New Shafts not yet Completed.

Wilkes Barre Coal and Iron Company's, No. 14, shaft near Gaylord slope, Plymouth, Pa. This is a large shaft and is intended to work the Red Ash seam, and to be connected to the Nottingham shaft where the seam is being worked.

Hollenback Shaft is located within Wilkes Barre city limits, a short distance east of Market street, near the P. R. R. This shaft will penetrate the Baltimore seam, in the early part of 1874.

South Wilkes Barre Shaft.—This shaft is intended to win the coal of the Baltimore seam, which is thought to lie at a depth of about 500 or 600 feet. It is also intended to commence a second shaft at a distance of 150 or 200 feet west of the present shaft for a second opening to the former.

Audenried Shaft.—This shaft, although the sinking has been completed, will not be ready to hoist coals for some time to come, as it needs timbering and lining beside, that there is no coal breaker yet ready. This shaft is the deepest in the Wyoming valley—the Dundee not excepted—the latter being 810 feet and the former being 892 feet. The plan of the proposed breaker indicates that the coal will be hoisted over one hundred feet above the pit mouth, making a total hoist of over 1,000 feet; the hoisting to be done with first motion engines.

Riverside Coal Company's New Shaft, near Port Bowkley slope, Plainsville.—This shaft was commenced in 1872, but operations since suspended have just been again resumed. It is now in contemplation to continue sinking until it reaches the Baltimore seam, which lies at a depth of several hundred feet below the surface at this point.

Susquehanna Coal Company's Shaft, at East Nanticoke.—Shaft No. 1 is located a short distance south of the village of Nanticoke, and alongside that branch of the Susquehanna railroad connecting Nanticoke, New Port and Wilkes Barre. The said shaft is 42 feet 4 inches by 13 feet 4 inches, to be divided into suitable compartments. It is calculated that this shaft will cut the Baltimore seam at the depth of about 700 feet, and then to continue one part of said shaft still downward until the Red Ash is reached, getting a second opening for the Baltimore seam by connecting with No. 2 slope, and for the lower seam by driving up to No. 1 tunnel workings.

No. 2 Shaft.—This shaft is located a few hundred yards north of the old mill, and close to the pond connecting with the water of the Nanticoke dam. Some dredging has been done, no doubt preparatory to bringing in their canal boats to this point. It is intended that this shaft also be sunk to the Red Ash seam, but it will not require so deep a shaft at the point where No. 2 is located as it will where No. 1 is located, as some of the overlying strata at the latter place is missing at the location of the former.

Luzerne Coal and Iron Company's Oakwood Shaft.—This shaft is intended to be a second opening for the Prospect shaft, and is down at present about 300 feet; will probably reach the Baltimore seam in 400 feet more, or a total depth of 700 feet.

Northern Coal and Iron Company's New Shaft, near No. 3 Shaft.—This shaft is intended to serve for a second opening for No. 3 shaft, and may be completed during 1874.

Old Shafts Being Sunk Deeper.

Northern Coal Company's No. 4 Shaft, Swetland.—The company is having things prepared for the purpose of sinking this shaft from their Bennet or Baltimore lower bed to the Red Ash seam, a distance probably of about 300 feet or over.

therefrom to fall and intermingle with a current of fresh air, and be drawn into their other workings.

ASHLEY COLLIERY FIRE.—This colliery has been the scene of a serious fire this year, necessitating the flooding of that portion of the mine where it occurred, called No. 3 slope, being the deep workings on the Baltimore seam. This fire occurred, it is stated, from the gas igniting from a miner's lamp; he having, a short time previously, fired a blast, and on his return to the face of the gangway, where he worked in company with his laborer, the gas ignited along the roof, and all efforts towards extinguishing it failed, on their part. They then went out of the mine to report and seek assistance. In their excitement they forgot to call upon, and inform another party of men driving a gangway and air-way in an adjoining part of the same mine; and it was with great difficulty that those men made their escape, the gas affecting them so seriously that two of their number were left prostrated on the gangway, while the other two went wending their way, as best they could, to escape its deadly contact, and to send succor to their dying comrades. Fortunately they were met on the way by a fresh gang of men from the surface, and assistance rendered just in the nick of time to save the whole party, thus averting the loss of any human lives in this catastrophy. It was found that the fire had made such headway that the only way to be certain of its speedy extinguishment was in the flooding of the deep slope where the fire existed; an operation requiring some weeks of time, to say nothing of the many months of time to be taken in pumping the same out of the mine to enable them to resume mining operations again.

Mine Improvements.

Improvements in mining, as in other branches of business, have been very limited in 1877.

MALTBY COLLIERY.—C. S. Maltby has not done anything towards completing his circular shaft, but has erected a new breaker near the old shaft. North-easterly from the same, a new shaft is being sunk to be used as a second opening, pumping, and ventilating shaft, in conjunction with the old one. Also, he has driven the tunnel on the mountain side further on, and penetrated the Cooper, Bennett, and Ross seams, some of which, it is said, are in very good condition. It would appear, from the very extensive improvements going on at this colliery, that it is destined to be one of the finest on that side of the river. There is about 600,000 feet of lumber in the said new breaker, and contains, it is claimed, all the modern improvements to be found anywhere in said branch.

No other improvements of importance were done in the district during the year.

Second Openings.

The Conyngham shaft, Delaware and Hudson Canal Company, the Nos. 1 and 2 shafts of the Susquehanna Coal Company, are the only shafts now

We know but little in this country about the worst kind of danger from gas explosions—caused from the sudden liberation of large quantities of explosive gas, whereby a whole side or section of a mine is flooded. This takes place where the mines are very deep, and the gas pent up, under heavy pressure. Such cases are of frequent occurrence in Europe. A safety lamp, in such cases, is the only hope of the miner, and that only under favorable conditions. We are very free from this danger, and working mines on longwall system, another evil.

Mine Improvements.

For several years past, mining improvements already commenced have been suspended, and those in contemplation postponed, but the great and sudden change that took place in the coal business during 1879, with its unprecedented increase in the production of coal, caused a stir in the matter of mine improvements, as it is well known that with having done so little dead work since 1873, and with the prospects ahead of mining from twenty-three to twenty-five millions of tons of anthracite coal for 1880, and an increase afterwards yearly during the period of time required to produce, as it certainly will be, another general business stagnation, if not a panic, then I say our coal men see at a glance that the sooner they get to work on improvements, the sooner they will be able to take part in the increase above mentioned. Knowing that it is necessary to do so, in order to keep their capacities even up to an ordinary production, much less the apparent increase. Hence, I say, the work of sinking shafts, erecting breakers and new machinery of various kinds, has been resumed.

