,511 |
| Total..... | 47,106 |

This ore was treated at the company's works at Bessemer, and converted into the following manufactured products:

| | |
|--------------------------------------|--------------------------------|
| Merchant bar-iron and mine rail..... | 4,647 tons of 2000 pounds each |
| Pig-iron..... | 25,706 " 2000 " |
| Casting..... | 1,378 " 2000 " |
| Steel rails..... | 16,246 " 2240 " |
| Muck-bar..... | 3,184 " 2240 " |
| Nails..... | 66,724 kegs of 100 " |
| Spikes..... | 9,841 " 100 " |

OHIO.

There has not been any change in mining affairs at Chapman, with the regular running mines. The railroad to Willow mine No. 6 has been completed, and several cars were taken up during the week.

At Fosterville, the work has been very dull for the last month. The men at Fosterville shaft have not worked more than one third time. The Manning shaft, operated by Henry Manning, of Younstown, and located about three quarters of a mile from here, has not been working regularly during the last month.

Work at the different mines at Palmyer is going rather slowly at present for want of orders. The new mine on the McKelvey farm is turning out some of the best of coal. The men are busy driving entries. It appears to be a good find.

Scrip Hill shaft, near Kyle's Corners, has been doing very well for some time, with good prospects for a continuation through the winter. It is employing about sixty men. The vein of coal is very good, and varies from three to four and a half feet. A great deal of trouble has attended this shaft heretofore on account of its being so wet, but it has been obviated by operating one of the largest Pittsburg pumps.

Work at Youngstown is very dull, but it is hoped that after the 1st of January the works will mostly resume again, as it is known that some of them have only stopped for the holiday week. Witch Hazel shaft, which is the nearest coal-works to the city, has been doing very little for the last month or more. There not being any contract at present, the only coal put out is that consumed by the citizens of Youngstown. The shaft is 192 feet deep, with four and a half feet of coal, and 65 cents is the basis for four feet and over for mining. The

mine, when running full, employs ninety men, but at present is only working about seventy men.

PENNSYLVANIA.

ANTHRACITE.

Tunnels from the Mammoth and Skidmore veins at Plank Ridge and Indian Ridge collieries have been started.

It is reported that Capt. George W. Johnson, of Shenandoah, will open a colliery near the Pottsville shoe factory next spring. The lands are known as Chamberlain's tract, and are owned by P. W. Sheaffer.

The large boiler-house attached to the Monitor colliery, at Locust Gap, was destroyed by fire January 6th. The boilers and machinery were injured beyond further use. The Philadelphia & Reading Coal and Iron Company took possession of the colliery January 7th. The fire is supposed to have been started by a party of tramps.

ALLIANCE.—This colliery, at New Philadelphia, which has been undergoing extensive repairs, will resume operations shortly.

DRAPER.—Major E. J. Phillips has taken charge of this colliery as superintendent.

LEHIGH VALLEY.—This coal company has begun the sinking of what will be one of the largest shafts in the anthracite coal regions. The new shaft is near Lost Creek, on the north side of Bear Ridge, opposite Hammond colliery, and will be known as Packer No. 5. It will be a quadrilateral, 48 feet by 13 feet in dimensions, to be divided into six compartments—one for ventilation, one for pumps, and four for hoisting. The entire depth of the shaft, when completed, will probably be 1400 feet, at which depth the Buck Mountain seam will have been intersected. The breaker will have its machinery duplicated in every particular, and will be at least equal in capacity to any ever erected in the anthracite region. Usually anthracite breakers have but one dump-chute, one set of rollers, and two main screens; but the one in question will have two sets of rollers, two dump-chutes, and four main screens, or about twenty screens altogether. One portion of the breaker will be used exclusively for the preparation of white ash coals, while in the other portion only red ash will be prepared.

MORRIS RIDGE.—In diving the 660-foot tunnel at this colliery, the contractor occupied ten months and used 1½ tons of dynamite, 3000 squibs, and 700 caps, without the slightest accident.

OXFORD.—A recent explosion of fire-damp at the Oxford colliery, in the Hyde Park quarter of Scranton, tore out the lining of the hoisting-shafts and the new air-shafts, and cut off communication with fourteen men who were in the mine. Within an hour, men descended in a basket and found all alive. Three were seriously burned, however, and the injuries of one of them are probably fatal. The others are more or less seriously injured.

PHILADELPHIA & READING.—This company has purchased the Kobinoor colliery of Richard Heckscher & Co., near Shenandoah. The price paid is said to be \$200,000. This is the eighth colliery which has recently come into the hands of the Reading Company. It has also purchased Lincoln colliery, operated by Levi Miller & Co., and Rausch Creek colliery, operated by Miller, Graeff & Co. Both collieries employ about 700 men and boys. The capacity of the collieries is 200 and 140 cars per day respectively.

RED ASH.—It is said that this mine will produce over 200,000 tons in 1884. Morgan B. Williams has just been re-elected general manager of the mines.

BITUMINOUS.

The mines at Du Bois are now running about as usual, and it is thought that the miners of the Rochester Works will have a fair winter's work. The Hildrup mine has done comparatively nothing for the past two weeks, there being no orders. Punxsutawney is running slowly, and there is no telling whether it will do much better this season or not.

COKE.

A retrospect of the coke trade for the past year shows that it opened up with dull trade and low prices, and these have been the rule ever since. In the spring, trade brightened, says the *Connellsville Courier*, and things assumed a hopeful aspect; but June found prices down to 90 cents, and still declining. A month later, coke was selling at 85 cents, lower than it has ever been in the history of trade. From this time forward, a rising move took place, followed latterly by a slight shrinkage and the adoption of the scheme to curtail production and thereby advance prices. During the year, over 1000 ovens have been added to the list.

WEST VIRGINIA.

ATLANTIC AND GEORGE'S CREEK CONSOLIDATED.—The coal property of this company in Mineral County, on the West Virginia Central & Pittsburg Railroad, is to be opened early in the spring. It is to be worked in common with the present mines of the company located at Pekin, Md. The property in West Virginia includes 79 acres of the 14-foot vein.

UTAH.

EMERY COUNTY.

We are still pushing the mines ahead at Orangeville, writes a correspondent of the *Salt Lake Tribune*, and every thing is in good shape. The four-foot vein and twenty-five foot vein of bituminous coal are very bright and glossy, and also very hard. The vein that I thought would be anthracite coal has proved to be what we call in England honey coal. It will ignite with a match, and a pick will hardly penetrate it. The other vein is bituminous coal three feet thick, making altogether six feet of coal. There is one vein of shale sixteen feet, with a vein of canal six feet thick, making a vein twenty-two feet in size of shale and canal. Then there is a twenty-five foot vein of excellent bituminous coal, all of it clear and not a particle of waste in it, and with three splendid partings in the vein. All of the veins are of canal formation, making it very convenient to wheel the coal out. The vein is a four-foot one of bituminous coal, very hard and bright. The next is a three-foot vein of the same quality of coal as the four-foot bituminous vein. Then follows the honey coal with a four-foot vein. This is a splendid article. All the veins are now opened out in good shape, making twenty-four openings in all, of four different kinds of coal. What we lack is a railroad up to the mines, and the lucky parties who get hold of this property will control a large area of country producing a great variety of coal.

GENERAL MINING NEWS.

ARIZONA.

COCHISE COUNTY Y.

The work for the past year at the different mines of the "great copper camp," as it is termed by the local papers, shows in most cases very favorable results. The Copper Queen stands at the head. It has kept up its production steadily and paid to the fortunate stockholders dividends to the amount of \$500,000. Official figures show that, during the past year, 31,122 tons of ore were smelted, which produced in black copper 8925 tons, and at 98½ per cent pure metal, 3788 tons of refined copper. The mine is now opened to a depth of 400 feet. Water was encountered on the 300-foot level, but pumps were erected, and at present the water has materially decreased and does not interfere with the work. Recently, the company acquired possession of the Rucker mine. About 200 men are employed, but the prospects appear to be so good that, before the present year ends, no doubt this number will be greatly increased. The Neptune Company—a

New York corporation—owning the Neptune, Excelsior, Uncle Sam, Brother Jonathan, etc.—has done much work in the past year. It has, however, not been very successful, for reasons unknown. The mines are said to be valuable. The Hendricks, one of the oldest locations, is leased to the Tombstone Mining and Milling Company. Previous to that, no work had been done for some months. The ore is a lead carbonate, which is used at the above company's smelter. South of the Copper Queen and lying parallel with it, is the Atlanta, owned by Messrs. Phelps, Dodge & Co., of New York. Some work has been done, but the prospects of the property would allow developments to be carried on on a greater scale. At the Silver Bear, a thirty-ton smelter is on the ground ready to be erected. The properties are opening up. There are many other properties still undeveloped. Among them are Mammoth, Broad Gauge, Empire, Galena, Black Jack, New York, Della Mack, while as properties that are likely to produce much lead carbonates, the Watson and White Tailed Deer are mentioned.

TOMBSTONE DISTRICT.

Owing to a lack of space, the review of the work done at the prominent mines of this district are crowded out.

MOHAVE COUNTY.

SCHUYLKILL.—The first car-load of ore has been shipped. It went to the Benson smelter.

YAVAPAI COUNTY.

UNITED VERDE.—The copper production, according to the Tucson Citizen, is valued at \$300,000. The enterprise has only been in active operation four months of the past year, and this, in addition to the gold and silver shipped, makes a good showing. The Wonder, Imperial, Hiack, Superior, Bell Key, Big Chief, Keystone, Butter Cup, Australia, Georgia, Paragon, Richmond, Juniata, and Last Stake mining claims, at Pine Flat, Turkey Creek District, have been sold for \$80,000. The purchasers are interested in the Hidden Treasure Mining Company, which has been operating at Turkey Creek for some time past.

CALIFORNIA.

In the celebrated case of Woodruff against the North Bloomfield Mining Company, better known as the great *débris* case of the farmers against the miners, Judge Sawyer, of the United States Circuit Court, at San Francisco, January 7th, rendered a decision granting a perpetual injunction against hydraulic mining. The defendants are permitted to apply to have the injunction dissolved or modified if a plan is devised for abating the nuisance. The case involved the agricultural prosperity of the entire Sacramento Valley, and the decision is the most important ever rendered on the Pacific coast. The farmers are holding joyous demonstrations in different parts of the State. The case will be appealed to the Supreme Court.

