

Mr. Robt. Looney, and his assistant, have made better use of the quantity of air they have than two-thirds of the mining bosses in this district, i. e., the air is better kept up to the face of the workings and thereby makes it safer and healthier for their men. Very few persons have been injured there in any way, and especially by burning, during the last year.

Machinery.—There has been much trouble in having the safety appliances satisfactory, such as safety catches, covers on carriages and an adequate brake on the hoisting drum. There have been three brakes condemned at this place during the last two years; the fourth is on the drum at present and gives good satisfaction; it is a compound lever brake without any dead weight attached. The superintendent of this company has decided to put on in future a different kind of safety catches from the ones in use at present; they are to be similar to the kind in use at Avondale shaft.

Robert Looney, mining boss.

Red Ash tunnel.—This is a small opening or mine located south of the borough of High, on the mountain side. The tunnel has been driven into the Red Ash vein. There are two lifts being worked in this mine when in operation, but it has not been worked much during this year.

Condition and ventilation.—This mine may be considered a safe one. It has good rock roof and no explosive gases are evolved. The ventilation is produced by the use of a furnace which is located above the workings in the outlet, the results depending much upon the temperature of the atmosphere outside. This mine has been worked by contract. Mr. J. Lovel, contractor.

Robt. Looney, mining boss.

No. 10 slope.—This mine is located a short distance north of the No. 9 shaft at Sugar Notch. It is a new colliery, the slope now being sunk about 600 feet and not yet graded, but will be ready to commence opening gangways and drive for a second opening early next spring.

Geo. H. Parrish, general superintendent; Thomas Cassidy, assistant superintendent; Adam Harkness, mining boss.

Hartford Slope No. 1.—This slope is located near Ashland borough and sunk on the Baltimore vein. The workings on the same lift at the slope have been worked out and another slope has been sunk on the same vein, commencing at a point several hundred feet east of the foot of No. 1. The coals from this slope are being hoisted to the surface through slope No. 1. There is also a tunnel driven from the Baltimore vein into the Ross vein, and one lift is being worked there, and its coals are taken out through said tunnel and hoisted through No. 1 slope.

Condition and ventilation.—These parts of the mine are considered tolerably safe. Ventilation is produced by a fan 15 feet in diameter, in the Ross vein, and by natural means, with the assistance of the heat and steam from boilers in No. 3 slope, on the Baltimore vein. Number of persons employed in No. 8 slope 36. John Clinton, mining boss.

No. 2 slope.—This slope is located south of No. 1, but is started from the inside on the water level gangway of the old tunnel, through which its coals are brought to the surface; it is sunk on the Ross vein, and through it the coals from one lift is being hoisted; the lift below being worked through the tunnel from the Baltimore vein.

Condition and ventilation.—These workings are tolerably safe. The roof is good, but there are small quantities of fire-damp generated in the lower lifts in both veins. Ventilation is produced in the Ross vein, both lifts, by a fan 15 feet in diameter. The air is divided east and west at the lower tunnel. This is then coursed through both lifts, and as a matter of course the air cannot but be very foul before it traverses the whole route, an unavoidable result where the system of coursing the air for so long a distance is adopted. It is an old working, and badly arranged for a systematic ventilation of the same. Geo. H. Parrish, Esq., general superintendent; Mr. William Tiffeny, assistant superintendent in charge; Mr. John T. Griffith, mining superintendent; Thomas Harkness, mining boss.

Slope No. 8.—This slope is located east of and adjoining the Hartford mines. It is sunk on the Baltimore vein. This colliery is nearly worked out, there being but some few places at work robbing pillars, &c., preparatory to abandonment. Ventilation is produced by a fan 15 feet in diameter. Number of persons employed inside, 20. Samuel Marsdon, contractor, and other officials same as over the Hartford mines.

Empire No. 2 shaft.—This shaft is located south of Wilkesbarre and near the Empire mines. It is 280 feet deep and sunk into the Red-Ash vein. This shaft has not been worked any since July, 1870, when it was stopped by the inspector,

not having a second opening. The company began to drive for a second opening, but the driving was suspended and has remained idle ever since.

Slope No. 2.—This slope is located close to the No. 2 shaft. It is sunk on the Baltimore vein. Its upper workings having been worked out, it was continued down and connected to the west side of the **Empire** shaft workings. The coals from the west gangway workings are being hoisted through this slope. Besides this, a slope has been sunk still deeper, which is located a short distance west of the foot of No. 2 slope, and is called No. 4 slope. The coals from this No. 4 slope are also hoisted through No. 2 slope to the surface.

Condition.—This mine cannot be called a very safe one. It has tolerably good roof in most parts, but the vein is thick and has various pitches, *i. e.*, in different parts of the mine. A number of persons have been injured by falls of coal, &c., and a good many by being burnt by explosions of fire-damp. Some of them have been crippled for life, others having lost their lives, and caused in divers ways—some from their own carelessness, others from ignorance of the elements they had to contend with.

The officers in charge have generally exercised a great deal of care in the management of this mine, and in order to try and lessen the number of accidents from explosions of fire-damp they employed a fire-boss for night as well as for day. A set of special rules have been drawn up and are being put into practice, which work well.

Ventilation.—The ventilation is produced by a fan 15 feet in diameter, which is placed inside of the mine and discharges in the old workings. Amount of air at face of mine, 22,000 cubic feet; amount at outlet, 29,000 cubic feet per minute. Number of persons employed inside, 159.

George H. Parrish, general superintendent; John T. Griffith, mining superintendent; Christ Konrad, mining boss.

EMPIRE SHAFT WORKINGS.

This shaft is located a short distance south of the city of Wilkesbarre. It is 320 feet deep and sunk to the Hillman (or 7 feet) vein. The workings in this vein consist of about 30 places and were lying idle from July, 1871, until last spring, having been stopped for want of sufficient ventilation, when there was a ten feet diameter fan put up to ventilate it, and this small fan was put up against the remonstrances of the Inspector, as it was very evident that it would be too small to produce the circulation required. It was started and gave as good results as could be expected, but not as much as was claimed it would give, by some of the officers of the company, and after having been in operation but six months, it has been replaced by a fan fifteen feet in diameter, and which gives very good satisfaction. The vein worked is a small one in comparison to the Baltimore vein. It is hard to mine and has some few wet places, the whole requiring a great deal of powder to loosen the coal and in consequence makes much powder smoke, which requires a strong current of fresh air to carry the same away. This vein also generates a small quantity of fire-damp.

Amount of air at inlet in 1870, 3,000 cubic feet per minute; amount of air at inlet in year 1872, as per report, 29,600 cubic feet per minute; amount at face of mine, 9,200 cubic feet per minute. Number of persons employed inside, 84.

A short distance south-west of the shaft a tunnel has been driven into the Baltimore vein, and on the east side of which No. 5 (an inside) slope has been sunk where two lifts are being worked and opening a third at present.

Condition.—This part of the mine has good roof and does not give off a very great quantity of explosive gas. Ventilation is produced by the action of the fire under the steam boilers, together with the assistance of the steam exhaust from the hoisting engine. Amount of air at inlet, 27,900 cubic feet; amount at face of mine, 9,050 cubic feet per minute. Number of persons employed, 132.

Safety appliances and machinery at shaft.—These are all of the best kind in use in the district except the safety catches on the hoisting carriages, which are soon to be changed. There has been a large bull pump put up in 1871, of 500 horse power. This year a pair of first motion engines have been put up to hoist coal, which were built by Snyder, Pottsville. The engine, its drum, brake, &c., are of the same make as those put up at the Prospect shaft by the Luzerne coal and iron company, previously described, of a smaller size. Too much praise cannot be

given to the officers of the company in regard to the manner in which they endeavor to protect their employees while ascending and descending this shaft. They have the required gates on the shaft head. Besides that they keep a man there from the time the first persons descend in the morning until the same are all hoisted in the evening, and not more than ten persons are ever allowed to descend or ascend at a time. Each person must procure a ticket before getting on the carriage, if there are but ten. There have been some special rules drawn up at this mine in regard to places generating explosive gases which are much needed to become general through the district in addition to these few.

George H. Parrish, general superintendent; John T. Griffith, mining superintendent; Lewis S. Jones, mining boss.

Slope No. 7.—This slope is located west and adjoining the No. 4 slope and sunk down from the old Stanton slope through the western end of the No. 4 gangway. It is at present about seven feet long and below the No. 4 workings, and is intended to connect with the Audenreid shaft for a second opening for the same. There are over 2,000 feet of rope at present on the hoisting drum.

This slope has all the appearance of becoming an extraordinary fiery place. It is being driven by contract by Messrs. John Haycoke, James H. Williams and Morgan R. Morgans. J. T. Griffith, mining superintendent.

Hollanback, No. 3, slope.—This slope is located within the south-east corner of the city limits, opened on the Hillman vein, and is 12 feet deep. This slope has not been worked for several months, except preparing to sink a new lift and further preparing a new road to take the coal from there in future to a new breaker which is being built east of the slope and near the Diamond shaft.

Condition.—This vein is usually very safe; has good bone roof and can easily be timbered, and does not generate much fire-damp. Ventilation is produced by a fan 15 feet in diameter. Amount of air at inlet, 30,000 cubic feet; at face of mines, 18,000 cubic feet per minute; number of persons employed, 60. William Dickie, mining boss.

Hollanback, No. 2, slope.—This slope is located a short distance south-east of the No. 3, but it is opened on the Baltimore vein. It has another slope inside which supplies it with coal from the lower workings.