Salem Coal Company, Shickshinny, has driven a new, tunnel to reach a basin or trough of coal dipping westward, and disconnected from their former workings by a rock fault, and which is claimed will enable them to mine considerable coal in time to come.

SUSQUEHANNA COAL COMPANY.—The most important of the improvements made by the above company that I know of, is the erection of two new fans, and a new breaker under way. A fan, twenty feet in diameter, was placed adjacent to the one previously located near No. 2 slope, to assist in the ventilation of No. 4 and No. 2 slope workings, and the old mines. This fan, at first, did not operate satisfactorily, but after that they separated the air passages, so that each could work independent, then it gave more satisfactory results. The other fan was located near the same place, and was of the same dimensions, but it is to ventilate the upper seam operated in the No. 1 shaft, which was formerly ventilated by the fan located at the shaft head, but which may now be used exclusively for the lower seam, where they are driving out for a second opening, and confining themselves to the number of "not exceeding twenty persons" employed there at one and the same time, as per last decision of his honor, Judge Harding. A new fan is soon to be placed near No. 1 slope, twenty-five feet in diameter, to ventilate No. 2 shaft mine.

new double fan was erected to supersede their old furnace. The fans are seventeen and a half feet in diameter, and fastened on the same axis, about eight feet apart; a plan of which is kindly furnished for this report, which can be seen in connection with the report of tests of the fan.

The breaker formerly at Young's slope was removed and erected at the Conyngham shaft. It was completed by August 13, when they began shipping coal. When the colliery is fully opened they will be able to put out about seven hundred tons of coal per day. About twelve years have elapsed since ground was first broken to sink this shaft.

Susquehanna Coal Company.

A tunnel was driven in No. 1 slope, from the Red Ash seam to the Ross. Its length is four hundred and eighty-seven feet, and size seven by ten feet. The coal is thin, but of good quality. Another tunnel is in progress lower down on the dip, in No. 2 shaft, to cut the same vein. A slope is also in progress of sinking in this shaft, towards the basin. It is down, at this writing, four hundred and eighty feet from the gangway level, near the bottom of the shaft, on a varying grade of from seven to twelve degrees.

Kingston Coal Company.

This company's new shaft, at Kingston, is down to the Red Ash vein, and has cut, in all, five seams of good workable coal. The Red Ash, at the point cut, is six feet thick. A tunnel was driven in No. 1 shaft, from the Cooper to the Bennett seam, which is ten feet thick, and has opened a convenient section of coal of good quality. The tunnel is two hundred feet in length.

Gaylord Coal Company.

The Gaylord shaft is completed to the Red Ash vein, and has cut three veins hitherto not worked in this track, viz: Bennett, Ross, and Red Ash seams. They are now working to effect second openings, which will be accomplished in about three months. The shaft is forty-seven by twelve feet area, and five hundred and seventy-five feet in depth. There are two pairs of hoisting engines and four cages—all of the latest and most approved plans. The coal will be shipped through the old Gaylord breaker, and will eventually be able to ship about twelve hundred tons per day.

Franklin Coal Company.

In the Brown slope a new tunnel was driven from the Baltimore to the Red Ash vein, and a new plane was made in the former to let the coal down from the upper lifts.

W. G. Payne & Co.

In the East Boston mine a new tunnel was driven from the Bennett to the Cooper vein, which is one hundred and fifty feet in length, and fourteen by six feet area. The seam is six feet thick, and the coal of excellent quality.

proved that a volume of 1,800 cubic feet of carbonic acid gas, per minute was generated, and that there must be a brisk fire existing somewhere in the mine to produce such a large quantity. Shortly after the temperature rose so as to verify our apprehensions. At the South Wilkes-Barre colliery, and also at the Nanticoke collieries, the instrument is used to ascertain the percentage of fire-damp in the air of each split, and it enables them to regulate the air so that the gas can be diluted evenly in the different air currents.

AN AUTOMATIC CAR TRANSFER SYSTEM.

A drawing is here presented showing an automatic system for transferring cars from the shaft-head to the breaker dump at the Baltimore No. 2 shaft of the Delaware and Hudson Canal Company. It has been in operation for about one year, and works satisfactorily. This was designed by Mr. C. H. Scharar, chief engineer of the coal department, who kindly consented to have it appear in this report. It explains itself, and can be easily understood from the drawing.

THREE NEW COAL BREAKERS.

Three new breakers were erected in this district during the year 1892. The first one completed was that of the Susquehanna Coal Company, a short distance north of their No. 1 shaft at Nanticoke. It is to prepare the coal previously shipped through the old No. 2 breaker, now abandoned, and is known as the No. 7 breaker.

The second was the No. 5 breaker at the South Wilkes-Barre colliery of the Lehigh and Wilkes-Barre Coal Company. This breaker was completed in the latter part of September, and has been operating successfully since.

The third is the No. 4 breaker of the Kingston Coal Company, erected to replace and do the work of the two breakers burned May 5, 1891. This new breaker started to prepare coal for the market in December, 1892.

The three breakers are large structures, equipped with the latest and most efficient machinery, and on the most approved plans for the purpose of cleaning and preparing a large production of coal. They are safe for the employes, and heated comfortably by steam. The stairs and machinery are well guarded, so that no one can be hurt inadvertantly.

RECORD OF COLLIERY IMPROVEMENTS DURING 1892.

The spirit of improvement was active during the year 1892 in this district, and a detailed account of its work is shown in the following:

Improvements by the Lehigh and Wilkes-Barre Coal Company.

At the Hollenback No. 2 colliery a new fan was erected to ventilate the new Red Ash seam workings. It is 35 feet diameter, and in run-

At the Pine Ridge colliery a new double fan was erected to ventilate the workings of the Hillman and the Baltimore seams. The old fan was removed and the new one was placed at a distance from the shaft, so as to insure its safety in case the breaker takes fire. A passage is made, underneath the surface of the ground, leading from the shaft to the fan, through which the return air passes. This is arched by mason work, and is of sufficient area to pass a large quantity of air.

The Susquehanna Coal Company.

