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MR. HADFIELD, a Sheffield steel manufacturer, claims to be producing steel of exceptional qualities by adding to his metal 12 per cent of 60 per cent ferro-manganese, thus carrying the percentage of manganese in the steel up to about 9 per cent. Such an alloy, containing only 0.05 per cent of carbon, is said to be free from the weakness of spiegel, which carries 6 per cent of carbon, and it is claimed that it possesses valuable mechanical properties.

THE BEHAVIOR OF PHOSPHORUS IN THE BLAST-FURNACE.

Since the introduction of the basic process in Germany, blast-furnace engineers in that country have begun to study the question what is the source of their losses of phosphorus in the charge and how great they are. Herr G. HILGENSTOCK, a prominent engineer connected with the Hoerde works, which are pioneers in the manufacture of basic pig, has recently given the results of his experience, which upset some of the opinions hitherto held and establish a number of interesting points. The phosphorus not recovered in the pig-iron may have been carried off by the waste gases or be present in the cinder. At first, Herr HILGENSTOCK and

other German engineers were convinced that in making basic pig they could with reasonable accuracy predict the percentage of phosphorus in the pig when its contents in the charge were known. A daily examination of the pig and cinder for a whole month proved to him that the percentage of phosphorus varied much more than was generally believed. The results of these analyses seemed to show that under some conditions as much as 30 per cent, or even more, of the phosphorus supposed to have been in the charge was apparently volatilized, as it was not recovered in the pig or in the cinder. When running on ores yielding a calculated percentage of 3 per cent of phosphorus in the pig, a loss of one third of it would represent the volatilization of a pound of phosphorus per minute in a blast-furnace making 72 tons of iron a day.

Starting with the assumption that the ores charged did not vary much from their average of phosphorus contents, Herr HILGENSTOCK made a series of elaborate tests to detect that element in the waste gases. He could, in the most favorable cases, detect only faint traces. Meanwhile, a careful examination of the materials charged revealed the fact that they varied as to their phosphorus contents. The following results were obtained:

	I.	II.	III.	IV.
Phosphorus in charge, referred to unit of iron.....	3.235	3.235	3.25	3.250
Less phosphorus in the cinder.....	0.240	0.070	0.33	0.225
Difference.....	2.995	3.165	2.92	3.025
Phosphorus found in the pig.....	2.760	2.740	3.18	3.410

When it is considered how difficult it is to get the average sample of cinder corresponding with a given cast of pig, it will be conceded that, whenever there are striking discrepancies between the quantity of phosphorus computed and actually found, there is probably an irregularity in the contents of the charge. The quantity of phosphorus volatilized is so small that it can not be determined.

In producing a series of casts of high-grade phosphorus pig, the following analyses were obtained:

No.	Pig-Iron.				Cinder. Phosphorus.
	Silicon.	Phosphorus.	Manganese.	Carbon.	
1.....	trace.	5.96	0.92	0.88	2.57
2.....	0.02	7.20	0.36	1.11	2.09
3.....	0.05	6.24	0.51	0.95	1.74
4.....	0.09	6.07	0.75	1.19	1.22
5.....	0.28	4.57	1.98	0.90	0.38
6.....	0.28	3.61	1.69	1.19	0.18
7.....	0.28	3.79	1.13	1.12	0.19

Casts Nos. 5, 6, and 7 were made during the change to a burden running low in phosphorus. The figures prove clearly that, as the percentage of phosphorus in the charge increases, the cinder grows richer in phosphorus. Tests made showed that the phosphoric acid in the cinder is that quantity which has not been reduced in the furnace, and that its quantity will increase in the cinder, the smaller is the quantity of reducing agents and the lower the temperature. Considering the fact that the phosphoric pig analyzed above was made with a comparatively large charge of coke, the low percentage of silicon and of carbon will be conceded to be a striking circumstance. It indicates that phosphorus displaces both silicon and carbon in the pig. The following series of analyses amply proves this point.

No.	Pig.				Cinder. Phosphorus.
	Phosphorus.	Silicon.	Carbon.	Manganese.	
1.....	3.26	1.03	2.01	4.66	0.13
2.....	3.98	0.68	2.00	5.16	0.15
3.....	4.04	0.57	1.92	5.87	0.13
4.....	4.25	0.74	1.95	6.23	0.10
5.....	4.44	0.61	1.92	5.21	0.13
6.....	4.48	0.65	1.85	5.36	0.13
7.....	4.65	0.51	1.78	4.65	0.21
8.....	4.77	0.53	1.80	4.38	0.23
9.....	5.47	0.35	1.61	5.82	0.42
10.....	5.70	0.42	1.40	3.61	0.42
11.....	6.02	0.05	1.44	3.93	1.40
12.....	6.52	0.07	1.29	4.82	0.71
13.....	6.78	0.03	1.22	3.28	0.86
14.....	7.08	0.04	1.28	4.31	0.57
15.....	8.24	trace	1.13	4.21	1.76
16.....	8.62	trace	1.10	5.46	1.36
17.....	8.75	0.08	1.18	4.64	1.35
18.....	8.91	0.09	1.01	3.46	1.54
19.....	9.17	0.06	1.14	4.88	0.46
20.....	9.41	0.02	1.03	3.64	1.00
21.....	9.93	0.03	1.08	5.39	1.03
22.....	10.47	0.04	1.05	4.91	0.60
23.....	12.12	0.02	0.87	4.53	1.49

Herr HILGENSTOCK explains these facts on the theory that at high temperatures carbonic oxide is a more constant compound than silica, and silica, in turn, a more constant compound than phosphoric acid. It is not, in reality, the phosphorus which displaces silicon and carbon. These two elements are oxidized at the expense of the oxygen of the phosphoric acid. It does not follow from the fact that pig carrying 12.12 per cent of phosphorus has been produced in the blast-furnace with only 0.87 per cent of carbon and traces of silicon that such pig is incapable of containing a larger percentage of these elements. Herr HILGENSTOCK alloyed phosphoric pig, running about 15.5 per cent, with an equal weight of 9 per cent silicon pig, and obtained an alloy containing 7.73 per cent of phosphorus, 1.43 per cent of carbon, and 4.34 per cent of silicon, the ferro-silicon melting earlier than the phosphoric pig. Equal parts of ferro-manganese with 5.7 per cent of carbon and phosphoric pig yielded an alloy containing 9.71 per cent of phosphorus and 2.85 per cent of carbon. He made another alloy containing 4.83 per cent of silicon and 4.86 per cent of

carbon. Silicon, phosphorus, and carbon are capable of alloying at high temperatures within a much wider range than is generally believed.

The percentage of manganese in the series varies considerably, and seems to influence the carbon. The variations indicate a rising and falling of the temperature of the furnace and inversely of the percentage of phosphorus in the cinder. It is possible, by running up the heat in the furnace, to produce pig both high in phosphorus and silicon; iron carrying 14.36 per cent of phosphorus and 0.93 per cent of silicon, having been made at Hoerde.

The relation between the quantity of phosphoric acid and silica in the cinder is shown by the following series of analyses, the samples having been taken at the time when the metal referred to above was produced:

	Phosphoric acid.	Silica.
1.....	6.00	34.58
2.....	3.20	36.00
3.....	4.45	36.42
4.....	3.38	36.78
5.....	3.65	36.94
6.....	2.46	37.15
7.....	3.31	37.39
8.....	1.18	37.96
9.....	3.01	38.33
10.....	1.26	38.75

With the growing percentage of silica, the contents of phosphoric acid decline.

High-grade phosphoric pig is very fluid, even when it contains only 0.8 per cent of carbon and traces of silicon, and phosphorus is capable of alloying with iron almost as easily as manganese, pig containing 25.65 per cent phosphorus having been made. As the percentage of phosphorus increases, the pig becomes weaker, with a crystalline fracture, and its magnetic properties decrease, until 25 per cent metal is not attracted by a strong magnet.

THE CINCINNATI MEETING OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.

Those members of the Institute who started from the East earlier than they would have done had they not desired to make allowances for possible delay through obstruction of the railroad by the floods, found few to greet them when they arrived in Cincinnati. Those who had taken the Baltimore & Ohio Railroad found the rails covered with water for only a few hundred yards on Monday night, and none reported any serious trouble. Still when

THE FIRST SESSION

was opened by President R. W. Hunt, President of the Albany & Rensselaer Iron and Steel Company, comparatively few members were present. This was partly due to the fact that a train on the Pan-Handle road had been delayed twelve hours by a serious wreck.

Mr. L. E. Warner, Chairman of the Reception Committee, introduced Mr. John D. Banks, who, representing the mayor of the city, extended to the Institute a cordial welcome; Professor Eddy, speaking in a similar strain in behalf of the University of Cincinnati, the Ohio Mechanics' Institute, and the Society of Natural History. Ex-Governor J. D. Cox then followed with a vigorous speech, in which he dwelt upon the power for good which scientific associations possess.

Mr. Arthur V. Abbott, of New York, was then called upon to read his paper on

THE PHYSICAL TEST OF METALS.

It dealt chiefly with an ingenious testing-machine designed for the well-known scale manufacturers Messrs. Fairbanks. Mr. Abbott illustrated his paper very thoroughly, and so clearly and fluently referred to the many details which make it a self-recording automatic machine that his lecture—for so it might well be called—was received with emphatic signs of approval. We shall publish a full abstract, illustrated, in a future issue.

THE SECOND SESSION.

was held on Wednesday morning at Greenwood Hall, the meeting being opened by the reading of an abstract of a paper by Magnus Troilius, of the Midvale Steel-Works, Nicetown, Philadelphia, Pa., on

SULPHUR DETERMINATION IN STEEL

Mr. Troilius takes issue with those chemists who urge that the bromide method gives too low results, owing not to incomplete separation of the sulphur in the gaseous state, but to the formation of some combination with carbon which can not be retained by the bromine solution. Mr. Troilius states that two years of constant practice with the bromine and aqua regia methods have shown that it is very difficult, particularly in the case of pig-iron, to obtain the BaSO₄ free from SiO₂, not to speak of other contaminations by the aqua regia method. If, to avoid this error, a very high temperature be used for separating the silica completely, SO₂ may be lost, and thus too low results be obtained. The differences in results, when care and skill are used, are indeed not greater than would justify the conclusion that the higher results sometimes obtained by the aqua regia method are due to impurities in the BaSO₄.

A second paper by the same member, Mr. Magnus Troilius, was presented, giving tables for facilitating the heat calculations of furnace gases containing CO₂, CO, CH₄, H, and N. Its character was not such as to give rise to a discussion.

This was followed by the presentation of a paper entitled "Further Determinations of Manganese in Spiegel," by G. C. Stone, of Newark, N. J., who has, since the Troy meeting, received 26 additional results of the analysis of the same sample, of which 46 analyses by different chemists had already been reported. Mr. Stone has again grouped the results in five classes—Williams's volumetric method, other volumetric methods, methods in which the manganese is precipitated and weighed as phosphate, methods in which the manganese is precipitated as a basic salt and weighed as Mn₂O₃, and all other methods.

Following up the experiment reported by Mr. Mackintosh at the Roan-

oke meeting, that the precipitate was MnO₂, Mr. Stone inquired into the question whether foreign substances present in a spiegel might not have some influence upon its composition. The results show that the foreign substances do exert an influence.

There being no discussion, the following paper, by Dr. T. Sterry Hunt, of Montreal, was read:

ON THE APATITE DEPOSITS OF CANADA.

The presence of apatite in the Laurentian rocks of North America has long been known to mineralogists, and within a few years so much interest has been excited by the economic importance of deposits of this mineral found in certain parts of Canada that a brief history of our knowledge of these deposits may be acceptable to the members of the American Institute of Mining Engineers. It was in 1847 that the present writer was shown by a local collector of minerals some large crystals, which had been called beryl, found in North Burgess, in Ontario. These were at once recognized as apatite; and, after a visit to the locality, this was described in the report of the Geological Survey of Canada for that year as likely to furnish an abundant supply of a valuable fertilizer; the opinion being then expressed that the fact of "the existence of such deposits as these will prove of great importance."

Specimens of apatite from this locality, then collected by the writer, were shown among the economic minerals of Canada at the great exhibitions of London and Paris in 1851 and 1855, and the mineral had already been found by explorers at several other points in the same regions previous to 1863. In the *Geology of Canada*, published in that year, the writer resumed the results of his further studies of these deposits, and described the apatite as occurring in the Laurentian rocks, both distributed in crystals through carbonate of lime, and in "irregular beds running with the stratification and composed of nearly pure crystalline phosphate of lime." This was further said to occur in North Burgess, in several parallel "beds interstratified with the gneiss."

In a subsequent report of the Geological Survey, in 1866, I again noticed the occurrence of the apatite in beds of the pyroxenic rocks often found associated with the gneiss. It was said, "The presence of apatite seemed characteristic of the interstratified pyroxenic rocks of this section, in which it was very frequently found in small grains and masses, alike in the granular and the micaceous schistose varieties." In these rocks, the apatite was said to mark the stratification, and to form, in one example, a bed, in some parts two feet thick, which was traced 250 feet along the strike of the pyroxenic rock. I at the same time described the occurrence of apatite, often with calcite, in "true vein-stones, cutting the bedded rocks of the country," alike gneiss, pyroxenite, and crystalline limestone. These latter deposits were further spoken of as well-defined veins, traversing vertically and nearly at right angles the various rocks; as often banded in structure, and including besides apatite both calcite and mica occasionally with pyroxene, and more rarely with hornblende, wollastonite, zircon, quartz, and orthoclase. These veins were said to be very irregular, often changing rapidly in their course from a width of several feet to narrow fissures. It was added, "It is evident that this district can be made to supply considerable quantities of apatite;" and while the uncertainties arising from the irregularities of the veins were mentioned, it was said, "Some of the deposits might probably be mined with profit."

Before following farther this history, it may be stated that there are two districts in Canada which have, within the past few years, been found to contain deposits of apatite of economic importance; one in the Province of Ontario, in which the above observations were made by the writer previous to 1866, including parts of the counties of Lanark, Leeds, and Frontenac; and the other, since made known, in the Province of Quebec, chiefly in Ottawa County. In both cases, it is found in the rocks of the Laurentian series, consisting of granitoid gneisses with bands of quartzite, of pyroxenite, and of crystalline limestone. These ancient and highly inclined strata, with a northeast strike, rise from beneath the horizontal Paleozoic rocks near Kingston, and again pass beneath them near Perth. These overlying strata belonging to the Ottawa basin hide, moreover, to the eastward, the apatite-bearing gneisses of this district; which, a short distance to the westward, are again concealed by the Taconian and other overlying pre-Cambrian groups in Hastings County. The gneissic belt is here seen chiefly in the townships of Loughborough, Storrington, Bedford, North and South Crosby, and North Burgess, where the apatite was first discovered.

The country presents a succession of small, isolated, rounded rocky hills, alternating with numerous small lake-basins, hollowed out of the gneiss, and sometimes out of the interstratified limestones; the general trend both of the hills and the lakes being coincident with the strike of the rocks. These, though concealed in the valleys by considerable depths of alluvial soil, are seen in the hills to be hard and undecayed. The geographical features, as I have elsewhere pointed out, were apparently determined by sub-aerial decay previous to the erosion which removed from them the softened and disintegrated portions, leaving the present outlines.

When, after cutting the forest-growth which covers these hills of granitoid gneiss, fire is allowed to pass over the surface, destroying the undergrowth, the comparatively thin layer of soil is laid bare, and is soon washed away by the rains, leaving the bald, rocky strata exposed in a manner singularly favorable for geological study, but rendering the region sterile. To prevent this process of denudation, it has become the practice in some parts of the country, after burning over the hillsides, to sow them, without loss of time, with grass-seed, which, at once taking root, protects the soil from the destructive action of rains, and transforms it into good pasture land. This system, which has been adopted to a considerable extent in parts of Frontenac County, Ontario, is worthy of record and of imitation in other regions.

The similar apatite-bearing gneisses which are found to the north of the river Ottawa, a little northeast of the city of that name, are in Ottawa County, Quebec, and chiefly in the townships of Buckingham, Templeton, and Portland. They reproduce all the characteristics of the first-mentioned district, and may be looked upon as a prolongation of it, beneath the northwestern limb of the Paleozoic basin already mentioned. Later observations, both in Ontario and in this latter district, where mining

* Loc. cit., pp. 592, 761.

† Loc. cit., pp. 204, 224, 229.

‡ See the author's paper on "Rock Decay Geologically Considered." *Amer. Jour. Sciences*, Sept. 1883.

operations have been carried on within the past few years, have been recorded by Messrs. Broome and Vennor, and by Dr. Harrington, the latter up to 1878. They have, however, added little to our knowledge of the conditions of occurrence of the mineral beyond what had already been set forth in 1863 and 1866.

I have, within the past few months, examined with some detail many of the apatite-workings in Ontario, which have served to confirm the early observations, and to give additional importance to the fact, already insisted upon in previous descriptions, that the deposits of apatite are in part bedded or interstratified in the pyroxenic rock of the region, and in part are true veins of posterior origin. The gneissic rocks, with their interstratified quartzose and pyroxenic layers, and an included band of crystalline limestone, have a general northeast and southwest strike, and are much folded; exhibiting pretty symmetrical anticlinals and synclinals, in which the strata are seen to dip at various angles, sometimes as low as 25 degrees or 30 degrees, but more often approaching the vertical. The bedded deposits of apatite, which are found running and dipping with these, I am disposed to look upon as true beds, deposited at the same time with the inclosing rocks. The veins, on the contrary, cut across all these strata, and, in some noticeable instances, include broken angular masses of the inclosing rocks. They are, for the most part, nearly at right angles to the strike of the strata, and generally vertical, though to both of these conditions there are exceptions. One vein, which had yielded many hundred tons of apatite, I found to intersect, in a nearly horizontal attitude, vertical strata of gneiss; and in rare cases what appear, from their structure and composition, to be veins, are found coinciding in dip and in strike with the inclosing strata.

The distinction between the beds and the veins of apatite is one of considerable practical importance, first, as related to the quality of the mineral contained, and second, as to the continuity of the deposits. The apatite of the interbedded deposits is generally compactly crystalline and free from admixtures, though in some cases including pyrites, and more rarely magnetic iron ore, with which it may form interstratified layers. Many will recall in this connection the bands of magnetite, with an admixture of granular apatite, found interstratified in parts of the great magnetic ore-deposit known as the Port Henry mine, near Lake Champlain, where, in certain layers formerly mined, the apatite made up about one half the bulk. I have seen an example of a similar association of magnetite and apatite from Frontenac County, Ontario. The latter mineral is, however, for the most part found included in the beds of pyroxene rock, already mentioned, which is generally pale green or grayish-green in color, sometimes containing quartz and orthoclase, and distinctly gneissoid in structure.