Condition.—This mine is a safe one; has good roof generally and does not evolve any fire-damp as yet, but no telling how soon it may be met with.

Ventilation is produced by a fan 15 feet in diameter, which is located on the surface near the head of the slope, and has to draw the air through an air-way made along the main slope through the old workings, and being a large vein and an occasional crush on it, it is hard to keep in good order; however, the ventilation is better than it was prior to the fan being put up, but the mine cannot be called a well ventilated mine up to the present time. Usually it has considerable powder smoke along the faces of the chambers. The parties in charge are very sparing in driving cross-cuts from one place to another, and not enough of its air forced through the faces of the chambers, caused by too few cross-cuts and check doors on main gangway. Amount of air at out-let, 30,675 cubic feet; at face of mine, 20,716 cubic feet per minute; number of persons employed inside, 104. M. B. Williams, mining boss.

Diamond shaft.—This shaft is located a short distance east of the city limits, is 300 feet deep, and sunk into the Baltimore vein. This mine has a good roof, with the exception of a few places where the vein pitches rapidly and the coal very full of slips; but has considerable gas in some parts of the mine. It is an extensive mine, has an inside slope, sunk down west of the shaft towards the Hollanback new shaft; a new lift is being opened at the distance of 300 feet below the old gangway; besides this the slope is being continued downward. This slope has symptoms of considerable gas in the coal.

Ventilation is produced by a natural draught, assisted by the heat from steam boilers and steam exhaust from hoisting engines placed inside to hoist from inside slope. The amount of air is sufficient in this mine to do the work, but it is coursed in one single current through the whole mine, which causes a great deal of foul air and smoke to linger along the chambers, the vein being about 18 or 20 feet thick in some parts, and the men having to wheel the coal for long distances, this smoke makes it both unpleasant and unhealthy and in some instances unsafe. In other particulars this is well provided with the necessary safety arrangements, and first class doors, and as many of them, such as check doors, as can be of any advantage. The air-ways are large, and the stoppings are being built at present with stone and mortar instead of wooden ones as heretofore. Amount of air at inlet 19,360 cubic feet, at face of mine 15,600 cubic feet per minute; number of persons employed inside, 220. Leopole Stutz, mining boss.

Sugar Notch Shaft.—No. 1 carriage dropped, first trial, 6 inches; second trial, 4 inches; third trial, 5 inches. No. 2 carriage dropped, first trial, 7 inches; second trial, 5 inches; third trial, $4\frac{1}{2}$ inches.

Empire Shaft.—No. 1 carriage dropped, first trial, $1\frac{1}{4}$ inches; second trial, $1\frac{1}{8}$ inches; third trial, $1\frac{1}{4}$ inches. No. 2 carriage dropped, first trial, $1\frac{1}{2}$ inches; second trial, $1\frac{1}{4}$ inches; third trial, $1\frac{1}{2}$ inches.

Diamond Shaft.—No. 1 carriage dropped, first trial, 1 inch; second trial, $1\frac{1}{4}$ inches; third trial, $1\frac{1}{2}$ inches. No. 2 carriage dropped, first trial, $1\frac{1}{4}$ inches; second trial, $1\frac{1}{4}$ inches; third trial, $1\frac{1}{2}$ inches.

IMPROVEMENTS.

Among other improvements of importance that have been made during the year, quite a number of ventilating fans have been built, all in the most suitable places, according to the views of the parties erecting the same. Some were erected on the surface, others were erected under ground.

The Delaware and Hudson Canal Company had one fan 20' 0" dia, built at the Mill Creek colliery. This fan exhausts about 72,000 cubic feet of air per minute. Of this amount, 38,000 are from the Pine Ridge shaft workings, and 34,000 are being circulated through the Mill Creek slope workings, in addition to 106,000 cubic feet exhausted by another fan, making an aggregate quantity of 140,000 cubic feet of air per minute circulated through the workings of the Mill Creek slope. The current exhausted from the Pine Ridge shaft ventilates the workings north of a large fault lying between the workings of the two collieries. Besides the amount of 38,000 cubic feet of air caused to be circulated by the aforementioned new fan, there is another current circulated and exhausted by another fan 20' dia, located at the Pine Ridge shaft, averaging about 70,000 cubic feet, giving a total of 108,000 cubic feet of air per minute for the workings in the Pine Ridge shaft.

The Delaware, Lackawanna and Western Railroad Company had a fan erected at Jersey colliery, near Plymouth. This fan is similar in dimensions and construction to that at Avondale, being a short iron casing revolving disk, 12' 8" dia, with open periphery. Much better ventilation is had in said mine since the fan has been started.

The Wilkes Barre Coal and Iron Company has had the following fans built during the year, to wit: At the Diamond shaft a fan 15' 0" dia was built inside the shaft workings for the purpose of ventilating the workings in the new slope. This fan receives its fresh air from the hoisting shaft, which is some few hundred feet east of the point where the fan is located, and it discharges its foul air into a large air-way, conveying it to the main upcast leading to the surface. The main air-ways, both in the upcast and intake, are of large areas. This fan, when being driven about 75 revolutions per minute, exhausts 40,000 cubic feet of air.

At the *Sugar Notch colliery* a fan 15' 0" dia has been built inside the shaft workings to ventilate the workings of the new slope. It is built under similar circumstance to that at the Diamond shaft. Other things not being quite ready, the fan has not yet been started.

The Franklin Coal Company has had one fan 15' 0" dia erected to ventilate their new tunnel workings on the Red Ash vein. This is comparatively a new mine, and the fan having but very recently been built, has not yet had much trial; but there can be no doubt of its being just what is required.

This being my fifth report, covering a period of four years and nearly six months, and considering that before the time arrives to make out another report, my present term of office will have expired, I would state that when I first took this office, the ventilation of this district was secured—such as it was—by the aid of 16 fans, varying in diameter from 8 feet up to 15 feet, and one as large as 20 feet. Besides the above there were a few tolerably good furnaces, many small grates, steam jets and exhausts and a few by nothing but natural ventilation.

At the present time we have 67 fans, 51 having been erected during my term of office, and averaging in size from 15 feet up to 20 feet, the exceptions being a few 12 feet and a few 21 and 24 feet fans.

FIRES IN ANTHRACITE COAL MINES.

During the year just ended we had three great fires in this district, to wit: At **Empire** colliery, Prospect Shaft colliery and Baltimore old mines.

It may be proper here to give a brief history of each of those fires, that other parties interested in mining may be made more fully acquainted with their various causes, which led to so much loss to employers in property, and danger to the lives and limbs of their employees. Also the different methods employed for the purpose of extinguishing the same, together with the success attained up to the time of making up of this report, December 31, 1874.

EMPIRE FIRE.

The fire was first discovered breaking out in the air stack, alongside the Kidder plane, about one o'clock on the morning of December 31st, 1873.

Subsequently it was learned that the fire had its origin in the return air-way, somewhere near the steam boilers located inside the mine, near the head of No. 5 slope. The coals from No. 5 slope were being hoisted to the shaft gangway, at a point nearly four thousand feet from the foot of hoisting shaft. There being some four or five hundred mine cars per day to be taken from said No. 5 slope, hence it was that steam boilers were located at that place.

The mine being of considerable extent, required large quantities of pure air for ventilation, and no fan having been erected at this slope at the time, the heat from the steam boilers was made use of to assist ventilation, by conveying the return air from No. 5 slope into the large air-way made from those steam boilers, before mentioned, up to the surface, through the old Kidder slope, to the stack where the fire was first discovered breaking out.

The said air-way was about 1,000 feet in length, with sectional area of about 60 feet. The quantity of air passing through said air-way must have been over 60,000 cubic feet per minute, as there was about 50,000 returning into it from No. 5 slope, and an escape also left into the boiler room to keep the place cool, and to furnish the necessary amount of air for the fires under the six steam boilers. The total vertical height, from the location of steam boilers to the top of air stack, at the surface, was about 420 feet; this height, together with heat generated by the steam boiler fires, the heat given off by men and animals, and the increased temperature attributable to the depth of the mine, caused the draught and circulation of the aforementioned quantity of air. In view of the quantity of air escaping through said air-way, there must have been a very high velocity—1,000 feet per minute, or nearly 11.5 miles per hour, thus requiring but one minute for

air to pass from the steam boilers to the top of air shaft on the surface, and that velocity, no doubt, increasing rapidly from the increase in heat caused by the additional fire now kindled in the upcast air-way. So it can be seen at a glance, that it did not require a long time for a fire that originated even at the back end of the steam boilers to make its way to the surface, along the upcast air-way, which was lined with timber almost to the foot of the wooden stack, on top of the same on surface.

The six steam boilers before mentioned were put in place at two different periods of time, and when the last two were placed, the officers in charge made extraordinary efforts against the possibility of a fire. The mine boss, Lewis S. Jones, stated that the air-way was being examined in whole or in part each day, and that nothing unusual had been detected by those whose duty it was to examine the same on their last visit, the day previous to the fire breaking out.

How the fire began in the aforementioned air-way is not certain. Of one thing we are certain, and that is this: that even in stone and brick chimneys, it often occurs that the soot in the same ignites, and no doubt the burning of many dwelling houses could rightly be attributed to such a cause.

Then if such a thing takes place in stone and brick chimneys, why might not such have taken place in said air-way, as it is well known to all persons acquainted with such places, that the roof and sides of such passages are usually covered with a coating of accumulated soot, which is nothing but small particles of carbon, the result of imperfect combustion.