MONO COUNTY—BODIE DISTRICT.

BODIE CONSOLIDATED.—The average assay value of the pulp for the week ended December 31st was \$31.21; that of the tailings was \$4.72 per ton.

BODIE TUNNEL.—For the week ended December 31st, the average sampling of the ore in the levels and uprisings was \$19.50 per ton, although the 300-foot level and the uprise gave an average of over \$22 per ton.

STANDARD CONSOLIDATED.—There were extracted and shipped to the mill 1151 tons of ore; 2075 ounces of crude bullion were received for the same week.

NEVADA COUNTY.

IDAHO.—The seventeenth regular annual meeting took place recently. Directors for the ensuing year were elected as follows: Edward Coleman, John C. Coleman, Myles P. O'Connor, Eugene C. Creller, and George W. Hill. The report of the Treasurer, John C. Coleman, shows:

| | |
|--|--------------|
| Cash on hand at last annual meeting..... | \$35,460.82 |
| Receipts during the year..... | 362,231.30 |
| Total..... | \$397,712.12 |
| Total disbursements for the year..... | 378,747.86 |
| Balance on hand..... | \$18,964.26 |

The superintendent gives the expenditures for the fiscal year, as follows:

| | |
|--------------------------------------|--------------|
| Mill and mining..... | \$248,847.72 |
| Saving sulphurets..... | 1,645.00 |
| Grinding tailings on percentage..... | 134.50 |
| Self-feeders..... | 2,296.46 |
| Heater for mill..... | 755.31 |
| Water-works for power..... | 46,496.32 |
| Sinking shaft..... | 10,519.13 |
| Retimbering air-shaft..... | 1,235.87 |
| Retimbering old pump-shaft..... | 889.85 |
| General account..... | 29,719.82 |
| Total..... | \$344,647.86 |

Seven dividends were paid during the fiscal year ended December 3d, aggregating \$34,100, or 11 per cent on the capital stock of the company. From 1869 to 1883, both inclusive, the Idaho has paid 169 dividends, amounting to \$3,399,150. The reports of officers show the mine to be looking well in the lower levels, and work of sinking is constantly going forward.

SIERRA COUNTY.

RUBY.—The company has recently purchased six mining claims and a water right. This gives the company exclusive rights to the waters of Rock Creek and possession of quite a large tract of mining ground, some of which probably contains rich gravel.

SIERRA BUTTES.—Tunnel No. 9 is pushed ahead. The rock is getting softer, requiring the tunnel to be closely timbered. The first ore-body will be tapped about 1000 feet farther. It is expected to have the new mill in operation next spring.

CANADA.

PROVINCE OF QUEBEC.

Another phosphate mine on the Eighth Concession of Portland has been opened. Phosphate mining on the Lievre is rather at a stand-still at present for want of good roads, and some mines have discharged their men.

COLORADO.

The mining product of this State for the year 1883—gold, silver, copper, and lead—is estimated by the Denver Republican as follows:

| County. | Amount. | County. | Amount. |
|------------------|------------|-----------------|--------------|
| Boulder..... | \$400,000 | La Plata..... | 128,688 |
| Chaffee..... | 300,000 | Ouray..... | 700,600 |
| Custer..... | 800,721 | Park..... | 400,000 |
| Clear Creek..... | 2,000,000 | Pitkin..... | 125,000 |
| Dolores..... | 200,000 | Rio Grande..... | 182,000 |
| Eagle..... | 930,000 | Routt..... | 75,000 |
| Fremont..... | 20,000 | Saguache..... | 100,000 |
| Gilpin..... | 2,208,988 | San Miguel..... | 225,000 |
| Grand..... | 10,000 | San Juan..... | 418,954 |
| Gunnison..... | 650,000 | Summit..... | 350,000 |
| Hinsdale..... | 390,000 | | |
| Lake..... | 15,691,200 | Total..... | \$26,306,131 |

Total production last year, \$25,750,898, showing an increase this year of \$655,233.

ARAPAHOE COUNTY.

BOSTON & COLORADO WORKS.—The report from these smelting and refining works for the year 1883 is as follows:

| Localities. | Gold. | Silver. | Copper. | Totals. |
|-------------------------|-----------|-------------|-----------|-------------|
| Gilpin County..... | \$48,000 | \$83,000 | \$87,000 | \$606,000 |
| Clear Creek County..... | 44,000 | 640,000 | 41,000 | 725,000 |
| Boulder..... | 146,000 | 59,000 | 41,000 | 205,000 |
| Lake..... | 56,000 | 56,000 | 56,000 | 56,000 |
| Summit..... | 152,000 | 152,000 | 152,000 | 152,000 |
| Park..... | 6,000 | 80,000 | 86,000 | 86,000 |
| Gunnison..... | 3,000 | 150,000 | 153,000 | 153,000 |
| Custer..... | 9,000 | 7,000 | 16,000 | 16,000 |
| Hinsdale..... | 4,000 | 31,000 | 12,000 | 47,000 |
| Saguache..... | 11,000 | 11,000 | 11,000 | 11,000 |
| San Juan..... | 2,000 | 16,000 | 6,000 | 24,000 |
| Ouray..... | 15,000 | 3,000 | 18,000 | 18,000 |
| Chaffee..... | 11,000 | 11,000 | 11,000 | 11,000 |
| New Mexico..... | 12,000 | 101,000 | 11,000 | 124,000 |
| Arizona..... | 13,000 | 13,000 | 4,000 | 17,000 |
| Utah..... | 4,000 | 88,000 | 40,000 | 132,000 |
| Montana..... | 63,000 | 646,000 | 130,000 | 839,000 |
| Miscellaneous..... | 240,000 | 417,000 | 28,000 | 685,000 |
| | \$969,000 | \$2,576,000 | \$362,000 | \$3,907,000 |

"Miscellaneous" includes purchases from smelting companies, sampling works, and ore-buyers, and it is impossible to tell from what district they came.

GRANT SMELTING COMPANY.—Receipts of lead, silver, and gold at Omaha & Grant Smelting and Refining Works, at Denver, in 1883:

| Counties. | Pounds lead. | Ounces silver. | Ounces gold. | Value. |
|---------------------------|--------------|----------------|--------------|----------------|
| Lake..... | 25,476,950 | 2,248,997 | 329,138 | \$3,688,922.27 |
| Clear Creek..... | 650,170 | 209,274 | 30,816 | 265,828.71 |
| Custer..... | 2,750 | 113,733 | 2,903,985 | 725,483.74 |
| Gilpin..... | 119,120 | 5,738 | 66,625 | 25,443.58 |
| Eagle..... | 3,268,900 | 57,057 | 83,425 | 227,107.14 |
| Summit..... | 1,470,400 | 62,213 | 19,915 | 138,718.73 |
| Gunnison..... | 440,280 | 69,666 | 25,900 | 101,798.73 |
| Boulder..... | 9,720 | 4,718 | 222,705 | 51,658.12 |
| Chaffee..... | 179,240 | 19,086 | 14,795 | 33,138.52 |
| Ouray..... | 101,960 | 3,640 | 8,100 | 32,366.47 |
| Park..... | 228,740 | 36,972 | 66,065 | 64,029.33 |
| Pitkin..... | 284,340 | 24,963 | 5,265 | 40,041.97 |
| San Juan..... | 1,366,930 | 136,964 | 31,185 | 218,618.18 |
| Saguache..... | 8,800 | 1,192 | 1,707.20 | 1,707.20 |
| San Miguel..... | 39,040 | 11,535 | 13,700 | 17,277.09 |
| Miscellaneous..... | 333,170 | 36,565 | 45,160 | 64,548.72 |
| | 33,980,510 | 3,062,311 | 3,866,809 | \$5,696,638.50 |
| New Mexico..... | 11,330 | 125,221 | ..... | \$138,252.95 |
| Arizona..... | 261,090 | 255,918 | 7,445 | 292,087.71 |
| Utah..... | 1,689,500 | 73,155 | 16,880 | 162,183.02 |
| Idaho..... | 134,160 | 16,158 | ..... | 23,811.00 |
| California..... | 18,800 | 29,624 | 47,960 | 33,345.73 |
| Old Mexico..... | 11,440 | 2,280 | ..... | 2,559.45 |
| | 2,066,320 | 504,356 | 72,265 | \$652,239.86 |
| Colorado..... | 33,980,510 | 3,062,311 | 3,866,809 | \$5,696,638.50 |
| Other States and ter..... | 2,066,320 | 504,356 | 72,265 | 652,239.86 |
| Total..... | 36,046,830 | 3,566,667 | 3,940,874 | \$6,348,878.38 |

Tons of ore smelted during the year—101,240.

CHAFFEE COUNTY.

According to the Mountaineer, the monthly expense account of the leading mines of the St. Elmo District is as follows: The Murphy Company, \$3700; Tressie C. Company, \$3300; Livingstone, \$1200; Brittenstone, \$700; Northern Boy, \$600; Chrysolite, \$600; Big Bonanza, \$550; Sierra Nevada, \$500; Gold Field, \$300. Total, \$11,450, besides what is paid out by individuals, which will swell the amount to more than \$15,000.

The Richmond Mining and Smelting Company has handled a total amount of 664 tons of ore, valued at \$24,030.16; the bullion shipped is six cars, valued at \$17,680.66; the value of the ore now on hand is \$6349.50. The Mary Murphy Company has shipped a total of 510 tons, valued at \$28,650; and it has more ore than has been shipped lying in its ore-houses, waiting shipment.

CALUMET.—It is stated that the production last year amounted to 16,900 tons of iron ore, which had an average value of twenty-six dollars a ton.

FREMONT COUNTY.