The veins present more complex conditions; while they are often filled throughout their width by apatite as pure and as massive as that found in the beds, it happens not unfrequently that portions of such veins consist of coarsely crystalline, sparry calcite, generally reddish in tint, holding more or less apatite in large or small crystals, generally with rounded angles, and often accompanied by crystals of mica, and sometimes of pyroxene and other minerals. Occasionally these mixtures, in which the carbonate of lime generally predominates, will occupy the whole breadth of the vein. These *lime-veins*, as they are called by the miners, sometimes include cavities from which the carbonate appears to have been dissolved by infiltrating water, leaving free the inclosed crystals of apatite. In some cases, however, these veins present cavities which have apparently never been filled with solid matter, and exhibit drusy surfaces, with quartz, and more rarely with barytine and zeolites. These calcareous veins often carry so much carbonate of lime as to be valueless for commercial purposes, unless some cheap means for separating the apatite can be devised. It may be said, in general terms, that while some of these true veins, throughout portions or the whole of the breadth, yield good and pure apatite, others are of comparatively little value. The bedded masses, on the contrary, are free from carbonate of lime, and although they may occasionally contain small quantities of mica, pyroxene, hornblende, or pyrites, these are seldom present to an injurious extent.

The question of the continuity of these deposits of both classes is an important one. Veins filling fissures that have been formed in rocks are sometimes continuous for great lengths and to great depths, but experience shows that their extent varies very much for different regions and for different rocks. Inclined beds, which were once horizontal sheets, inclosed in strata that have since been folded, should be as persistent in depth as they are in length; and when traced in the outcrop for many hundreds of feet, may be expected, under ordinary circumstances, to continue downward as far, unless a turn of the inclosing strata brings them up again to the surface. The inclosed beds of apatite in the regions already noticed are often traced for from 500 to 1900 feet and more, and there is reason to believe that they are continuous for long distances. The workings upon them have, however, as yet been very superficial, generally from twenty to forty feet, and rarely exceeding 100 feet. The deepest mine, which is in Ottawa County, is now about 200 feet.

The ordinary thickness of the bedded masses of apatite may be said to vary from one to three and four feet, though not unfrequently expanding to eight and ten feet, and even more, and sometimes contracting to a few inches; the same layer being subject to considerable variations. In some cases, the apatite in a bed is found to thicken and then to diminish, or to be divided by the interposition of the accompanying pyroxenic rock. The condition of the apatite in these cases recalls the thickening and thinning sometimes observed in a layer of coal among disturbed strata, where, as the result of great pressure attending the movements of the harder inclosing rocks, it is alternately attenuated and swollen in volume; in which case, a thinning in one part is necessarily compensated for by a thickening of the parts adjacent.

The thickness of the veins also, as above stated, is very variable, and the same vein in a distance of a few hundred feet will sometimes diminish from eight or ten feet to a few inches. We have already noticed the variable nature of the contents of these veins, which are sometimes filled with solid and pure apatite, and at other times present bands or layers of this mineral, with others chiefly of calcite, of pyroxene crystals, or of a magnesian mica, occasionally mined for commercial purposes. While these veins have yielded in many cases considerable amounts of apatite, they have not the persistency of the beds. Their study presents many interesting facts in paragenesis, which I have described in detail

in the report of the Geological Survey for 1866, already quoted, and more briefly in my *Chemical and Geological Essays* (pp. 208-213).

It is worthy of remark, that some of the first attempts at mining apatite in Canada were upon these veins, and that their irregularities contributed not a little to the discouragement which followed the early trials. The larger part of the productive workings is upon the bedded deposits. These, however, as already noticed, are for the most part opened only by shallow pits; a condition of things which is explained by the peculiar character and the frequency of the deposits, and also by the economic value of the apatite. This mineral, unlike most ordinary ores, is, in its crude state, a merchantable article of considerable value, and finds a ready sale at all times, even in small lots of five or ten tons. Like wheat, it can be converted into ready money, at a price which generally gives a large return for the labor expended in its extraction. Hence it is that farmers and other persons, often with little or no knowledge of mining, have, in a great number of places throughout the district described, opened pits and trenches for the purpose of extracting apatite, and at first with very satisfactory results. So soon, however, as the openings are carried to depths at which the process becomes somewhat difficult from the want of appliances for hoisting the materials mined, or from the inflow of surface-waters, which in wet seasons fill the open cuts, the workings are abandoned for fresh outcrops, never far off. In this way, a lot of 100 acres will sometimes show five, ten, or more pits, often on as many beds, from twelve to twenty feet deep; each of which may have yielded one or more hundred tons of apatite, and has been abandoned in turn, not from any failure in the supply, but because the mineral could be got with less trouble and cost at a new opening on the surface near by.

These conditions are scarcely changed when miners, without capital and unprovided with machinery for hoisting or for pumping, are engaged, as has often been the case, to extract the mineral at a fixed price per ton. These, having no interest in the future of the mine, will work where they can get the material with the least expenditure of time and labor, and often will quit the opening for some one which is more advantageous. The very abundance and the value of the mineral mined has thus led to its careless, wasteful, and unskillful exploitation. It is the working of these causes, in the way just explained, which has thrown undeserved discredit on this mining industry, and, more even than the injudicious schemes of speculators and stock-jobbers, has retarded its legitimate growth.

It is evident that the proper development of these deposits will require regular and scientific mining in place of the crude plan of open pits and trenches, which, from causes already explained, has hitherto, with few exceptions, been followed. As a basis for calculation in mining, it becomes necessary to establish some data as to the production and the value of the apatite layers which we have described. The specific gravity of the mineral, as deduced from many specimens of massive Canadian apatite, is from 3.14 to 3.24. If we assume 3.20, this will give for the weight of a cubic foot of apatite almost exactly 200 pounds. A fathom of ground carrying a bed or vein of apatite one foot in thickness will thus contain thirty-six cubic feet, or 7200 pounds of apatite; equal to a little over three and one fifth tons of 2240 pounds each. Allowing the fractional portion, equal to nearly seven per cent, for loss in mining (it will be noted that coarse and finely-broken apatite are equally merchantable), we shall have as a net product of a layer of apatite, for the fathom of ground mined, three gross tons for each foot in thickness.

The apatite of these deposits is generally greenish in color, often clear sea-green, but more rarely reddish-brown in tint. The massive varieties are sometimes coarsely crystalline and cleavable, but sometimes finely granular. The veins often yield crystals of large size.

The mineral is essentially a fluor-apatite, containing not over two or three thousandths of chlorine, and in its purest state about 92 per cent of tricalcic phosphate. The analysis of a selected specimen gave me 91.2 per cent of phosphate, but is generally mingled with small portions of foreign matters, chiefly insoluble silicates. The analyses of seven specimens from different Canadian mines, published by Mr. C. G. Hoffman in 1878, showed from 85.2 to 89.8 per cent of phosphate.

The market value of apatite, which, as is well known, is chiefly consumed for the production of soluble phosphate by the manufacturers of artificial fertilizers, varies greatly, other things being equal, with its purity. Thus, while at present the price in England is 1s. 2d., the unit for apatite giving by analysis 75 per cent of tricalcic phosphate, there is paid an addition of one fifth of a penny for each unit of phosphate above that percentage, so that a sample yielding by analysis 80 per cent is worth 1s. 3d. the unit. The price in the English market is subject to considerable fluctuations, having within the last four years been as high as 1s. 5½d., and as low as 11d. the unit for 80 per cent phosphate. The present may be considered as an average price.

The Canadian apatite shipped to England has yielded for various lots from 75 to 85 per cent, 80 being the average from the best conducted mines, though lots from mines where care has been used in the dressing and selection of the mineral for shipment have yielded 84 and 85 per cent. Many of the smaller miners to which we have alluded, selling their product to local buyers, take little pains in dressing, and hence their product is apt to be lower in grade. It will be seen in the rule adopted by foreign purchasers, that there is great profit in a careful selection and dressing of the mineral for market. The basis being 1s. 2d. the unit for 75 per cent, with a rise of one fifth of a penny for each unit, it follows that while a ton of 75 per cent apatite will bring only 87s. 6d., a ton of 80 per cent will command 100s., and one of 85 per cent 113s. 4d.

In the present state of the industry, it is not easy to say what would be the cost of production. At the outcrop of the large masses of apatite, and in the open cuts and quarries already described, the cost of extraction and dressing is of course very variable, estimates in different deposits giving from \$2 to \$8 the ton. In Ottawa County, where, within the last four years, deposits have been opened and mined on a better system than heretofore, the figures of production and cost are instructive. According to the report of its manager in July, 1882, the High Rock mine, in Buckingham, yielded, in 1880, 2400 tons, and in 1881 2000 tons of apatite. An adjoining portion of land having been then acquired, the production of this company's mines in 1882 and 1883 is stated at 5000 tons annually, from eighty to ninety men being employed. The cost of the mineral is here given at \$4 the ton,

dressed at the mine; in addition to which, \$3 is paid for carriage to the railroad or the river, and about \$1 additional to Montreal, the port of shipment. The mines in the Ontario District are for the most part in or near to the waters of the Rideau Canal, or some of the many lakes connected therewith, from which the freight to Montreal is \$1.50 the ton. I am informed by a merchant, who is a purchaser and shipper of apatite, and is also engaged in mining it both in Ontario and Quebec, that the average cost for freight from Montreal to England, including incidentals, is 20s. the ton; which, for apatite of 80 per cent, now worth 100s. the ton, would leave 80s., or \$19.36. Deducting from this the cost of production and of transportation to Montreal, there remains a large profit.

The amount of apatite shipped from Montreal has gradually increased, and, according to published figures, attained, in 1883, 17,840 tons, of which, it is to be remarked, that 1576 tons were delivered in Hamburg and 650 in Stockholm, the remainder going to Liverpool, London, and other British ports. Of this, about 15,000 tons were from Quebec and the remainder from Ontario. It should be noticed that this was, with small exceptions, mined in 1882, and brought to the water-side during the winter season. It is estimated that the shipments of apatite for 1884 will equal 24,000 tons.

The methods of mining hitherto generally pursued in the apatite deposits of Canada allow of many improvements which would materially reduce the average cost of production, and give a permanency to the industry which the present modes of working can never attain. The regularity and persistence of the bedded deposits and of some of the veins warrant the introduction of systematic mining by sinking, driving, and stopping, with the aid of proper machinery for drilling, as well as for hoisting and pumping. The careful dressing and selection of the apatite for the market is also an element of much importance in the exploitation of these deposits. The cost of labor in the apatite-producing districts is comparatively low, and there are great numbers of beds now superficially opened upon which regular mining operations, conducted with skill and a judicious expenditure of capital, should prove remunerative. It must be added that the areas in question have as yet been very partially explored, and that much remains to be discovered within them, and also, there is reason to believe, in outlying districts, so that in the near future the mining of apatite in Canada will, it is believed, become a very important industry.

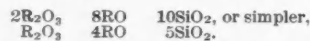
Mr. Nelson W. Perry then made a

PRELIMINARY ANNOUNCEMENT OF A NEW MINERAL.

When engaged in mining work in Mexico at Ramos, San Luis Potosi, he found samples of a mineral in the form of pebbles in a dry bed. These pebbles contained a mineral having a hardness of 9; it was opaque, like pitch-blende, though slightly translucent at the edges of small splinters. It is fused with difficulty, and has a vitreous and conchoidal fracture. The mineral shows no signs of cleavage planes or crystalline structure. The mineral is found in a volcanic country in the alluvium, and it is likely that the pebbles are derived from the trap rock, its matrix, after decomposition of the trap. The specific gravity of the mineral varied from 3.805 to 3.869, the average of a number of determinations being 3.83. Analysis yielded the following results:

I.		II.		I.		II.	
SiO ₂	42.36	48.865	SiO ₂	9.500	9.86		
Fe ₂ O ₃	13.00		Fe ₂ O ₃	1.000			
Al ₂ O ₃	9.19		Al ₂ O ₃	1.097			
CaO	17.74		CaO	3.874			
MgO	13.13		MgO	4.040			
MnO ₂	trace.						

These analyses give the approximate relation of acid to base, as follows:



The mineral resembles garnet. Professor Perry advocates for it the name of *Ramosite*.

The next paper presented was that of Messrs. Frank Firmstone and Kenworth Robertson,

ON CERTAIN INCRUSTATIONS ON PIG-IRON.

Peculiar crusts appearing on certain irons made at Glenwood and Pequest were so entirely new to the managers of the furnaces that some analyses of them were made. At Pequest, the ores used were one third Peters, from Ringwood, N. J., one third sulphurous ore, from Charlotteburg, N. J., and one third red ore (decomposed magnetite), from Chester, N. J. The fuel was seven eighths Lehigh anthracite and one eighth Connellsville coke, and the limestone a dolomite from Andover, N. J. The resulting iron varied in silicon from 0.84 per cent in No. 1 foundry to 0.51 per cent in gray forge; in phosphorus, from 0.81 per cent to 0.55 per cent; sulphur, 0.035 per cent; and manganese, 0.375 per cent. It was highly chilling and very strong. In running, it invariably appeared to be of a lower grade than it was, the higher grades scintillating as much as hard iron usually does. After getting into the molds and beginning to cool, the black crust began to show itself, seeming to exude from the pigs, till finally, when cold enough to break, it completely covered the face of the pigs. At this time, it was a dense black, but, after some exposure to the air, it acquired a purplish tinge. The higher the grade of the iron, the heavier was the coating, being very heavy on foundry iron, a little less on gray forge, hardly perceptible on mottled, while on white iron it was entirely wanting. After some experience, it served to give a very correct idea as to what the grade was before the iron was broken, and was a much more reliable guide than its appearance while running.

A sample, scraped off the faces of the pigs as they came from the cast-house, was analyzed with the following results:

Sesquioxide of iron	38.14
Silica	45.69
Alumina	3.56
Oxide of manganese	4.97
Lime	1.61
Magnesia	0.66
Titanic acid	5.59
Phosphoric acid	9.06
Sulphuric acid	trace
Chromic acid	0.48
Moisture	0.24

Afterward a portion was taken from the iron which had been exposed to the weather for some months, and the following partial analysis was made in the laboratory of Dr. Drown:

Silica	23.68
Titanic acid	4.43
Manganese	2.92
Vanadic acid	1.82

The difference in the percentages of silica in the two analyses is doubtless caused by the pig bed sand having been weathered off the second sample.

The reporting of chromic acid instead of vanadic acid in the first analysis was probably due to the inexperience of the chemist.

The cinder which accompanied this iron was very basic (containing from 34 to 37 per cent of silica), which was made necessary by the sulphur in the ore mixture.

The crusts on the iron at Glendon do not differ much in appearance and mode of occurrence from those above described from Pequest, except that they are best seen on No. 2 iron, from which they may be easily detached by scraping with a knife. They adhere pretty firmly to the No. 1 iron.

A sample taken from No. 2 iron gave the following composition when analyzed by Mr. P. W. Shimer in Dr. Drown's laboratory:

Silica	50.36
Sesquioxide of iron	32.11
Oxide of manganese	9.96
Lime	0.10
Magnesia	none
Titanic acid	5.77
Vanadic acid	1.15
Phosphoric acid	0.12

99.57

It was easy to see that the sample was largely contaminated with sand and dust from the pig bed, which could not be separated in collecting it, and from this source, no doubt, came most of the silica in this case.

Such crusts are very common on the iron at Glendon, and the iron that shows them is certain to be of good quality, and especially to chill well; but the absence of the crust is no proof that the iron will not be good in that respect.

After a few remarks on the subject by Mr. I. P. Pardee, Prof. T. Egleston, of the Columbia School of Mines, spoke on

THE TEST COMMISSION BILL.

in which he reported what has until now been done in the matter. During the present session, two bills have been introduced, one drawn up by the committee and one amended by the chairman of the Committee of Manufactures of the last Congress. This amended bill has been referred to the present Committee of Manufactures, who will report favorably on it.

This was followed by a note on the Determination of Phosphorus in Pig-Iron, by Mr. Frank Julian, of Iron Mountain, Menominee County, Mich.

We give below the last paper of the session, by Mr. Frank Firmstone, on

TAMPING DRILL-HOLES WITH PLASTER OF PARIS.

In the summer of 1881, the Glendon Iron Company, of Easton, Pa., was forced to break up and move the large mass of iron which had accumulated under No. 2 furnace, to prepare the foundation for the new furnace which has taken its place. Atlas powder was used, the holes being drilled with a pair of Rand drills, which worked very well when the iron was at all uniform in hardness. This was not, however, often the case, and it frequently happened that the holes were hopelessly blocked when but little over a foot deep, so that good tamping became very important. Tamping holes having percussion-caps in them in the ordinary way is very dangerous, and has no doubt caused many of the accidents attributed directly to high explosives. An excellent and safe method was found to be to use plaster of Paris mixed to the proper consistency and poured into the holes as soon as loaded. Clean, dry sand was mixed with the plaster, to reduce the quantity needed. With proper attention, the tamping set in a few minutes, and little or no more time was required than for tamping in the ordinary way.

The Laffin & Rand "Magnet" machine was used to fire the holes, and an additional advantage in the plan was, that any risk of cutting the exploder wires in tamping was avoided.

It was found that it was not worth while to load holes over thirteen inches deep in a block three or four feet thick, because the bottom of the hole was enlarged by each shot, so that the next time it could be loaded more heavily. Three or four shots fired in that way often did as much good as a new hole twice the depth, to drill which might have taken ten or twelve hours. The rise in temperature when boiled plaster solidifies is not sufficient to ignite the exploders, as was found by repeated trials before using it in a loaded hole.

PUBLIC LANDS DISPOSED OF.—During the quarter ended September 30th, 1883, 9,280,144 acres of public lands were disposed of, at an aggregate price of \$3,426,298. The increase in acres of land disposed of, as compared with the corresponding quarter in 1882, was 5,636,453, and the increase in receipts was \$1,401,680.

METHOD FOR MEASURING THE INTENSITY OF THE LIGHT OF ELECTRIC LAMPS.—Dr. Hammerl has devised an ingenious method for measuring the intensity of the light of electric lamps, by which the necessity for placing them at a great distance from the standard candle is avoided. He interposes a revolving disk, in which are cut out sectors, allowing only a portion of the rays to pass. For instance, if the sum of the angles of the sectors be 180 degrees, half the light will be intercepted. It has been found that three sectors are sufficient to give a uniform light with a moderate speed of rotation. Consequently, to reduce the light to a third, three sectors of 40 degrees are employed. With three sectors of 12 degrees, the light is reduced to one tenth of its actual power. By employing two disks, each provided with three sectors of 60 degrees, cut out and arranged one behind the other on the same axis, they may be made to give as great a reduction of luminosity as may be desired.

THE CLARK CONCENTRATOR FOR FLOAT OR FLOUR GOLD.