This company is making preparations to mine a large quantity of coal at the Newport colliery. A brief note was made of it in my previous report. The shaft is now at a depth of four hundred and ninety-five feet, having passed through four seams of workable coal, aggregating a thickness of twenty-six feet. A tunnel is also being driven which has reached a length of nine hundred and forty-two feet, having cut through three seams of coal in the first five hundred and eight feet; at which length it also cuts a fourth seam on the anticlinal axis, the thickness of which is not yet determined. The tunnel is continued across a small basin where more seams of coal are expected to be found.

Prepartions are in progress also to sink a slope to work the upper seams. The open cut and a short tunnel to an eight-foot seam is driven, and the slope will now be sunk in that seam, which promises to produce good coal. The coal from all these openings will be shipped from one breaker, which is now being erected, and bids fair to be the largest structure for the purpose ever erected in the anthracite coal region.

The No. 1 shaft, at Nanticoke, was extended from the Hillman to the Red Ash seam, and they are now driving a second opening, which is to be effected by holing into the workings of the No. 2 shaft.

A new fan was erected to ventilate a part of the workings of Nos. 1 and 2 shafts; the details relative to this may be seen in the table of new fans presented in this report.

The Delaware, Lackawanna and Western Railroad Company.

A new air shaft was sunk at the Avondale colliery of this company with the view of placing a new fan upon it to improve the ventilation. Its size is 12′×26″ and its depth to the workings of the Red Ash seam is two hundred and forty-one feet.

The No. 1 Woodward shaft is now at a depth of eight hundred and fifty-one feet, and is still being sunk. The No. 2 was sunk to a depth of one thousand and three feet, where it cut the lowest seam of coal supposed to be in the property. These shafts pass through several excellent seams of coal, and the capacity of these openings, when ready for mining coal, promises to be very large.

The Pettibone shaft is still in progress of sinking and has reached a depth of three hundred feet.

Lehigh and Wilkes-Barre Coal Company.

At the Empire colliery of this company a new fan was erected on the No. 2 shaft, which is 24 feet diameter, and produces a ventilation of 145,000 cubic feet of air per minute, running 70 revolutions per minute. A tunnel was also driven, for the purpose of ventilation and haulage, from the bottom to the top split of the Baltimore seam. It is 100 feet long and has a sectional area of 84 square feet. The South Wilkes-Barre shaft is continually sinking, and is now at a depth of 500 feet. The arrangement of the head of this shaft is very good; is heated by steam so that no ice forms in winter, and is thus kept in much safer condition than if ice was formed.

Delaware and Hudson Canal Company.

One of the new shafts at the Baltimore slope is sunk from the surface to the Red Ash seam, where it is found at a depth of 400 feet. The coal is fair and about 10 feet thick. They are now driving toward the other shaft, which will soon be sunk to the same vein, and by which a second opening will be effected.

Susquehanna Coal Company.

A number of improvements, such as tunnels and planes, were made in the mines of this company. In No. 4 slope two planes were made; one is 500 feet long, and the other 800 feet. These will facilitate the haulage of coal, and also enable them to mine coal which could not be reached otherwise. The slope was also extended a distance of 1,060 feet.

In the No. 1 slope a tunnel was driven from the Red Ash to the Ross and Twin veins. It is 9×14 feet area, and has a length of 1,150 feet.

Kingston Coal Company.

At the No. 4 shaft, this company erected a new breaker, which is nearly completed. It is a very large structure, built with a view of preparing the coal of the Ross and Red Ash seams. It will be heated throughout by steam, a new feature in coal-breakers, and for this purpose seven thousand feet of wrought-iron pipe were used in making the heating apparatus. It will be ready to ship coal early in 1886.

A new fan was erected on the No. 4 shaft. It is 24 feet diameter and running 60 revolutions per minute, gives a water gauge pressure of 1.10 inches and 14,000 cubic feet of air. The engine is horizontal, direct-acting, and the cylinder is 18-inch diameter.

Hillman Vein Coal Company.

At the Hillman shaft of this company a new upcast was made having an area of 150 square feet, and a new 24-foot fan was erected upon it. This fan, running 75 revolutions per minute, produces a pressure equal to 1.75 inches water-gauge and a ventilation of 180,000 cubic feet per minute of air. The engine is 15×24 inches and is direct acting. They are driving

Colliery Improvements During 1886.

The desire for improvement was not very active during the year 1886. The demand for coal and the price received for it were not such as would encourage expensive outlays to obtain it. The improvements, therefore, were confined chiefly to what was necessary to maintain the existing production.

Susquehanna Coal Company.

At the No. 1 deep shaft of this company a new fan was erected, twenty-five feet diameter, and of the Guibal pattern. This was found necessary to ventilate the workings of the red ash seam, which are becoming extensive and require a large volume of air.

In the George seam of the same shaft a slope is being sunk to reach the coal lying below the shaft gangway. The hoisting engine will be located on the surface and the rope passed down through a bore-hole already made for that purpose.

At the Newport shaft a second opening was effected for the upper seam, and another is being driven for the lower seam. The second openings for the tunnel seams and also for the slope were completed.

Lehigh and Wilkes-Barre Coal Company.

The new shaft which is being sunk by this company at South Wilkes-Barre, and which is named Tillinghast shaft, was at a depth of eight hundred feet at the close of the year, having passed the Hillman vein a short distance. It is a large shaft, fifty-two by twelve feet, and located a short distance south-west of the old South Wilkes-Barre shaft; was started in 1884, and operations have been going on continually since.

At the Nottingham colliery a new shaft was started for the purpose of improving the ventilation. It will be divided into two compartments, one an upcast and the other a downcast. It will be used chiefly to ventilate the workings of the Ross vein, which are now spreading extensively.

At the Hollenback colliery an underground slope was completed. The hoisting engine is located on the surface and the rope passed down through a bore-hole. It works admirably. Signals are given by electric bells, and conversation between the engineer and inside men effected by telephone.

Delaware and Hudson Canal Company.

Work is continued in the Baltimore shaft of this company, driving passages toward the No. 2 Baltimore shaft. The latter was standing idle until the close of the year, having been stopped upon sinking it to the rock. It was walled with a thick, cement-laid stone from the rock to the surface, and was left to stand idle for several months after, but preparations are being made now to complete its sinking.