ROYAL GORGE SMELTER.—The following is the statement of ore purchased and smelted during 1883:

| Localities. | Tons of ore. | Ounces silver. | Ounces gold. | Pounds of lead. | Amt. paid for ore. |
|-----------------------|--------------|----------------|--------------|-----------------|--------------------|
| Lake County..... | 4,494½ | 59,724 | 538 | 1,360,040 | \$84,312 |
| Summit..... | 831½ | 11,574 | ..... | 442,860 | 14,858 |
| Saguache..... | 65½ | 1,150 | 13 | 52,292 | 1,920 |
| Chaffee..... | 114½ | 4,196 | ..... | 29,729 | 3,455 |
| Custer..... | 67 | 1,867 | 4 | 2,988 | 1,798 |
| Gunnison..... | 54½ | 1,631 | ..... | 856 | 1,197 |
| Pitkin..... | 69½ | 1,620 | ..... | 18,986 | 887 |
| Denver Supply Co..... | 121 | 7,239 | 27 | 65,675 | 7,009 |
| Utah..... | 621 | 22,466 | 29 | 299,240 | 24,132 |
| Miscellaneous..... | 1½ | 125 | 40 | ..... | 2,455 |
| Totals..... | 6,495½ | 111,592 | 651 | 2,272,666 | \$142,020 |

Total value of bullion, gold, silver, and lead—\$177,602.

GILPIN COUNTY.

CASHIER STAMP-MILL.—This thirty-five stamp-mill treated during the past year 736 cords of ore, which produced 1873 ounces of gold.

EMPIRE MILL.—Apparently this mill has been running only from June 1st to December 1st of the past year. Of stamp-mill dirt, 421 cords were treated, which yielded 1473 ounces of gold.

NEW YORK.—The following statement of this seventy-five stamp-mill shows that, during 1883, 2325 cords of ore were treated, which produced 7979 ounces of gold.

RANDOLPH.—The mill crushed 1458 cords of mill-dirt, in 1883, the average yield being 2.37 ounces per cord.

JEFFERSON COUNTY.

GOLDEN SMELTING COMPANY.—The production for 1883 is reported as follows:

| Locality. | Tons. | Gold. | Silver. | Lead. | Totals. |
|-----------------------------------|-------|----------|-----------|----------|-----------|
| Clear Creek County..... | 1,908 | \$14,400 | \$261,502 | \$45,715 | \$321,618 |
| Gilpin..... | 4,359 | 137,844 | 74,262 | 20,666 | 232,763 |
| Boulder..... | 746 | 89,242 | 28,148 | 1,316 | 118,707 |
| Park..... | 126 | 32 | 5,340 | 1,520 | 6,893 |
| San Juan..... | 64 | 411 | 5,274 | 2,396 | 8,083 |
| New Mexico..... | 23 | ..... | 9,838 | ..... | 9,838 |
| All other sources..... | 317 | 6,747 | 21,116 | 8,419 | 36,283 |
| Totals..... | 7,543 | ..... | ..... | ..... | \$734,190 |
| Total production in 1883 was..... | ..... | ..... | ..... | ..... | 659,161 |

Showing an increase this year of \$73,000.

MINERS' SMELTING COMPANY.—The following figures show the production for 1883 :

Table with 5 columns: Counties, Tons, Gold, Silver, Copper, Total. Rows include Clear Creek, Gilpin, Boulder, All other sources, Tailings, and Total.

Of the amount of bullion shipped during the year, \$193,399 was gold, \$277,181 silver, and \$35,100 copper. The business of these works for 1883 was \$697,640

LAKE COUNTY.

The following statements have been published by the Leadville Herald Production of the county for 1883 :

Table showing production by smelters and mills, ore-shippments from Leadville, and placer mines.

Total net product of Lake County.....\$15,538,446

The season for placer mining during the past year was very short, the water failing in nearly all the gulches six or eight weeks after the frost was out of the ground. In consequence, the yield was rather light, and the product from this source amounted to only about \$25,000.

Production of the Leadville smelters and mills during 1883 :

Table with 5 columns: Name of works, Tons of lead, Ounces of silver, Ounces of gold, Value. Rows include Arkansas Valley Smelter, Harrison Reduction-Works, The La Plata Smelter, etc.

Compared with 1882, this production shows a decided falling off, the figures being short of last year's statement by over a million of dollars. The decrease is principally in the commercial value of the metals, the markets of both silver and lead having ruled very much lower during 1883 than in the previous year.

Mr. William Parker, of Leadville, is endeavoring to effect a combination of claims in Graham Park, on Carbonate Hill, with the view of sinking on one of them a deep shaft. Before beginning work, he desires to secure the necessary amount of money (estimated at from \$200,000 to \$250,000), to carry the project through successfully.

CARBONATE HILL.—Mr. H. G. Bond, President of the Carbonate Hill Mining Company, has submitted a report of the accomplishments of the Yankee Doodle mine since its acquirement by the company. The first year's (1881) work, it seems, resulted in a production of only 223 tons of ore, worth \$12,774, at an expense of over \$40,000.

LITTLE PITTSBURG.—The recently reported strike promises to amount to something. Forty tons of iron ore have been shipped from the new find, which have been settled for, netting over twenty dollars per ton.

LITTLE SLIVER.—The mine is producing at the rate of about 200 tons of ore a month. The product of the mine is rapidly changing from siliceous chloride ores into galena and sulphate of lead minerals, running fairly well in silver.

MATCHLESS.—The manager has closed a contract with the Colorado Smelting-Works, at Pueblo, and, beginning with the first of the new year, the product of this mine will all go to Pueblo.

SMALL HOPES.—Notwithstanding that the mines have produced regularly since the recent discovery of rich ore, the present resources are very extensive, no stopping having been done, and the extraction of mineral has been confined to the driving of drifts cutting the large ore-body into blocks.

SMUGGLER CONSOLIDATED.—This property, on Iron Hill, is not producing as largely at present as it was several months ago. The working force on the mine has gradually been decreased until now only eight men are employed.

PUEBLO COUNTY.

McCowan's Camp, a new gold discovery in this county, twenty miles from Pueblo, on the St. Charles, has become the scene of busy activity. The character of the new find is gold-bearing sandstone, and the latest assay returned \$16 in gold and nearly \$3 in silver.

SUMMIT COUNTY.

The freight rates on ores from Red Cliff to Leadville, it is stated by the Herald, are to be advanced from two dollars a ton to three dollars. If this proposed policy of the railroad is put into effect, the Little Chief, Clinton, Belden, and Kingfisher will shut down entirely.

GOLD HILL MINING AND SMELTING COMPANY.—Articles of incorporation have been filed. The capital stock is \$3,000,000. The business in Colorado is carried on at Kokomo.

GOVERNOR.—The new concentrating mill at these mines, near Breckenridge, has just been completed. The mill is said to be well arranged and equipped with Hartz jigs. The mines are looking well and are in a condition to supply a large quantity of ore.

ROBINSON CONSOLIDATED.—It is stated that this mine was in the possession of the sheriff of the county for several days. The attachment has been removed and the mine is working again.

WARRIOR'S MARK.—The recently reported strike in this mine below Breckenridge is opening up well as development advances. A car-load of ore shipped last week averaged about four hundred dollars to the ton.

MICHIGAN.

We have been unable to obtain, up to the time of going to press, says the Houghton Mining Gazette, full official figures from all mines of Lake Superior, but we think we are not far out of the way when we put the total production of mineral in 1883, which may average about 78 per cent of fine copper, at 37,000 tons, against 35,726 the year before.

The following gives the production of the leading mines for the year 1883, as compared with that of 1882 :

Table comparing yield in 1883 and 1882 for mines in Michigan: Calumet & Hecla, Quincy, Osceola, Franklin, Atlantic, Allouez, Fewabic.

The figures of the Quincy are estimated. MASS.—The product of this mine, in Outonagon County, amounted in 1883 to 453 tons 30 pounds of mineral, which contained about 74 per cent of fine copper.

NEVADA.

ESMERALDA COUNTY.

NORTHERN BELLE.—It is rumored that the Carson & Colorado and Virginia & Truckee railroad companies have attached the personal property of this company for an amount aggregating \$11,169 for wood, salt, and hauling ore.

STOREY COUNTY—COMSTOCK LODGE.

Owing to the low water in the Carson River, little is doing in the way of extracting ore in the Yellow Jacket, Crown Point, and other Gold Hill mines. At Alta, the 2150 level—the lowest in the mine—is drained, and they are now preparing to resume active operations.

The Imperial west drift is about entering the old levels, when miners will be put to work at exploring for ore in that mine and in the Alpha and Eschequer. The northeast drift on the 3100 level on the Sierra Nevada is now fairly started. It has in the face several streaks of quartz that show well in gold.

As it advances, it will intersect the streaks passed through by the east cross-cut, which has run out a distance of 28 feet on the line between the Sierra Nevada and the Union Consolidated. The main south drift on the 3100 level of the Union Consolidated is making good progress. It is thought that the main ore-deposit lies west of this drift.

At the Ophir, a winze is going down below the 150 level.

NEW JERSEY.

MORRIS COUNTY.

The High Branch Railroad carried 332,705 tons of iron ore; the Mount Hope Mineral Railroad, 145,895 tons; and the Hibernia Mine Railroad, 103,106 tons—together, a total of 580,706 tons. Last year, the same roads carried 599,608 tons, showing a decrease this year of 18,902 tons.

UTAH.

Wells, Fargo & Co.'s statement of the mineral product of Utah for 1883 :

Table showing mineral product of Utah for 1883: Base bullion, Doré Bars, Ontario Silver Mining Company, Silver Reef District, Tintic Mining and Milling Company, Other mills and placers.

RECAPITULATION.

Summary table of mineral products: 3,230,547 pounds refined lead at 5 cents per pound, 63,431,964 pounds unrefined lead at \$50 per ton, etc.

Total export value.....\$6,872,085 Computing the gold and silver at its mint valuation and other metals at their value at the seaboard, it would increase the value of the product to \$8,000,000.

SUPERIOR.—This company has been organized in Salt Lake City, with a capital of \$1,000,000. The purpose of the corporation is to conduct the business of mining, milling, smelting, dealing in mines, buying, working, and selling of ores, and generally all manner of things pertaining to the mining business. The property to be worked is situated in Little Cottonwood Mining District. Fifty years are fixed upon as the corporate existence.

BEAVER COUNTY.