Mr. A. D. Clark, now in this city, is exhibiting an apparatus invented by him, and in actual use on Snake River, Idaho, for avoiding the loss of float and flour gold in the ordinary method of working placer deposits. As will be seen from the engraving, the gravel is hydraulicked in the usual manner and conveyed through a sluice *B* to a large screen *A*, made of parallel bars of iron of the proper shape, placed from one eighth to three eighths of an inch apart and firmly bolted together. All the water carrying with it the particles of sand and gold small enough to go through the openings in the screen falls upon an apron by which it is conveyed to a transverse sluice *G*, the supply being regulated by the sliding door *G²*, by which it is distributed into any required number of tanks *D* upon each side of the machine. At the bottom of the front side of each tank and parallel with it is a narrow opening *N* closed by a sliding door *I*. In front of these openings are tables *J*, upon which ordinary blankets, amalgamated plates, the Howland, Morey, or Sperry cast-iron riffles may be placed. These tables discharge into the central sluice *C* at a point considerably to the rear of the front end of the tanks. Immediately to the rear of the narrow openings in the front ends of the tanks, the bottoms of the tanks rise at an angle of about twenty degrees to within six inches of the top of the machine, thus forming a series of

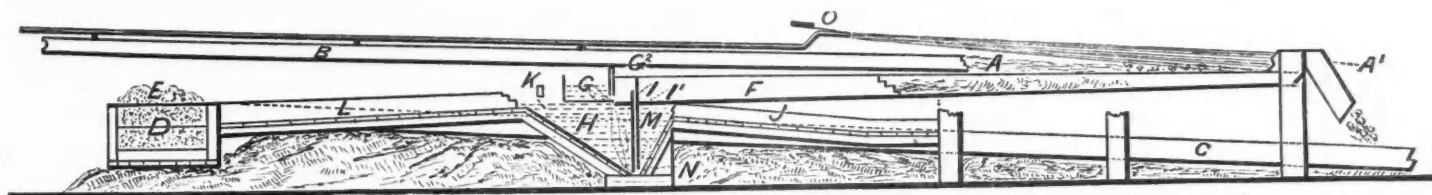
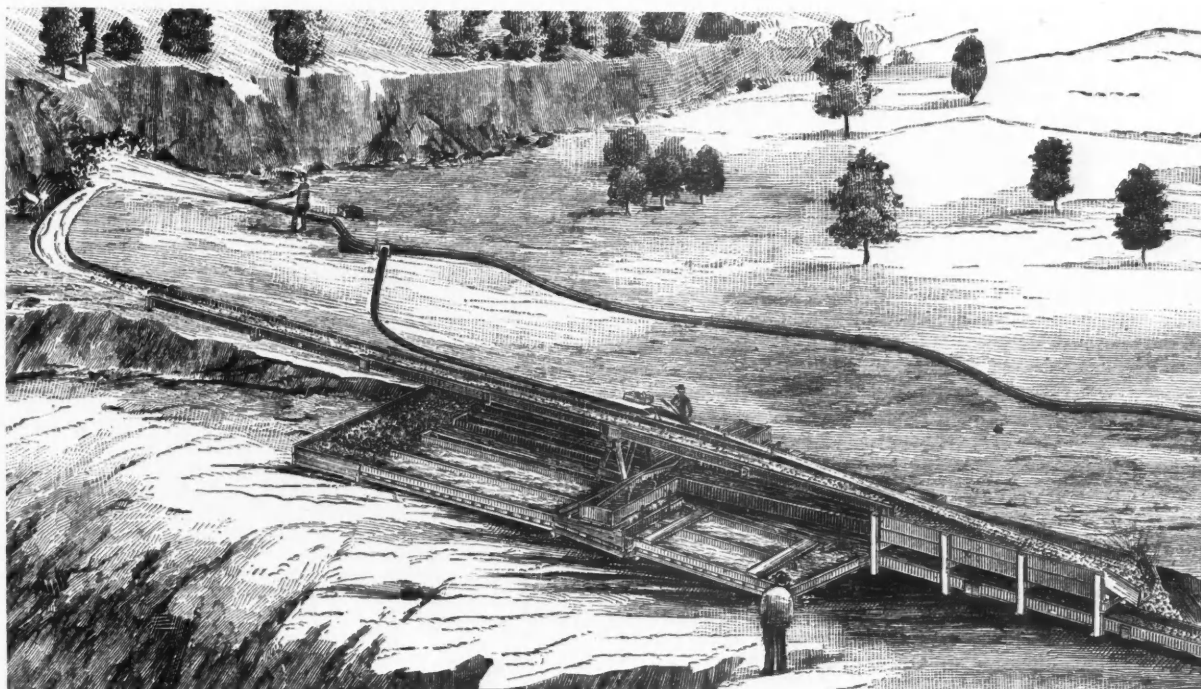
the tables, runs directly underneath the screen. All that is necessary is to move these tailings a few feet, by a little giant or otherwise, until they drop off from the front end of the screen into the central sluice below, through which they are carried to the dump.

THE BENEFICIAL FUND OF THE LEHIGH COAL AND NAVIGATION COMPANY.*

By Mr. Joseph S. Harris, President of the Lehigh Coal and Navigation Company.

The officers of the company have given a good deal of thought to the formation of such a fund for the persons employed about their mines, and have made use of the experience of other companies, so far as it could be had. There are two cases directly in point in the funds established by the Philadelphia & Reading Coal and Iron Company in 1877, which is still in operation, and the Employes' Benefit Fund of the Lehigh & Wilkes-Barre Coal Company, which grew out of the Avondale disaster in 1869, in which 108 men lost their lives, and which continued in operation till 1877, when the pecuniary and other difficulties of the times led to its abandonment.

Mr. Harris then gives in full the rules of the two companies, followed



THE CLARK CONCENTRATOR FOR FLOAT OR FLOUR GOLD.

tanks *H* with inclined bottoms, the front ends and sides of which are six inches higher than the rear ends. At these rear ends, are placed tables *L*, upon which blankets or amalgamated plates may be used. These rear tables all discharge into a transverse tank *D*, connecting both sides of the machine. In this transverse tank, is thrown a lot of sage brush, hay, or straw. From the center of this transverse tank, and between the series of tanks upon each side of the machine, runs a sluice which passes immediately beneath the screen. This sluice is continued to the dump.

All the water and the sand pass through the screen into the tanks. The narrow openings in the bottom of the front end of each tank being closed, and the rear end of each tank being lower than the front end and sides, the water has no escape but over this lower end, over the rear tables, and through the filter of sage brush in the transverse tank to the central sluice, through which it flows to the dump. The sand and gold heavy enough to sink fall to the bottom of the tank, and the current being backward, the floating particles of gold are carried to the rear and are arrested by the sage brush, through which the water is filtered. When the machine is in operation, the sliding doors *I* closing the narrow openings in the front of the tanks are raised, allowing a portion of the water and the heavy gold and sand to flow over the tables in front; and there are two currents flowing simultaneously, one current carrying the heavy sand and gold over the tables in front, the other current flowing backward and depositing the float gold in the transverse tank at the rear end of the machine. The coarse gravel too large to pass through the screen remains on top, and must be got rid of. The central sluice *C*, into which all the water which passes through the screen is discharged from

by those framed by the Lehigh Coal and Navigation Company, which are: This fund shall be created and maintained by the following contributions, to be made monthly:

The Lehigh Coal and Navigation Company will pay into it one cent for every ton of coal produced at its mines. The inside workingmen employed on its property will pay into it one per cent of their earnings and the outside workingmen will pay into it one half of one per cent of their earnings; but no one shall pay more than one dollar in any one month.

All contributing workingmen who may be accidentally injured when actually engaged in the service of the company shall be entitled to the following benefits, to be paid out of the fund:

In case of accident so received, which shall cause disability lasting more than one week, the person injured shall receive a sum equal to one half the weekly wages of the class of workmen to which he belonged, for each week of such disability; but no one so injured shall receive from this fund such benefits for a longer period than six months for any one accident.

In case of accident so received, which shall result in death, thirty dollars will be paid for funeral expenses, and a sum equal to one half the weekly wages, as in the case of injury, will be paid to the legal heirs of the deceased, for one year from the date of the accident.

These benefits will be paid only on the statement of the proper foreman that the injury was received in the service of the company, and on a

* Read at the Cincinnati Meeting of the American Institute of Mining Engineers, February, 1884.

certificate from the physician to the fund, in case of accident, that the accident was a disabling one, and in the case of death, that the death resulted from accident, and not from disease. In case of accident, the certificate of disability must be renewed every two weeks.

All moneys which shall be paid into this fund shall be placed in charge of a board of trustees, to be appointed, from time to time, by the President of the Lehigh Coal and Navigation Company, and to be chosen by him partly from the officers of the company and partly from the business men of experience and of good reputation in or near the mining region. A report of the receipts and expenditures of this fund shall be published by the board of trustees at least once a year. The first Board of Trustees to be so appointed will be Mr. George Ruddle, of Mauch Chunk, Hon. Michael Cassidy, of Nesquehoning, and Mr. Daniel Shepp, of Tamaqua. They shall receive no remuneration for their services.

The physician to the fund shall be appointed, from time to time, by the President of the Lehigh Coal and Navigation Company from the practicing physicians in the region. The physician to the fund for the present will be Dr. Edward H. Kistler, of Summit Hill. He will make no charge to the contributors for the necessary certificates; but if the contributors desire medical attendance, they must themselves pay such physicians as they may select to attend them.

Any workman not desiring to contribute to this fund nor to share in its benefits can, after any monthly pay-day, receive from the Lansford office the sum deducted for the fund from his last month's pay; but his name will not be again enrolled among the contributors, nor will he be entitled to any benefit from the fund until after he shall have made another payment.

The fund thus established is believed to be ample to meet all claims arising from accidents to the contributors, and if, as is hoped, there shall be more than is required under this plan, the benefits will be increased as, from time to time, the trustees may think prudent.

The Lehigh Coal and Navigation Company, in making this contribution and establishing this fund, desires to relieve the suffering which accidents cause among its workmen, and to render unnecessary the collections which make a heavy tax on the benevolent, and also to promote the growth of the kindly feeling which now exists between the company and the men engaged in its service.

The operations of this fund will commence January 18th, 1884.

Mr. Harris then reviews critically the grounds which have led him to frame the rules as given. He says: The first two (the Philadelphia & Reading and the Lehigh & Wilkes-Barre) plans have had the advantage of successful operation for several years, and the third (the Lehigh Coal and Navigation) is in its infancy; but it is thought that in some respects, which will be indicated below, it is an improvement on the others. In the remarks which follow, no explicit reference will be made to either of the two earlier plans, the features criticised being in some cases peculiar to one of them.

1. Any plan which adopts only two or three rates of contribution is objectionable because it bears unequally upon the earnings of the contributors, making a comparatively heavy tax on those in each class whose rate of pay is least, or whose earnings through interrupted employment may be lowest, and too light a tax on those who are better paid or more regularly employed.

2. Similarly, there is an objection to having two or three rates of benefits, as this will give to the laborer whose average compensation is low for his class nearly or quite as large an income when disabled as when he is at work, making the temptation great for him to put himself in the way of receiving slight disabling injuries; and experience has shown that the less worthy class of workmen do not always resist the temptation.

In the third place, an attempt has been made to escape these two evils by fixing each person's contribution at a definite percentage of his monthly earnings, and his benefit in case of injury at a percentage of what a man employed at labor similar to his can ordinarily earn.

If this percentage of benefit should be one half of the earnings of his class, this plan does not remove the temptation above mentioned, in case there is half-time work, but the evil is less than under the other plans.

3. When a barely sufficient sum of money to pay accruing benefits is provided, whether by the employer virtually agreeing to make up deficiencies, or by contributions being levied on both parties whenever the fund is exhausted, it results in the first case that, as the extra payment comes out of the employer's pocket, so that, however wasteful the administration of the fund is, the employe is none the poorer, and however carefully it may be administered, there is no accumulation in the fund, there is no incentive to save and no further benefits to hope for; and in the second case, there is the additional danger that the exhaustion of the fund may occur when, from inability or from dissatisfaction, either or both parties may decline to make the comparatively large contribution of one day's product of coal or labor.

In the third place, the contributions are small and frequent, so that neither party is likely to feel them much, and yet a careful investigation leads to the belief that they will furnish a fund which will be so much more than will be required that the benefits can be increased as the fund accumulates. As the fund inures wholly to the benefit of the workmen, they will have some motive to prevent the improper depletion of what is to be a resource for themselves in case of injury.

4. When benefits are paid upon the certificate of any reputable physician, it will happen that, in order to preserve the custom of a family and its friends, some of the less respectable of the profession will unduly favor the applicant for benefits; and the drawing of the line between physicians who are and who are not reputable would be a very ungracious task.

Nor does making the application pass before a board of workmen materially mend matters, or give the fund satisfactory protection; for a feeling of good fellowship, a desire to avoid offense, and the thought that the committee's turn may come next, will ordinarily lead to a decision in favor of the applicant; and when it is adverse, it arouses much more feeling than if the rejection had come from another source than the men's fellow-workmen.

In the third case, it was practicable, on account of the compactness of the territory over which the operations of the plan will extend, to appoint the best and most respected physician of the region as arbiter between the fund and its beneficiaries.

5. To take contributions from no man without his written authority has much to recommend it, and among men accustomed to act intelligently as to their own affairs, this would be the only true course. To take them without provision for refunding in case of dissatisfaction is certainly an arbitrary exercise of authority. The first course requires a long time to bring into successful operation, and always excludes a considerable percentage of the workmen. The second plan, of course, creates a certain amount of discontent.

The third plan adopts the middle course of including every body in the contribution, but, in case of dissatisfaction, allowing every man to withdraw his contribution if he is not entirely satisfied after having the plan explained to him.

Mr. Harris gives a very interesting tabular statement embodying the experience of the Philadelphia & Reading Coal and Iron Company for the years 1878 to 1883, inclusive. We present the following summary:

Total men employed.....	79,943
Average per year.....	13,324
Total number of contributors.....	48,327
Average.....	8,226
Percentage of contributors.....	61.74
Total tonnage shipped.....	23,090,106
Average " " per year.....	3,848,351
" " " per man.....	280
Total number of disabling accidents.....	8,069
Yearly average.....	1,345
Disabling accidents per 1000 contributors.....	163.5
Total number of fatal accidents.....	261
Yearly average.....	43.5
Fatal accidents per 1000 men.....	3.26
" " per 100,000 tons.....	1.13
Total number of serious accidents.....	1,275
Yearly average.....	21.25
Serious accidents per 1000 men.....	15.65
" " per 100,000 tons.....	5.52
Total amount of men's contributions.....	\$128,264.93
Yearly average amount of men's contributions.....	\$21,377.49
" " " per capita.....	\$2.59
Total amount of benefits.....	\$194,498.06
Yearly average.....	\$32,416.44
" " " per capita.....	\$3.94
Average percentage of benefits for fatal accidents.....	.66
Total amount of benefits for fatal accidents.....	\$68,875.97
Yearly average amount of benefits for fatal accidents.....	\$11,479.33
" " " per capita.....	\$1.32
Total amount of benefits for disabling accidents.....	\$125,622.09
Yearly average amount of benefits for disabling accidents.....	\$20,937.11
" " " per capita.....	\$15.57
Percentage of benefit payments for fatal accidents.....	35.4
" " " disabling accidents.....	64.6

This information was used by Mr. Harris in determining the sum that would be needed to carry out the provisions of his plan. For mines situated like those of the Philadelphia & Reading Company, 1.13 fatal and 56.6 disabling accidents may be expected for each 100,000 tons of coal mined, and 3.26 fatal and 16.53 disabling accidents for each 1000 workmen employed, and further that the fatal accidents will call for benefits to the amount of \$191.32 each, while the average cost of disabling accidents will be \$15.57.

Now, in the year from November 30th, 1882, to November 30th, 1883, the mines of the Lehigh Coal and Navigation Company produced 927,000 tons of coal, and the pay-rolls for that time aggregated \$1,264,906. By the experience of the Philadelphia & Reading Company the outlay might be expected to be

Fatal accidents, 10.49.....	\$2,006.05
Disabling accidents, 524.7.....	8,169.58
Requiring a total benefit payment of.....	\$10,176.53

An investigation, made some years ago, showed that of the wages paid by the Lehigh Coal and Navigation Company, 55 per cent was paid to inside workmen and 45 per cent to outside workmen, the unusually large proportion of the latter arising from the fact that it includes men employed in the machine-shops, in the screen building, in transportation, and in other ways not usually so closely associated with coal mining. Dividing the years payable in this proportion, and taxing the inside workmen one per cent, and the outside workmen one half of one per cent of these wages, we have:

Inside men, \$695,698.30 @ 1 per cent.....	\$6,956.98
Outside men, \$569,207.70 @ 1/2 per cent.....	2,846.04
Company's contribution, 927,000 tons at 1 cent per ton.....	9,270.00
Total funds available for benefits.....	\$19,073.02

In the same way, Mr. Harris examines the experience of the Lehigh & Wilkes-Barre Coal Company, which from 1874 to 1877 worked these mines, and whose experience, therefore, is valuable. In 1876, under a system which made all workmen contributors, there were paid:

Total accidents.....	\$1,282.83
Disabling accidents.....	8,491.50
	\$9,774.33

The number of each kind of accident is not recorded. In that year, the mines produced 606,773 tons of coal, so that the cost of the accidents was

Fatal accidents per 100,000 tons.....	\$211.42
Disabling accidents per 100,000 tons.....	1,399.45
Total cost per 100,000 tons.....	\$1,610.87
" " " 927,000 " ".....	14,932.76

This figure is 47 per cent greater than that found from the Philadelphia & Reading Company's expenses, owing mainly to the fact that their rate of benefits was considerably higher. Judging from the experience of either company, the plan proposed by the Lehigh Coal and Navigation Company should raise money enough to show a handsome surplus of earnings to be distributed hereafter in increased benefits.

F. Z. Schellenberg, Superintendent of the Westmoreland Coal Company, Irwin station, Westmoreland County, Pa., sent the following report of the system of the relief fund at that colliery, and its working. The following regulations have been substantially unchanged for several years:

Levy to be twenty-five cents per month, or more, if needed [amended: to keep balance on hand above \$500]. Benefits: For two weeks' disability, or more, five dollars per week, after first week, shall be paid. Benefits to cease after twenty-six weeks from date of accident. Disa-

bility must be from actual casualty at the mines, not injury from strain or otherwise that may be due to weak condition of the body. Beneficiaries are prohibited from doing any work unless specially permitted by whole committee. In case of loss of limb, the full amount of \$125 may be payable at any time and at discretion; \$75 more may be paid toward getting an artificial limb. Death: To the widow or legal heirs, one hundred dollars will be paid when a member dies from accident, and fifty dollars when death is from natural cause. The directors of the Westmoreland Coal Company, at their meeting in June, 1879, resolved: "That, in the event of any of our men or boys being killed while working for us, this company will contribute for the relief of their families an equal amount to that paid from their relief fund." Notice of accident to be given to the committeemen within three days of the accident. Committeemen for the year to be selected on pay-day in January; in case of vacancy, on first pay-day thereafter.