Again, this soot might have been ignited by the high temperature escaping from the fires under the steam boilers at times, if not from a spark carried immediately from the fire of wood or other combustible making much flame through the flue; this is not very probable although possible. Then it might have happened by the falling upon the mouth of the tube or flue of coal, slate and other rubbish, in sufficient quantities to decrease the outlet, thereby increasing the temperature at the time, in such rubbish of wood, bark, coal, slate, &c.

The immediate cause or origin of the fire may be attributed to either of the above suggestions. At all events, the fire must have originated very close to the flue at the back end of the boilers, as there was quite a fire there, when first visited, when the men reached there from outside.

From the very day, yes, the hour that it was known that the mine was on fire, until it was decided to hermetically seal the same, every available means were used to extinguish the fire according to the best judgment and opinions of the most experienced men under the Lehigh and Wilkesbarré Coal Company, and other companies as well.

It would be too tedious to give the details of this matter, also it would make this report entirely too lengthy to be of interest. But I would state amongst other things, that the great fire was combatted with that courage, skill and determination, peculiar to the hardy men of the mines. Each person having a certain duty allotted him, attended to the same most cheerfully, let the task be ever so hazardous. The men employed at these mines, as a body, are a very intelligent class of workmen, and courage combined with intelligence, in time of apparent danger, as in this case, are of much importance and above price.

The number of persons employed was increased from time to time, as circumstances required, until finally they numbered many hundreds. The large force of men employed was organized into squads, each squad having its leader or foreman, who received his instructions from officials in higher grades, and each party having its allotted territory.

The whole work was usually divided into three sections. The time of working was divided into six hour shifts, or in other words, four parties would occupy the time of twenty-four hours, in turns of six hours each, except in places of not more than ordinary exhaustion or danger, when the hours would be longer accordingly.

The extinguishing of the fire by forcing water upon it was doubted, until about the first of March, when a large portion of the roof on the east side caved in. This caving in had been looked for for some weeks previous to this time, and most persons acquainted with the fact, felt some little uneasiness regarding the consequence that might result from it, fearing that it might come with such a force that the wind from it would do serious damage to some of the wooden brattice, upon the condition of which the lives of scores of our men always depended.

When the roof and sides gave such signs and indications that the dreaded cave or fall was about to take place, the workmen were withdrawn from the mines; but before doing so, the fires from under the five portable steam boilers were all taken out, and all the steam pumps, consisting of six No. C Knowles' pumps, had to be stopped and left to their fate.

Work was again resumed within two days, notwithstanding that the fire had already destroyed hundreds of feet of wooden brattice, forming the man-ways, and had ran back over ground that had once been one mass of fire, and since conquered, and which was perfectly cool when left. I would remark here, that there was one side of the fire, that on the west, which had not been surrounded, although extraordinary efforts had been made to do so from the commencement, and there being no opposition to it on that side it must have spread rapidly in that direction from the time the fire first broke out, even when it was being slowly curbed in on all other sides.

Soon after the aforementioned cave came down, and the forcing of all hands back nearly to the place of beginning on three sides; the fire on the fourth side made its way into an old cave in the old No. 1 drift and Kidder workings, on the west side.

At this time, the temperature had got so high in the adjoining old workings, that it was thought tinder might be ignited by it, at any point where that high degree of heat might reach in the old mines, thereby spreading the fire where it could not be extinguished, unless by some other means. The officers of the company again held a consultation, and this time determined on another method, to supersede the old one, in trying to quench the fire. The new method was the sealing up of the mine, at the points most advantageous, so as to exclude the atmospheric air from the fire, and the injection of steam into the enclosed territory.

Mr. Lewis S. Jones, the mining boss, had been experimenting on the use of steam on the fire for a week or two previously, by letting it escape into the open fire—using it instead of water; its use in that manner was most beneficial, when left to escape upwards. The specific gravity of water being heavier than air it must fall; the reverse was the case with the steam, its tendency being upwards.

In course of time the enclosure around the whole area was completed. The materials used in the construction of the stoppings and walls inside the mines were lime mortar, cement, brick, stone and planks and boards. Everything was done that was thought of as an assistance, to exclude the atmospheric air so as to enable them to keep the injected steam within the enclosure together with the gases generated.

The surface leakages, although having numerous large cave holes, were also sealed up by the hauling of immense quantities of earth and clay, and

tamping the same hard into each hole and crevice in the broken surface and rocks.

A nine inch drill hole, bored with a diamond drill down into the mine nearly where the fire originated, was made use of to introduce steam from nine steam boilers, located on the surface near the hole, and letting it penetrate the fire at that point on the north side.

Also, steam was forced in from the Kidder or south side from nine boilers, and from nine more at No. 1 slope, west end of the enclosure. There was steam also forced in from 10 boilers on the eastern end during each night, the same being required during the day to hoist coals from No. 2 Hollenback slope.

About the first of May steam was let on or forced into the burning mine from three of the abovementioned points and on the fourth side shortly afterwards.

During the day steam from 27 boilers and from ten more each night, was forced in, equal to 32 continuously, the pressure guage often indicating 45 or 50 pounds to the square inch.

The steam was kept on until the first of December, 1874.

About the middle of December the mine was entered, and upon examination the fire in the lower section was found to have been extinguished. In the upper or Kidder section the heat was so intense that the examination for the time had to be abandoned until the heat has decreased, although no fire had been seen. Consequently the entrance was again sealed up until sometime in the future.

Whether the fire is all extinguished or not is not quite settled; but let that be as it may its final extinguishment in that manner is only a question of time, as it has been fully demonstrated since that the lower section, where such strong fires were left when the mine was closed, has been completely examined and no fire discovered.

It is but fair to state that were it not for the misfortune of the great cave before mentioned, it is presumable that the fire would have been extinguished through the use of water alone, unless the fire had already penetrated the old cave on the west side in the old Kidder and other workings.

Many people wonder why it was that a fire in one thousand feet of an air-way should have caused such a calamity. I would here state that the air-way was the only opening from the steam boilers to the surface through that part of the mine. And very soon after the fire broke out the cribbing in the shaft upon which the air stack was located burning out it caved in, this immediately impeded the ventilation, causing the carbonic acid gas, manufactured from the burning wood and coal in the air-way to fall back to the lowest level or gangway, where the main traveling had to be done. Soon afterward the wooden doors in the stone stoppings were burned out, and a draught was formed by the heated air escaping to the surface through the old cave holes on the east side of Kidder old slope.

This, in part, relieved the lower passages of gas, but it was only to increase its force as the fire increased. In order to be able to combat the fire at all, it became necessary to increase the ventilation. From time to time, no less than three fans, 15 feet diameter each, had to be used for ventilation. It was well known and considered that to introduce more fresh air, was equivalent to increasing the force of the fire in a rapid rate; and again, to proceed with work without more pure air, was impossible.

So strong were these gases at times, that scores, yes, hundreds, from time to time were overcome by their effects; sometimes a whole squad of 15 or 18 men would be stricken down simultaneously.

Several narrow escapes were had from losing not only one, but large numbers of persons at one and the same time. On one sad occasion, March 16, one of the blades or vanes of the fan broke off, thereby causing a few minutes delay or stoppage of the fan, and before an alarm could be given to the men inside the mine, the deadly gases fell on either side of advanced man-ways, and kept back by the wooden brattice and the air pressure, fell back into what was before an open channel man-way, filling every space with this deadly poison, thereby cutting off the retreat of Michael Harte, who happened to be at that moment in the advance. His comrade at once gave the alarm, when many brave chargemen, miners and laborers rushed in to aid in rescuing their fellow miner; but the enemy held the field, and at one time no less than six of the volunteers were piled one across the other. Fortunately the fan was again in motion, and fresh air sent to their relief, else it is difficult to think how many more lives would have been lost at this time. The ventilation then improved, and the asphyxiated persons were taken care of—all survived except Harte; his body was secured, and although everything was done to restore him to consciousness, all proved of no avail. I would state that a physician, and a good supply of restoratives had been secured by the company's officials from the commencement of the fire, and a station fixed, and men selected to attend to the same. There was but one case that proved fatal, although dozens would be effected by those gases during a shift of six hours.

It is impossible to state or estimate what might have been the result in serious accidents and deaths resulting from the same, had it not been for the extraordinary constant care taken in each department by the general superintendant and his assistants, George H., and Frederick Parrish, in providing everything that could be gotten for the safety and comfort of their employees; also by the indefatigable exertions and care of the mining superintendent, John T. Griffith, together with the following staff of under bosses and chargemen: Lewis S. Jones; S. J. Tonkins, master machinist; A. Reese, Wm. Smyth, D. L. Richards, Reese Jones, Robert Looney, Jno. Clinton, Wm. Dickie, James B. Davis, David Jonathan, Jas. M'Dade, John Heycocke, Richard Roderick, John S. Jones, Morgan Jones, M. R. Morgan, D. W. Evans, Robert Rutledge, Ed. Lynop, Joseph Edwards, Benjamin Pryor, T. W. Miles, and others that I cannot at once recall to my mind.

The writer made it his business to examine carefully each and every place where there were persons employed, for the first two months about once in each twenty-four hours; at times entering places that under ordinary circumstances would be considered recklessness—yes, worse. Still, since men were required to work in these places, he felt it a duty on himself to examine the same, so that if any thing more could be done towards their safety, it should be made known to the officers, as each recommendation made was always complied with, either by the immediate orders or instructions of Messrs. Parrish or Griffith. And when we look back to the most fearful places in which men were at times required to work, and that some six hundred persons were employed in each twenty-four hours, in great danger—the most of them—I say it is surprising that so few accidents occurred, and certain it is, that too much credit cannot be bestowed upon the aforementioned officers, from the highest to the lowest, according to the part that each had in charge.