HORN-SILVER.—The output of this company for 1883 was: Lead, 14,923 tons of 2000 pounds, and 1,133,352 ounces of silver. The output for month of December, 1883, was: Lead, 1100 tons; silver, 180,000 ounces.

FINANCIAL.

Gold and Silver Stocks.

NEW YORK, Friday Evening, Jan. 11.

There has been but a small business transacted in the mining market this week, but what was done was more generally scattered over the list than is usually the case. Bodie Consolidated continues to be the feature of the market, and was forced up to a very high figure and was actively dealt in. Green Mountain was stronger, owing to favorable news from the mine. The low-priced fancy stocks were dull and weak. The remainder of the market was of but little interest. Below will be found a complete summary. The total number of shares sold aggregates 78,730, as against 151,490 last week.

The Comstock shares were very quiet at irregular prices. California was quiet and steady at 6@9c. Consolidated Virginia was irregular, with a small business, selling from 26@29@28c. Sierra Nevada was quite weak, selling from \$4.25@2.85 under a small business. Union Consolidated sold to-day at \$2.45. Sutro Tunnel was very quiet at irregular prices; it sold from 15@17@16c.

The Leadville stocks were also dull and irregular. Amie sold from 10@9c., with a small business. Chrysolite was a little weak, with a small business; it sold from \$1.15@1.10. Duukin declined from 24@21c., with sales of 200 shares. Iron Silver was fairly dealt in at irregular prices; it sold from \$1.75@1.90. Little Chief was quiet and steady at 65@60c. Climax sold from 6@5c., with moderate transactions.

Bodie Consolidated continues to be the only stock of interest in the Bodie list. It was liberally dealt in and was strong, selling from \$3.50@4.35@4 assessment paid, and from \$2@4, assessment unpaid. Standard was quiet and a little weak, selling from \$5.75@5.50. Bulwer sold at 55c.

The Tuscarora stocks were almost neglected. Argenta sold at 20c. Belle Isle was quiet and weak at 17@10c. Navajo sold to-day at \$2.25; and North Belle Isle sold from 15@14c., with a small business.

In the miscellaneous list, Alice was very quiet at \$2.50. Gold Stripe was quiet at 8@7c. Green Mountain continues to grow strong, and advanced this week from \$1.75@1.90; it was liberally dealt in. The superintendent of the company reports favorable indications in tunnel No. 6. He expects to reach the edge of the Blake chute about the 20th inst., depending on the dip of the ore-body. With an ore-body of \$10 ore, which the Blake chute has heretofore furnished, it is estimated that the mine will net to its stockholders \$20,000 a month. Homestake was also strong under a small business, selling from \$10@10.50. Horn-Silver was moderately dealt in at strong prices; it sold from \$6.25@6.50. Northern Belle was quiet and steady at 45@47c. Robinson Consolidated was weak under a small business, selling from 27@22c. Sierra Grande was very quiet at 66c. Silver King was strong, selling from \$7.75@8, under a small business.

Barcelona was a little weak, with moderate transactions, selling from 18@14c. Bradshaw was moderately dealt in at irregular prices; it sold from 10@15@12c. Central Arizona was quiet and steady at 15@18c. Eastern Oregon sold at 10c. under a small business. Harlem was weak, with a fair business, selling from 14@8c. Rappahannock was quiet and steady at 8@7c. Sonora Consolidated was moderately dealt in at weak prices; it sold from 11@8c.

MEETINGS.

The Cisco Consolidated Gold Mining Company, No. 120 Broadway, New York City. Annual meeting of stockholders and election of trustees, January 21st, at twelve o'clock M.

The Edison Ore Milling Company, Limited, No. 65 Fifth avenue, New York City. Annual meeting of stockholders and election of trustees, January 15th, at twelve o'clock M.

The Gold Stripe Mining Company, No. 18 Broadway, New York City. Annual meeting of stockholders and election of trustees, January 15th, between ten A.M. and twelve o'clock M.

The New England Gold and Silver Mining Company, No. 101 Spring street, New York City. Annual meeting of stockholders and election of trustees, February 1st, at twelve o'clock M.

The Van de Water Gold and Silver Mining Company, No. 115 Broadway, New York City. Annual meeting of stockholders and election of trustees, January 15th, at eleven o'clock A.M.

DIVIDENDS.

The Copper Queen Mining Company, of Arizona, has declared a quarterly dividend of one hundred thousand dollars, payable on and after January 17th.

The Jackson Mining Company has declared a dividend (No. 2) of ten cents per share, payable January 4th.

PIPE LINE CERTIFICATES.

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

The oil market has been very active, with considerable fluctuations. Opening Monday at \$1.14%, it sold up to \$1.15% with a bull feeling, and on Tuesday it sold up to \$1.15%, closing at \$1.14%. On Wednesday, Thursday, and to-day, the market weakened, and closed about one cent lower each day.

The opening on Wednesday of the McKinney well north of Sheffield, on Cooper tract, started the selling movement, as the well was a good one. On Friday, there was a rumor of a wild-cat well near Irvington being good, but late in the day it appeared to be false, as the well had no show of gas or oil.

Refined oil, firm.

The monthly report of the Pipe Line companies shows that there was, during December, an increase in stocks of 214,000 barrels.

The following table gives the quotations and sales at the New York Mining Stock and National Petroleum Exchange:

| | Opening. | Highest. | Lowest. | Closing. | Sales. |
|------------|----------|----------|---------|----------|------------|
| Jan. 5 | \$1.14% | \$1.14% | \$1.14% | \$1.14% | 3,223,000 |
| 7 | 1.14% | 1.15% | 1.14% | 1.15% | 3,951,000 |
| 8 | 1.15% | 1.15% | 1.14% | 1.14% | 3,905,000 |
| 9 | 1.15 | 1.15% | 1.13% | 1.13% | 4,676,000 |
| 10 | 1.13% | 1.14% | 1.12% | 1.13 | 5,368,000 |
| 11 | 1.13 | 1.13% | 1.11% | 1.11% | 7,099,000 |
| Totalsales | | | | | 28,227,000 |

SAN FRANCISCO MINING STOCK QUOTATIONS.

Daily Range of Prices for the Week.

| NAME OF COMPANY. | CLOSING QUOTATIONS. | | | | | |
|------------------|---------------------|---------|---------|---------|---------|----------|
| | Jan. 4. | Jan. 5. | Jan. 7. | Jan. 8. | Jan. 9. | Jan. 10. |
| Albion | | | | | | |
| Alpha | | 1 1/2 | | | | |
| Argenta | .05 | .05 | 2 1/2 | 2 1/2 | 2 1/2 | 2 1/2 |
| Bechtel | | | | | | |
| Belcher | 1 | 1 | | 1 | 1 1/4 | 1 1/4 |
| Belle Isle | .15 | .10 | | .10 | | |
| Best & Belcher | 2 1/4 | 2 1/2 | 2 1/2 | 3 | 2 1/2 | 2 1/2 |
| Bodie | 2 1/4 | 3 1/2 | 5 1/2 | 4 1/4 | 3 1/2 | 4 1/4 |
| Bullion | | | | | | |
| Bulwer | | | | | | |
| California | .05 | | | | | .10 |
| Chollar | 2 1/2 | 2 1/2 | 2 1/2 | 2 1/2 | 2 1/2 | 2 1/2 |
| Con. Virginia | .25 | .25 | .25 | .30 | .30 | .30 |
| Crown Point | | .95 | 1 | 1 | 1 1/4 | 1 1/4 |
| Elko Cons | .20 | | | | 2 | 2 |
| Eureka Cons | 2 | | | | | |
| Exchequer | | | | | | |
| Gould & Curry | 1 1/4 | 1 1/4 | 1 1/4 | 2 | 2 | 1 1/4 |
| Grand Prize | .15 | .15 | | .20 | .15 | .15 |
| Hale & Norcross | 2 1/4 | 2 1/4 | 2 1/2 | 2 1/4 | 2 1/2 | 2 1/2 |
| Independence | .25 | .25 | | | | |
| Martin White | | | | | | |
| Mexican | 2 | 2 | 2 | 2 | 2 | 2 |
| Mono | | | | | | |
| Mount Diablo | 2 | 2 | | 2 | | |
| Navajo | 2 1/2 | | | 2 1/2 | 2 1/4 | 2 1/4 |
| Northern Belle | .55 | .50 | .50 | .55 | .55 | .50 |
| North Belle Isle | | | | | .55 | .50 |
| Ophir | 3 1/2 | 3 1/4 | | | 3 1/4 | 3 1/4 |
| Overman | | | | | | |
| Potosi | 1 | 1 1/2 | 1 1/2 | 1 1/4 | 1 1/2 | 1 |
| Savage | 1 | 1 | 1 | 1 1/2 | 1 | 1 |
| Scorpion | | | | | | |
| Sierra Nevada | 3 | 2 1/2 | 2 1/4 | 3 1/2 | 3 | 3 |
| Silver King | | | | | | |
| Tip Top | | | | | | |
| Union Cons. | 2 1/2 | 2 1/2 | 2 1/4 | 2 1/2 | 2 1/2 | 2 1/2 |
| Utah | 1 1/4 | 1 1/2 | 1 1/2 | 1 1/4 | 1 1/2 | 1 1/4 |
| Wales Cons. | | | | | | |
| Yellow Jacket | 2 1/2 | | 2 1/4 | 2 1/2 | 2 1/4 | 2 1/4 |

Copper and Silver Stocks.

Reported by C. H. Smith, 15 Congress street, Boston, Stock Broker and Member of the Boston Mining and Stock Exchanges.

BOSTON, January 10.

There has been more activity in the market the past week, and prices for the leading copper stocks show quite an advance from last week. This is especially noticeable in Quincy, the dealings in which for several weeks past have been very small, and it is evident that good orders have been received, which could not be filled except at higher prices. The opening price was \$45, and it has steadily advanced to \$47, with no stock offered to-day at less than \$48.