At the No. 3 colliery, at Plymouth, a new fan, eighteen feet diam-

Delaware and Hudson Canal Company.—A new opening was effected for the Conyngham colliery, connecting with the workings of the Baltimore slope, in October, 1887. It provides a convenient escape way for the workmen of both collieries, and makes everybody connected with those mines feel safer in case anything should happen to prevent exit through the main openings.

The No. 2 Baltimore shaft is now at a depth of over 500 feet, and is expected to cut the Red Ash seam at a depth of 670 feet. At No. 3, which is to constitute the second opening, gangways are being driven to open work, and to be ready to ship coal when the main shaft shall be completed

At the Boston mines the fan at No. 3 was applied to ventilate its workings, and it gives fair results. Still the ventilation of this mine is not satisfactory, but when the air-ways are fully prepared, an improvement is confidently expected.

Susquehanna Coal Company.—At the No. 1 shaft of this company two new underground slopes were sunk, one in the Forge seam and the other in the Buck Mountain. To avoid the trouble arising from the heat radiating from the steam pipes, the hoisting engines are located on the surface, and the ropes pass through bore-holes made for the purpose. Telephones and electric bells are used to converse and give signals.

At the No. 6 colliery, Glen Lyon, a new fan twenty-five feet diameter was erected. The engine is 24″x36″, connected directly to the shaft of the fan. It is used to ventilate the workings of the shaft. The second openings for the workings of this shaft are now completed to each of the seams.

Kingston Coal Company—The new breaker erected at the No. 4 shaft of this company was started to prepare and ship coal in October, 1887, and has been running since. It is one of the largest structures in the district. It is heated throughout by steam, and is equipped with the most efficient machinery.

Delaware, Lackawanna and Western Railroad Company.—At the Avondale colliery a new fan was erected on the new air-shaft. It is an open fan sixteen feet diameter, connected with a horizontal engine by belt gearing. Under a ventilating pressure equal eight-tenth inch of water-gauge it is exhausting 137,600 cubic feet of air per minute. A new opening was made from the lower lift of the Red Ash seam to the Ross. It is a rock tunnel 226 feet long on a grade of 18½ degrees and 7x18 feet area. It opens an extensive field of this coal seam.

The new breaker at the Woodward shafts is nearly completed. Four cages are in operation in the main shaft, and workings are being opened in both the Bennett and Red Ash seams. Second openings are being driven in both seams to connect with the air-shaft.

West End Coal Company.—A new fan was erected on this colliery sixteen feet in diameter and connected directly with the engine. It is

which has been idle since 1878. The gangways were retimbered and the tracks relaid, so that the mine is now in shape to produce coal. It is to be hauled to, and shipped through, the No. 18 breaker.

At the Nottingham colliery, in Plymouth, the new air shaft was completed to the Ross seam, and a twenty-four foot Guibal fan was erected thereon to ventilate the workings. A cage and an engine adapted to hoist the workmen was also placed thereon, which proved a relief to both employés and company.

Delaware and Hudson Canal Company.

The new Baltimore shaft of this company was completed to the Red Ash seam, which was cut at a depth of 655 feet. It opens an extensive field of this seam, and the other shaft (No. 2), already working that seam, will be connected to effect a second opening.

At the Boston mine a new seventeen and a-half-foot fan was erected, which improved the ventilation of the mine to some extent. It was located at the No. 3 shaft—too far away to be of much effect as a ventilator of the Boston workings; hence, the result is not quite satisfactory.

The No. 2 shaft of this company, at Plymouth, was sunk from the Cooper to the Bennett seam, and opened an extensive field of that seam.

At No. 3 colliery a slope is being sunk underground in the Cooper seam. The hoisting engine is located on the surface, and the rope passes into the mine through a bore-hole made for the purpose.

Susquehanna Coal Company.

A number of minor improvements were effected at the mines of this company, but I shall note only a few. At No. 1 shaft, in both the Forge and Red Ash seams, underground slopes were sunk, extending to lower levels. The hoisting engines of both were located on the surface, and the ropes pass down through bore-holes.

The No. 4 slope was graded and thereby made to work much more satisfactorily. It is now being extended through the rock into the Hillman seam.

Red Ash Coal Company.

The No. 1 slope of this company was extended and a new pair of direct-acting hoisting engines were placed to hoist therefrom. The cylinders are 28x48 inches, and they work admirably.

At the No. 2 colliery a new slope was made to a length of 750 feet, and a pair of direct-acting hoisting engines were furnished, having cylinders 28x48 inches.

A new sixteen-foot fan was also erected on this mine, which has improved the ventilation to an appreciable degree. The collieries of this company are now in good shape for producing coal for a number or years.

D + H Co.

11′x46½′. The engine cylinders are 26″x48″, connected directly to a cone drum having a diameter of 10′ in center and 6′ at the ends.

At the Conyngham colliery a shaft was sunk from the surface to a depth of 93′ where it penetrated the Hillman seam. It is equipped with a pair of hoisting engines, drum and cages and makes a second opening for the workings of the Hillman seam. The sectional area of the shaft is 11′x25′.

At the Boston mine the underground engine hoisting from the slope was taken out and another to do the same work was erected on the surface. These are a pair of engines having 22″x48″ cylinders, having a parallel drum 7′ in diameter attached. The rope passes over a wheel and down through a bore-hole 8″ in diameter, incased by a 6″ pipe. The slope from which this is hoisting was extended a distance of several hundreds of feet during this year. The temperature of the air in the mine was considerably reduced by the removal of the hoisting engine to the surface, and the condition of the ventilation was much improved.

At the No. 3 shaft a new underground slope was sunk to work coal to the dip from the shaft in the Cooper seam. The hoisting engines were located on the surface and the rope passing down into the mine through a bore-hole. This slope opens a wide range of good coal at a very convenient point to the shaft.

At the No. 5 colliery six new boilers were located at a point convenient for the underground hoisting engines and slope pumps. They were erected on the surface and the steam-pipe passes into the mine through a bore-hole 340′ deep.

Susquehanna Coal Company.

In the No. 1 shaft, Lee vein, a tunnel was driven from the Lee to the Ross seam, a length of 1,460′. Its sectional area is 7′x16′. The second opening will be effected by driving opening to connect with the Ross vein workings of the No. 2 shaft.

The underground slope in this mine was extended to a length of 1,030′, on an average grade of 6½°, which is the average inclination of the strata. The hoisting plant is located on the surface, and the rope passes down a bore-hole 929′ deep. Electric bells are used for signals and a telephone used for conversation between the slope men and the engineer.