Concerning the hardships endured so patiently, and dangers braved so cheerfully, by the workmen, almost without exception, it is beyond my ability to do them justice in this article, but can unhesitatingly state, that in my own personal experience of underground life, covering a period of over thirty years, I never saw men face such daily dangers, knowingly, as

they did in this case; dangers that no human being can form any idea of, unless it be one that had been through the whole campaign; and which no pen can describe or picture to the uninitiated.

No doubt some people are ready to ask the question, why it was that the sealing up of the mine was not resorted to immediately after it was found that the fire had got such a start?

The answer to the same is hereby given by the writer from his own knowledge of matters connected with the same. The fire originated as before mentioned, near the head of No. 5 slope, where a large quantity of coal was hoisted daily, and it was thought that the fire could be extinguished without resorting to the abandonment of this slope; besides that, the matter of expense and the time necessary to do so, then appeared too enormously great to be thought of. Subsequently, however, when all hands became better acquainted with matters of expense, and saw that it would prove the cheapest in the long run, then it was that such an idea was entertained. To think of the amount of labor and material requisite to enclose the west end of the mine, at a point twenty-five hundred feet from the origin of the fire, up to the surface, a distance of 1,200 feet, fill up the many dozen cave holes along the surface line of four thousand feet, and the diameter of many of these caves being not less than one hundred feet; and again, wall up the stoppings necessary on the eastern end, from the Hollenback lower gangway to the No. 1 drift, a distance of over fifteen hundred feet, and along said drift westward many hundreds of feet. I say, that at that time, it would have been considered almost impossible, but after having battled the fiery monster so long and hard, officers and men had almost courage enough to do impossibilities.

The whole length of the line, or perimeter of the space enclosed containing the mammoth fire was eleven thousand feet, including the rib on the north or lower side where, happily for the officers, there were but few holes to be closed, the same being the pillar between the shaft level gangway and the workings in No. 5 slope.

The whole superficial area of the territory enclosed equals about four million eight hundred thousand square feet, (4,800,000.)

The seam averaging at least sixteen feet in height, it is fair to infer that about seven-sixteenths of the same may be calculated upon as the vacancy to be filled by steam and gases, making an aggregate of thirty-three million six hundred thousand cubic feet, (33,600,000.) This leaves nine feet, or nine-sixteenths of the seam, to make up for pillars, rubbish and caves in the enclosed territory.

The seam lying at an angle of 60 or 75 degrees in some parts, it would take a long time for the carbonic acid gas, generated by the burning fire, to fill up to the height of 420 feet vertical, to the top of the old workings at the outcrop; as it would undoubtedly fill from the lower level gangway upwards, and whatever amount of oxygen there was admitted by any means, it was at once consumed by the fire, adding the residuum to the reservoir already forming below of the carbonic acid gas.

This process must have continued so long as there was any fire in the seam above the aforementioned reservoir, filling up from below.

The same filling up fast or slow, as the amount manufactured by the natural process before mentioned, would be great or small, less the quantity escaping to the surface through leakage.

Any leakages found, and there were but few of them, always indicated a tendency to admit fresh air at the lower points, and a desire to escape outwards by the much expanded or lighter air, from inside the fire enclosure, at the higher points.

From this state of things the writer would deduce the following: That the fire would be extinguished gradually from bottom or lower gangway upwards, the same burning but very feebly from want of sufficient oxygen, and dying out completely after its being overflowed by the carbonic acid gas for a sufficient length of time. This operation would continue so long as there would be any fire at an higher elevation, which would be fed with oxygen from leakages of air, and that introduced as part steam. And whenever there was no fire to manufacture the gas, then its services is rendered unnecessary, as the fire must soon die out for want of oxygen, in the same manner that a human being would from the same cause. Hence, it is possible that the fire was opened out before the last of the fire had been covered over by the accumulated gases before mentioned, notwithstanding that the fire was already extinguished in the lower section. In regard to the action of steam on the fire, I am able to say but very little about. We know that whatever quantity of water was converted into steam, that a portion of the same was likely to have been distributed in the inclosed space in the form of spray, its specific gravity being lighter than that of the heavy gases or atmospheric air, would cause it to fly upwards.

What effect the high temperature in this enclosure would have on this spray I know not.

It is beyond controversy that any fire, large or small, must necessarily die out unless fed with the necessary quantity of oxygen to support combustion.

The question that interests those in mining is this: Does the introduction or injection of steam into a body of fire, already deprived of an additional supply of atmospheric air, as near as can be by the closing of the mine, facilitate the process of nature's own in the matter of extinguishing the fire? And taking it for granted that it does, then to what extent? or, in other words, does the results in the saving of time, &c., pay for the additional expense required in applying the same and in obtaining those results? If it does, the sooner the better, that it be proved and made known so that parties may profit by the information should they be unfortunate enough in having a fire in their mine, with its attendant loss of time and heavy outlays in other expenses.

Steam has been used successfully in the extinguishing of fires in coal mines in Germany and Wales. In the latter it was used as an adjunct, being used to force large quantities of carbonic acid gas into a burning mine, generating explosive gases. It was intended to both neutralize the carburated hydrogen gas, and at the same time flood the mine with the carbonic acid gas, as it were, and thereby extinguish the fire.

The writer had a conversation, March 26, 1874, with an individual named Jago Jones, who had witnessed the working of such a case, as described above, at a mine in Rhuabon, Derbyshire, North Wales

He gave a brief history of the fire and its extinguishment; also a rough sketch of the mine.

In the case just cited, the steam and carbonic acid gas was a complete success. Subsequently it was tried at another mine on fire, and for some reason, not explained, it did not answer, and its use was abandoned.

In conclusion I would state that the re-sealing up of that portion of the mine that was on fire does not impede the matter of mining coal in the Empire mines, as a new slope had already been opened into the No. 4 workings, connecting with No. 5 slope workings, through which new slope the coals were being hoisted to a point a short distance west of the tunnel between the Hillman and Baltimore seams. Mining was resumed in full blast in September, 1874, and coal hoisted at the rate of 700 or 800 cars per day from the shaft.

Prospect Shaft, L. V. C. Co.—This mine has had a second opening by connecting with the Oakwood shaft just sank, which is intended to give a lawful second opening and an additional means for ventilating Prospect shaft, besides that it will be used as a separate and independent hoisting shaft. Depth, 600 feet, nearly.

D. & H. C. Co.'s No. 4 Shaft, Plymouth Mines.—This shaft, having been sank from the Baltimore to the Red Ash seam, required a second opening, which was effected through sinking a new shaft west of the hoisting shaft, at the proper distance. The said new shaft is intended to be used for pumping and ventilation.

SHAFTS AT PRESENT WITHOUT SECOND OPENINGS.

D. & H. C. Co.'s No. 3 Shaft, near Plymouth.
L. & W. B. C. Co.'s Hollenback Shaft, located in the city.
S. C. Co.'s Nos. 1 and 2 Shafts, East Nanticoke.

BALTIMORE MINES FIRE.

The fire in the mines above named, which was described in my report for 1874, has not yet been extinguished, although confined within the barricade made of earth and clay, except that occasionally it breaks out, besides that the roof or covering, which is so thin and broken, falls in once in awhile. The force of persons that was required is now reduced to a very few men.

The steam from the boilers, mentioned in my last report as being forced into the fire, has been discontinued for some time.

EMPIRE FIRE.

It is not definitely known whether the fire in the above named mine, which was also described in my last report, is still burning or not. When last that the enclosure was penetrated the heat was so great in some parts, near the surface or crop of the seam, that it was considered advisable to close it up again, although it causes no other inconveniences than the expense of keeping a man or two to watch for fear of surface caves, which they had to guard against from the breaking out of the fire.

The coal that would have been brought to the shaft, being hoisted through No. 5 slope, has been done just as successfully through the new opening made west of the tunnel into No. 4 slope workings, and mining carried on just as extensive as prior to the fire.

STEAM BOILERS UNDER GROUND.

Nearly all the steam boilers located under ground in this district have, within the last few years, taken them out, and especially so since the great fires in the **Empire** and Baltimore mines. The boilers of Nos. 4 and 5 slopes, at the Empire mines, have been taken out, and a bore-hole 9 inches in diameter was put down with a diamond drill at No. 4, through which steam pipes were taken from boilers on the surface, and steam is conveyed from the surface to the No. 5 engines, the pipes being about fifteen hundred feet in length.

At Sugar Notch a hole has been put down preparatory to taking out boilers from said mine.

Franklin Coal Co.'s Old Slope.—The steam boilers that they have had inside of their mines for many years have this year been taken out.

Jersey Mine.—The steam boilers, located near the head of their inside slope, have been taken out about two or three years ago.

tios of the different regions; of the said total. It is very evident that Luzerne, in this case, was the loser, and just as evident that the Schuylkill and Lehigh regions were the gainers, as their respective tonnages prove.

During the year, 3,836,164 tons of coal were sent to market, and 244,163 tons sold and consumed about the mines; total of 4,080,327 tons; against a total production of 4,615,384 tons in 1876. This shows that 107,377 tons of coal were produced in 1877 per life lost, against 83,916 tons in 1876; an increase of 23,461 tons per life lost=27.7 per cent.