Since strains, which were so liable to be complicated with rheumatism, etc., have been eliminated, the committee have donated to the book-keeper \$100 for his services, and there is a rising balance on hand. Last year, there was but one death from accident in mining and shipping 600,000 tons of coal, and the company can deny all canvassing for subscriptions at the works. After nine years of experience, none too much is done, keeping benefits below earnings to prevent an undue extension of the former, and there is room left for charitable work in each neighborhood. The receipts of the fund in 1883 were \$2603.75, and the disbursements to 92 beneficiaries \$1920, besides \$100 to the book-keeper, thus increasing the balance on hand from \$274.05 to \$857.80 at the close of the year.

Aside from the relief fund, there is an optional subscription to doctors' lists. The physicians of the vicinity return monthly to the office the names of their patrons who agree to pay the uniform sum of one dollar per month for all medical attendance, and who have the privilege of changing their patronage from one doctor to another any month. The monthly payments once subscribed, however, run for the year, or less time of employment, and are for the month in advance.

THE DECAY OF BUILDING-STONES.

Mr. Alexis A. Julien, of the School of Mines, Columbia College, sums up the results of a series of papers read before the New York Academy of Sciences on the decay of building-stones as follows:

If a rough estimate be desired, founded merely on the observations made of the comparative durability of the common varieties of building-stone used in New York City and vicinity, there may be found some truth in the following approximative figures for the "life" of each stone, signifying by that term, without regard to discoloration or other objectionable qualities, merely the period after which the incipient decay of the variety becomes sufficiently offensive to the eye to demand repair or renewal.

	Life, in years.
Coarse brownstone	5-15
Laminated fine brownstone	20-50
Compact fine brownstone	100-200
Bluestone	Untried, probably centuries
Nova Scotia stone	Untried, perhaps 50-200
Ohio sandstone (best siliceous variety), Perhaps from 1 to many centuries	
Limestone, coarse fossiliferous	20-40
Limestone, fine oolitic (French)	30-40
" " (American)	Untried here
Marble (dolomite), coarse	40
" " fine	60-80
Marble, fine	50-200
Granite	75-200
Gneiss	50 years to many centuries

Within a very few years past, it has become frequent to introduce rude varieties of rusticated work into the masonry of buildings in New York, or to leave the stone rough and undressed in huge blocks, especially in the basement or lowest stories, where it is under close and continuous inspection, and the results of its decay will be disguised by its original rough surface. Although there are certain large buildings in which such a massive treatment of stone may be appropriate, its common use, with stones of known feebleness or lack of durability, is a disingenuous evasion of responsibility and a mere confession of ignorance, want of enterprise, and despair, in regard to the proper selection of building material and in regard to its protection.

Finally, it may be pointed out that many of the best building-stones of the country have never yet been brought into New York; for example, siliceous limestones of the highest promise of durability, allied to that employed in Salisbury Cathedral; refractory sandstones, like some of those of Ohio and other Western States, particularly fitted for introduction into business buildings in the "drygoods district," storage-houses, etc., where a fire-proof stone is needed; and highly siliceous varieties of Lower Silurian sandstones, such as occur near Lake Champlain, quartzitic and hard to work, like the Craighleith stone of Edinburgh, but possessing the valuable qualities of that fine stone in resisting discoloration, notwithstanding its light color, and in remarkable resistance to disintegration.

As it is, we have many and need many varieties of stone for our various objects, but do not know how to use them. It is pitiable to see our new buildings erected in soft and often untried varieties of stone, covered with delicate carvings of foliage and flower garlands, which are almost certain to be nipped off by the frost before the second generation of the owner shall enter the house. It is now time for one who loves stone to express his indignation at the careless and wasteful way in which a good material is misused.

LADY SIEMENS has given to the Society of Telegraphic Engineers, for its library, 230 volumes from the library of her husband, the late Sir William Siemens.

TEST OF AN ELECTRIC MOTOR.—A railroad track has been built around the Brush Electric Light Works, in Cleveland, Ohio, for the purpose of testing a new electric motor applied to street cars. The motor and electrical machinery are placed on the front end. The electricity will be in the car, and not in the rails, as in the Edison system. By this method, the conductor of the car can operate the motor, and stop or propel the car at will. The new invention, if successful, will probably be put in use on the street-car lines of Cleveland.

COMPOSITION AND FUEL VALUE OF PENNSYLVANIA ANTHRACITES.*

By Charles A. Ashburner, Geologist in Charge Survey Pennsylvania Anthracite Fields

(Concluded from page 121.)

Specimen No. 19.

Collected from Turkey Run colliery at Shenandoah, Schuylkill County, Western Middle Coal-Field, October 13th, by Assistants Wells and Winslow, assisted by Mr. F. Reese, outside boss. Philadelphia & Reading Coal and Iron Company, operators.

The Mammoth bed alone is worked at this colliery, about 500 tons being shipped daily. The specimen was sampled as follows:

From market chute of steamboat coal.	
" " " " broken	"
" 2 " " cars	egg
" 2 " " " " stove	"
" 2 " " " " small stove	"
" 2 " " " " chestnut	"
" 2 " " " " pea	"
" 4 " " " " buckwheat	"

Specimens Nos. 0 and 21.

Collected from Kohinoor colliery at Shenandoah, Schuylkill County, in the Western Middle Coal-Field, October 12th, by Assistants Wells and Winslow, assisted by John C. Glover, boss. R. Heckscher & Co., operators.

At this colliery, both the Mammoth and Primrose beds are mined, and the coal from each is shipped from a separate breaker. The specimen of Mammoth coal (specimen No. 20) was sampled as follows:

From 1 market car of lump coal.	
" 8 " " cars of steamboat coal.	
" 1 " " chute of broken coal.	
" 1 " " " egg coal.	
" 1 " " " stove coal.	
" 1 " " car of small stove coal.	
" 3 " " chutes of chestnut coal.	
" 1 " " chute pea coal.	

The Primrose coal (specimen No. 21) was sampled as follows:

From 1 market car of lump coal.	
" 3 " " cars of small stove coal.	
" 2 " " " egg coal.	
" 1 " " car of chestnut coal.	
" 2 " " cars of pea coal.	
" 3 " " " large stove coal.	
" 1 " " chute of broken coal.	
" 1 " " " steamboat coal.	

Specimens Nos. 22 to 30 Inclusive.†

Collected from the collieries of the Lehigh Coal and Navigation Company in the Panther Creek basin, Carbon and Schuylkill counties, Southern Coal-Field, June 26th and 27th, 1882, by Assistant Winslow, assisted by Mr. John C. Rutter, mining engineer. The individual specimens were sampled as follows:

Specimen No. 22, sampled from	
3 mine cars from tunnel workings.	
3 " " " shaft	"
No. 23, sampled from	
3 mine cars from slope workings.	
5 " " " shaft	"
No. 24, sampled from	
3 market cars of egg coal.	
8 " " " broken coal.	
2 " " " lump coal.	
No. 25, sampled from	
3 market cars of lump coal.	
5 " " " of broken coal.	
No. 26, sampled from	
4 mine cars.	
No. 27, sampled from	
4 mine cars.	
No. 28, sampled from	
5 market cars of broken coal.	
5 " " " egg	"
No. 29, sampled from	
4 market cars of buckwheat coal.	
4 " " " pea	"
4 " " " chestnut	"
4 " " " stove	"
4 " " " broken	"
No. 30, sampled from	
15 market cars of buckwheat coal.	
7 " " " pea	"
3 " " " broken	"
Nos. 31, 32, and 33 (see page 181).	

As has already been stated, these specimens (1 to 21 inclusive) were sampled in the same way as the Panther Creek coals. The specimens were collected in all cases in the presence of the superintendent, engineer, or mine-boss at each colliery. As it was desired to obtain the constitution of the market product, the specimens were collected from the market cars wherever it was possible to do so. In some instances, where the coal shipped came from two beds and was mixed in the market cars, specimens were taken from the mine cars in order to make an analysis of the coal from each bed. In such cases, special care was taken to sample the coal so that it would represent a product of equal purity to that shipped from the breaker. It is possible, however, that the analyses of such specimens will show a smaller percentage of ash than if the coal could have been taken from the market cars, as it is impossible to include or exclude just the same proportion of slate or bony coal as might be found in the market product. Naturally, the tendency in sampling would be to reject the pieces of poorer coal.

*From proof-sheets of the First Report of Progress of the Anthracite Survey.

†Specimens Nos. 22 to 30 inclusive, referred to here, are the same as specimens Nos. 1 to 9, respectively noted on pages 179 and 180.

Mr. McCreath, in remarking on the analyses of these coals, says: "In nearly every case where the ash is high, the sample indicated it by showing considerable slate, sometimes as small lenticular masses of slate in the coal, and sometimes by separate pieces of slate. In the case of specimen 17, whose analysis show 1.5 per cent of sulphur, a large proportion of the sulphur was contained in a single piece of slaty coal, which on being broken was found to be strongly impregnated with iron pyrites."

Although the analysis of this particular coal may probably show too much sulphur, I believe that the percentage of sulphur shown in the analyses generally is not above the average of that contained in the coal marketed for each colliery, for which the analyses have been made.

The analyses in table No. I. have been grouped in the order of the geographical positions of the collieries from which the coals were obtained, from north to south. In No. II., I have arranged them in the order of the fuel ratio of the individual coals, and, in addition, have added the percentage of ash in the specimen analyzed for convenient reference.

The amount of ash which many of these analyses show is, doubtless, due to an imperfect separation of the slate and poor coal from the better coal in the preparation of the market product. In many cases, I believe the percentage of ash could be reduced by the construction of better breaker machinery and a more careful handling of the coal. It is important to remember that the practical solution of such questions is dependent upon so many varying conditions that it would be impossible to say that it would be economical for all operators of anthracite coal to adopt any standard of product, as far as the percentage of ash is concerned. If a trade can be found for a coal containing ten per cent of ash, it would certainly be unwise in any operator to adopt more expensive methods to reduce the ash in his coal to six per cent without gaining an increase in profits. The coal trade, however, is becoming more discriminating every year in regard to the true fuel value of coals, and it is probably not premature to call the attention of coal operators to what seems an unreasonably high percentage of ash in their product.

TABLE NO. II.

No. of specimen.	NAME OF COLLIERY AND COAL-BED.	Fixed carbon.	Volatile combust- ible matter.	Fuel ratio C. H.-C.	Percentage of ash in specimen an- alyzed.
6	Coleraine Nos. 1 and 2, Wharton bed.....	96.93	3.07	31.57	6.032
10	Spring Brook No. 5, Mammoth	96.31	3.19	30.35	6.038
8	Spring Mountain No. 4, "	96.73	3.27	29.58	4.384
7	Coleraine Nos. 1 and 2, "	96.66	3.34	28.94	5.540
11	Spring Brook No. 5, Wharton	96.36	3.44	28.07	5.212
4	Jeddo Nos. 3 and 4, Mammoth	96.34	3.66	26.32	7.044
5	Ebervale No. 2, "	96.23	3.77	25.53	6.602
9	Spring Mountain No. 4, Wharton	96.17	3.83	25.11	7.410
20	Kohinoor, Mammoth	96.00	4.00	24.00	9.248
28	L. C. & Nav. Co.'s No. 8, Mammoth bed.....	95.88	4.12	23.27	5.933
13	St. Nicholas, Bot. split Mammoth bed	95.72	4.28	22.36	10.278
27	L. C. & Nav. Co.'s No. 6, Red Ash (F) bed.....	95.68	4.32	22.15	4.716
11	Kohinoor, Primrose bed.....	95.66	4.34	22.04	9.850
19	Turkey Run, Mammoth bed	95.65	4.35	21.99	12.624
18	Draper, Primrose	95.63	4.37	21.88	11.458
26	L. C. & Nav. Co.'s No. 6, Mammoth bed.....	95.60	4.40	21.73	5.146
17	Draper	95.50	4.50	21.22	10.662
14	St. Nicholas, Buck Mountain	95.47	4.53	21.08	9.736
16	Gilberton	95.41	4.59	20.79	10.030
23	L. C. & Nav. Co.'s No. 3, Red Ash (F) bed.....	95.36	4.64	20.55	4.043
15	Gilberton, Seven-Foot bed	95.31	4.69	20.32	11.232
3	D. & H. C. Co.'s No. 5, Bennett bed	95.22	4.78	19.92	5.502
12	St. Nicholas, Middle split Mammoth bed	95.21	4.79	19.87	12.574
24	L. C. & Nav. Co.'s No. 4, Mammoth	95.18	4.82	19.75	7.690
22	L. C. & Nav. Co.'s No. 3, Mammoth	95.15	4.85	19.62	5.850
1	Hollenback Shaft No. 2, Baltimore	95.08	4.92	19.33	8.544
29	L. C. & Nav. Co.'s No. 10, Mammoth	95.05	4.95	19.20	10.876
25	L. C. & Nav. Co.'s No. 5, "	94.73	5.27	17.98	8.056
2	D. & H. C. Co.'s No. 5, Cooper	94.09	5.31	17.83	10.564
30	L. C. & Nav. Co.'s No. 11, Mammoth	94.33	5.67	16.64	13.740
31	L. C. & Nav. Co.'s No. 10, Bony coal No. 1	95.48	4.53	21.13	9.796
32	L. C. & Nav. Co.'s No. 10, Bony coal No. 2	95.40	4.60	20.74	7.313
33	L. C. & Nav. Co.'s No. 10, Bony coal No. 3	95.08	4.92	19.32	10.386

In table No. III., an average analysis has been computed of the coals from the individual beds in the different coal-fields, and arranged in the order of their fuel ratios.

TABLE NO. III.

Average of specimens, Nos.	NAME OF COAL- BED.	NAME OF COAL- FIELD.	CHEMICAL ANALYSIS.						Specific gravity.	PERCENTAGE OF CONSTITUENTS OF FUEL.		
			Water.	Volatile matter.	Fixed carbon.	Sulphur.	Ash.	Total.		Fixed carbon.	Volatile combust- ible matter.	C. H.-C.
6, 9 & 11	Wharton.....	East. Mid.	3.713	3.080	86.404	.585	6.218	100	1.620	96.56	3.44	28.07
4, 5, 7, 8 &	Mammoth	" "	4.119	3.084	86.379	.496	5.922	100	1.617	96.55	3.45	27.99
18 & 21	Primrose	West. Mid.	3.541	3.716	81.590	.499	10.654	100	1.654	96.61	4.36	21.95
12, 13, 17, 19 & 20	Mammoth	" "	3.163	3.717	81.143	.860	11.078	100	1.657	95.92	4.33	21.83
23 & 27	Primrose (F.)	Southern.	3.008	4.125	87.982	.506	4.379	100	1.584	95.52	4.48	21.32
14 & 16	Buck Mountain	West. Mid.	3.042	3.949	82.692	.462	9.885	100	1.667	95.44	4.56	20.93
15	Seven-Foot	" "	3.410	3.978	80.868	.612	11.262	100	1.651	95.31	4.69	20.32
22, 24, 25, 26, & 29 & 30	Mammoth.....	Southern.	3.087	4.275	83.813	.611	8.184	100	1.631	95.15	4.85	19.62
1, 2 & 3	Mammoth.....	Northern.	3.421	4.381	83.263	.727	8.208	100	1.575	95.00	5.00	19.00

As has already been stated, the investigation, which has been made by the Survey, of the constitution of the anthracite coals is a very necessary

preliminary one, but the results thus far attained are of comparatively limited importance to the coal trade. What is wanted is a measure of the evaporative capacity of the different coals which are marketed; and it is hoped that the resources of the Survey, some time in the future, will permit of such an investigation being made.

ON THE CONDENSATION OF GASES.

A paper detailing results has appeared in the *Anzeiger der Wiener Akademie der Wissenschaften* and the *Comptes Rendus*, xcvi., 1140. It treats of the facts arrived at by S. von Wroblewski and K. Olszewski. They say that the results which Cailletet and R. Pictet obtained in their valuable work on the Liquefaction of the Gases, lead us to hope that the time is not far distant when we shall be able as easily to examine liquid oxygen in a glass tube as it is at present to look at a tube filled with carbonic acid in the liquid state. The one condition which must of necessity be arrived at is a sufficiently low temperature. In a paper published by Cailletet a year ago, he directs attention to fluid ethylene as a means of reaching an exceedingly low temperature. This gas, in a fluid state, boils under the atmospheric pressure at -105 degrees, as measured by a thermometer of carbon disulphide. Cailletet himself compressed oxygen in a very narrow tube, and cooled it down to -105 degrees in this fluid. In the moment of expansion, he saw a tumultuous ebullition; it boiled during an appreciable time, and resembled the projection of a liquid in the cooled part of the tube. The ebullition was formed at a certain distance from the bottom of the tube. "I was not able to recognize," he goes on, "whether the liquid pre-existed or whether it formed at the moment, because I was not able to see the separation of the liquid and the gas." S. von Wroblewski has recently constructed a new apparatus for higher pressures, in which considerably large quantities of gas can be subjected to a pressure of 200 atmospheres, and with this apparatus it is proposed to study the temperatures at the moment of expansion. The experiments soon led them to the discovery of a temperature at which carbon disulphide and alcohol became solid, and oxygen was rendered completely liquid with the greatest ease. This temperature is reached by letting liquid ethylene boil in a vacuum. The boiling-point depends, of course, in such a case on the goodness of the vacuum of the pump. By the vacuum which, up to the present, it has been found possible for us to attain, the temperature falls to -136 degrees. This low point—in fact, all the temperatures which we place on record—are measured with the hydrogen thermometer. The critical temperature of oxygen is lower than that at which the liquefied ethylene boils under the pressure of one atmosphere. The latter is not -105 degrees, as at first it was assumed to be, but lies between -102 degrees and -103 degrees, as is shown by our thermometric observation. From a number of determinations which we have made, we quote the following, which will serve to show where the point lies:

Tempera- ture.	Pressures in atmos- pheres under which the oxygen begins to liquefy.
-131.6 degrees.....	26.5
-133.4	24.8
-135.8	22.5

Liquid oxygen is colorless and as transparent as fluid carbonic acid; it is very mobile and exhibits a very beautiful meniscus. Carbon disulphide freezes at about -116 degrees, and again becomes liquid at about -110 degrees. Absolute alcohol at about -129 degrees is thick and viscous like oil, and at about -130.5 degrees solidifies to a firm mass. The more accurate numbers will be given in another paper. In the same way as referred to above, the author endeavored to liquefy nitrogen and carbonic oxide. The liquefaction of these two gases is brought about with more considerable difficulty than in the case of oxygen, and under such similar conditions that at the moment it is difficult to say which of the two gases is the easier. At a temperature of about -136 degrees, and under the pressure of about 150 atmospheres, neither nitrogen nor carbonic oxide appears to liquefy. The glass tube with the gases appears to be quite transparent, and no traces of liquid can be observed. If the gas is suddenly freed from the pressure, there is remarked in the tube containing the nitrogen a powerful boiling-up of the liquid, which is best compared with the boiling of liquefied carbonic acid in a Natterer's tube when it is placed in hot water. In the case of carbonic oxide, the boiling does not take place in so strong a degree. If, however, the expansion be not allowed to take place so suddenly, and it be allowed to sink to 50 atmospheres, both the liquefied gases, nitrogen and carbonic oxide, evaporate completely, the liquids show a perfect meniscus, and rapidly evaporate. The two gases can only be retained for a few seconds in the form of liquid in the static condition. To retain them longer in that state, a somewhat lower temperature must be reached than we have at present succeeded in attaining. Nitrogen and carbonic oxide in the condition of liquids are, both of them, colorless and transparent.