A telephone was also placed at the main shaft by which conversation can be held between the footmen and the hoisting engineer.

At the No. 4 slope the main slope was extended through the strata intervening between the Mills and Hillman seams, at a point where a small anticlinal intersected the slope in the Mills seam. The extension was 220′ long on a grade of 15°. Second opening was also effected by driving a passage through the rock on a grade of about 30°.

At the Reynold's colliery a new slope was driven through the rock from the Ross seam to the surface. It is 240 feet in length and 84 square feet area, on a grade of 20 degrees. This is to take the place of the old slope and leads to a new breaker now in course of erection.

Delaware and Hudson Canal Company.

The new breaker at the Baltimore No. 2 shaft of this company was completed and began to prepare coal for the market in the month of November, 1890. This is a new colliery. The shaft is sunk from the surface to the Red Ash seam, a depth of 650 feet, and having a sectional area of 11 by 45½ feet. A compartment having an area of 11 by 12 feet is bratticed off for upcast, upon which a fan 20 feet diameter is erected. There are three cages, two for hoisting coal and one to hoist the workingmen. The coal is hoisted by a pair of engines 26″ by 48″ cylinders directly connected to a conic drum 6 and 10 feet diameters. The men will be hoisted by a pair of engines 18 by 36 inches, geared 4 to 1 to a parallel drum 9 feet diameter. The fan is operated by a pair of engines 14 by 24 inches.

At the No. 2 colliery, Plymouth, a new pair of hoisting engines were erected having cylinders 24 by 48 inches, directly connected to a parallel drum 8 feet diameter. A new fan was also erected to take the place of the old one. It is 17½ feet diameter, operated by an engine 14 by 36 inches. They also added ten feet to the length of the breaker-wings in order to enable them to lengthen the screens used to separate the different sizes of coal.

Susquehanna Coal Company.

At the No. 1 shaft an underground shaft was sunk from the Ross to the Red Ash seam, a depth of 180 feet. It is to be used to hoist the coal from the Red Ash to the Ross level. Its size is 12 by 21 feet. A space of this area was driven up a distance of 35 feet to give height to land the cages. The hoisting engines are located on the surface, from which the ropes pass down through bore-holes 950 feet deep and eight inches diameter. Another hole of the same diameter was sunk for the signal wires. The three holes are incased by a pipe 5⅝ inches diameter. This shaft will enable this company to work all the lower parts of the Red Ash seam in their property which could not be reached without incurring greater expense from their other openings.

In the Forge seam of the same shaft, the underground slope was extended to a depth of 1,150 feet. This slope has an area of 14 by 7 feet, and an average grade of 8½ degrees.

At the No. 2 shaft the underground slope was extended a distance of 600 feet, and the hoisting engine was placed on the surface. The bore-hole for the rope is 500 feet deep.

At the No. 2 slope the timber was removed from the underground engine house and replaced by walls of masonry. Now everything is in-

The Red Ash slope was extended, and a new lift was opened. A line of water pipes was laid into the lower gangways ready in case of fires from ignition of gas. The weak and affected pillars were strengthened by having the exhausted breasts filled up with refuse. A new underground slope was sunk on the Ross seam a distance of 660′ and the rope for hoisting, passes down a hole 206′ deep from surface. The hoisting engines on surface are 22″×48″ direct-acting to a parallel drum 9′×14′.

Two batteries of Babcock & Wilcox high pressure boilers, 212 horse power, were added to the surface plant and three elevators and three setts of conveyors were added to the breaker.

At the Reynolds No. 16 colliery the new breaker in course of erection in 1890 was completed and the old one was removed. The new breaker was started to prepare coal for the market in April, and so was the new slope described in my last report. An underground slope was sunk in the Ross seam with hoisting engines located on the surface, size of cylinders 14″×24″. The bore-hole through which the rope passes is 125′ deep. A tunnel 300′ feet long was driven through rock fault in the third west gangway, and a new plane was made in the Red Ash seam.

At the No. 18 colliery, Wanamie, a tunnel was driven from the Baltimore to the Ross seam a distance of 630 feet, and at the No. 19 colliery a tunnel was driven from the Ross to work the overlying seams. The main slope is also being extended to work another lift in the Ross seam. The breaker was remodeled, and one sett of elevators and two large conveyors were added to its machinery.

Improvements by the Delaware and Hudson Canal Company.

At the No. 2 shaft, Plymouth, an underground slope is in progress of sinking in the Bennett seam. This will enable them to mine the coal lying to the dip from the shaft level. A second opening was made for the Bennett seam by driving to connect with the workings of the No. 5 shaft, making a very convenient place of exit in case the shaft became unavailable. At the No. 3 shaft, Plymouth, a plane 1,000′ long, on a grade of 9°, was made in the Five Foot seam.

Improvements by the Susquehanna Coal Company.

At the No. 1 shaft the second opening for the underground shaft was completed by driving to connect with the slope level workings. Second opening for the tunnel to the Ross was also effected by driving a rock plane from the Red Ash level gangway. This will be useful also to work a large area of the Ross seam to the rise from that point.

A sixteen-foot Guibal fan is in course of construction to ventilate the workings of the George seam.

An underground slope is being sunk in the Forge seam east of the shaft. The hoisting engines for which are located on surface near the No. 2 shaft and the rope passes into the mine through a bore hole drilled for that purpose.

breasts may have been driven farther than the map shows, or the coal may have run since the breasts were driven, and this would cause the pillar to be less than the width represented at the points where the cracking of the pillar occurred. It was the intention of the Delaware and Hudson Canal Company to have the workings re-surveyed, in order to test their accuracy, but they were prevented by the accumulation of water.

At the close of the year the Lehigh and Wilkesbarre Coal Company was preparing to apply for an injunction to prohibit the Delaware and Hudson Canal Company from filling the Conyngham mine with water, lest it might burst the pillar and damage their property. Additional account of this trouble will be given in the report for 1892.

A DISASTROUS EXPLOSION OF GAS AT NO 1 SHAFT, NANTICOKE.