The collieries only averaged 135.82 days of actual work during the year. This proves that if the district, when working 135.82 days, could produce 4,080,327 tons, then it could have produced 9,012,600 tons, had there been 300 days worked; thus leaving only 13 days for holidays and stoppages from breakages, &c. Besides this, there were a number of collieries idle in the district during the year. Were all those in operation, the capacity of production would be increased considerably, probably a million tons more.

The accidents are arranged in a tabulated form, both fatal and non-fatal. The fatal accidents are described and treated more in detail, under the respective heads under which they are classified, in the descriptive part of the report; also, plans and sectional views are furnished, to assist in their explanation, in two cases.

Considerable attention and space is here given to explain the position of the writer, in his official capacity, in relation to complaints of workmen and of operators, with a sample or *fac-simile* of one of the many anonymous communications received from time to time.

Also, other matters are treated of, which, in the writer's opinion, bear directly or indirectly upon the "health and safety of persons employed in around the coal mines" of the district.

Very respectfully submitted,

T. M. WILLIAMS,
Inspector of Coal Mines.

Mines on Fire.

THE **EMPIRE** OLD MINE, formerly called the Kidder slope, is still closed in, and a watch of one person is still kept upon it; the fire is near the crop of the seam, in old caves, &c. The inclosure, however, extends to, and is adjoining their present workings. I requested Messrs. John T. Griffiths and L. S. Jones, the company officers, to see to it that the whole periphery of said inclosure be examined daily, except the surface, to the end that every thing may be kept safe from any caves or breakages in the enclosure around said fire, with its poisonous gases, for fear that they escape and mingle with the air entering any portion of the working mine.

BALTIMORE OLD WORKINGS.—These are still burning to some extent, and a small force of men keep watch on the same, fearing it may break out, or that a cave may suddenly take place, causing the carbonic acid gas

been lowered to a depth of about one hundred and forty feet, and the superintendent stated that they had about fourteen feet more to go before striking the solid rock. Subsequently I have been informed that the whole operation has been suspended for some time.

Second Opening.—The following shafts at present have no lawful second opening: Nos. 1 and 2, Susquehanna coal company, at East Nanticoke; Conyngham shaft, Delaware and Hudson coal company, near Wilkesbarre; Ellenwood shaft, Ellenwood coal company, near Kingston. The respective parties are driving for the second opening in each case, except the latter; operations in the same having been suspended since 1875.

MINES ON FIRE.

The **Empire** mine fire is not extinguished altogether yet. Although it causes but very little inconvenience or expense as at present. Whatever amount of fire that there is in the said old mines is located very near the crop of the seam. The same being above water level is hard to overcome in any manner, as the periphery of so large an area is almost impossible to be made perfectly air tight; hence a certain amount of fresh fuel is added to the fire, no doubt continually. The inclosed space having been opened at the lower level several times, the carbonic acid gas has been drained from the higher point, and to get another fresh supply sufficient to fill the whole space, the same being manufactured by the slow process of the consumption of oxygen by the present fire is almost out of the question.

The Baltimore Old Mine Fire.—This old mine is still burning. It is confined to the boundaries, as described in my last report, and requires but a few persons to attend to the same.

Prospect Shaft Fire.—The Prospect shaft colliery was again visited by the ravages of a fire during the year of a very severe character.

On the — day of January, at about 8 P. M., a blast was fired in the face of the north-west gangway, from which the gas ignited around the face. The men began to combat the fire, but by some mishap one of the water connections would not work, hence they could not employ their hose and force of water upon which they depended. Before they got the same changed and in order to work, requiring perhaps three-quarters of an hour, the fire had gained such headway that they were unable to cope with it. The fire had crept back opposite them through the airway or return, they being in the intake. In the combat the boss, Samuels and two of his men were more or less burned on their faces and hands, but not seriously, but before twelve o'clock midnight they were all compelled to abandon their efforts and retreat to the surface, after which the water from the reservoir was turned in to flood the mine. They had a two and a-half inch gas pipe from the shaft's foot to the face of the gangway, connected immediately with the reservoir on the surface, thus having a head of six hundred (600) feet. This appliance had been kept in readiness and often successfully employed since the great fire of 1874. The operation of flooding the mine by letting in the water from the large reservoir near the shaft's head, and pumping from the river and canal, sufficient to prevent the admittance of atmospheric air, took several days. After that the water had reached a height of about one hundred (100) feet, or sixty (60) feet above the highest point excavated in the workings—pumping water into the shaft was discontinued. Having given ample time for cooling the strata, the hoisting of water from the mine was now commenced. Some of the chambers on the pitch had been worked up quite a ways, having reached perhaps, in some cases, as high as forty feet vertical above the shaft gangway.

On the seventh of March they had reached or got the water out to within about forty (40) feet of the shaft's bottom.

Condition of the Collieries.

The condition of the mines in the district, generally is quite satisfactory. There are a few collieries, however, that ought to be mentioned as being below the general standard, to be found in the district, which is caused from the inefficiency or incompetency of those in charge. These parties frequently attribute the deficiencies to their superiors in office, or their employers; but I have seldom, or never found a badly arranged and badly ventilated mine where there was a person in charge who had the necessary qualifications to make things satisfactory, as such persons, generally, have stamina enough to overcome the objections raised to their plans, in a pecuniary point of view, by their employers—unless it be that the said officers, having been but a short time in charge, had not had sufficient time to make the improvements necessary. In fact, employers can mostly be convinced, by their head officers and their assistants, when properly explained, that it is cheaper to have a mine well arranged and well ventilated than otherwise. There are some exceptions to this, like other rules, no doubt. It is not only once, but many times, that the writer has heard the head officers blame those under them with having failed or neglected to carry out their wishes, and, in some instances, their positive instructions to comply with the provisions of the mining law. The following are the mines comprising the class above referred to, to wit: East Boston, Hutchison, Ellenwold, Maltby, Forty Fort tunnel, No. 5 shaft D. and H., Plymouth, Pools, Chauncey, and West Nanticoke collieries. The last named colliery is in a fair way for improvement, I believe. A new fan is about being erected at the Hutchison. Ellenwold shaft has changed ownership, which may cause improvements there. And new mine bosses are to be employed in Maltby, and several others of those mines, which may also be beneficial.

Mines on Fire.

THE **EMPIRE**, or Kidder slope fire is about the same as when my last report was made; parts of the surface caving in occasionally, which has to be filled up promptly.

BALTIMORE OLD WORKINGS.—These are burning up quite briskly, near the outcrop, for a large area, and but little hopes are entertained of ever extinguishing the fire in them until it exhausts the fuel within its boundaries at least.

Mine Improvements.

Improvements in mining have been very limited again, during 1878, as in 1877.

MALTBY COLLIERY.—Mr. Maltby had the new coal breaker started in the month of August, to prepare the coals from a tunnel on the mountain side, as, also, from a new shaft sunk during this year. The old shaft was not yet ready to do any mining in, as it was being timbered anew, besides some other improvements.

RED ASH COAL COMPANY'S COLLIERY.—This company has been organized to operate a small local opening, partially opened out many years ago

Number of Employees in the District during 1879.

	Actual miners.	Employés inside.	Employés outside.	Total.
Number of actual miners employed,	3,697			
Number of men employed, including miners,		8,886	2,322	11,208
Number of boys employed,		1,676	2,698	4,374
Total employés,		10,562	5,020	15,582

Conditions of the Collieries generally, and their Management.

The present condition of most of our mines in this district is satisfactory, although there are yet a few lagging behind for various reasons. I am sorry to say that our present system of management is blamable for most of the complaints that now exist in these mines not up to a fair standard. Mining is conducted on a different scale to what it was a dozen years ago, the mines being more difficult to handle, as they are many times more dangerous, being so much deeper and more extensive. More work is being done in a month now than was done in six months a few years ago. The present vetical depth of workings is from five hundred to nine hundred feet, when there were only a few workings below water-level say ten years ago. Then they employed fifty or one hundred hands; now many have as high as three hundred to six hundred and fifty hands employed inside the mines, exclusive of about twenty to fifty per cent employed as outside hands, employing as high as eight hundred and fifty hands at a colliery. Then no fire damp was met with in our mines, except it be a very rare case; now it is a rare thing to find a colliery without having it in large quantities. Then natural ventilation, small furnaces, steam jets, or exhausts were the principal measures employed as ventilation, with a few fans of very small dimensions; now each colliery is provided with from one to three or four fan ventilators, varying in diameters from fifteen to thirty-five feet respectively—the Prospect colliery having three fans, one twenty feet and two thirty feet each in diameter. Exeter colliery has two fans, one twenty feet and one twenty-one feet diameter. The Diamond colliery has two fans, one twenty feet and one twenty-four feet diameter, and an arrangement whereby to connect the fan erected to ventilate the Hollenback shafts, which is thirty-five feet diameter. The Empire colliery has four fans, one fifteen feet diameter at the No. 5 slope; one fifteen feet diameter at the old No. 1 slope, connected to Nos. 4 and 5 slopes; and two on the Hillman seam, one fifteen feet and one twenty feet diameter. Mill Creek colliery has two fans connected or running on the same shaft, ten feet diameter each, and one fan twenty feet diameter; the latter assists in ventilating one

under sixteen years of age, during the period of three months, if necessary, but not longer, except on unanimous request of the committee.