Calumet & Hecla, on good demand, advanced from \$237@239, and is offered at the latter price. The product for December was 1765 tons, and for the year 20,624 tons, against 19,946 tons for 1882. Franklin is more freely dealt in, and is very firm at \$9 1/2@10. The product for 1883 was 2153 tons, against 1988 for 1882. Osceola, a little heavy at \$17@17 1/2. There is a better demand for Pewabic, and sales are reported at \$1 1/2, an advance of 3/4. Copper Falls is showing considerable activity, and has advanced from \$1 1/2@1 1/4 on sales of less than 1000 shares. The product of this mine for 1883 was 536 1/2 tons. It is estimated that the total product of the Lake Superior copper mines last year was 37,000 tons, against 35,700 tons in 1882.

In silver stocks, there is no activity. A small lot of Harshaw sold at 50c. Silver Islet declined to \$1 1/4, sales 125 shares; and 1000 shares Bonanza Development sold at \$1 1/4.

At the Mining Exchange, there is a little more activity, confined, however, to one or two specialties. Bowman Silver, now selling assessment, 10 cents, paid, is in fair demand at 14@15c. Empire, an old favorite, is again in active demand. The reports from the mine are of a very satisfactory character, and higher prices for the stock are looked for in the near future. Sales have been made at 25@32c., and there seems to be very little stock in the market, and any large orders to fill would materially advance the price. Dunkin Silver is in fair demand at 24c. bid, 25 asked.

3 P. M.—At the afternoon Board, Calumet & Hecla sold at \$239. Quincy, at \$48. Huron, at \$1 1/2. Allouez, offered at \$1. The rest of the list unchanged.

BULLION MARKET.

NEW YORK, Friday Evening, Jan. 11.

Under lower India and China exchanges, the silver market in London and here has declined the past week, as shown by the rates given in the accompanying table:

| DATE. | LONDON. | | DATE. | N. Y. | |
|--------|---------|---------|--------|--------|---------|
| | Pence. | Cents. | | Pence. | Cents. |
| Jan. 5 | 50 1/2 | 110 1/2 | Jan. 9 | 50 1/2 | 110 1/4 |
| 7 | 50 1/2 | 110 1/2 | 10 | 50 1/2 | 110 1/4 |
| 8 | 50 1/4 | 110 1/2 | 11 | 50 1/2 | 110 1/4 |

United States Assay-Office at New York.—Statement of business for the month ended December 31st, 1883:

| | |
|---|---------------------|
| Deposits of gold: | |
| Foreign coin | \$101,000 |
| Foreign bullion | 108,000 |
| United States bullion | 461,500 |
| United States bullion (re-deposits) | 139,000 |
| Jewelers' bars | 86,000 |
| Refined gold | 158,000 |
| Total gold | \$1,056,500 |
| Deposits of silver: | |
| Jewelers' bars | 19,300 |
| Foreign coin | 6,900 |
| Foreign bullion | 35,500 |
| United States bullion (contained in gold) | 6,200 |
| United States bullion (re-deposits) | 6,500 |
| Colorado | 6,000 |
| Dakota | 4,000 |
| Lake Superior | 600 |
| Montana | 172,500 |
| New Mexico | 20,000 |
| Utah | 149,000 |
| Refined silver | 68,900 |
| Total deposits | \$1,550,500 |
| Gold bars stamped | \$2,812,758 |
| Silver bars stamped | 500,534—\$3,313,292 |

Foreign Bank Statements.—The governors of the Bank of England, at their regular weekly meeting, made no change in the bank's minimum rate for discount, and it remains at 3 per cent. During the week, the bank gained £45,000 bullion, and the proportion of its reserve to its liabilities was increased from 34 1/2 to 36 1/2 per cent, against 37 11-16 per cent at this date last year. The weekly statement of the Bank of France shows a decrease of 345,000 francs gold, and a decrease of 4,650,000 francs silver. The Imperial Bank of Germany gained specie to the amount of 3,240,000 marks.

United States Mints.—The total coinage executed at the mints of the United States last year was 106,600,248 pieces, and the total value of the coinage was \$60,092,749. Owing to the continued demand for dimes at the Philadelphia Mint, the Director of the Mint has authorized the purchase of 50,000 additional ounces of silver for coinage into dimes.

BULLION PRODUCTION FOR 1883.

We give below a statement showing the latest bullion shipments. These are officially obtained from the companies, where that is possible; and where official statements can not be procured, we take the latest shipments published in those papers nearest to the mines reported. The table gives the amount shipped for the week up to the date given, as well as the aggregate shipments to such date from the first of January, 1883.

The shipments of silver bullion are valued at \$1.29-29 per ounce troy; gold at the standard \$20.67 per ounce troy. The actual value of the silver in the following table is therefore subject to a discount, depending on the market price of silver. If the price of silver be counted at \$1.11 an ounce, which has for some months been about its average value, the following figures, where they relate to silver bullion, should be diminished by about 14½ per cent, to arrive at actual value.

| MINES. | States. | Month of November. | Year from Jan. 1st, 1883. |
|----------------------------------|---------|--------------------|---------------------------|
| *Alice, g. s. | Mont. | | \$885,934 |
| *Alta-Montana, g. L. s. | " | | \$10,625 |
| *Belmont | " | | 12,604 |
| *Bodie, g. s. | Cal. | | 199,859 |
| *Rodie Tunnel, g. | " | | 52,742 |
| *Bonanza King, g. | " | | 426,967 |
| *Boston & Montana, g. | Mont. | | 140,323 |
| *Central Arizona, s. | Ariz. | | 35,845 |
| *Christy, s. | Utah. | 17,141 | 239,000 |
| *Chrysolite, s. L. | Colo. | 17,624 | 345,403 |
| *Consolidated Bobtail, g. | Colo. | 8,484 | 71,227 |
| *Contention, s. | Ariz. | 63,497 | 854,886 |
| *Crescent, g. s. L. | Utah. | | 266,498 |
| *Custer, g. s. | Idaho. | | 43,572 |
| *Deadwood-Terra, g. | Dak. | | 388,552 |
| *D-rbec Blue Gravel, g. s. | Cal. | 12,976 | 128,019 |
| *Dunkin, s. L. | Colo. | | 49,250 |
| *Evening Star, s. L. | Colo. | | 47,061 |
| *Father de Smet, g. | Dak. | 24,556 | 325,237 |
| *Frisco M. and S. Co., g. s. L. | Utah. | | \$77,084 |
| *Granite Mountain, s. | Mont. | | 323,523 |
| *Gunnell, s. | Colo. | | 58,828 |
| *Haile, g. | S. C. | 3,317 | 37,942 |
| *Head Center Consolidated | Ariz. | | 45,340 |
| *Head Center and Tranquility | Ariz. | | 89,108 |
| *Hecla Consolidated, g. s. L. | Mont. | ** | 63,979 |
| *Homestake, g. | Dak. | | 866,709 |
| *Hope, s. | Mont. | | 82,060 |
| *Horn-Silver, s. L. | Utah. | 240,000 | 2,977,200 |
| *Howell S. and Mg. Co., g. s. L. | Ariz. | 49,075 | 193,952 |
| *Idaho, g. | Cal. | | 150,642 |
| *Independence, g. s. | Nev. | | 32,991 |
| *Iron Silver, s. L. | Colo. | | 1,031,952 |
| *Jocuitita, s. | Mex. | | \$258,959 |
| *Kentuck, g. s. | Nev. | | 20,550 |
| *Lexington, s. | Mont. | 119,134 | 1,173,685 |
| *Little Pittsburg, s. L. | Colo. | 15,441 | 87,552 |
| *Marguerite, g. | Cal. | | 74,622 |
| *Martin White, g. s. | Nev. | | 136,317 |
| *Morning Star, s. L. | Colo. | | 84,428 |
| *Mount Diablo | Nev. | 30,992 | 468,242 |
| *Navajo, g. s. | " | | 411,642 |
| *North Belle Isle | " | | 2,153 |
| *Northern Belle, s. | " | 30,502 | 569,607 |
| *Ontario, s. L. | Utah. | | 1,807,178 |
| *Oxford, g. | N. S. | | 54,055 |
| *Phoenix, g. | N. C. | | 21,009 |
| *Pinal Consolidated, s. L. | Ariz. | | 181,485 |
| *Plymouth Consolidated, g. | Cal. | 77,306 | 450,456 |
| *Satemo, g. | N. S. | | 2,500 |
| *Silver Bow, g. s. | Mont. | | 203,947 |
| *Silver Cord, g. s. L. | Colo. | 31,262 | 972,567 |
| *Silver King, s. | Ariz. | | 367,802 |
| *South Yuba, g. | Cal. | | 37,272 |
| *Standard, g. | Cal. | 71,066 | 1,034,685 |
| *Star, s. | Nev. | | 27,095 |
| *Stormont, s. | Utah. | 17,086 | 232,638 |
| *Syndicate, g. | Cal. | 10,230 | 66,238 |
| *Tintic M. and M. Co. | Utah. | 1,873 | 36,543 |
| *Tip Top, s. | Ariz. | | 37,868 |
| *Tombstone, g. s. L. | " | | 664,618 |
| *Wyoming Consolidated. | Cal. | | 31,541 |
| *Yellow Jacket, s. | Nev. | | 265,885 |

Total amount of shipments to date.....\$20,903,634

* Official. † Net value. ‡ Assay value. § Not including value of lead. G. Gold. S. Silver. L. Lead. The dash (—) indicates that no shipments have been made in the month named. ** Silver valued at \$1.10 per ounce.

METALS.

NEW YORK, Friday Evening, Jan. 11.

Copper.—Nothing has occurred to disturb the quiet state of affairs which has characterized this metal for months past. Refiners complain, as they have done for some time, of the scarcity of raw material, while the Lake companies, being in a good position, maintain their attitude of firmness. As yet, manufacturers show little disposition to buy, and prices remain 15c. for Lake, and 14½@14¾c. for other brands, according to quality. England cables £57 7s. 6d. for Chili Bars, and £64 for Best Selected.

Tin.—The market remains quiet and dull, only a jobbing business being done with 18¾c. bid and 19c. asked for spot Straits. London cables to-day the market firmer at £83 10s. @ £84.