Shaft No. 1 at Nanticoke, is the property of the Susquehanna Coal Company. It is a double shaft having four hoisting cages, two of which are used to hoist the coal from the Forge or Hillman seam, and the other two to hoist the coal from the Lee or Red Ash seam, three hundred feet deeper than the former. The Red Ash seam is known at Nanticoke as the Lee vein, and the Hillman as the Forge vein. The Ross seam lying between these two, is not worked directly from the shaft, but is worked from a horizontal tunnel driven through the overlying rocks from the Lee seam at a point 1,440 feet south of the main shaft. In order to enable the reader to understand the circumstances of this accident, a map embracing the scene of the disaster is herewith furnished. The workings in red are those of the Lee seam and the workings in black are those of the Ross seam, which are connected to the Lee workings by a rock plane and a horizontal rock tunnel, and also by an underground shaft, designated on the map as the Bore Hole shaft. Thus there were three openings connecting the workings of the two seams. The Bore Hole shaft extends from the Ross east gangway to the Lee seam, a depth of 180 feet. It has two hoisting cages; the engines are located on the surface and the ropes pass down through bore-holes to the Ross seam over the shaft. A second opening for this shaft was recently completed, leading down the bottom of shaft and connecting to old workings near the door 3, the vicinity of the disaster, all in the Lee seam. Near the upper end, this second opening enters in the upper member of a lap-fault, while for a distance of about 50 feet a passage was driven down to meet it from 5 to 6 in the lower member of the fault and enters beneath the upper one at a vertical distance of about 12 feet. Connection was made at this point by a short rising passage through the rock (see fault). The passage from above (5 to 6) dipped at a pitch of about 30 degrees towards the fault, and the passage from the shaft up, was rising all the way and had an increased pitch as it approached the fault, terminating at the fault in a rising pitch of about 40

degrees. At the upper point of this passage where the rock-hole driven up through fault connected, a small quantity of gas was standing, which the air current in making a short turn from the rock hole failed to reach.

Preparations were being made to make this second opening the permanent return airway for the borehole shaft workings. Several wall stoppings had to be built in order to effect the desired changes in the courses of the air currents, which could not be effected with safety during working hours. Hence it was decided to have this work done between Saturday night and Monday morning, when the mine would be idle. By Sunday afternoon, November 8, all the wall stoppings were completed, except the one at B, which was not yet plastered. The two masons, Caleb Gething and Thomas R. Powell, were working at this wall when the accident occurred. Prior to this time an air current came in through the passage C and passed through B, but an opening was made at A leading directly to the return airway passing over the air bridge, hence B was closed as soon as A was sufficiently opened.

At about five o'clock p. m., William J. Williams, Sr., William J. Williams, Jr., Thomas R. Thomas, Edward D. Williams and Daniel R. James, were all at work cleaning a gob at A, which partially filled the passage. They were at the upper side and David T. Smith, Joseph Robofski and Thomas Bozak were throwing the gob back on the lower end towards B. The two masons, Gething and Powell, were plastering the wall B. Thomas Lloyd and the three fire-bosses, Henry R. Jones, William Jonathan and John Arnott, had gone back from the others towards C shortly before the accident. All had safety-lamps and no one used naked light. There was a strong current of pure air coming in directly from the main shaft and passing the men at A, over the gob which they were removing towards the air-bridge. Suddenly and unexpectedly the men at A noticed their lamps filling with gas, and instantly called one another's attention to it. All reached for their lamps and instantly they were surrounded by a burning flame which filled the whole passage.

One man, a Polander, who was unloading a car of rock some distance away escaped uninjured, but all the others that have been named, were either killed or severely injured. The three fire-bosses and Lloyd were found near the door at C. Arnott, Jonathan and Lloyd were evidently killed instantly. Jones lived about one hour, but was unconscious all the time. The others except Daniel R. James and Edward D. Williams died within forty-eight hours. The two named, after a period of intense suffering, finally recovered.

It is not known with certainty where the gas came from nor how or from whose lamp it was ignited, but it is reasonably evident that it ignited from one of the safety-lamps. The current of gas was swift, and a sharp movement of a lamp against it would cause the flame to pass through the meshes of the gauze. Smith and his two companions on the lower side of the gob at A would have to go against the current, and

if they made a move towards escaping, it was certainly made in that direction. Any of the others also might have moved a lamp quickly against the current, either of which under the existing conditions would most certainly have ignited the gas by the flame passing through the apertures of the gauze.

The gas may have accumulated at either the old breast marked on sketch " roof fallen " or at the lap or fault in the second opening. The old breast mentioned is only twenty-five feet long between the wall stopping shown, and its intersection with the passage A, B. The roof had fallen to quite a height, leaving a large cavity. The cross cut H, though hidden by a gob along the rib of the passage C, was open. The opening of the breast was also partially closed by gob along that side of the passage B. Owing to the existence of the gob a stranger would not be likely to notice the cross cut "H," nor the breast, but the fire-bosses knew of its existence and had been in it frequently prior to this time, making examinations. Yet the circumstances seem to show that they had overlooked it at this time. The cross cut "H" would have to be closed before the desired change in the course of the air could be fully effected, but it was not closed, nor was there anything showing an intention of doing so. The door at C was erected several days before, and was fastened open to prevent it being closed until everything was ready for the change. They had about six hours work to finish clearing the gob at A. Now the question is, did the fire-bosses take off the temporary stoppings 5 and 6 and close the door at C? If they did, and if there was gas in the old breast on top of the fall, the air current would pass through the cross cut "H" and move the gas upon the men at A; or, if there was a body of gas in the "lap fault," the air would also pass up the second opening and sweep that gas directly upon the men. Under these circumstances the gas may have come from either or both places. It is not known that the door was closed or that the stoppings 5 and 6 were taken off, but it is supposed that they were. The fire-bosses were all intelligent and were experienced in this kind of work, and in the absence of a motive we cannot conceive a reason for closing the door and effecting the change without taking the precaution of withdrawing the men from the path of the return air-current. This precaution is invariably taken when work of this kind is being done. Some contend that if the stoppings 5 and 6 were practically removed, the air current might have reverted in the second opening without closing the door, and unexpectedly to the fire-bosses. A careful study of the situation suggests the probability of it doing so under conditions that might have existed at that time, but subsequent experiment failed to verify this. It was indeed a deplorable accident occurring when it was thought that every chance for an accident had been foreseen and provided against. Nearly all the men were the best and most experienced for this class of work, and we cannot believe that it occurred through any recklessness on the part of any of them.

Improvements by the Susquehanna Coal Company.