Sixth. In case such injured person shall require medical treatment at the Wilkes-Barre or St. Luke's hospital, Bethlehem, and shall himself desire to be treated there, it shall be the duty of the committee, or any two of them, to make an order for his maintenance and care at said hospital, and deliver the same to the superintendent.

Seventh. None but contributing employés, who, while performing their duty at said collieries shall have been accidentally injured, and the families of contributing employés who have been accidentally killed while engaged in the work of the company, shall be entitled to the benefits of the fund. A list of the contributors shall be kept posted at each colliery.

The foregoing plan will be pursued for the year . . . ; at the end of which time such changes and alterations will be made as experience may prove to be necessary.

Mine Fires.

The old Baltimore mine is still burning, and my remarks thereon, in my last years' report, need no modification or addition.

The **Empire** or Kidder slope fire is also in about the same condition as last reported, the surfaces caving in, in small sections, occasionally, which have to be filled up to prevent the admission of atmospheric air to the smoldering fire.

AUDENRIED COLLIERY.—On the 6th day of May, about midnight, the fire that had been discovered there about noon of the same day, was considered to be too far gone to successfully subdue it, unless by the great risk of doing so when it was known that there were some fifteen or twenty chambers to the west of it, and immediately connecting with it, full of explosive gas, and subject to explode at any moment. Having been notified of the case about eleven, P. M., of this day, I immediately proceeded to the mine, and there met Messrs. F. B. and G. H. Parrish, superintendent and assistant superintendent for Charles Parrish & Co., Mr. J. Harris, engineer for the receivers, and others, at the shaft-head. We soon descended the shaft which is nearly nine hundred feet in depth, and we had just reached the fire-boss's station or room, and were preparing lamps, and looking over the mine tracing preparatory to going to the scene of the fire, when a messenger brought the sad news that a large party of workmen, at the fire, were very seriously burned while applying the water hose. The whole party started, accompanied by this time by Mr. Smith, mine foreman, and we soon met the unfortunate victims being conducted out by their comrades as best they could, eight of whom were seriously burned, so much so, that six of them succumbed to an untimely death after days and some of them weeks of excruciating and indescribable pain and suffering.

As soon as it was ascertained that all the victims of the disaster were brought out, a consultation was held, and all further efforts to put out the fire by the hose was at once abandoned, and the mine ordered to be flooded,

sary to make provisions to meet the forces, and difficulties here pointed out, and in addition thereto a demand for extraordinary ventilation, to meet the large amounts of gas generated and encountered. We have mines in this district generating a much larger amount of explosive gas per minute than this mine, but they are not as difficult of handling, on account of the irregular lay of the seam and its thickness. Then it is just as true, that the management has been very unsuccessful here. Mr. Weir, was the fourth mine boss, and Mr. William T. Smyth, second general mine foreman, under whose administration the terrible calamity, from which eight persons were horribly burned, and from which six died, and in consequence of which the mine was flooded, and subsequently the breaker burned. Mr. Weir has also been superceded by Mr. M. R. Morgans.

HARTFORD COLLIERY.—Great improvements have been made at this colliery during the year just past. A new slope has been sunk from the surface in a north-westerly course, and reaching down to the bottom lift, being No. 3 slope, south-west side, and is being driven downward from there towards the center of the basin lying between the south-west and north-west gangways in the said No. 3 slope, on the Baltimore seam. A pair of first motion engines, from No. 3, Hollenback slope, have been placed at the head of the said slope. Two tunnels have been commenced there also: one from the Ross to the Red Ash seams, in No. 2 slope, and the other from No. 3 slope, Baltimore, to the Ross seam. A new fan, twenty-five feet diameter, of the Guibal pattern, has been erected near the head of the aforesaid new slope, which will be very convenient and timely, as the old ones are too far away, besides being too small to properly ventilate the said extensive workings.

WANAMIE COLLIERY, No. 19.—A new tunnel has been driven here, from near the slope foot southward, to cut the Ross and Red Ash seams, besides opening of two drifts higher up on the mountain on the Ross seams. Another tunnel has been started near the No. 18 breaker, to prove a territory formerly left for some reason untouched, yet being quite convenient to the said colliery.

I should have said also that a new slope is being sunk to the north-west in the No. 2 slope, or No. 19 colliery.

EMPIRE COLLIERY.—A new fan, twenty feet diameter, has been erected at this colliery, on the Hillman workings, to substitute the one on the south side of the basin, which was only fifteen feet diameter, but which had done valuable services, having been run to one hundred and thirty revolutions per minute at one time. A little of the history of the ventilation of the Hillman seam, from 1872 up to the close of this year, probably, would not be out of place here. In April of 1872, I notified the officers of the company, being then Messrs. G. H. Parrish and John T. Griffith, to suspend all further mining in the Hillman seam, until properly ventilated. They complied in stopping, but the first day after it was done, or the same evening, a committee of five miners waited on me to beg of me to let the mine

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work on while the improvements were being done, and pleaded very hard for a compliance, as they put it for their sake, &c. I did not see the propriety of so doing, replying that the company's officers had been given ample time before to improve the same, and that, should I do so, it would establish a bad example for other mines to do the same, by sending committees to beg off, &c. This committee was composed of five persons, at the head of which was Mr. John T. Walters. Subsequently Mr. Parrish informed me that he was going to put up a fan, ten feet diameter, that would answer all purposes for said workings. I remonstrated as to the size. He said that he would guarantee that the little fan would cause to circulate at least thirty thousand cubic feet of air per minute. Then I had to consent to their trying it, as I had no power to dictate size, &c., as I had no right to do any more than call their attention to what appeared to me an absurdity; and I did, and further informed them that it would be money thrown away, as I would be compelled to ask them to stop again very soon, unless the said fan would give results much beyond my expectation.

In May the fan was started. Shortly afterwards I visited the mine again, and by this time my predictions of the utter inability of the little ventilator to give the result claimed, was only too well known to the mine officers, Messrs. Parrish, Griffith, and Jones. The consequence was, they had soon again to stop, and put in another ventilator, fifteen feet in diameter, which did very good work. In the month of June, of this year, I found the ventilation again entirely inadequate to remove the powder-smoke in the said workings, and I once more made a request on Messrs. G. H. and F. B. Parrish for one of two things, to either suspend one half the men there at work—*i. e.*, to stop one half the number of workmen in the said seam, or else put in double the amount of ventilation they then had. They at once replied that they would put up a new fan of larger dimensions, &c., which they did in very short time, and proved quite satisfactory, thus making a third fan put on said seam-workings, and each of different dimensions, being successively larger, and all within a few years.

A new tunnel is being driven from the Big, or Baltimore seam, south, from the level of the shaft gangway, to cut the Ross and Red ash seams, should the former prove in the said tunnel. This tunnel, which will be from ten to eleven hundred feet in length, will open an area of the red ash seam from the said level up to the crop, and extending east to their boundary line, and west the same. It is intended to drive a connection from the said tunnel, up the pitch of the seam to No. 2 shaft. This shaft and its workings were stopped by the writer in August, 1870, except the number of persons then allowed to work for a second opening. The company's officers, for some reason, determined not to make a second opening at that time, and no work has been done there ever since. It is now supposed work will be resumed there within a year or two, as they have already taken out the water. There is another tunnel being driven in this mine, from the Hillman to the next overlying seam, called the kidney seam.

One pump, ten inches, diameter of cylinder; twelve inch stroke; piston speed, forty feet per minute; discharging fifty gallons water; one hundred and five feet, vertical height.

One pump, ten inches, diameter of cylinder; twelve inch stroke; piston speed sixty-four feet per minute; discharging eighty gallons of water; eighty-one feet, vertical height.

We do our pumping at night, lifting about seven hundred tons of water to foot of shaft. The ventilation of our lower levels is greatly improved; the temperature normal; and the total quantity increased.

We hoist the coal from our lower (No. 2) slope, with air; it does the work nicely, far better than steam, owing to the great condensation of the latter; the pipes leading to engine being somewhere over a mile in length.

In summing up the advantages of compressed air over steam, I find that, when the pipes leading the steam are longest, there we have the best results with air. Take our lower pump as an illustration, we have somewhere about six thousand one hundred feet of pipe leading to it. With steam pressure of sixty pounds on boilers, we could get only twenty-eight feet per minute of piston speed. Now, with air pressure of forty-eight pounds, we can get a piston speed of sixty feet. The ratio of gain is less as we approach the boilers. The temperature of the air exhausting from the pump into the air currents is about thirty-five degrees Fahrenheit.

My impressions are that for deep workings compressed air is a grand success. There is necessarily a small loss by condensation in long pipes when steam is used, and, besides, the pressure with air is effective at all points.

I have written this for your information, at your request, and trust it may embody all you expected.

Yours respectfully,

WILLIAM E. LINES.

This company is sinking a new shaft called Dorrance, on the Bidlack farm, near Wilkes-Barre, the sectional area of which is fifty-two by twelve feet, and it is expected to cut the Baltimore seam at a depth of one thousand feet. When completed, it will have two distinct hoisting departments, one for the Hillman, and the other for the Baltimore seam. There are twenty-five men employed in it, and at the time of this writing, December 31, it is down two hundred and fifty feet. Several years will elapse before it will be completed ready to ship coal.

Lehigh and Wilkes-Barre Coal Company.

At the **Empire** shaft a tunnel was driven from the Baltimore vein to the Red Ash. It is one thousand and twenty feet in length, and has a sectional area of seven by fourteen feet. The coal is fourteen feet thick, and of good quality.