FURNACE, MILL, AND FACTORY.

Mr. A. Kidder, agent of the Champion Iron Company, Marquette, Michigan, writes that, at the Champion mine, one of the Rand Drill Company's 10 by 16 duplex air-compressors has been in use about five years, and a 20 by 48 duplex compressor over a year. Both have given the most perfect satisfaction, never getting out of order, or requiring a dollar's expenditure in repairs, although the smaller machine, owing to press of work at the mine, has been driven at the rate of 130 revolutions a minute. No cards have been taken lately from the small machine; but the cards from the 20 by 48 are as nearly theoretical as possible for any engine to give.

The Beaver Falls Car-Works are engaged on an order for one hundred gondola cars for the Pittsburg & Chartiers Coal and Coke Company.

Mr. Henry Stanton, assignee for the Manchester Iron Company, Pittsburg, has filed his report in court. It shows that, when he took charge of the property, there were \$184,640.92 of assets to pay \$248,875.60 of liabilities. On the date of the account, there were \$187,922.57 of personal property to pay \$150,337.07 of debts.

The Baldwin Locomotive-Works, Philadelphia, have, during the past year, built 557 locomotives, averaging 32½ tons in weight, which gave a fair test of the utmost capacity of these works. The greater demand was for the four pairs of driving-wheel locomotives, and the rest for the mogul of three pairs of driving-wheel locomotives. Including both classes of locomotives, 151 were exported

to Mexico, the West Indies, South America, Australia, and the Sandwich Islands. The remaining 406 locomotives were sold to the various railroad companies of the United States.

The Putnam Tool Company has recently been formed in Fitchburg, Mass., for the manufacture of machinists' tools. This company has several new designs for machinists' tools that are quite a departure from the old style.

The Farrel Foundry and Machine Company, Ansonia, Conn., has undertaken and successfully poured what is probably the largest hollow chilled roll in this country. It is 18 feet long on the face, 17 feet over all, and 30 inches in diameter, requiring about 14 tons of iron to cast it.

Mr. George J. Fritz, proprietor of the Central Iron Works, St. Louis, Mo., has applied for letters patent for clay crusher-rolls of new design that he is now manufacturing.

An improved puddling-furnace has been started in the puddle-mill of the Bethlehem Iron Company, after plans made by William Stubblebine, foreman of that department. An addition has been built to a puddling-furnace, and while one heat is working in it, the pig-iron for the next heat is heated by what is called a stove, which is in the furnace. When the first heat is drawn, the heated iron for the next is pushed into the working-chamber, and in a short time is also ready to be drawn. By the improvement, an hour's time is saved in the working of each heat, and also a large amount of coal. In the old furnaces, when a heat of iron has been drawn, the furnace grows cold, and, before another heat, it becomes necessary to fire up, thus wasting some forty-five minutes.

The Rogers Locomotive-Works, Paterson, N. J., have been closed, pending an entire reorganization in the operative management of the establishment.

Samuel N. Shreve has purchased the entire works and effects of the Robbins Manufacturing Company, Camden, N. J., and will continue the building of Gray's patent revolving head-screw machine.

The Cleveland Rolling Company's steel-works resumed work February 18th, and the rail-mills will resume February 25th, when the entire works will be in operation again.

Dean Brothers, of Indianapolis, Ind., have recently furnished a complete set of water-works for a large lumber company, at Eau Claire, Wis.; also a large pump for the Clarksville (Tenn.) water-works; also a set of vertical pump machinery for the Citico Furnace, Chattanooga, Tenn., capacity one million gallons a day.

Hooven's pipe mill, at Morristown, Pa., shut down on February 16th for an indefinite period, in consequence of the dullness of trade. About seventy men are thrown out of employment.

The superintendent of the Wando Phosphate Company, Charleston, S. C., writes to the Lucop & Cook Pulverizer Company, under date of February 9th, 1884, in regard to the pulverizers supplied to the company last year: "The three (Lucop & Cook) mills at Wando give great satisfaction and run all the time. The peripheries last six months, the pins for five months, and the rolls three weeks, or, if the wearing surface is good, by bushing the hole they will run longer. The arms that I fixed up by inserting a piece of flat steel on the top side of the slots will run for years. The average daily product of the mill (single) is eleven and a half tons of fine powder."

The contract for supplying lock-boxes and other furnishings for post-offices that may be required during the next six months has been awarded to the Yale & Towne Manufacturing Company.

The Ansonia Brass and Copper Company, of New York, is now manufacturing what it calls "Acme bronze" wire, especially for telegraph and telephone purposes, which is highly spoken of. Lake Superior copper is used in its construction.

LABOR AND WAGES.

The Laclède Sheet and Plate Mills in St. Louis are running full-time. Nail mills in all directions are starting up again.

The Reeds, tack manufacturers, will concentrate all their works at Brockton, Mass., removing their rolling-mill from Matfield.

A general strike of railroad coal miners at Pittsburg against a reduction of half a cent is looked for shortly. The ruling rate is 3½ cents, but in a number of instances the operators have refused to pay more than 3 cents, claiming that they are unable to run their pits at a profit and pay the former rate. The producers offer to sign a yearly contract to pay 3 cents, but the men refuse to entertain the proposition, and a strike seems inevitable.

At Shaner's station, no pits were in operation on the 10th. The men who went in at the reduction have come out again. The Buena Vista miners also refuse to return to work at less than the arbitration award.

The railroad miners at Scott Haven, Pa., struck against a reduction February 16th, and the mines have shut down.

A reduction of ten per cent has been made in the wages of the operatives at the Penn Iron-Works, at Lancaster, Pa. A strike is threatened. The puddlers at the same establishment, who struck some time ago, are still out.

A dispatch from Wheeling, Va., says that the question of wages is agitating the iron-workers there. It must be settled within a month, and the men are waiting for a sign that will direct them in their movements. The manufacturers think that Eastern prices should rule here, but they have so little hope of receiving this that they will not attempt the task. The workers hold that wages should be advanced. Both sides expect a brisk spring trade, and neither is willing to injure it by pressing an opinion on the wages question. The best informed gentlemen here do not anticipate any trouble, but think that the present prices will rule next year. Whether there is a strike or not, the probabilities are, that the Wheeling mills will close during the two hot months.

RAILROAD NEWS.

Within two weeks, the completion of the Union Pacific extension from Lincoln to Beatrice will supply the link to connect Omaha with the Kansas system of roads, and trains will run through to Marysville, Kan., 171 miles from Omaha, via Valley, Wahoo, Valparaiso, Lincoln, and Beatrice. Another important extension which is evidently following upon the heels of the foregoing is a road to fill the gap between Marysville and Manhattan. This is now under way, and when completed will afford a continuous line from Omaha to Kansas City along the western bank of the Missouri River. This will be completed within a year.

The Supreme Court of New Mexico has rendered a decision sustaining the law of that territory which exempts railroads from taxation for six years after they are completed.

The financial statement of the Delaware & Hudson Canal Company for 1883 makes the following showing: Receipts from coal, \$9,827,874.18; receipts from railroads, \$7,417,643.26; miscellaneous receipts, \$596,982.04; total receipts, \$17,842,499.04. The net earnings were \$1,995,842.54.

The following is an official statement of the operations of the Denver & Rio Grande Railroad for the year 1883: Gross, \$7,361,545; operating expenses, \$4,743,111; net, \$2,618,434; receipts from other sources, \$114,531; total net \$2,732,965. The fixed charges of the road for the year, including all charges not reported in operating expenses, amounted to about \$2,635,000, which, deducted from the net earnings of \$2,732,965, leaves a surplus of \$107,965.

The proposed railroad from Sheffield, Ala., at the head of navigation on the Tennessee River, to a connection with the Georgia Pacific, will be built by the Alabama Improvement Company, which owns the town of Sheffield and large tracts of ore, coal, and pine lands along the line of the proposed road. The improvement company is composed of railroad capitalists in Memphis, Nashville, Chattanooga, Atlanta, and other places in the South. George I. Seney, President of the Metropolitan National Bank, Calvin S. Brice, and Samuel Thomas are the

New York members of the board of directors. The project is under the special charge of Jeremiah Baxter, President of the Memphis & Charleston Railroad, with which the new road will connect. It is expected that seventy-five miles of the road, from Sheffield to the Black Warrior coal-fields, will be built this year. It is not yet decided whether the link between the new road and the Georgia Pacific, which has a line in operation about twelve miles northeast of Birmingham, will be built by that company or by the two companies jointly.

The report of the managers of the Lehigh Coal and Navigation Company for 1883 states that the total revenue for the year was \$2,194,489, and the disbursements \$1,249,845, leaving net earnings of \$944,644, from which, after making sinking fund charges, accounting for depreciation on coal and improvements, and paying two dividends, there was a balance carried to the credit of the dividend fund of \$130,476. The coal tonnage of the Lehigh & Susquehanna Railroad and the Lehigh Canal for the year was 5,152,218, being an increase, as compared with 1882, of 486,367 tons. The increase in the earnings of the Lehigh & Susquehanna Railroad, the report says, came mostly from the territory directly tributary to the road, and a further gain may be expected when the Philadelphia & Reading Railroad Company perfects its arrangements to throw a portion of its New York business over the road. The canal traffic shows an increase over the previous year of 81,357 tons. After referring to the agreement with the Philadelphia & Reading Railroad Company, under its lease of the Central Railroad of New Jersey, and giving the terms already published, the report says: "While we have thus protected our interests, we feel that the Philadelphia & Reading Railroad Company will have great advantages in the possession and use of our railroads, which enable it to handle the great and growing traffic between New York and Central and Northwestern Pennsylvania more cheaply than it could over its own longer lines; and as all our relations with it since the lease have been harmonious, we have no doubt that the arrangement will largely conduce to the best interests of both parties. The transportation of the tonnage of the Alliance Coal Company has been permanently secured to the Lehigh & Susquehanna Railroad Company, and the business from this source is expected shortly to amount to 300,000 tons annually."

COAL TRADE NOTES.

MARYLAND.

The superintendent of the Swanton Company's mine, at Barton, has received orders to suspend operations. The duration of the stoppage is not known.

The shipments of coal from the seventeen mines of the Potomac coal-basin—generally called the Cumberland coal region—during the year 1883 were as follows:

Shipped by Baltimore & Ohio Railroad.....	Tons.
Shipped by Chesapeake & Ohio Canal.....	1,382,008
Shipped by Pennsylvania Railroad line.....	681,225
	418,968

Total shipments in 1883..... 2,482,200

Of the above quantity, 260,995 tons were shipped from the Elk Garden mine and 68,942 from the Big Vein mine on the West Virginia Central & Pittsburg Railroad; a total of 329,937 tons, or over one seventh of the product of the whole basin for the year—a most excellent showing in energy of management and furnishing capacity for mines that made their first shipments of coal October 20th, 1881. The West Virginia Central & Pittsburg Railroad Company, which has offices at 57 Second street, Baltimore, Md., and 21 Exchange Place, Boston, Mass., is now shipping from its wharves at Baltimore over 1000 tons daily of this Cumberland steam coal.

MONTANA.

The Union Pacific Railroad Company has invested fully \$150,000 in Gallatin County in the purchase of the Maxey and other coal mines in the vicinity of Bozeman. The fact that the product of these mines can be readily manufactured is what adds to the importance of the investment as far as the Butte District is concerned. Some time ago, a ton of the Bozeman coal was taken to Omaha, where thorough experiments were made, and where it was converted into coke that was pronounced of very fair quality. Since then, a coking-oven has been constructed at one of the mines, and experiments on a larger scale are now making. Should the result be satisfactory, a branch of the Utah & Northern from Glen station to the mines will probably be constructed next summer, and not only will the price of coal for domestic purposes be reduced, but the smelting companies will be abundantly supplied with coke at a much lower figure than they now pay for the Pennsylvania article.

NEW MEXICO.

An excellent article of coke, it is stated by local papers, is turned out at San Antonio, by the Atchison, Topeka & Santa Fé Company, which has erected there a large number of coke-ovens, and is supplying the Billings smelter, enabling that concern to do its smelting effectually without the aid of charcoal. The belt of coal from which the coke is made extends for twenty or thirty miles along the low mountain range bordering the Rio Grande on the east, and reaches from a point east of Socorro to within six miles of San Marcial, and nearly opposite. A railroad is contemplated going west from the Billings smelter across the river, where coal may be found within six or eight miles from Socorro. The coal now opened on this belt is taken from what is known as the San Pedro coal mines, about eight miles west of San Antonio and eighteen miles from Socorro.

OHIO.

The mines around Wadsworth are doing a pretty good business with the exception of the Brewster Coal Company, which is running not over two days a week. A part of the Excelsior slope is not working on account of the flood. Carol shaft is doing good business. Also W. B. Coleman (Humphrey's slope).

Owing to the floods, work in the various coal districts has been almost entirely suspended.

PENNSYLVANIA.

ANTHRACITE.

A dispatch from Harrisburg, Pa., announces that a judgment has been rendered in favor of the State for \$5386 against the Pennsylvania Coal Company, for tax on capital stock.

Mine Inspector Williams, of the Middle District coal-fields, in his annual report states that the amount of coal mined and taken out during 1883 was as follows: Lehigh Valley Coal Company, 64,676,015 tons; Lehigh and Wilkes-Barre Company, 175,116,735 tons; Delaware & Hudson, 135,781,055 tons; Susquehanna, 111,932,065; Wyoming Valley companies, 45,549,600 tons; miscellaneous companies, 234,463,660 tons. The number of persons actually employed in mining coal was 17,833. These figures show an excess of more than 600,000 tons and more than 3000 employes over the previous year.

John Runkle, a miner at Carson colliery, Shamokin, was last March smothered by gas, and suit was brought against Charles Hutchinson, the operator, for violating the act of Assembly, which says, "Operators must furnish fifty-five cubic feet of pure air per second to every fifty miners." The court decided that the defendant could not be convicted, as there were only twelve men in the mines when Runkle's death occurred. The jury, however, put the costs, amounting to \$1000, on Mr. Hutchinson.

North Franklin colliery will not be ready to ship coal for three months yet; but the Reading Company has offered to buy it at a good price.

The recent rains and thaw have partially flooded the Stanton mine of the

Lehigh and Wilkes-Barre Coal Company. The hoisting of coal was abandoned February 18th, until the water shall be removed, which will take several days.

The Philadelphia & Reading Railroad and Coal and Iron Company, it is reported, has in course of construction at its shops at Philadelphia, 1500 cars of fifteen tons each, for the anthracite carrying trade. The anticipations of the company are, that the spring trade will be enormous, and that its equipment will be taxed to its utmost. The anticipated increase in the trade of this year may be measured by the fact that the number of cars built by the company last year was only 644, or 856 less than the number to be built in 1884. Thirty locomotives are also to be built for the coal service. An officer of the company states that the suspensions in mining adopted by the coal combination for the regulation of supply will be continued until April 1st, making nineteen days more of suspension this year, if the rule of three days' work in each week of that time is carried out. This will give a total suspension for the year of forty-eight days, against fifty-one days last year. The total amount of coal mined by the company in 1883 was 4,582,667.06 tons, and the expectations for this year are 6,000,000 tons. It is contemplated gradually to increase the output until in three years' time it shall reach the enormous figure of 10,000,000 tons. This will necessitate new openings in the southern coal-field, where shafts will be sunk to the depth of 1500 feet, and at which depth it is calculated that the Mammoth vein will be pierced at a thickness of forty feet. This field has been extensively worked before, but only in the overlying veins. The Reading Company's officers state that, notwithstanding the enormous amount of coal taken out of the territory controlled by it, there is still an almost inexhaustible field to draw upon. Ex-President Gowen, of the Reading Company, contends that the Schuylkill region is the most prolific of all the coal territories, and that, when the others have been despoiled, that one will be called upon to meet the demands of the country. The company is preparing to meet the increased demand for coal by the employment of machinery, which will not only facilitate its production but lessen the cost of mining it. It is estimated that the losses in mining anthracite coal are from 40 to 45 per cent of the entire yield, and with improved machinery it is proposed to reduce this to 30 per cent, and also to lessen the cost of production per ton from \$1.49 in 1883, to \$1.14, the cost in 1879. The company has been very fortunate with its collieries during the present wet season. While, according to reports, a large number of individual collieries, as well as those operated by other companies, have been compelled to shut down on account of high water, only two collieries thus far belonging to the Coal and Iron Company have succumbed to the pressure, the Peerless, in the Shamokin region, and the Colket, in the west end of Schuylkill County. During the last few years, the Coal and Iron Company has expended an enormous sum of money in perfecting the pumping machinery of its collieries.

W. L. Scott & Co., of Erie, have purchased and begun working four of the largest collieries in Northumberland—the Green Ridge Mineral colliery, at Mount Carmel, and the Cameron, Hickory Swamp, and Luke Fiddler, at Shamokin—operated by the Mineral Railroad and Mining Company. The collieries are among the most remunerative in Northumberland County. Scott & Co. had contracted to ship by the Pennsylvania Railroad 300,000 tons per annum at one half cent per mile. Other coal shippers have to pay three cents per mile. Andrew Robertson's Excelsior colliery ships all its coal to Scott & Co., at Erie. Its annual shipment amounts to about 100,000 tons. Scott & Co., to fulfill their contract of 300,000 tons per annum with the Pennsylvania Railroad, concluded to get possession of the Mineral Railroad and Mining Company's collieries.

An explosion of fire-damp occurred February 20th at No. 10 shaft at Sugar Notch, worked by the Philadelphia & Reading Coal Company, by which two miners lost their lives. It is supposed that the explosion was caused by a naked light carried by one of the miners.

BITUMINOUS.

At Leechburg, the coal trade remains dull, the No. 3 mine of Leechburg colliery and No. 2 of the same company having been worked less than half-time. The Pittsburg & Kiskiminetas Coal Company's and Bagdad Coal Company's mines will be running full in a short time.

COKE.