Lead.—The movement begun last week has culminated this week in a sudden rise. About 1200 tons of Common have been taken off the hands of one holder by a Western firm at 4'20c., and since then about 800 tons of Common and Refined have been bought by manufacturers, dealers, and holders of lead, the bulk of it at 4'20 and 4'25c., but some lots as high as 4'30 and 4'40c. The asking price is now 4½@4¾c. The movement is the outgrowth of what appears to be concerted action between very strong parties in the West, who, it is stated, are operating on the basis that the stocks are not by far as large as they have been represented to be; that the long-continued decline has caused a restriction of the production; that heavy snow-falls in the Western camps are bound to restrict ore-shipments for a long time to come; and that smelters are carrying only the supplies of ore needed to insure the smooth running of their works. There is no doubt that consumers have been buying for months from hand to mouth only, and are therefore generally without good stocks; but, on the other hand, business here in the East is dull, this being the most quiet season of the year. Consumers will not be eager to rush into the market, at least not until they have convinced their customers that they must get higher prices. As most of their manufactured stock is the product of low-priced lead, they are not likely to succeed immediately, though they will not be averse to making the attempt. The main point is, whether manufacturers in the West will be heavy buyers. A good deal of lead was sold during the last month of the year for delivery during January, February, and even March, and this will tend to make some buyers less anxious to come into the market. If the rise had taken place at an active season, it might mean much more than it does now, though the strength of the parties engineering it is such that they are not likely to recede from their position for some time to come. In the mean time, refiners and smelters who are saddled with high-priced raw material will be able to place some of it without as heavy a loss as anticipated. The practical test of the soundness of the views of those who are now holding the candle so high will not come for many weeks. They have reached the limit now beyond which they can not go. Spanish lead has been offered here at 2'50c. this week, delivered at New York, equivalent to 4'50c., and the foreign market, thus becomes once more a possible factor. It is stated that the Richmond Company has declined 4'25c. for the 2000 tons which it has piled up here.

Summing up the position, we are convinced that there will not be any early change; but we feel inclined to believe that, unless consumption in the West proves heavy, the artificial state of the market can not ultimately be maintained. In one direction, the sudden advance is unfortunate. It will attract undue attention to the metal on the part of the agitators who are eager to make political capital out of any thing that affects tariff matters.

Under date of the 9th, Messrs. John Wahl & Co. write us from St. Louis:

Since our last, freight rates East have declined from 35½c. to New York City to 29c. per 100 pounds from East St. Louis, with privilege of advancing at any time without giving the customary ten days' notice.

To-day, they telegraph us freight rates will advance on Monday to 35c.

On the market at St. Louis, Messrs. John Wahl & Co. wire us to-day:

Our market is strong and higher, there being a fairly active demand for both hard and soft lead, and prices being held stiff. We quote sales of 210 tons of Common at 3'75 and 3'80c.

Spelter.—The market drags along at 4½@4¾c. London cables £15 5s.

Antimony.—The market is firm at 11½@11¾c. for Jackson's, and 10½@10¾c. for Hallett's. Cable quotations for the latter are £45.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, Jan. 11.

Mr. Edward J. Shriver, Secretary of the Metal Exchange, has compiled the following table of the

imports of iron and steel into New York during the years 1882 and 1883:

| Articles. | Nov., 1883. Tons. | Dec., 1883. Tons. | Total, 1883. Tons. | Total, 1882. Tons. |
|-------------------------------|-------------------|-------------------|--------------------|--------------------|
| Pig-iron..... | 16,268 | 9,943 | 129,082 | 242,498 |
| Spiegeleisen..... | 3,891 | 5,504 | 57,684 | 65,950 |
| Old rails..... | 1,362 | 344 | 6,004 | 39,516 |
| Scrap-iron..... | 783 | 8 10 | 19,508 | 38,918 |
| Scrap-steel..... | 150 | 417 | 17,893 | 15,917 |
| Steel blooms..... | 114 | 122 | 1,162 | 108,203 |
| New steel rails..... | 1,010 | 29 | 37,597 | 59,757 |
| New iron rails..... | 93 | 147 | 568 | 9,392 |
| Steel-wire rods..... | 3,096 | 2,880 | 84,329 | 79,653 |
| Iron-wire rods..... | 645 | 1,281 | 8,284 | 11,020 |
| Swedish iron..... | 1,612 | 1,917 | 23,356 | 23,970 |
| Iron, bds. and bars..... | 02 | 98 | 1,111 | 5,464 |
| Iron beams..... | None | 13 | 3,158 | 5,518 |
| Hoop-iron..... | 2 | 4 | 1,973 | 3,392 |
| Sheet-iron..... | 414 | 334 | 4,129 | 6,843 |
| Russia sheet-iron..... | 346 | None | 1,346 | 1,392 |
| Steel, bds., bars, etc..... | 398 | 420 | 6,009 | 8,007 |
| Steel tires and forgings..... | None | 510 | 4,017 | 3,053 |
| Iron tubes..... | 131 | None | 282 | 759 |
| Iron ore, tons..... | | 1,148 | 34,511 | 148,352 |

These figures tell their own story.

American Pig.—We are reported sales of Foundry pig aggregating from 3000 to 4000 tons at \$19 and \$20. The trade is quiet, without any features of marked interest. There is some disposition to ask higher prices for small lots. We quote: Foundry No. 1, \$20@22.50; No. 2, \$18.50@19.50; and Gray Forge, which is weaker, \$17.50@19; all at tide-water. There has been some business in Bessemer pig at \$19.50@20, and in Spiegeleisen at \$23.50@23.75 for 20 per cent.

On Saturday, 200 tons of No. 1, April, were sold at \$20.50, 200 tons at \$20.63½, and 100 tons, No. 1 May, \$20.50.

Scotch Pig.—Business is limited, and the feeling unchanged. Arrivals are very light.

We quote ex ship and to arrive: Coltness, \$22@23; Langloan, \$22.50@23; Summerlee, \$22.50; Eglinton, \$20@20.50; and Dalmellington, \$20@20.50.

At the Exchange, the following cable quotations were received to-day: Coltness, 55s. 6d.; Langloan, 53s.; Summerlee, 52s.; Garissherrie, 50s. 3d.; Eglinton, at Ardrossan, 45s. 6d.; and Dalmellington, 47s. 6d.

Steel Rails.—The market is firmer, and the greater number of makers ask \$35 or even \$35.50 at mill for small lots, though there are reports that \$35.50 has been asked for tide-water delivery, equivalent to \$34.50 at mill. There is considerable inquiry for small lots. Most of the mills running are well supplied, and we have it from the best authority that fully 700,000 tons of orders have been booked for work this year, a heavier amount than ever before so early in the season.

Old Material.—The market is dull, with quotations ranging between \$22 and \$23 nominally.

Philadelphia. January 10.

[From Our Special Correspondent.]

Pig-Iron.—Notwithstanding the very vigorous efforts of brokers holding stocks of iron of which they wish to dispose, no large sales can be announced; but a good many negotiations are in hand, which brokers say may result in business any day or hour. Mill irons are strong, and foundries are weak, but in neither of them is there much business. Buyers of iron are making inquiries and submitting offers in some cases; but there seems to be a conservatism prevailing in the market which is against any great activity, at least for the present. Persons who have made a tour of consumers' yards, both here and at a distance, are assured that the present inactivity must be but temporary, and at a very early date requirements will be filled. Nominal quotations are, \$20@21.50 for No. 1 Foundry, but the average iron selling is at \$21, and some very good lots have sold as low as \$20.50. No. 2 iron is plentier, and can be had at \$19, very little selling above this figure. Stocks of Gray Forge are not large, and there is no increase in supply, when we consider the furnaces going out of blast; 2000 or 3000 tons were sold this week, at a little under \$18. Other negotiations for much larger quantities are in hand, some of them for 1000-ton lots, but they amount simply to offers which will not be taken because of the low prices offered. Consumers seem

NEW YORK MINING STOCKS.

DIVIDEND-PAYING MINES.

Table with columns: NAME AND LOCATION OF COMPANY, HIGHEST AND LOWEST PRICES PER SHARE AT WHICH SALES WERE MADE (Jan. 5-11), SALES. Lists various mining companies like Alice, Mon., and American Flag.

NON-DIVIDEND-PAYING MINES.

Table with columns: NAME AND LOCATION OF COMPANY, HIGHEST AND LOWEST PRICES PER SHARE AT WHICH SALES WERE MADE (Jan. 5-11), SALES. Lists various mining companies like Alta-Montana, American Flag, and Barcelona.

Full tables giving the total amount of dividends, capital, etc., will be printed the first week of each month. Dividend shares sold, 40,930. Non-dividend shares sold, 37,750.

BOSTON MINING STOCKS.

Table with columns: NAME AND LOCATION OF COMPANY, HIGHEST AND LOWEST PRICES PER SHARE AT WHICH SALES WERE MADE (Jan. 4-10), SALES. Lists various mining companies like Allouez, Amie, and Atlantic.

PHILADELPHIA MINING STOCKS.

Table with columns: NAME AND LOCATION OF COMPANY, HIGHEST AND LOWEST PRICES PER SHARE AT WHICH SALES WERE MADE (Jan. 4-10), SALES. Lists various mining companies like Amer. Cons., Argent., and Arizona So.

determined to wait until the last possible hour. Meanwhile, stocks are being depleted, and brokers and representatives of furnace companies say that prices can not decline any farther, and that asking prices will eventually be paid. Whatever the outcome may be, furnace companies now show more confidence in winter demand and prices than during December.

Foreign Iron.—Several negotiations are hanging fire, as usual, and no sales of consequence can be announced. Bessemer is offered at \$20@20.50, according to quality, and \$19@19.50 is bid.

Muck Bar.—No business has been done, but one or two orders are likely to be placed this week at \$32.

Merchant Iron.—There is so little moving that it is impossible to give any details of interest. Manufacturers and brokers say that the outlook is favorable for good business during the next month; but just at present, very little early spring business is before the market. The lowest prices heard of for what is called Refined Iron were 1.80c., and a little business is coming in all the way up to 2c., and stores are selling a little iron as high as 2.10c.