At the Hartford slope a new tunnel was driven from the Baltimore to the Ross seam, the area of which is seven by twelve feet, and is five hundred

Owing to the general destruction, enormous expense, and great loss caused by flooding mines with water, it should be the last method adopted for extinguishing fires. And even by flooding mines, there are many instances where, upon taking the water out and admitting air, the fire again ignited and burned as briskly as ever. This occurs where fires are located upon elevated grounds, having no escape for the air and gases, which as the water rises, are compressed and pent up, so that the water cannot approach the fire nor cool the surrounding strata; consequently, this space is converted into a magazine of heat, retaining a combustible temperature; and upon taking out the water and admitting fresh air, the fire instantly rekindles. This has repeatedly happened in all countries where fires occur in coal mines; therefore, in cases where a mine must be flooded, and the locality of the fire being such as to have no passages for the escape of the pent air and gases, the precaution of providing such should invariably be taken before the water is admitted. As stated before, many instances could be cited where, after flooding mines, and upon taking the water out again, the fires were found burning, and an escape for the pent gases had to be afterwards made before the fires could be effectually extinguished.

RECORD OF COLLIERY IMPROVEMENTS FOR 1882.

The Lehigh Valley Coal Company.

This company bought the Maltby colliery from Mr. C. S. Maltby, and took possession June 14, 1882. Prior to this, the sand and surface-water had broken into the No. 1 shaft, filling it up to the upper seam, causing it to be of no further practical value; and the coal seam, then opened into, in the No. 2 shaft, was exhausted. This company concluded to abandon all this, and erect substantial dams around the No. 2 shaft, and sink it to the next lower vein. By erecting these dams the large expense of pumping the water of the No. 1 shaft and all its adjoining workings was obviated. A plan of the dams was furnished by the mining boss, Mr. Thomas Lawther, which is found in this report. The perpendicular height of water which has to be sustained is about eighty feet. The No. 2 shaft is now extended to the eleven-foot seam, where they are working to effect a second opening.

Lehigh and Wilkes-Barre Coal Company.

In the Hollenback colliery a tunnel was driven from the Baltimore to the Hillman seam, where they found good coal, seven feet thick. The tunnel was 8x16 feet area, on a grade of 18 degrees, and is 700 feet long. They are now working to effect a second opening by connecting with the main shaft. They also sank a slope from the west gangway on the shaft level to the bottom of the synclinal, a length of 700 feet, on a grade of 10 degrees, which opens room for a convenient range of chambers.

At the **Empire** shaft a tunnel was driven on the level of No. 5 slope, from the Baltimore to the Red Ash seam, which was 7x12 feet area, and

600 feet in length. This opens to a large tract of coal, which will be extensively mined as soon as a second opening can be effected. The old No. 2 shaft, whose workings were connected with the upper Red Ash tunnel in this mine, was arranged as an escape for the men, in case of emergency, by having good accessible ladders erected up through it.

At the Stanton shaft, a force of men were kept at work through the year re-opening the mine and restoring the ventilation of the old workings. A gangway has been driven a long distance, from which a series of chambers will be opened as soon as connection can be made with the new air-shaft. The latter is now sunk to the Baltimore seam, a depth of 840 feet, and they expect to have it connected with the Stanton workings by the middle of April, 1883. A 35-foot fan was erected on top of this shaft, ready to set to work when the connection is made, which will produce splendid ventilation upon the starting of the operation. The new breaker is completed, ready for operation, as soon as the connection with the air-shaft is made.

At the No. 9 shaft Sugar Notch, the two tunnels reported in last year's report were completed—one from the Ross to the Red Ash seam was 7x12 feet area and 705 feet long, the other, not on the same level, but from the Ross to the Red Ash vein, also was 7x12 feet area and 560 feet long. A new fan was also erected on this colliery, which has improved the ventilation and made the colliery much more comfortable to work in.

At the Lance colliery a new air-shaft was sunk, which is 10x18 feet area and a depth of 520 feet, and its connection with the main shaft effected. A new 35-foot fan was erected, on top of the air-shaft, to ventilate the colliery, when ready for operation. The old breaker was pulled down, and a new one is in progress of construction, which they expect to have completed by the beginning of next May, when the mine will begin to ship coal again.

At the Nottingham shaft a new tunnel was driven from the Red Ash seam to work the Ross, none of which has yet been mined. The tunnel was 7x12 feet area, and 1,075 feet in length, and they are, at this writing, working to effect a second opening to it.

At the Reynolds slope a tunnel is in progress from the Red Ash to work the Ross seam, 7x14 area, and had been driven, at the close of the year, a distance of 300 feet. Another tunnel was driven through a large fault, which opens a large tract of coal hitherto untouched; it was 360 feet long, and has an area of 96 square feet.

At the Wanamie colliery a new tunnel was driven from the Ross to work the Red Ash seam, which has an area of 72 square feet, and is 390 feet long. A new fan, 15 feet diameter, was also erected at this colliery, which has been the means of producing much improvement in the ventilation.

The South Wilkes-Barre shaft is completed to the Hillman seam, a depth of 700 feet, and have found the vein proving better than their expectation. This has opened a large tract of hitherto solid territory of coal, and

is continued, but another year, at least, will pass before it will reach its destination.

In the Red Ash seam of the **Empire** mine, a slope was made to hoist the coal from the lowest point in the mine to a point on a level with the bottom of shaft. It is one thousand one hundred and sixty feet in length, on a grade of about twenty-five degrees, and it facilitates the drawing of coal from a wide extent of territory which was hitherto out of their reach.

The old Hartford breaker took fire and burned down about eight o'clock in the evening, January 22, and the old Jersey, or No. 8 breaker, was remodeled to take its place. This, however, is not large enough to pass the coal of more than one opening—the new slope, the other two slopes remaining idle. The tunnel at the bottom of the new slope was extended from the Ross to the Red Ash seam, a distance of 380 feet, from which a large extent of coal can be mined. The slope was also extended to a further depth of 950 feet where it touched the synclinal of the basin and opened a wide field of the Baltimore seam.

In the Stanton mine a slope was driven towards the basin in line with the bottom of the new air-shaft, which opens a new lift of excellent coal. The hoisting-engine is located at the top of the air-shaft on the surface and the rope is passed down the shaft and to the slope over pulley-wheels. It works admirably, and the inconvenience of having steam pipes in the mine, and the detrimental effects of the heat radiating therefrom, is thus successfully avoided.

A tunnel is being driven from the Baltimore to the Hillman seam, the size of which is 16×8 feet on a rising grade of nineteen degrees. By the close of the year, it was driven a distance of 222 feet, and it is expected to cut the Hillman seam at a distance of about 775 feet.

In the No. 11, or Lance colliery, a slope was sunk reaching from the level of the shaft-bottom to a length of 1,350 feet, the average grade of the coal-seam being seven degrees. A new gravity plane was made also in the same mine to lower the coal from the highest point of the workings.

Delaware and Hudson Canal Company.

A new shaft was started by this company in April, 1884, and completed to the Baltimore seam before the end of the year. It is located about a quarter of a mile south-east of the Mill Creek colliery. The depth of the shaft is 132 feet, and its size 10ft.×22ft. 8 in. It was sunk for the purpose of working the coal from a small basin, which cannot be reached from the Mill Creek slope. The coal will be shipped from the Mill Creek breaker. Therefore, it is intended to maintain the present production of the colliery, although some portions of the slope are about being exhausted.

The Baltimore Red Ash shafts reported last year are still in progress of sinking. The depth of No. 1 was 304 feet at the end of the year, and of No. 2, 382 feet. Both these shafts are located in Wilkes-Barre township, and are intended to work the Red Ash seam. For dimensions see table in this report.

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

prior to the 10th of September, a squeeze was noticed in a few pillars in the eastern workings of the Bennett vein in the No. 5 colliery. It spread with amazing rapidity from pillar to pillar in all directions during a few hours before it caved. Work was in progress in the three mines on that day and no indications of trouble in neither No. 2 nor No. 3 were perceptible until a short time before the day's work was over.

No one expected an extensive cave, and no preparation for that was made, but at about 8 o'clock P. M., September 10th, at least one hundred acres of ground sank a few feet, and an equal area of workings collapsed affecting the workings of the three collieries. Caves of this extent invariably prove damaging, and this proved so to each of the mines.

In No. 3 it extended to the underground barn and killed three of their mules. The others very narrowly escaped uninjured.

An increased quantity of water found its way into each of the mines and in Nos. 2 and 5 extra pumping machinery had to be put in, as the inflow of water proved to be much greater than their pumping engines were able to pump out. The mines were idle for several weeks, and though the coal had nearly all been won, it was a severe loss and a cause of much disadvantage that the workings caved so unexpectedly.

ABANDONMENT OF THE DIAMOND MINE.

Work was permanently suspended at this mine on the 31st day of January, 1889. It had been in operation since the year 1871 when the shaft was completed and the workings connected to those of the Old Mordacai workings. In the year 1872 the inspector reported this as an extensive mine, having a natural ventilation of 19,360 cubic feet at inlet. Then they had steam boilers and a steam engine inside, the heat of which assisted in producing the ventilation. Since then the boilers have been taken out and fans provided to furnish ventilation. The workings caved twice causing the mine to fill with fire-damp; but, with care and good management, it was cleared in both cases without injury to anyone. Once a fire took place and this could not be extinguished without flooding that portion of the workings with water.