At the No. 1 shaft a tunnel was driven from the "Forge" to the Hillman seam. It is 650 feet in length and 7×14 feet area. It is intended to work the coal of No. 2 slope through this tunnel and abandon the slope.

The workings of the Forge Vein No. 1 shaft were connected by a tunnel from the No. 2 shaft and it is intended to convey the coal from a part of the Forge Vein workings by that way, to the No. 2 shaft when necessary.

In the No. 4 slope a tunnel was driven from the Mills to the George seam on a grade of twenty degrees, to make a gravity plane. It is 300 feet in length and 7½×12 feet area. A second opening was driven to connect with the workings of the George seam in the No. 1 shaft, and from there an airway was driven out to the surface. Upon this airway to ventilate the George seam workings, a new fan was erected, 18 feet in diameter, which is exhausting about 50,000 cubic feet of air per minute. At the No. 6 shaft a rock gravity plane has been completed, extending up to the No. 6 tunnel. It is 700 feet in length on an average grade of 14 degrees.

A great deal of work has been done in enlarging the return airways in several of the mines of this company, which has effected a marked improvement in the ventilation in each case.

Improvements by the Kingston Coal Company.

At the No. 1 shaft a tunnel was driven 1,200 feet from the Bennett seam to what is supposed to be again the Bennett. Its size is 7½×11 feet. In the No. 2 shaft an outlet has been driven to the outcrop to be used as an intake and travelling way.

At the No. 4 shaft two underground slopes were completed in the Red Ash seam.

Improvements by the Delaware, Lackawanna and Western Railroad Company.

At the Avondale mine each of the two underground slopes were extended, and they have commenced to drive a tunnel from the Red Ash to the Ross. Its size is 7×12 feet. At the Woodward colliery, a rock tunnel was driven from the Red Ash seam to the Ross, and continued to be driven to the Baltimore seam. Its length now is 1,200 feet, having an area of 7×14 feet. The two slopes, one in the Red Ash seam, and the other in the Baltimore, were extended to a length of 1,713 and 3,700 feet respectively, the Baltimore slope being the longest. This is now an extensive mine, well ventilated and kept in good order.

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the year. The hoisting engines for both these slopes are located on the surface, the ropes passing down through bore holes.

At the Boston colliery, several hundred feet east of the old shaft, a new shaft has been started. It is intended to sink it from the surface to the red ash seam. Its size is 12x33½ feet and it was sunk to a depth of 110 feet by the end of the year 1893.

The sinking of another shaft is in progress by this company about a quarter of a mile east of the No. 5 shaft. It was sunk at the close of the year to a depth of 115 feet. Its size is 10½x33½ feet.

Improvements by the Susquehanna Coal Company.

At the No. 1 shaft a slope was made through old workings a length of 1,400 feet on a dip of 8½ degrees; size 8x16 feet.

Another slope is being sunk in the George seam. Its size is 8x16 feet and it was at a length of 1,000 on an average dip of 8½ degrees at the end of the year.

A new tunnel was driven from the Forge to the Mills seam a length of 800 feet, and a size of 8x14 feet.

At the No. 4 slope, a tunnel 300 feet long was driven from the Mills seam and a rock plane was driven from the Mills to the George seam. Its length is 300 feet; grade, 20 degrees, and size, 8x14 feet.

Improvements by the Delaware, Lackawanna and Western Railroad Company.

At the Avondale colliery a horizontal tunnel was driven through the rock from the red ash to the Ross seam. Its size is 7x10 feet and its length 300 feet. This opens a large area of the Ross seam.

At the Woodward colliery both underground slopes were extended, the one in the red ash seam a length of 306 feet to a total length of 2,019 feet and the slope on the Baltimore seam was extended a length of 372 feet, thus opening in each a new lift. The tunnel mentioned in last year's report, which is being driven from the red ash to cut the Baltimore seam was driven a distance of 486 feet. Its total length now is 1,686 feet. When this tunnel is completed it is intended to haul the coal of the Baltimore seam below a certain line in the slope out through it to the foot of the red ash shaft, where it will be hoisted to the surface.

The three new shafts in progress of sinking by this company in Hanover township are not yet completed. The Bliss shaft was at a depth of 669 feet. The Auchincloss No. 1 at a depth of 661 feet, and the Auchincloss No. 2 at a depth of 659 feet. The size of each shaft is 12x43 feet 3 inches.

Improvements by the Parrish Coal Company.

At the Parrish colliery a new air shaft was sunk to a depth of 60 feet, having a sectional area of 216 square feet. For the purpose of

Delaware and Hudson Canal Company.

No. 2 Baltimore—

A new double fan was erected, 17½ feet diameter, enclosed in brickwork, and an underground slope was driven to a depth of 700 feet, which is still being extended.

Boston—

The new shaft was sunk to a depth of 475 feet, and its sinking is continued. It is 12x33.5 feet, and has passed through three coal seams.

No. 5 Colliery—

The new shaft was sunk to a depth of 725 feet during 1894, and its sinking was continued. Its size is 10½x33 feet.

Susquehanna Coal Company.

Five new tunnels were driven in the mines of this company:

One 8x14 feet and 800 feet in length from the Ross to the Twin seam.

One 8x14 feet and 400 feet in length from the Hillman to the Hillman seam.

One 8x12 feet and 200 feet in length from the Forge to the Forge seam.

One 8x14 feet and 800 feet in length, from the Forge and was unfinished at end of year.

One 8x14 feet and 500 feet in length, from the Mills to the Mills seam.

Three of the underground slopes were extended. The No. 10 slope was extended a length of 2,000 feet. No. 12 was extended 500 feet, and No. 13 1,500 feet.

Five new gravity planes were made, varying in length from 200 to 1,500 feet. These improvements open new areas of coal property in each of the seams.

Improvements by the Parrish Coal Company.

The underground slope on the Baltimore seam in the Parrish colliery was extended a distance of 900 feet, making the total length of this slope 2,316 feet.

Improvements by the Alden Coal Company.

A new air shaft was sunk for the Alden colliery from the surface to the Cooper seam, a depth of 612 feet. Its sectional area is 416 square feet. A new fan, 24 feet diameter, is in progress of construction. The engine is 20x36 inches, directly connected. This will be applied to ventilate the north basin workings of the property.

Improvements by the Susquehanna Coal Company.

This company drove a tunnel from the George to the same seam which is 700 feet long.