Plate and Tank Iron.—In plate iron, shell, and flange, very little business has been closed thus far, but there are numerous negotiations for small lots, which will be closed this week. Quotations range from 2.30@2.50c. Beams and Channels are still quoted at 3.50c., but concessions have been named for some business which is expected to be placed in a week or two. Several important enterprises are in sight, which have been reported heretofore. Boston, New York, and Philadelphia expect to construct elevated railroads, and besides this, a large amount of building iron will be wanted. Cofrode & Saylor and the Delaware Bridge Company have secured contracts for 2000 tons of structural iron from the Pennsylvania Company, a part of the 15,000 tons reported as wanted two months ago. The rest will come along in due time.

Nails.—Nail-makers report an improving inquiry, but, as a rule, buyers and jobbers are loth to place orders for more than present requirements, because of the conditions of the market and the probabilities of an accumulation of stocks. Quotations are nominally \$2.45@2.55.

Wrought Pipes and Tubes.—No new business has been reported at the new price-list, but manufacturers are preparing for an active trade.

Sheet-Iron.—Latest quotations in sheet-iron show that special inducements are offered to spring buyers, if they will place large orders at present.

Steel.—Manufacturers of steel are in receipt of inquiries this week for larger than usual quantities of high-grade steel, and expect to secure a good deal of business before the first of February.

Steel Rails.—For steel rails, \$34.50 is asked, and \$33@34 offered. If offers are accepted, 30,000 tons will be sold in two or three days.

Old Material.—Prices of old rails are declining. Quotations are nominally \$22@22.50. Crop-Ends, \$20.50. Cargo Scrap, \$22.50. No. 1 Wrought, \$24@24.50.

Pittsburg. January 10.

[From our Special Correspondent.]

The past week has not brought the expected improvement in the iron trade. Furnace-men and brokers who were hopeful of an early improvement report business now as dull as at any time during the winter. Prices remain unchanged. Standard brands of lake ore forge iron are quoted at \$18 at city furnaces, but outside irons of a quality said to be nearly as good are to be had at \$17. Foundry is in very light demand. Muck Bar is still without sale; quotations nominal. Most of the mills have resumed, some of them double turns, and there is a prospect of an average spring trade. The price is still quoted on a basis of \$1.75@1.85 for bars. All but two of the nail factories have suspended production, in accordance with the agreement, but trade has not yet improved. Prices are steady at \$2.40, 60 days. No large business has been done in wrought-iron pipes. Prices remain steady at the new card rate. Sales of Old Rails have been reported at \$23@23.50, and there is an active inquiry, with prospect of large business. Steel Rails are quoted firmly at \$35 at mill for near-by delivery. Crop-Ends and Scrap are in very light demand. The glass strike is still unsettled.

COAL TRADE REVIEW.

NEW YORK, Friday Evening, Jan. 11.

Anthracite.

The cold weather of the first part of the week, following so soon upon the announcement of a restriction, had the effect of leading to quite a general distribution of coal, reducing tide-water stocks and causing a hardening of prices, which has not yet been lost, although the weather has taken an unfavorable turn. There is still more coal afloat at this point, but as yet there are no indications of any weakness.

Bituminous.

To-day, the bids for the Fitchburg Railroad contract were to be opened; but as we go to press, the results have not been announced. Current business is small in volume, and prices have not exhibited any hardening tendency.

Philadelphia. January 10.

[From our Special Correspondent.]

The coal managers feel in a much better frame of mind this week than they have felt for some time past. For some months, heavy buyers of coal have been looking wise, anticipating trouble among the managers with reference to restriction. The impression has been abroad for a long time that the anthracite coal companies could not permanently harmonize their interests; that restriction would not be acceded to by all; and that production would be so far in excess of the market requirements as to depress prices and enable them to purchase to better advantage. But a contrary condition of things has been developed, as, since the opening of the year, influences have united to make it probable that buyers will be obliged to go into market and pay nearer circular rates than for four or five weeks. A strong downward tendency had developed in December, as shown by a few large transactions; but that tendency, to whatever extent it existed then, has entirely disappeared, and there are indications that stronger prices will be obtained, and that the restriction will compel buyers to look out for supplies. There will be practically six days' suspension this week. The three days' suspension agreed upon began on Thursday. On Monday, the shipments were not much more than half what was due, on account of the bad weather; and on the second and third days of the week, work was suspended at a great number of collieries on account of the intense cold. The Pennsylvania & Reading Coal and Iron Company is pushing its policy of control over collieries as far as possible. This is simply carrying out the original policy of Mr. Gowen, which was shaken for a while during the depression; but now, since the wisdom of his course has been vindicated, the management is seeking by every means in its power to give full scope to this policy. A careful estimate shows that there is a large number of collieries which it is possible for his company to obtain. The Lehigh Company will not transfer its title; but very few outside companies will find it to their interest to decline the prices that have been or will be offered. Negotiations will be actively pushed during the next sixty days, at the end of which time, it is believed by those intimately acquainted with the affairs of the company, the desires and purposes of the Reading will have been consummated. There are prominent coal authorities here who assert that this company can not obtain the collieries it desires, and furthermore, that it would not be desirable for them to do so if they could. But the Reading will not stop for any such sentimental considerations as these. The attention of local consumers here has been attracted to the fact that at Chester, Wilmington, and other cities along the Delaware, coal has sold at prices 50c. to \$1 per ton below the prices here. The Pennsylvania Company is selling Shamokin coals in the southern part of the city at 41c. less than the Reading coal. This is cutting into Reading business somewhat, although its "specials," as some coals are termed, are still in the usual demand. The Delaware & Hudson Canal Company has shipped 7400 tons so far this year, against 50,000 for the same time last year. The Reading Company shipped last week 129,401 tons, an increase of nearly 20,000 tons over shipments for the same time last year. Stocks are depleted very slowly. There is better inquiry from the interior. Some managers look for an active demand in a few

days, owing to the fact that consumers find themselves short of stocks and with thirty-nine days' suspension before them. If the possibility of this suspension had been anticipated, December would have been a much more active month.

Leading bituminous coal operators, consulted by your correspondent this afternoon, said that the condition of the trade was but little changed from that of two months ago; that no progress had been made with reference to a combination, for which meetings were held a few weeks ago; that nothing had been done with reference to freight rates by which the Clearfield region was to gain such an advantage over the Cumberland; that very few large orders had been presented; that probabilities were not favorable for any immediate activity in the soft coal; and that the general outlook was blue. The average consumption of coal exists in the line trade, where less would be possible, with proper organization.

Pittsburg. January 10.

[From our Special Correspondent.]

Trade here, during the past week, retains the dullness that has marked it for months, added to local disturbances due to causes outlined below.

Railroad trade was, until three days ago, picking up somewhat, when the tremendous snow-storm paralyzed it. Mill demand shows a trifle more activity as the year grows older, and the cold weather increases domestic consumption considerably. Pan-Handle pits are averaging but half-time as a whole, with here and there a firm running full. All, or very nearly all, are paying the full rate awarded by the umpire last fall, 3½ cents. Prices are unimproved, and remain at 5¼@6c. for lump coal on the wall. On the 9th inst., snow fell to the depth of eighteen inches, causing such delay as to shut out the coal supply from mills. At present, some stoppages have been reported on this account, but strenuous efforts are making to move coal trains, and within twenty-four hours, unless more snow should fall. Prices as yet are unaffected, but the snow has upset the trade considerably. The outlook for this trade is better than it was a week or two ago, though operators grumble at paying a rate for mining which is, in their opinion, by no means justified by the present condition of the coal-producing industry.

River trade is still in pretty bad shape, and prices demoralized at markets below. Second pool is selling at Cincinnati at seven cents per bushel, or a full cent below cost at that point. Other river markets are in no better shape. Added to this is the present anxiety of shippers at this point. The heavy fall of snow just now promises to disappear rapidly, as the weather has moderated and rain is reported at different points. This must produce such disastrous floods in the Monongahela and Ohio valleys as are unpleasant to contemplate. The disasters to coal and coal craft of the first days of the new year promise to be doubled and trebled if the rain becomes general up the rivers which unite at this point. There are not more than 4,000,000 bushels of coal afloat here; but the steamboats and coal craft, landings, tipples, etc., exposed to destruction by a sudden rise in a river full of heavy ice, represent millions of dollars. Very little river coal is mined. The operators in the fourth pool have closed their works rather than pay the umpire's award of three cents per bushel. In the other pools, the condition of the markets produces a similar result, and to-day not more than a dozen of the sixty or seventy river pits on the Monongahela and Youghiohony rivers are in operation. Prices are unchanged.

Coke shows no new features. Demand keeps up to 600 or 650 cars a day, chiefly 48 and 72-hour coke, and prices are unchanged at \$1@1.25, Crushed \$1.75, f. o. b. The growing evidence of a better feeling in the iron trade, faint as it is, is keeping the coke men in a fairly good humor. Eastern demand keeps up well, and furnace demand, though slight, is conceded to be at its worst, with the chances of better things in the near future.

Buffalo. January 10.

[From our Special Correspondent.]

There are no changes to report in the condition of the coal and coke trade. The topic of conversation has been relative to the agreement of the anthracite

coal companies to restrict the days of working the mines to three a week. It is stated that only 400,000 tons of anthracite will be produced weekly in consequence of the adoption of this half-time policy, which will cause a deficiency of four million tons at the opening of spring business; and that the managers calculate that this restriction of output will enable them to command their own prices when the demand comes.

The entire line of the New York, West Shore & Buffalo Railroad was opened for passenger traffic on January 1st.

The law of 1882, creating a Board of Railroad Commissioners, has been in operation for ten months. Governor Cleveland, in his last annual message, says: "The Commission has done a vast amount of work of a character that demonstrates the need and usefulness of such a department, and with results that are creditable to their zeal, fidelity, and intelligence."

My prognostications of trouble among the miners have been realized.

The annual reports of the commerce and trade of our city show that Buffalo has enjoyed a degree of prosperity not equaled by any city of its size in the country, and has developed possibilities for future growth that point to a population of half a million in a comparatively short period. Buffalo enters upon the new year with very bright prospects.

On the first of January, the new organization called the Buffalo Merchants' Exchange was inaugurated into life in its handsome quarters in the Board of Trade building. Already the membership lacks but a dozen of 400, and the cry is, "Still they come."