Another coke pool scheme at Pittsburg includes a proposition from the smaller operators to the largest firms for the latter to sell the former's coke at \$1.25 from March 1st, 1884, to May 1st, 1884, and from the latter date to March 1st, 1885, at \$1.40 per ton, on a commission of 7 per cent. The small operators agree to build no more ovens without the consent of the large firms and to shut down when necessary. The large firms referred to are Frick & Co., McClure & Co., and J. M. Schoonmaker.

Jacob R. Kunkle and Mr. Boltz, of Irwin, backed by a syndicate of New York capitalists, have purchased a tract of coal land lying in the vicinity of Adamsburg, and aggregating over 4000 acres, valued at nearly \$500,000. The conditions of the purchase are such that the titles are to be furnished within thirty days from the present time, and the entire price to be paid in ninety days. The coal lies west of Adamsburg, in Hempfield and North Huntingdon townships. The purchasers propose to sink a shaft, and a branch railroad will be made to the Youghiogheny branch.

The Hecla mines and coke-works are situated on the Sewickley branch road, which connects with the Southwest Pennsylvania road at Youngwood Junction, five miles from Greensburg. They have 272 ovens running full-handed six days in the week, turning out from 25 to 27 cars per day. The product is first-class. Coal is reached by shaft, at a depth of 214 feet from the surface. This company furnishes employment to some 270 workmen. The company owns some 425 acres of land at this point. The works have been in operation from one to two years.

The little village of West Leisenring, four miles north of Uniontown, was on February 20th the scene of the most terrific explosion ever known in the region. The Connellsville Coal and Iron Company, of which Judge Leisenring, of Mauch Chunk, is president, has 200 coke-ovens here, which have been in operation about a year. The works give employment to about 100 men. The coal is obtained by means of a shaft which reaches the mine at a distance of 400 feet from the surface. At about half-past six o'clock A.M., while the men were digging, suddenly and without warning, there occurred an explosion that shook the mine in every apartment and threw the men into the utmost consternation. The scene of the explosion was in an apartment fully 800 feet from the bottom of the shaft, and therefore 1200 feet from the opening at the surface; yet the report was heard outside for a considerable distance, and the concussion was so great that the top of the derrick, 100 feet high, was knocked off. The explosion was caused by fire-damp, and cost the lives of nineteen men.

TENNESSEE.

At Coal Creek, dull times are reported, on account of orders being slack and the mines being overcrowded with men. The Coal Creek Coal Company is working 225 men. The Star Coal Company has changed hands. The purchasers, it is said, will push work vigorously.

VIRGINIA.

The Southwest Virginia Improvement Company, on the Norfolk & Western Railroad, Tazewell County, shipped 76,614 tons of coal during 1883, and coked 42,439 tons making a total output of coal of 119,053 tons. The company also shipped 25,282 tons of coke. Operations began on the 1st of May, so that the return only embraces eight months.

WYOMING.

The party of men now at work in North Park coal-fields has so far done assessment-work on twenty-four claims. This party has a shaft on Red Hill down twenty-five feet; on Coal Hill, a tunnel in twenty feet; and at coal-bank No. 1, a tunnel in 120 feet. This tunnel has been timbered and closed up for the winter. The men are now engaged in running an inclined shaft to the old Ballenger coal-bank.

GENERAL MINING NEWS.

CALIFORNIA.

The appeal from the decision of Judges Sawyer and Deady, in favor of plaintiff, to the United States Supreme Court, in the case of Edward Woodruff vs. the North Bloomfield Gravel Mining Company, the famous *débris* case, has been vacated on motion of counsel for the defense, in the United States Circuit Court at San Francisco.

INYO COUNTY.

DEFIANCE.—It is rumored that a 20-foot vein of good ore has been struck in this mine.

ELNA.—This furnace is again in full blast.

MONO COUNTY—BODIE DISTRICT.

BODIE CONSOLIDATED.—During the week ended February 9th, 90 tons of ore were hauled to the mill and 140 tons reduced. The ore now sent to the mill from the stopes from the uprise 306-foot level will materially increase the bullion production for the coming week.

BODIE TUNNEL.—Operations at the mine continue.

GOODSHAW.—This company is still delayed in starting up its work, owing to the impassable state of the road to the mine, and inability to procure water for the boilers, which have to be supplied by teams.

STANDARD CONSOLIDATED.—There were 1430 tons of ore extracted and shipped to the mill during the week ended February 9th; 1000 ounces of crude bullion were received, which are not yet melted, and will be carried over until the 18th inst.

COLORADO.

During the past month, it has been our duty, says the *Leadville Herald*, to record the organization of no less than half a dozen new smelting companies. Each of these new smelting enterprises proposes to immediately erect reduction-works of from fifty to two hundred tons smelting capacity daily. If the managers of these different enterprises are all competent and experienced men, which is not at all likely, Colorado miners may look for a reduction in smelting charges in the near future that will prove surprising. The works now in existence are forced to display considerable activity, in order to secure sufficient ore to keep their furnaces in blast, and there is already active competition in all the mining districts for their mineral production. Leadville, assisted by Red Cliff and Monarch, is now keeping up the smelters of Colorado. The production of these three districts was about as large last year as it will be this. Their products were seized by the smelters as fast as made, and consumed, or nearly so. To such an extent was the competition for ore carried on in the Leadville District, that, notwithstanding the enormous output of from 375,000 to 425,000 tons of ore during the year, several of the local works were closed down for some months on account of the absence of ore to keep their furnaces going. The price of lead last year was good, and the mines in every section made strenuous efforts at large production. This year, the price promises to rule low; there is a general apathy in mining, and the indications point to a reduced ore production, so far as tonnage is concerned, few of the mines being willing to market ores low in silver and high in lead.

With this condition of affairs, we fail to realize the necessity of erecting a number of additional smelters. Among the works recently proposed is a large smelter at Pueblo, the resurrection of the Swansea works near Denver, a proposed new smelting plant at Golden, and a new smelter at Gunnison, besides several others that we can not now recall.

The addition of furnaces in Colorado last year was out of proportion to the increase in the ore production of the State; and if the same folly is to be repeated again this year, the State will be monumented with idle smelters. Last year, the Leadville works lost time equal to two large furnaces for one year, the Cañon City smelter was operated less than half the time, besides a number of lesser works. During the year, there were added to the smelting capacity of this section, the Colorado Works at Pueblo, the Billings smelter at Socorro, New Mexico, which withholds New Mexico ores from Colorado works, and several smaller establishments.

To insure prosperity for the proposed new enterprises, their projectors and promoters should wait until the idle smelter at Golden is again in blast; the Cañon City smelter once more turning out bullion; the Moffat smelter at Gunnison permitted to keep its fires going; the works at Aspen tainting the air with arsenical fumes; and the smaller smelters in Chaffee County allowed to make runs of more than a fortnight or two. It is no credit to a State to see it dotted over with evidences of failures, and no benefit to have the stockholders of such enterprises vent their disappointment by crying down the producing capacity of the mines.

CHAFFEE COUNTY.

A recent mill-run on ore from the new copper strike near Salide returned 25.06 per cent of copper, three tenths of an ounce in gold, and 9.4 ounces in silver to the ton. The copper consists of the native metal, carbonate, oxide, and sulphide. The vein in places is twenty feet in width.

CLEAR CREEK COUNTY.

GRAND VIEW.—Under the new management, the mine is systematically developed. The main shaft is fifty feet in depth, and work on it has been, for the present, suspended. A tunnel 6½ by 4 feet in the clear has been started some fifty feet below the shaft, and run in on the vein. It is the intention of the owners to drive this tunnel ahead until the pocket known to exist is reached. The tunnel will intersect the lode at 105 feet from the surface. The character of the ore is a galena.

OLD VIRGINIA.—A mill-run of 3331 pounds of ore from this mine, at Dumont, was recently made with the following result: 2.8 ounces of gold, and 23 ounces of silver per ton. The mine is steadily worked.

GILPIN COUNTY.

BOBTAIL.—This company is employing 75 of its 125-stamp mill capacity, 70 of which are crushing ore from the Bobtail tunnel workings and 5 stamps on ore from the Roderick Dhu lode on Quartz Hill.

GUNNISON COUNTY.

The smelter at Gothic, owned by Mr. Avery, of Chicago, and others, will be put in running order early in the spring.

HINSDALE COUNTY.

CROOKES MINING AND SMELTING COMPANY.—Work has been resumed on the Ulé mine in a small way, a contract having been let for 25 feet in the main shaft. This contract is probably a test, the old workmen having declared their inability to make fair wages on the rates offered for contract work. There is no conflict between employers and employes beyond a matter of opinion as to how much wages can be made on contract work at a certain price per foot.

LAKE COUNTY.

The *Leadville Herald* has the following: A gentleman at Leadville, in a position to know whereof he speaks, says he thinks the smelters will revoke their

late agreement not to pay for fractional ounces of silver, and other regulations, within thirty days. It will be done, he says, as soon as a meeting can be held of all the smelting men who were present when the smelters' rules were adopted.

IRON HILL CONSOLIDATED.—The White Cap and Forfeit mines of this company have been connected with the workings from the Ines shaft, a property belonging to the same company, but located higher up on Iron Hill.

IRON SILVER.—It is currently reported that this company contemplates the purchase of the Colorado No. 2 lode, situated on Iron Hill, back of the Iron Silver group of mines.

IKE & STARR.—The mine is shipping about twenty tons of oxidized ore a week, ranging in value from twenty to twenty-five ounces in silver to the ton.

MINNIE.—The workings from the Loomis shaft at this claim on Iron Hill now disclose fourteen feet of ore.

MORNING STAR.—The suspension of the extraction of ore is doubtless due to the low prices paid by smelters for lead, and Manager Ward's objection to the terms on which smelters are buying ore, particularly their refusal to pay for fractions of an ounce in silver. The suspension of ore-shippments does not necessarily signify the complete shutting down of the mine, and exploration work will unquestionably be continued. The pumps of the mine will also have to be kept running, otherwise portions of the mine's workings would become flooded and irreparably damaged.

QUEEN CONSOLIDATED.—An assay made on some of the ore recently opened in these mines, on Yankee Hill, returned seventy ounces in silver to the ton.

RUBIE.—Mr. Tingley S. Wood, manager of the Silver Cord mine, has purchased Judge J. L. Perdry's one fourth interest in the entire Rubie claim, paying for the same \$30,000. The southern portion of the claim was unquestionably bought for the Silver Cord Mining Company, which already owned three fourths of this portion of the Rubie. What Mr. Wood will do with the northern portion was not ascertained.

OURAY COUNTY.

Mr. J. C. Day, of New York, Mr. Pantaleoni, Engineer of the Westinghouse Air-Brake Company, and Mr. Carr, of the same company, are at present at Ouray, looking over the ground with the view of erecting a tramway from the San Miguel Valley to the head of Marshall Basin, and also to the head of what is generally known as Argentine Basin. They have obtained the signatures of all the principal mine owners and managers of companies in that district to a paper which pledges them to give their patronage to the tramway company in transporting their ores and supplies between the mines and the valley at \$2 per ton. They also purpose putting up large reduction-works at the terminus of their tramway to treat the ores.

YANKEE GIRL.—Considerable interest is manifested in the reported new strike in the Yankee Girl of a ten-inch streak of mineral which is said to assay very high. The ore is bismuth and native silver.

SUMMIT COUNTY.

The controversy existing for some months past between the owners of the Belden group of mines at Red Cliff has been amicably adjusted, Judge D. D. Belden withdrawing from the partnership.

GEORGIA.

LUMPKIN COUNTY.

COLUMBIA.—No work is at present prosecuted at either the mine or mill. It is reported that a tunnel will be driven from the south side of the hill to cut the veins. Should the company decide to adopt this plan of exploitation, it will probably be several months before the mill will be running again.

FISH TRAP.—A tunnel is driving into the hill on lot 932, to determine the character of the ground, with the view of enlarging the field of operations.

IVEY.—For the first time since the completion of the new mill, the 63 stamps are steadily at work. Various obstacles have hitherto prevented the continuous running of the entire number, prominent among which was the scant supply of water.

IDAHO.

The steady progress toward a development of the immense resources of the mineral wealth of Bayhorse and the adjoining mining districts continues with unabated ardor, says a correspondent of the Salt Lake Tribune. The Ramshorn group of mines, situated in the slate belt, consisting of the Ramshorn, Skylark, Silver Wing, Bull-of-the-Woods, Utah Boy, Post Boy, Pugilist, and Cuta, have during the past season been successfully worked. A tramway has been erected from the Ramshorn (over 3000 feet long) to the ore-house on Bayhorse Creek, and many other improvements have been made. Hitherto the mines situated on the limestone belt of the district from various causes produced but a meager output of ore, with the exception, however, of the Hood, Beardsley, and Excelsior mines. This group has steadily produced a certain amount of ore that would sample from 50 to 75 ounces of silver to 50 per cent lead, and, as a matter of course, was eagerly sought after by the smelting company for the high lead percentage. Other mines in this belt have to a certain extent been non-producing, simply because they have not been properly worked, and also that confidence necessary to stimulate labor was lacking. But happily all that sort of trouble has disappeared since the late discoveries in the lower levels of the Excelsior mine, and a new impetus has been given to the despondent, so that quite a number have begun prospecting other claims. The Excelsior mine is situated about three fourths of a mile from the smelter, on what is known as Beardsley Hill, and joins the Beardsley on the south. A good wagon-road has been graded from the mine to the smelting-works. Prospecting and working this mine in earnest began in the spring of 1882, and were continued with varied success until about the 15th of last January, when the largest and, as far as can be now ascertained, the most permanent ore-body was discovered that has ever been found the Salmon River Mining District. The Beardsley mine is another fine property of this group. This mine has produced a large amount of ore in the past three years, and is worked by an incline and tunnel similar to those of the Excelsior.

GOLDEN CHARIOT.—It is rumored that this company will start up its hoisting-works in the spring.

PARKER.—A fourth interest in this mine has been sold for \$15,000. The mine is directly above the Elkhorn, on the same hill, and is in the center of what is rapidly becoming the greatest silver mining district on Wood River. The distinguishing feature of the mine is the high grade of its ores. The mine is easily accessible, and in every respect fine property.

MICHIGAN.

CALEDONIA.—If arrangements can be made with the Chicago & Northwestern Railroad to build a branch to this iron mine, operations will be resumed.

COMMONWEALTH VS. CONGLOMERATE.—In the court at Harrisburg, Pa., February 19th, judgment for \$674 was given the Commonwealth in the suit against the Conglomerate Mining Company, to recover an office license for which the company claimed it was not liable, being a foreign corporation.

GOLD STAR.—At the annual meeting of this company, at Ishpeming, the following resolution was adopted unanimously: That the board of directors be and they are hereby authorized to empower the president and secretary to execute, in the name of the Gold Star Company, the deeds and conveyances which shall, in their judgment, be necessary to convey the title to all the property of this company for the purpose of effecting a consolidation with the Svalder Mining Company, if, in their opinion, they shall deem it best to consolidate the two companies in one.

MONTANA.

BEAVERHEAD COUNTY.

HECLA CONSOLIDATED.—Mr. H. Knippenberg, General Manager, has furnished us with the following table of production for the year 1883; lead, matte, copper in matte, in pounds; silver and gold in ounces:

Month.	Pounds lead.	Pounds matte.	Pounds copper in matte.	Ounces silver in lead and matte.	Ounces gold.
January	419,416	61,100	26,850	45,623.30	22.93
February	394,618	84,310	36,895	43,779.09	21.71
March	401,194	.....	.....	40,229.35	94.62
April	405,275	.....	.....	35,344.27	10.32
May	405,749	51,820	19,291	41,680.96	80.88
June	533,300	54,560	24,770	60,160.07	20.22
July	531,551	84,910	37,320	61,829.66	17.67
August	453,149	.....	.....	55,421.47	21.28
September	377,903	.....	.....	55,251.68	29.99
October	343,916	88,970	41,199	59,520.87	16.10
November	424,293	193,730	96,798	82,631.15	35.79
December	503,558	55,445	24,399	81,355.05	19.86
Total	5,203,922	674,795	307,519	662,835.92	401.37

LEWIS & CLARKE COUNTY.

GREGORY.—The new concentrator is completed, and has been started up. It is said to be the most complete and substantial concentrating works in the Northwest. It is lighted by ten of the United States Electric Light Company's arc lamps.

MADISON COUNTY.

A correspondent of the Butte Miner writes from Pony that several mines are worked with satisfactory results. The dump-piles are increasing in size and the Gatchell ten-stamp mill will shortly have to be started up to accommodate the wants of the camp. At Red Bluff, a body of good ore 12 feet in width has recently been struck in the Golconda mine, which will probably necessitate the enlarging of the mill and concentrator. The Mohegan is a wide, rich gold-bearing vein, and is developed by a shaft to a depth of 110 feet—water-level. It is said that the owners will erect pumping and hoisting-works on it next spring. The Red Bluff lode is developed by tunnel to a depth of 115 feet, where the vein is six feet in width, with quartz averaging \$20 in gold and \$20 in silver per ton. The Greenback is a fine vein of gold quartz, averaging \$65 per ton, and is developed to a depth of 300 feet. Numerous other promising mines are developing in the camp. Williams & Co. are erecting a ten-stamp mill for the Superior lode in the same district.

SILVER BOW COUNTY.

ORIGINAL.—Operations are confined chiefly to the 300-foot east level and to the winze leading to the 400-foot level. The product is divided into two grades, the first-class ore sampling 75 ounces, and the remainder from 40 to 50 ounces. The ore is worked at the Colorado smelter. The thirtieth consecutive dividend has been declared, making a total of \$90,000.

NEVADA.

EUREKA COUNTY.

ALBION CONSOLIDATED.—At the annual meeting, held in San Francisco, the following directors and officers were elected: C. H. Fish, President; Solomon Heydenfeldt, Vice-President; A. J. Ralston, H. T. Scott, Julius Jacobs, A. H. Hall, Directors. A. W. Haven was chosen Secretary, and T. J. Read, Superintendent.

STOREY COUNTY—THE COMSTOCK LODE.

At the Sierra Nevada, the connection between the 2900 and 2700 levels is about made. This connection is important, as it changes the draught and gives a circulation of air that renders it possible to economically prospect streaks of ore heretofore cut in the north end of the mine.

Connection between the main drifts on the 3100 level of the Union Consolidated will be made soon. This gives a great air-gallery on the 3100, which will command that level and all the levels above, as from it air may be carried to any point on the upper levels. It also commands all the ground above as regards drainage. This will make it easy to prospect the 2900 level of the Mexican mine and other points where heretofore explorations could not be economically made on account of water and the great heat.

It will not be long before cross-cuts will be run east and west in the Sierra Nevada and Union Consolidated on the 3100 level. Thus far, little has been done on that level except in a direction parallel with the quartz strata, therefore but little more is known of the ground at this depth than was ascertained when the 3100 station was first opened.