Two tunnels were also driven which are not yet completed. One from the Mills to the Mills seam 8x14 feet area which is now 300 feet long. The other tunnel is from the Hillman to the Hillman, through an anticlinal, having an area of 8x14 feet and is also 300 feet long.

The Kingston Coal Company.

In the No. 1 colliery an air shaft has been sunk from the Cooper to what is thought to be the Bennett seam and a short tunnel has also been driven from the Checker to the Bennett seam. The size of the shaft is 8x10 feet; depth, 125 feet; size of tunnel, 7½x12 feet and 250 feet in length.

Lehigh Valley Coal Company.

At the Dorrance colliery a new slope has been driven from the Hillman seam through the rock on a grade of 7 degrees to the Baltimore seam and following that seam on the north rib of the anticlinal. Its length is 1,300 feet and size 8x12 feet.

At the Franklin colliery a slope has been sunk from the outcrop on the next small seam above the Baltimore. It is 1,000 feet long and will work the upper lifts of said seam. A new fan has been also erected at this colliery to ventilate the upper seams. It is fifteen feet in diameter and operated by a vertical engine. It is the first machine put up in this district to act as a forcing fan. The conditions here are favorable for that, but in gaseous mines where the haulage roads would be the return airways such a method is not practicable.

The Parrish Coal Company.

The inside slope in this mine has been extended to a length of 3,814 feet. It was 3,216 feet before.

At the Buttonwood colliery two tunnels have been driven, one for coal haulage from the Hillman to the Kidney 335 feet long, and one for ventilation and "second opening" from the old Bennett to the Hillman seam. This is 62 feet long and has an area of 70 feet.

New Breaker at Warrior Run Colliery.

The old breaker having worn beyond the power of repair has been replaced by a new one having a capacity of about 1,000 tons per day. The machinery and stairs are boxed and fenced in a satisfactory manner. The old one was abandoned at the beginning of

Colliery Improvements During the Year 1896.

The coal trade was unusually lax, requiring work for less than two-thirds time; such improvements only as were urgently needed were made during 1896, and such as were made and had effect on the condition of the mines are recorded in the following:

Improvements by the Lehigh and Wilkes-Barre Coal Company.

In the Empire mine a rock plane on a rise of 25 degrees was driven from the Ross to Baltimore seam in the abandoned Diamond colliery. It is 10x10 feet area and 435 feet in length. It enables the ventilation to be improved and they can work the remainder of the coal in that part of the Diamond mine.

At the South Wilkes-Barre colliery the No. 4 tunnel was extended to a length of 1,200 feet. It is driven from the Hillman through an anticlinal to cut the same seam on the other pitch.

No. 2 slope was sunk and connected to the No. 1 air shaft, effecting a third opening by which the ventilation will be effectively improved.

At the Lance No. 11 colliery two short tunnels were driven from the Cooper to the Five Foot seam. Their lengths are 200 and 250 feet respectively, and they have sectional area of 7x12 feet.

Improvements by the Delaware and Hudson Canal Company.

At the No. 2 colliery the shaft was driven from the Bennett to the Red Ash seam on an extension of 273 feet, making the total depth of the shaft from the surface 859 feet.

Improvements by the Susquehanna Coal Company.

At the No. 1 shaft a rock tunnel was driven from the Lee to the Lee seam through an anticlinal. It is 600 feet in length and 8x16 feet area.

A rope haulage was installed in the Forge seam in place of a mine locomotive, which is a decided improvement to the quality of the air.

In the No. 4 slope and No. 2 shaft several minor improvements were made. A tunnel was driven from the Hillman to the Mills seam. It is 500 feet in length with 7x14 area. An extension was made to the No. 5 slope which added 600 feet to its length. Size, 7x14 feet, grade 11 degrees. An extension of 300 feet was also made to the No. 11 slope.

In the No. 6 colliery Glen Lyon, 5 new gravity planes were made, varying in length from 200 to 500 feet, and a tunnel was driven from the Twin to the Ross seam. It is 700 feet in length and 7x14 feet area.

the coal from the shaft to the breaker. Another conveyor line was constructed to convey the coal of the Baltimore No. 4 shaft to this breaker.

At the Boston colliery the breaker hoisting tower was torn down and a conveyor was constructed to scrape the coal from the dump at the shaft to the head of the breaker, and in the mine a tunnel has been driven from the bottom to the top split of the Red Ash seam. It is 400 feet in length and 7x12 feet area.

The No. 2 shaft at Plymouth was extended from the Bennett to the Red Ash seam 312 feet, making the total depth of the shaft 898 feet.

A new fan was erected to take the place of the old one. It is 22 feet in diameter, encased by a brick wall. It runs 70 revolutions and is exhausting 97,800 cubic feet of air. The engine is horizontal direct acting, 16x30 inch cylinder.

At the No. 3 colliery, Plymouth, the Hillman seam was opened and a slope was sunk to a length of 620 feet; average grade 12 degrees; 7x12 feet area.

At the No. 4 colliery a new slope has been sunk in the Red Ash seam to a length of 800 and it is still being driven. It is 7x14 feet area and has an average grade of 7 degrees. It opens a large area of excellent coal.

Improvements by the Susquehanna Coal Company.

In the No. 1 shaft, Nanticoke, an extension of tunnel has been driven from the Lee to the Ross seam a length of 960 feet, and 7x14 feet sectional area. A tunnel has been driven from the Forge through troubled ground a length of 1,570 feet, 7x14 feet area and is still being driven. An extension has been made by a tunnel from the Hillman to the Forge seam 650 feet in length, 7x14 feet area. A tunnel has been driven for ventilation purposes from the Hillman to the Hillman 240 feet in length and 7x14 feet area.

In the No. 4 slope, Nanticoke, the main slope has been extended through the rock from the Hillman towards the Forge seam a length of 350 feet and it is still being driven. The No. 21 tunnel was extended a length of 700 feet from the Mills to the Mills and Tunnel No. 23 driven on from the Hillman to the Mills a length of 500 feet. The area of all is 7x12 feet.

In the No. 2 shaft, Nanticoke, No. 5 slope was extended through an anticlinal from the Lee to the Lee a length of 420 feet and the No. 11 slope was driven through the rock from the Ross to the Lee seam an extended length of 850 feet. A new gravity plane 850 feet in length was made in the Ross seam.

At the No. 6 shaft, Glen Lyon, No. 5 tunnel was driven to a length