The old organization, the Board of Trade, a commercial body, is dead, after a long career of usefulness. The new Exchange has already shown its designs in many ways, especially in bringing together particular interests. As an illustration, let us mention the coal trade. Up to date, twenty-four firms are represented in the Board, in place of five in the old institution, as follows: E. L. Hedstrom. Walter T. Wilson (George R. Wilson & Co.). A. J. Packard. Horace A. Noble (Frank Williams & Co.). John J. McWilliams (Delaware, Lackawanna & Western Coal Company). T. Guilford Smith (Albright & Smith). J. J. Albright, Jr. (Albright & Co.). George H. Lewis (Bell, Lewis & Yates). F. A. Bell (Bell, Lewis & Yates). Robert Palen (Palen & Burns). Thomas Loomis (Loomis & Co.). R. R. Hefford. Abraham J. Elias (G. Elias & Brother). E. S. Hubbell. Peter C. Doyle (Lehigh Valley Company). Frank H. Goodyear. C. M. Underhill (J. Langdon & Co.). C. W. Austin (A. J. Hoole & Co.). A. J. Hoole (A. J. Hoole & Co.). W. H. Davis. James Ash. Andrew Langdon. Joseph E. McWilliams (Delaware & Hudson Coal Company). R. W. Chisholm (Chisholm & Parish).

Mr. Hedstrom was elected President of the Merchants' Exchange by a unanimous vote yesterday.

These gentlemen have agreed to meet together at noon, forming as it were "a coal exchange" for the purpose of mutual benefit and the gathering of statistics relative to their trade.

The following is an extract from the address made by Mr. Eric L. Hedstrom at the opening exercises, and is very interesting as well as suggestive:

"Figures are usually regarded as dry and uninteresting, yet they often convey what words can not, and we may be pardoned for introducing a few by way of comparison. I am indebted to Mr. Thurstone, secretary of the board, for much statistical information as to grain, flour, shipping, and live stock. These statistics are of great value to a business community, and sufficient interest has not been taken in the past to compensate for their compilation.

"Taking 1844 as a starting-point, there were received at the port of Buffalo of grain, including flour as grain, in round numbers, 7,000,000 bushels; in 1860, there was received 37,000,000; and in 1883, 76,000,000. This does not include the receipts by the Grand Trunk, Nickel Plate, Lake Shore and Canada Southern branch of the Michigan Central railroads, of which no records are kept. The coal traffic, now next in importance, was in 1844 of so small consequence as to have attracted but little attention. In 1835 or 1836, a cargo of soft coal, loaded at Cleveland and destined for Canada, was brought to this port, the vessel having been driven here by stress of weather, and the cargo unloaded at what was then the Twin warehouse, near the present Bennet elevator, and sold at sixteen cents

per bushel. In the year 1842, there were used in the city for manufacturing and domestic purposes from six to eight hundred tons of anthracite coal, mainly for manufacturing. The lake shipments for this same year amounted to three thousand tons. For many years thereafter, the only coal that came here was brought by vessel or canal, the railroads not deeming it a commodity that would stand what they regarded as a fair transportation charge. I do not know when the first anthracite coal was shipped from this port; the first brought here by rail, as I am advised, was over the Erie Railroad, about 1862. The New York Central did not do much in this direction until about 1868. The amount of anthracite received in 1860 was 34,181 tons, and of all kinds 112,621 tons, approximately valued at five hundred thousand dollars. In 1883, the amount of anthracite received was 2,100,000 gross tons, of which 1,310,000 gross tons were shipped by water and 530,000 gross tons were shipped West by rail, and it is estimated that 250,000 gross tons were consumed locally. The total value is say ten million dollars. The amount of soft coal coming to Buffalo, nearly if not all of which is shipped by rail, amounts to about 1,200,000 tons, valued at three million dollars, making the aggregate coal tonnage of soft and hard say about 3,250,000 tons. This does not include shipments to Canada for consumption, of which no record is kept.

"Buffalo to-day occupies the sixth place as a coal depot, and promises at no very distant day to be fourth if not the third in amount of tonnage."

From these remarks, you can see that the Buffalo "boom" progresses.

Chicago. January 9.

[From our Special Correspondent.]

The extreme cold of the past ten days has proved a godsend to the coal trade of the Northwest, which was gradually getting into a hopelessly discouraged condition. It had seemed as if every element in the situation had conspired to destroy the hopes of the trade during the latter part of December, and it was universally conceded that nothing but a continued term of severe weather could give the market any activity and the trade some little encouragement. The longed-for cold snap came, and it was severe enough to suit the views of the most cold-blooded dealer. The country retailer found himself suddenly confronted with an urgent demand from all quarters, and as he had, as a rule, been buying from hand to mouth, and carrying the lightest possible stocks, in many cases he found it necessary to telegraph to his shipper for spot deliveries at full circular rates, to insure his getting the coal promptly. The cold snap has developed the fact that there was a larger number of country yards nearly exhausted than was generally expected—that is, yards of the smaller class. The policy of this smaller class of dealers throughout the season has been to order only in the smallest possible amounts, with the expectation that prices were going to smash, if not before the New Year, at least soon after. As it now looks, there will be no break in prices this month, though, on the other hand, no one expects any higher prices. If the weather should grow milder and continue so for any length of time, the trade would doubtless drop off to where it was before the opening of the year.

The city retail trade, which was pushed to the highest notch of activity last week, is already lapsing into its former quiet condition. Stocks are large and the public generally understands that fact and looks for lower prices sooner than higher prices.

The receipts by rail during the month of December—though they have not been made public—we are authoritatively informed, amounted to about the same figure as for November, or 80,000 tons.

The expected break in freight rates to Missouri River points has not come, and can not now until after February 1st, as the roads in the pool must give thirty days' notice before withdrawal.

While the circular is maintained, in cases of urgent necessity and in small lots for spot delivery, concessions are made about as last month. We quote the circular rates unchanged as follows:

| PER NET TON BY CAR-LOAD. | |
|--------------------------|--------|
| Grate..... | \$6.29 |
| Egg..... | 6.47 |
| Range..... | 6.74 |
| Chestnut..... | 6.87 |
| Lehigh lump..... | 7.68 |
| Wilkes-Barre lump..... | 6.72 |
| Pittston lump..... | 6.72 |

There is a very appreciable improvement in the

activity noted in the market for bituminous coals since our last review, and for some grades the demand exceeds the supply, a condition of things somewhat unusual in this market of late. Shippers of Indiana Block report a shortage in receipts of that coal, though the mines are not now working up to their full capacity. Erie and Brier Hill are in good active demand and fair supply. An improved demand is reported for Wilmington and other standard grades of Illinois coals.

The fight in Hocking Valley has been brought to a peaceful and satisfactory termination, and the old \$3.75 rate has been restored. This is the only change in prices noted in the new circulars issued this month. The demand for soft coals from manufacturers is reported as improved since the opening of the year—a good sign surely. Cannel coal is in good demand and the supply is ample. We quote prices fairly well maintained at the following range:

| | |
|--------------------------|-------------|
| Erie and Brier Hill..... | \$4.75@5.25 |
| Winifrede..... | @ 4.50 |
| Pittsburg..... | 3.75@ 4.00 |
| Indiana Block..... | 3.25@ 3.45 |
| " Slack..... | 1.50@ 1.75 |
| " Nut..... | 1.75@ 2.00 |
| Baltimore & Ohio..... | 3.50@ 3.75 |
| Hocking Valley..... | @ 3.75 |
| Youghiogheny..... | 4.00@ 4.25 |
| Wilmington..... | 2.60@ 2.75 |
| Blossburg..... | @ 4.15 |
| Cumberland Smithing..... | @ 4.00 |
| Sonman..... | @ 4.00 |
| Kinkaid Lump..... | 3.40@ 3.50 |
| Kinkaid Nut..... | @ 3.00 |
| Grape Creek..... | 2.30@ |
| Fountain County..... | 2.35@ 2.50 |
| Clinton Lump..... | @ 2.30 |
| Streator..... | 2.25@ 2.35 |
| Minonk..... | @ 2.50 |
| Morris..... | @ 2.50 |

The demand for coke in small quantities is quite good, and shows some improvement since the first of the month. While no large contracts are reported, the aggregate sales foot up a very comfortable amount. Prices are unchanged, Connellsville selling at \$5.10, and Crushed Coke at from \$5.70@ \$6.

Chicago. January 5.

[From our Traveling Correspondent.]

The holiday season, together with the mild weather of last week, had a tendency to limit business with the coal interest, notwithstanding the fact that December proved to be a better month, at least for the Hocking Valley mines, than did November. This is true of mines which did not ship to Chicago, and therefore was not owing to the "cut" here, which has undoubtedly increased the sales of Hocking Valley in this market considerably beyond what they would have been had prices been as before. Some seem to think the "war" has injured the future sale of Hocking Valley by demoralizing the trade but I do not think Hocking will lose any thing by being introduced to trade heretofore using other soft coals. Just now, those interested, as well as outside dealers, are happy over the fact that the "war" is over, and \$3.60 on track, in car lots, is the lowest figure for Hocking lump. Retail, delivered, \$5; to dealers in yard in less than car lots, \$4; to dealers in yards, in car-load lots, \$3.75—mine weights.

Your regular correspondent will doubtless give the details of this market. With the temperature ranging from 10 to 45 degrees below zero all over the Northwest, and the railroads blocked and freight traffic demoralized, it looks as though the dealers who are fortunate enough to have a good stock on hand would reap a harvest. Favorable comment is made on the new arrangement for publishing COAL in connection with the ENGINEERING AND MINING JOURNAL, and I predict that the new paper will have more coal readers than COAL, and be much more valuable to that class of advertisers.

Boston. January 10.

[From our Special Correspondent.]

This is the time of year that the Eastern coal market depends upon the weather, if we can believe the dealers. That being the case, it would be hard to tell what kind of a market we are now having. We have forgotten who the humorist was who used to say that the weather for the whole country was manufactured in New England, and samples of it tried on its sturdy and patient inhabitants to see how it would work. That theory is the best explanation of this week's weather that I know of. At one time this week, there was a change of about 45 degrees Fahr. in less than