At the Hale & Norcross and Savage, they are now just starting in to explore the 2600 and 2800 levels. It will not be long before we shall hear of developments of interest in these mines.

The Crown Point and Belcher mines have shut down, throwing out of employment about 150 men. The intense cold and consequent freezing of the water in the Carson and its tributaries is assigned as the cause.

Very shortly the Alta will again draw the attention of mining operators. As the east drift on the 2150 level nears the ore-body tapped by the diamond drill, we shall see lively times at the south end.

NEW MEXICO.

A movement has been started in Lake Valley, having for its object the creation of a new county, to be about 100 miles long and 54 miles wide, and to include territory now embraced in Grant, Doña Ana, and Socorro counties. The new county, if created, will include the following towns: Deming, Colorado, Rincon, Nutt, Lake Valley, Hillsboro, and Kingston.

SOUTH AMERICA.

COLOMBIA.

Mining is looking up in the State of Tolima. Among recent transactions, has been the sale of the Organos mine, in the neighborhood of Neiva, for \$80,000. It has been purchased by an English company.

UTAH.

SUMMIT COUNTY.

CRESCENT.—This company, having bought the Nettie and an undivided one eighth interest in the Roaring Lion (for dumping), has ninety acres of ground. Twenty thousand feet of openings have developed thirteen acres of it. During the past year, eleven thousand five hundred and seventy-five tons of ore were taken out and sold at \$30.75 per ton. The total expenses for all purposes were \$15.95 per ton; the profits, \$14.80. There are 5000 tons of low-grade ore on the dump. Tests have shown it to be a good concentrating ore. The mine is well opened—1000 feet on the strike and 600 on the dip; it is well equipped with buildings, and has been made accessible. Nearly 8000 lineal feet of openings were made the last year. The proposed concentrating-works, five jigs with apparatuses, will cost \$10,000. It is expected that these and the tramway will be completed by July. The company owes on the Walker & Buckeye \$42,000, and that is all. The present output of fifty tons a day will be doubled, perhaps, within six months, and the expenses are already much less in comparison with the output than formerly.

PARLEY'S PARK.—A little ore is produced. The company has some trouble with the water encountered in the mine, and various projects are under consideration to remedy the evil.

FINANCIAL.

Gold and Silver Stocks.

NEW YORK, Friday Evening, Feb. 22.
The mining market was very dull this week, and there are no new or interesting features in connection with it to report. A holiday occurring to-day, there was no session of the Board, and this no doubt helped to further limit the transactions. Horn-Silver exhibited considerable strength during the week, and yesterday reached the strongest figure it has sold for in some time. Green Mountain showed signs of weakening and was rather depressed yesterday. The Bodie stocks were somewhat neglected, but continue strong. The low-priced stocks were very quiet, with the exception of Sonora, which was very largely dealt in, but with no material change in price. A full summary of the market is given below. The total number of shares sold aggregates 81,490, as against 112,341 last week.

The Comstock shares were very quiet and were steady. California was quiet and steady, selling from 25c@28c., assessment paid, and at 3c., assessment unpaid. Sierra Nevada was quiet at \$3.60. Ophir records one transaction at \$1.25. Union Consolidated sold at \$2.75. Sutro Tunnel was but moderately dealt in at steady prices; it sold from 15c@16c.

The Bodie stocks were moderately dealt in at strong prices. Bulwer was strong under a small business, selling from \$1.55@1.75. Standard was quiet and steady, selling from \$6.63@6.88@6.75. Bechtel sold from 15@10c., under a small business. Goodshaw was quiet and steady at 30c. Consolidated Pacific records a small business at steady prices; it sold from 35@30c.

The Leadville stocks record a moderate business at steady prices. Amie was very quiet and sold at 9c. Chrysolite was a little weak, with a moderate business, selling from \$1.05@1. Dunkin sold at steady prices, being quoted at 22@20c. Iron Silver suffered a slight decline, and was moderately active; it sold from \$2@1.90. Leadville was quiet and steady, selling from 50@55c. Little Chief was also steady under a small business, selling from 50@48c. Little Pittsburg sold at 43c. Climax sold at 6c.

The Tuscarora stocks were almost neglected. Belle Isle sold at 40c. and Grand Prize at 20c.

In the miscellaneous list, Alice was quite strong yesterday; it sold from \$1.95@2.50 under a small business. Eureka Consolidated was fairly dealt in, and was strong; it sold from \$2.50@2.70. Green Mountain exhibited some weakness, and was fairly dealt in; it declined from \$2.20@1.95. Hall-Anderson was quiet and steady at \$1.25@1.30. Horn-Silver was again quite strong; it advanced from \$6.88@7.75, and was fairly dealt in. Robinson was almost neglected and was a little weak; it sold from 35@30c. Sierra Grande sold at weak prices, under a small business; it was quoted at 78@75c. Bonanza King continues strong and was actively dealt in; it sold at \$10.

Central Arizona was quiet and steady at 30c. Decatur sold from 4@3c., under a small business. Eastern Oregon records but small transactions at steady prices; it sold from 9@8c. Harlem sold at 7c. Oriental & Miller was quiet and steady at 15@16c. Sonora Consolidated was very actively dealt in at steady prices, selling from 9@7@8c. The State Line stocks were quiet and steady. Nos. 1 & 4 sold at 3c. and Nos. 2 & 3 at 8@10@9c.

MEETINGS.

The following companies will hold their annual meetings for the election of trustees at the time mentioned:

The Estrella del Norte Mining Company, No. 29 Wall street, Room 62, New York City, March 11th, at twelve o'clock M.

The Horn-Silver Mining Company, No. 12 Wall street, New York City, March 6th, at twelve o'clock M.

The Lehigh & Wilkes-Barre Coal Company, No. 227 South Fourth street, Philadelphia, Pa., February 28th, at one o'clock P.M.

The National Mining Company, No. 32 Pine street, New York City, March 3d, at twelve o'clock M.

The New Pittsburg Mining Company, No. 23 Nassau street, Room 9, New York City, February 28th, at twelve o'clock M.

The Robinson Consolidated Mining Company, No. 54 William street, New York City, March 6th.

The Parley's Park Silver Mining Company, No. 58

Cedar street, New York City, March 5th, between eleven o'clock A.M. and two P. M.

DIVIDENDS.

The Delaware & Hudson Canal Company has declared a quarterly dividend of 1 1/4 per cent on the capital stock, payable March 10th.

The Kentuck Mining Company, of Nevada, has declared a dividend (No. 43) of ten cents per share, payable February 19th.

The Jocuistita Mining Company, of Mexico, has declared its eleventh quarterly dividend of \$50,000, being 50 cents per share, payable February 29th.

The Lexington Mining Company, of Montana, has declared dividend No. 2 of \$80,000, making the total dividends to date of \$500,000.

The Ontario Silver Mining Company, of Utah, has declared its usual dividend of \$75,000 for January, payable at the office, San Francisco, or at the transfer agency, Messrs. Lounsbury & Haggin, No. 15 Broad street, New York, on the 29th inst. Total dividends to date, \$5,300,000.

PIPE LINE CERTIFICATES.

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

Saturday morning, the market opened firm at \$1.03 1/2, having sold down as low as \$1.01 1/2; but the good feeling was short-lived, and the market soon broke away to \$1.01 1/2 again, closing at \$1.01 1/2. On Monday, the market touched \$0.99 1/2, closing at \$1.00 1/2. Tuesday, the market rallied and closed strong at \$1.02 1/2. Wednesday, the opening was firm, and the market advanced to \$1.02 1/2, but late in the day declined to \$1. Thursday, the feeling was weak, opening at 99 1/2 c. and closing at 99 1/2 c., selling down to 98 1/2 c. in the mean time, and closing at 99 1/2 c. This decline has been continuous from \$1.12 1/2 three weeks ago. The new wells on the Henry lands, north of Cooper's tract, are very good, but show drainage. The Standard Oil Company is supposed to have a hand in the deal. There is a good short interest and the bear feeling is general.

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

	Opening.	Highest.	Lowest.	Closing.	Sales.
Feb. 16	1.03 1/2	1.03 1/2	1.01 1/2	1.01 1/2	4,379,000
18	1.01 1/2	1.01 1/2	.99 1/2	1.00 1/2	5,653,000
19	1.00 1/2	1.02 1/2	1.00 1/2	1.02 1/2	5,846,000
20	1.02	1.02 1/2	1.00	1.00 1/2	5,032,000
21	.99 1/2	1.00	.98 1/2	.99 1/2	6,946,000
22					
Total sales					27,856,000

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, February 21.

The market for copper stocks the past week has shown a good degree of activity in the two or three leading dividend-paying stocks with higher prices. Calumet & Hecla, on good buying orders, advanced from \$234 1/2@240, at which price all the sales were made. At this price, it will net the purchaser over 8 per cent for his investment, and were it other than a mining stock, it would sell at much higher figures; but of course with all mining operations there is more or less uncertainty for the future, although, in this particular case, the risk is comparatively small. Quincy has been in good demand, and shows a handsome advance over last week, with sales at \$46, against \$42 1/2, the closing sale one week ago to-day. The condition of the Quincy is such as to warrant the payment of dividends even at the present low price of ingot copper, for many years to come, and at the market price the stock is undoubtedly a good investment. Franklin is very firm at \$11 1/4@11 1/2, although there has not been much doing in it. The latest advices say, every thing regarding the Franklin mine shows favorably. The February product is estimated to be at least 175 tons. A few shares of Osceola sold at \$16, same as last week. Pewabic sold at \$1 1/4, and Huron at \$1 1/4. Lake Superior advices say: The winze below the 31st level north of the cross-cut on the new lode in Pewabic is showing some very good stamp rock and a few small pieces of barrel copper. A mass of 600 pounds was taken from the bottom of the winze February 11th. Hoisting with the skip from the 34th level was begun May 9th. Huron's product in February promises to be from 70 to 75 tons.

At the Mining and Stock Exchange, there has been only a fair amount of business transacted, and prices generally are off a little. Empire sold at 22@23c. Dunkin, 23@24c. Bowman Silver advanced to 17@18c. The sale of delinquent stock is advertised to take place on Saturday, the 23d inst. American Electric Light and Illuminating Company advanced from \$5@5 1/2, but later declined to \$4 1/2@5. Standard Water-Meter, steady at 55@62 1/2c.

The silver mining stocks are generally very dull and lifeless, and there is not much disposition to operate in them. The continual call for assessments has a tendency to keep the public out of them, and the greater part of the transactions at the Board are on brokers' account. At the regular Stock Exchange, dealings in this class of stocks have ceased almost altogether, a single sale of Bonanza Development at \$1 1/4 being the only recorded transaction for the week. The once famous Silver Islet mine, it seems from the following statement, is about to be sold and wound up: "The attempt to capitalize the Mamanise property of the Silver Islet Consolidated Mining and Land Company at 40,000 shares, for the relief of the Silver Islet mine, is a failure, Silver Islet stockholders failing to subscribe the requisite amount. Silver Islet is therefore at the mercy of its creditors, and it is presumed that the American Exchange Bank of New York, the chief creditor, will sell the property. The company had temporarily exhausted its power to assess the stock, but could have tided over its difficulties had the capitalization scheme succeeded."

3 P.M.—There was no change in the market after noon. A few shares of Quincy sold at \$45 1/2@45 1/4. Calumet & Hecla, offered at \$240. Franklin, \$11 1/2 bid. Osceola, \$16 bid, \$20 asked. Pewabic, \$1 1/4 bid. Atlantic, \$8 bid, \$10 asked. Quincy, \$45 1/2 bid, \$45 1/4 asked.

BULLION MARKET.

NEW YORK, Friday Evening, Feb. 22.

The India exchanges in London are still active, and have affected the price of silver, while the higher rate for sterling exchange here has also contributed to the improved figures for this metal, as shown by our table:

DATE.	LONDON.		DATE.	N. Y.	
	Pence.	Cents.		Pence.	Cents.
Feb. 16	51 3-16	112 1/4	Feb. 20	51 1/4	112 1/2
18	51 3-16	112 3/8	21	51 1/4	112 1/2
19	51 3-16	112 3/8	22	51 1/4	112 3/8

BULLION PRODUCTION FOR 1884.

MINES.	States.	Month of January.	Year from Jan. 1st, 1884.
*Belmont	Mont.	\$ 8,081	\$
*Bonanza King, s.	Cal.	56,278	
*Boston & Montana, g.	Mont.	60,305	
*Chrysolite, s. L.	Colo.	4,721	
*Contention, s. g.	Ariz.	80,439	
*Deadwood-Terra, u.	Dak.	49,196	
*Father de Smet, g.	"	25,095	
Grand Prize, s.	Nev.	25,000	
*Homestake, g.	Dak.	104,231	
Horn-Silver, s. L.	Utah.	174,000	
*Iron Silver, s. L.	Colo.	58,995	
*Kentuck, g. s.	Nev.	3,810	
*Lexington, g. s.	Mont.	110,446	
*Little Pittsburg, s.	Colo.	8,588	
Mount Diablo, s.	Nev.	24,820	
*Navajo, g. s.	Nev.	28,840	
*Ontario, s. L.	Utah.	163,576	
*Oxford, g.	N. S.	3,060	
*Plymouth Consolidated, g.	Cal.	102,438	
*outh Yuba, g.	Cal.	2,040	
Syndicate, g.	Cal.	21,923	
Total amount of shipments to date.			\$1,114,482

* Official. G, Gold; S, Silver; L, Lead.

Foreign Bank Statements.—The governors of the Bank of England, at their regular weekly meeting, made no change in the bank's minimum rate of discount, and it remains at 3 1/2 per cent. During the week, the bank gained £343,000 bullion, and the proportion of its reserve to its liabilities remained at 40 13-16 per cent, against 44 1-16 per cent at this date last year. The weekly statement of the Bank of France shows an increase of 12,801,000 francs gold, and of 2,206,000 francs silver,

METALS.

NEW YORK, Friday Evening, Feb. 22.

Copper.—Since our last report, the market has remained stagnant, sales of Lake Superior being restricted to a couple of hundred thousand pounds at 14½@15c., other brands bringing 14@14½c. The statistical position on this side could hardly be better, but trade recovers very slowly from the prolonged, severe winter, and to a notable extent has been hampered and checked by the inundations. It may take a fortnight or three weeks ere, with the approach of the spring demand, manufacturers may feel induced to replenish stocks of raw material. Should the demand then expected, however, come forward with unusual strength and pressure, as it well may, the healthy position of the metal and the light stocks may warrant an advance in prices independently of the condition of the European market. The latter continues very much unsettled, the last cable quotation from London being £55 10s. @ 56 for Chili Bars. The lowest figure for these within the past ten years was £54. With the increased cost of living and wages in Chili, and the advancing price of coal there, it does not pay to produce copper to be sold in London at such prices, and a curtailment of production on the West Coast beyond what it was last year seems inevitable, greater not unlikely than a possible increase in Andalusia (Spain). The Chilian export last year was 43,623 tons, against 46,224 in 1882; in 1879, it was 53,827. The Spanish export during the first eleven months of 1883 was 21,394 tons of ingot copper against 19,920 tons in 1882; of ore, it was 521,060 tons, against 533,995. Messrs. James Lewis & Son, Liverpool, in their monthly review of February 1st, remark: "We look for a considerable diminution in the arrivals of copper produce from the Western States of America during the next six months, as the long winter there, lasting until June, interferes greatly with the shipment of ore and also with smelting operations." Meanwhile the January West Coast charters were 2800 tons against 2600 in 1883, and 6000 in 1879. Should the money market become easier in London, and a powerful speculation in Chili Bars be inaugurated induced by the cheapness of copper and its sounder aspect this year, such a movement might coincide with and receive support from a rise there in either March or April next. Seldom, indeed, has copper presented such sound elements for a lasting rebound on both sides the Atlantic as it does for the immediate future, unless we are greatly mistaken in our appreciations.

Tin.—This metal has lacked feature during the week and remains devoid of all inherent strength, London keeping between £82 10s. and £83 5s. with Straits, without much consumptive demand, either in Europe or here. A moderate trade has been done here at 18c. large lines Straits, and 18½c. jobbing lots; at these figures, it closes without any marked tendency, being dependent on the London quotations. The Straits shipped to the United States last year 6838 tons, against 6522 in 1882, and 4955 in 1881.

Lead.—Since our last report, some 500 tons additional have been bought by the one party of Common Domestic at 4'10c., making 1400 tons in all thus acquired and held very firmly, so that between this holder and the remaining interests out West lending their support to this advancement of price, the market may be sustained for some time longer, and, for aught we know, even advanced. But the difficulty is, that there is but a small consumptive demand, which may not assume greater proportions for some time to come, causing the outlook to remain precarious and greatly dependent on the spring trade, whether the latter will be early and vigorous enough to force consumers to replenish supplies at a figure which, under prevailing circumstances, they do not look upon as inviting. London cables a weaker market; Common English Pig £11 15s. @ £12. Spanish export during the first eleven months of 1883 has been 116,341 tons, against 106,972 in 1882.

Messrs. John Wahl & Co., of St. Louis, send us the following dispatch to-day: A dull and easier feeling has prevailed since we reported a week ago. Business has been quiet and of a limited character, with quotations at 3½c. for Refined and Hard lead; there have been sold about 100 tons of each.

Spelter.—Nothing new has transpired as to this metal, which only moves off in small amounts at 4¼

@4¾c., Common Domestic Silesian being nominally worth 5@5½c. Sheet-Zinc is jobbing at 5½c. Spanish Calamine exportation during the first eleven months of last year was 28,639 tons, against 24,597 in 1882. London is steady at £14 15s. Silesian.

Antimony is quiet, but supported, at 11¼c. Hallett's, and 12c. Cookson's.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, Feb. 22.

American Pig.—There has been a better business this week, and we understand that the Thomas Company have made some large sales, on a basis of \$20 for No. 1 Foundry, and \$19 for No. 2. It claims to have increased its price fifty cents per ton. Outside of this company, business has been dull, other companies not being disposed to accept season contracts at present ruling prices. Many of the furnaces throughout the country are out of blast, and the production, of course, is very much restricted.

The general impression seems to be that the market is more likely to decline than to rise just at present. We hear that the Crane Company has sold about 25,000 tons at \$21 since the first of January. Two or three additional furnaces have gone out of blast, the Glendon being one, and the production, in consequence, is more restricted than ever. We quote: No. 1 Foundry at \$20.55@21; No. 2, \$19@19.50; and Gray Forge at \$17.50@18.50. Bessemer Pig remains quiet at \$19.50@20, and 20 per cent Spiegel is selling at \$28.50@29 ex ship.

At the Metal Stock Exchange yesterday, the following transactions were recorded: 100 tons American No. 1 pig, March, at \$19.13; 100 tons American No. 1 pig, May, at \$19.50; 200 tons American No. 1 pig, April, at \$19.25; and 200 tons American No. 1 pig, May, at \$19.50.

Mr. Edward J. Shriver, Secretary of the Metal Exchange, has published the following returns: 235 furnaces, all kinds; 58 in blast, 177 out of blast.

Scotch Pig.—The market is very quiet but firm. Some 500 or 600 tons have been sold during the week at full prices.

We quote ex ship and to arrive: Coltness, \$22.50 @23; Langloan, \$22.25@22.50; Summerlee, \$21.50; Dalmellington, \$20.75; Gartsherrie, \$22.50@23; Eglinton, \$20.25; and Glengarnock, \$22.50@22.

Steel Rails.—We learn of sales amounting to about 14,000 tons during the past week, at different prices. The market is firm, both sellers and buyers seeming indifferent to do business at present figures. The price \$35 at the mill continues and is firm at that figure.

Old Material.—This trade continues very dull. Importation has about ceased, as it is impossible to obtain prices that would cover the cost of bringing it here. We quote nominally at \$31@31.50 for Ts. Wrought scrap has been in more demand than of late, and there has been an improvement in the amount of business.

Philadelphia. February 21.

[From our Special Correspondent.]

Pig-Iron.—The market demand for crude iron grows very slowly, and as a rule the transactions for the past six days were smaller, especially for Foundry iron. Large buyers are likely to close contracts in the course of ten days for large lots of Forge iron, and it is said at lower prices than have been named, taking into consideration the brand; \$18@18.50 represents the selling price of most brands. Some of the special makes have been moving more freely than a week ago, but at slight concessions. Makers of iron have been predicting all along that every week would strengthen the market and increase demand; but this prediction has not yet been realized. There are large buyers in the field, but they will not purchase at sellers' prices; \$17.50@17.75 has been offered for Forge in large lots; \$18.25 asked. Several small lots of Foundry sold at \$21.50; No. 2 sold at \$20. The lowest price for Gray Forge was \$17.50 for inferior makes.

Foreign Irons.—A few lots of foreign have been purchased at New York this week. The prices asked for spiegeleisen are too high to permit of much business on a large scale. There are plenty of buyers to be stirred up if prices suit. Spiegeleisen is quoted at \$28@29, and Bessemer \$20@21. Ferro-manganese, 45 per cent, \$45.

Blooms.—Charcoal quotations are \$55 to-day, and anthracite, \$45.

Muck Bar.—Offers were made this week at \$31.50, but not taken.

Merchant Iron.—The general condition of the merchant iron trade is better this week than it has been for a month. Buyers seem to have settled down into buying all they need at steady prices, averaging 1'85 @2'10c., according to quality and size of order. The tone of the market is strong, but there is no inducement to buy ahead. A few more puddling-furnaces have been fired up, and some idle rolls have been set to work in country mills.

Plate and Tank Iron.—Manufacturers report a quiet and steady movement of plate iron at old figures.

Sheet-Iron.—The week has not brought out the expected demand from large buyers, who it was thought would place orders for galvanized considerably in advance of the season; but all mills are turning out the usual quantity of work, which is promptly absorbed on orders.

Wrought Pipes and Tubes.—There is no change in quotations, and a small business is reported. Some manufacturers report indications favorable for large business in March. Makers of cast pipe are in negotiation for large quantities of cast pipe, for deliveries before the middle of March.

Structural Iron.—The business transacted at the structural mills last week was of the usual retail character. The statement is reaffirmed that large requirements are soon to be placed, but manufacturers decline to give any details until negotiations are consummated. No change in quotations, and no room for any. The lowest figures have been named within two weeks on bids that have been named for two or three years.

Nails.—Nails are quiet at \$2.50@2.60, but less than the average amount of business has been done, because of bad roads, and the expectation which the jobbers have of a further weakness when the strikes are over, and the Western mills take to sending their surplus stock East.

Steel Rails.—The prominent Pennsylvania companies have positively refused to take business under \$34, and are not anxious to crowd business at that price. Small lots are firm at \$35.

Old Rails.—As high as \$23 has been paid for small lots of T rails; large lots are wanted at \$22.50. A great deal of old material is wanted, but there is considerable higgling over prices.

COAL TRADE REVIEW.

NEW YORK, Friday Evening, Feb. 22.

Anthracite.

The situation of this trade remains about in the same condition as last week, and there is but very little to report. Business is very quiet. It seems to be the prevailing opinion that the future of anthracite coal depends largely upon what the facilities will be for its distribution through the new Western and Northern markets. That this demand is constantly increasing, every person interested in the subject well aware. Up to the present time, it has been more a matter of delivering the coal than securing orders for it. If the surplus which threatens to be thrown on the hands of the anthracite managers by parties changing to bituminous coal can be disposed of by more fully developing the new markets that are waiting to be opened, no great harm can result. At the same time, the situation is such that it will require the best management on the part of the inside magnates to keep the market on a steady basis. We think that, having the general good of the market in mind, the first thing that can be done is to start the year conservatively on a low and inviting rate of prices for the early buyer.

We understand that the Reading Company is building a great number of new cars, and the other companies we presume are doing the same, to move greater quantities of anthracite coal West.

Bituminous.

A very large business has been done during the week in bituminous coals, and both the Clearfield and Cumberland operators are showing great activity in canvassing the market. Extraordinary inducements have been offered to buyers to close contracts. This condition of affairs does not seem to have been checked by the announcement of an agreement reached between the Baltimore & Ohio and the Pennsylvania railroad companies as to the rates to be charged for transportation over their respective

roads. In fact, since the announcement that this agreement was made the activity of the sellers has been increased rather than checked, and large lines have been placed at prices that newly announced tariffs would not permit to be made. The conclusion is inevitable that the old, old story is repeating, and that under cover of the old dodge of contracts registered prior to the date of the agreement, new buyers are supplied at figures not in advance of those made before this very harmonious understanding was reached. On the day that the higher railroad tariffs were announced to go into effect, Clearfield succeeded in placing 30,000 tons with the Pittsburg Railroad, followed on the succeeding day by a sale, by one of the Cumberland producers, of a considerable quantity, said to be 40,000 tons, to the Boston & Lowell road. It would appear that the railroad companies themselves have no more respect for their agreements than the experience of the past few years leads the public to entertain. Considerable progress has already been made in placing bituminous where hitherto anthracite has been exclusively used, and the indications are, that the amount of consumption that will be transferred from the latter this year will be very considerable.

Mr. John H. Jones, official accountant, has published the following statement of the anthracite coal tonnage for the month of January, 1884, compared with the same period last year. This statement includes the entire production of anthracite coal, excepting that consumed by employes, and for steam and heating purposes about the mines:

	January, 1884.	January, 1883.	Difference.
Philadelphia & Reading Railroad Central Railroad of New Jersey.....	681,782 02	465,510 15	I. 216,271 07
Lehigh Valley Railroad.....	*.....	304,483 01	D. 304,483 01
Delaware, Lackawanna & Western Railroad.....	†392,832 01	431,577 06	D. 38,745 05
Delaware & Hudson Canal Company.....	‡307,255 18	338,260 12	D. 31,004 14
Pennsylvania Railroad.....	§199,711 15	247,725 10	D. 48,013 15
Pennsylvania Coal Company.....	¶212,323 17	161,858 01	I. 50,465 16
New York, Lake Erie & Western Railroad.....	||88,611 16	102,753 04	D. 14,141 08
Total.....	1,899,572 00	2,075,745 19	D. 176,169 19

* Included in tonnage of the Philadelphia & Reading Railroad.

† This amount includes the production of the mines of the State Line & Sullivan Railroad Company, amounting to 8287-03 tons.

‡ In addition, there were 26,327 tons transported from the mines by the Delaware & Hudson Canal Company, which are included in the tonnage of other interests.

The stock of coal on hand at tide-water shipping points, January 31st, 1884, was 637,987 tons; on December 31st, 1883, 748,330 tons; decrease, 110,343 tons.

Philadelphia. February 20.

[From our Special Correspondent.]

No activity is to be reported in the anthracite coal trade this week. Stocks at Port Richmond are between 157,000 and 160,000 tons to-day, made up of individual stocks and Reading stocks. This is an evident increase, and a greater or less increase is reported at other shipping points. The half-time output is found to be more than equal to the current requirements. Speaking of probabilities, the Reading authorities say that the half-time production will be disposed of with difficulty; that there are a great many inquiries, but they are not accompanied by orders. The bituminous coal trade is becoming a factor in the anthracite trade problem, especially with regard to supplies of broken. A 100,000-ton bituminous contract was recently placed in Boston, and statements have come to hand concerning the placing of over 50,000 tons additional, 20,000 tons to the Merrimack Company, 20,000 tons to the Pacific, and 20,000 tons to Warner & Co., besides various other 5000 and 10,000-ton lots. A large number of very important negotiations are in hand. The bituminous coal men are determined to capture as much of the anthracite trade as possible, and have already made a good start. Last year, coal, f. o. b., was \$3@3.25; this year, it figures back to \$2.60, after taking out cost of transportation from shipping ports to Boston. As to the relative merits of pea and buckwheat, with regard to broken and to soft coal, there is some differ-

ence of opinion, but, with the present great difference between prices of broken and bituminous coal, it is clearly to the advantage of the consumer to use the latter. Rates have not yet been fixed upon by the companies; but the belief is very strongly entertained that an understanding has been arrived at, especially as some parties seem to feel safe in placing large contracts for delivery in Boston at \$2.60. Some years ago, the Reading Company inaugurated the system of "consumers' contracts," by which supplies for manufactories were carried at a less rate. It is thought that the competition of bituminous coal will lead to a revival of that system, although the Reading Company has said nothing about it. The bituminous operators know that they must sell coal down to the lowest possible limit, and have started in with the determination to secure as much trade as close cutting can obtain for them. If these figures should be continued throughout the season, as it is probable that they will be, bituminous coal will control its full share of the business. Coal, f. o. b. Baltimore, \$2.60. There is a slight falling off in the demand for the domestic sizes of anthracite, and the local trade is rather dull, the weather being fine. The line trade is abundantly supplied. Inquiries from the West are coming along slowly. There is no urgent demand as yet, although the companies here are confident that in due time the Western requirements will be found to be up to their expectations. A good deal of interest is felt in the outcome of the influences now at work. The market for anthracite is now so extended that the placing of contracts for bituminous here and there will have no influence upon the trade.

Pittsburg. February 20.

[From our Special Correspondent.]

Trade at this point has been more deranged by the floods than I at first anticipated. In the first place, local demand is very slow to reach its former condition, inasmuch as the mills find themselves unable to resume as promptly as they hoped. The receding water has shown damage to foundations, furnaces, machinery, etc., unexpectedly great. This damage is now undergoing repair. A few of the larger mills have started up, and the rest are either idle or working short time. This restricts demand greatly, and railroad coal is slow and dull at 5½@5¼c. for lump on the wall. No improvement is to be looked for until business at the mills resumes its normal state.

River trade is somewhat better with the greater number of the pits at work. The spring run, which is usually a matter of three months, will this year hardly occupy sixty days. This is owing to three causes—big stocks already below, low prices in the markets, high prices for mining. The miners in the third pool are still holding out against the operators. The latter will not pay over 3¼c.—¼c. below the district price. A few of the pits only have accepted the lower rate. During the week, 1,700,000 bushels have gone down the river, two thirds of this to Louisville, and the rest to Cincinnati. This leaves 1,000,000 in the pools and at the lower landings, a smaller amount than has been on hand for ten years.

As to coke, there is a slightly better feeling, but no change in prices. A proposition made public lately, to benefit the trade, has for its feature a proposal by small operators to the larger concerns. This is, that the latter handle the coke of the former on a commission, and charge a certain price to the consumer. This proposition or scheme has fallen through. A leading operator states that nothing can help coke but a better iron trade, and that this not being forthcoming, low prices must rule. There does not seem to be much hope for the smaller coke makers. Prices steady, at \$1@1.25 per ton, free on board; crushed, \$1.75 per ton.

The disaster at Leisenring, Fayette County, yesterday, by which nineteen miners lost their lives by an explosion of fire-damp, excites a good deal of interest here. It is the first disaster of the kind and magnitude that has taken place in this vicinity during the present century, and turns the attention of both miners and operators to the condition of their pits. The Leisenring colliery is in the soft or coking coal district, where the vein is from 8 to 11 feet thick.

Lake contracts are still in *statu quo*, and the prospects for the securing of such are sadly interfered with by the attitude of miners here and competition at other mining points. In a week or two, matters may change for the better, but present prospects are not bright for the Pittsburg operator.

Buffalo. February 21.

[From our Special Correspondent.]

The anthracite and bituminous coal trade continues without noteworthy incidents relative to supply, demand, stocks, or prices. This section of country has not suffered in any way from freshets, floods, etc. The alteration of warm days with subsequent frosty periods has kept matters quite equitable; hence our safety.

In view of the competition in the coke trade from other sections, the rate of freight to this point from the Connellsville District has been reduced 35 cents a ton. The distance hence to Connellsville is 294 miles; to Reynoldsville, about 194 miles. The freight from the former point was \$3.35; now it is \$3 a ton. The rate now from Reynoldsville to Buffalo is \$1.50 a ton. If distance were taken into consideration, a still further reduction could be made, say to \$2.25 a ton from Connellsville, to equalize mileage. Probably another concession will be found necessary unless the superiority of the Connellsville coke enables the price to be kept up to the present figures.

The President of the Merchants' Exchange has appointed the following persons the Coal Committee of that institution: Messrs. T. Guilford Smith, Andrew Langdon, J. J. McWilliams, F. A. Bell, and Horace A. Noble. These are well-known merchants, and will doubtless make a good record.

The receipts of the Lake Shore & Michigan Southern Railroad for the week ended Saturday last were 476 tons; 96 tons for Buffalo and 380 tons for through shipment.

The following statement was telegraphed from Philadelphia a day or two since, to one of our local newspapers: "The Philadelphia & Reading Railroad Company is now having 1500 cars constructed of a capacity of fifteen tons each. The most of these are to be used in the transportation of coal to Buffalo. The officers of the company state this is an extra preparation of equipment, and is absolutely necessary to meet the enormous demands that will be made upon the company for coal this year. This is an increase of 856 cars over the number that were built last year. An officer of the company states that the suspensions in mining adopted by the coal combination for the regulation of supply and demand will be continued until the 1st of April. The total amount of coal mined by the company in 1883 was 4,582,667 tons, and it is fully expected that the amount mined this year will reach 6,000,000 tons. Its plans are to gradually increase the output until in three years it shall have reached the enormous figure of 10,000,000 tons. This will necessitate new openings in the southern anthracite fields where only the overlying veins have been worked. Shafts will be sunk to the depth of 1500 feet, and the Mammoth vein found is of an average thickness of 40 feet. The officers of the company state that, notwithstanding the amount of coal that has been taken out of the anthracite fields, it still has an inexhaustible supply to draw upon, and mention a stretch of 26 miles of comparatively virgin lands in Schuylkill County which are underlain by the Mammoth vein. Ex-President Gowen of the Reading Company contends that the Schuylkill coal region is inexhaustible, and that, when other anthracite fields have been despoiled, this region must supply the market. The company is preparing to meet the increased demand for coal by the employment of machinery which will not only facilitate production, but lessen the cost of mining. It is estimated that the losses in mining anthracite coal are from forty to forty-five per cent of the output, and it is proposed to lessen this to thirty per cent. It is also contemplated to reduce the cost of production from \$1.49 per ton, the cost in 1883, to \$1.14, the cost in 1879."

I briefly gave your readers a suggestive or prophetic paragraph last month, relative to the probable purchase by the New York Central & Hudson River Railroad Company of the only available water frontage now left in our city not owned by railroad corporations. From the testimony given by Mr. James Tillinghast before the referees appointed to appraise the value of some of this property, it was shown that the aforesaid railroad wishes to secure 120 acres of land (with many buildings thereon), with over one mile of water frontage, which, if laid out on the same plan as its Sixty-fifth street docks in New York, would give nearly five miles of dockage. It appears that 20 feet depth of water could be obtained, without striking rock, clear out to Lake Erie,

inal, \$1.75; Newport News, \$1.25; Richmond, \$1.35; Bay of Fundy, \$1.60@1.65; Cape Breton, \$2.25.

Retail trade is dull, and prices are not so firmly held. Our inside quotations of \$6 on white ash stove and \$5.75 on furnace and egg could be readily had.

Table with 2 columns: Item description and Price. Includes White ash, Red ash, Lorberry, Franklin, Lehigh, etc.

The fashion of burning wood in open grates has materially reduced the sale and importation of cannel coal. Dealers predict, however, that the annoyance of tending a wood fire, together with the fact that wood costs more to burn in this way than cannel coal, will after a while bring the consumer back to the latter.

Chicago. February 20.

[From our Special Correspondent.]

There has been little change in the situation since our last review of the market at this point. Trade has run along in just about the same channel as during the month of January and the early part of the present month.

Your correspondent has met with considerable objection to the impression carried by a recent letter in which the question of the stocks of anthracite on hand in Chicago at the time the report was written, and the probability of carrying over a surplus of some size the coming spring, was discussed.

I shall have more to say on this point in my next. The circular remains unchanged. The bituminous coal market continues dull and flat for nearly all grades.

Cincinnati. February 20.

[From our Traveling Correspondent.]

The angry waters have receded until nearly within the channel proper. By the end of this week, the coal elevators will probably all resume. The damage sustained can scarcely be computed, but is very serious.

The event of the year, so far, with the Western trade, is the recent "cut" on "Pittsburg" in the Chicago market. With Pittsburg lump selling at \$3.50, o. n. t., it would seem to be impossible for Hocking Valley to bring over 75c. a ton at the mines, a discouraging fact for both operators and workmen in that

region. Should this \$3.50 rate on Pittsburg be kept running for any considerable time, it must seriously affect the price of nearly all coals sold in the Northwest market. It is to be hoped, however, that the Baltimore & Ohio and its rivals will be able to come to an understanding and living rates be restored. News from Pittsburg says the mills and glass-works will all resume this week, and also all the mines except some few where the proprietors insist on mining below the district rates.

STATISTICS OF COAL PRODUCTION

Comparative statement of the production of anthracite coal for the week ended February 16th, and year from January 1st:

Table with 5 columns: Region, Tons of 2240 LBS., 1884 (Week, Year), 1883 (Week, Year). Includes Wyoming, Lehigh, Schuylkill, Sullivan regions.

* Included in tonnage of the Philadelphia & Reading Railroad.

The above table does not include the amount of coal consumed and sold at the mines, which is about six per cent of the whole production.

Table with 2 columns: Total same time in 1879, 1880, 1881, 1882 and corresponding tonnage.

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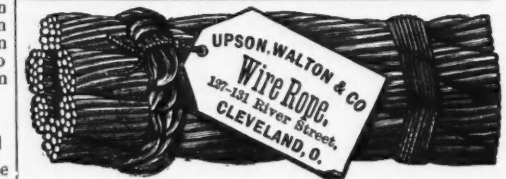
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