Both the Baltimore and Hillman seams were worked out and exhausted, leaving the old workings connected with those of the **Empire** in both seams, and with those of the Hollenback and Baltimore tunnel in the Baltimore seams. As long as these other collieries are kept at work the workings of the Diamond should also be well ventilated and closely watched.

ECONOMY OF WORK IN THE CONSTRUCTION OF MINE CARS AND CAR WHEELS.

In view of the great improvements that have been made in anthracite preparing, hoisting, pumping, ventilating and general mining ma-

EXAMINATION OF APPLICANTS FOR CERTIFICATES OF QUALIFICATION FOR THE POSITION OF MINE FOREMAN.

The annual examination of persons applying for certificates of qualification for mine foremen was held in this district at Wilkes-Barre, Pa., July 8th and 9th. The board of examiners were G. M. Williams, inspector of mines, W. A. Lathrop, superintendent of mines, and John Llewelyn, miner.

Thirty-four applicants appeared before the board of examiners, and the following-named persons passed a satisfactory examination and were recommended to have certificates:

Michael J. Brennan,	Plymouth.
Essex Williams,	Plymouth.
John E. Jones,	Plymouth.
John J. Thomas,	Glen Lyon.
Moses Jones,	Glen Lyon.
Hugh Jones,	Wilkes-Barre.
Edward Mates,	Wilkes-Barre.
Hiram Smith,	Wilkes-Barre.
Daniel Daniels,	Nanticoke.
Henry Adams,	Nanticoke.
Jacob A. Morgan,	Nanticoke.
Thomas M. Jenkins,	Edwardsdale.
Richard Rosser,	Edwardsdale.

Two of the above persons were appointed to fill the position of mine foreman after having received their certificates, viz: Hugh Jones and Hiram Smith. Henry Adams was already an assistant superintendent under the Susquehanna Coal Company at Nanticoke,

COLLIERY IMPROVEMENTS DURING THE YEAR 1890.

The improvements during this year were chiefly confined to what was indispensably necessary to maintain the usual coal production. The collieries were in operation only an average of 176 days, and since the cost of keeping a colliery idle is high, there was not much encouragement in the business for improvements. Yet there were a few improvements made which are briefly described in the following remarks:

Lehigh and Wilkes-Barre Coal Company.

At the **Empire** colliery two short tunnels were driven from the bottom to the top split of the Red Ash seam. One was 72 feet long, and the other 180 feet. Each has a sectional area of 12 by 7 feet.

At the No. 9 colliery, Sugar Notch, a tunnel was driven from the Soss to the Twin and Shaft seams. It is 275 feet in length and 12 by 7 feet area.

Empire

At the **Empire** colliery several short tunnels were driven from the top split of Red Ash to Ross seam and through a fault on the west side.

A new pair of hoisting engines 20"×36" were put up at the No. 2 shaft to hoist from the underground slope.

At the South Wilkesbarre shafts, the damage that was done by the fire of 1890 was repaired, and a much more reliable system of ventilation was effected by driving new passages. A new fan 35'×12', having an engine 20"×48", is also in course of construction. The experiment of trying to ventilate this gaseous mine by a twelve-foot Cappell fan has not proven satisfactory, and the new fan is expected to effect a much desired improvement.

At the Stanton colliery the damaging effects of the cave of 1890 were repaired, and so was the effects of the South Wilkesbarre fire on the rock plane connecting the two collieries. This plane is now in working shape and openings are being driven to connect with the air-shaft, which when effected, will place the Hillman vein workings of this mine in good condition for work.

A tunnel was driven across the basin in the Baltimore seam, near the bottom of the underground slope, a distance of 456', which has enabled them to ventilate a very gaseous portion of workings which has been idle for more than four years, owing to the prevalence of an unusual quantity of explosive gas.

A new air-shaft was also sunk for the Red Ash seam a depth of 318' upon which a ventilating fan 24' diameter, an engine 20"×36", and two batteries of Babcock & Wilcox boilers were erected.

At the Jersey No. 8 colliery a new air shaft was sunk, having an area of 12'×12' and a depth of 57', upon which a new fan 24' diameter, having direct acting engine 30"×36", were erected. Several other minor improvements were also made at this colliery.

At the No. 9 colliery, Sugar Notch, the underground slope was re graded and a new lift opened. The hoisting engines were taken out and new ones erected on the surface to do the work. These engines are 24"×48" direct-acting on a parallel drum 9' diameter. This has made a very agreeable change in the ventilation. Three tunnels were driven at different levels to work the Twin, Shaft and Top split seams.

At the Lance No. 11 colliery a new tunnel was driven from the Bennett to the Cooper seam, a distance of 222'. They have also improved the ventilation by enlarging the airways at contracted points through the mine. They also put in a system of water pipes in the gaseous gangways to be ready for extinguishing fires in case the gas-feeders should be ignited. A 100-horse power Dimmick & Smith high-pressure boiler was added to the plant on the surface.

At the Nottingham colliery the third and fourth east gangways closed by the cave of last year were reopened, and the standing gas removed by driving airways around the cave.

ning 45 revolutions per minute produces a ventilating pressure of 10.4 pounds per square foot, and is exhausting 250,000 cubic feet of air per minute. A self-recording pressure meter and automatic alarm is also attached to it. The fan engine is 16×48 inches direct acting. A tunnel was driven from the Hillman to the Kidney seam; also a second opening for the same. The main tunnel is 7×12 feet and 300 feet in length; and the second opening for the ventilation is 7×12 feet area and 90 feet in length. This is the first opening to the "Kidney seam," and it will enable them to work a large area of it.

Second openings were driven through the rock from the Red Ash, one to the top split and the other to the Ross seam. The first is 43 feet in length and the second 80 feet, and each has an area of 7×12 feet, which make roomy return airways. Another tunnel is being driven south from the West Red Ash gangway to cut the Diamond basin, which will open an extensive field of coal.

At the **Empire** colliery three new rock tunnels were driven, the first through a fault in the Red Ash seam a distance of 180 feet, the second from the top split of Red Ash to the Ross seam, a distance of 60 feet, and the third from the Red Ash to the top split, a distance of 130 feet. Each of these have an area of 7×12 feet.

At the South Wilkes-Barre colliery besides the new breaker already noticed, a new 35-foot Guibal fan has been erected which, running at a speed of 45 revolutions per minute, exhausts 240,000 cubic feet of air under a water gauge pressure of 1.9 inches. This fan was erected to supersede the old Capell fan, which was not of sufficient capacity for this gaseous mine. The new fan is supplied with a self recording pressure meter and automatic alarm.

Three new tunnels were driven through the rock, one from the Hillman to the Kidney seam in the No. 3 shaft, a length of 228 feet, and an area of 7×12 feet. This will enable them to work the Kidney seam, which is 4 feet 3 inches in thickness. The second was driven from the Baltimore to the next seam above, called there the "Stanton" seam. This tunnel is 300 feet long and 8×12 feet area. A second opening was driven for ventilation a distance of 84 feet, having an area of 9×12 feet.

An underground slope was sunk in the Hillman seam from the east gangway of the No. 3 shaft. It reached the basin at a length of 425 feet, which opens a productive lift of coal.

At the Stanton colliery a new fan has been erected to ventilate the old Hillman seam workings near the main shaft. Fire-damp would occasionally accumulate in these workings, making it dangerous to pass through the main shaft, and the erection of this fan has removed every vestige of the danger. It is a Sturdevant fan, 8 feet diameter, running 80 revolutions, and exhausting 3,000 cubic feet of air per minute—run by a horizontal direct-acting engine 10×14 inches.

A new gravity plane 1,000 feet long was made in the Hillman seam to work the coal to the rise. It has an average grade of 10 degrees.

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.

they should always be withdrawn when it is seen that their work does not produce the desired effect, and this can at all times be determined several hours before the collapse or final cave-in occurs. In all the caves that occurred in this district during 1896 the men were all withdrawn long before the cave took place. Caves of more or less extent took place in each of the following mines:

In the old workings of the No. 5 colliery at Plymouth a squeeze started in the latter part of 1896 and extended into the workings of the Boston and afterwards into the workings of the No. 3 colliery. On account of this, the Boston and No. 3 were suspended during the month of January, and No. 3 worked only two days in February. Considerable damage was done to both mines, but No. 3 has been re-opened and is now in fair condition.

In July another squeeze occurred in the Baltimore seam workings of the Boston mine, east of the slope. This affected all the work in that seam. The workmen were all withdrawn and they have done no work in that seam since, but they can mine the remaining coal again when needed. In the early part of February a squeeze appeared in the old workings of No. 5 Plymouth which extended down into the workings of No. 2 and affected the two seams. It did considerable damage to the openings, and the company concluded to leave all stand for the present and sink the shaft to the Red Ash seam. They have not shipped any coal from there since April, 1896.

In the Hillman workings of the Conyngham mine the damage done by a squeeze in 1895 was repaired ready for work in the latter part of January, 1896, but it recommenced in July and affected the upper seams so that they did not get in condition to mine coal up to the end of the year.

For the first three months of the year a squeeze was in progress in the workings west of the planes in the **Empire** mine, but it abated without doing much damage, although quite a large area had closed in. In the latter part of November another squeeze took place in the workings east of the planes. This required the suspension of all work on the planes for the remainder of the year and has caused great loss to the company and the workmen.

The Method of Mining in this District.

The method or system by which the largest quantity of coal can be extracted from a given area of land with the greatest degree of safety to the employes and at the least cost is the desideratum in every coal field.

Coal is too valuable to leave in the earth if it is practicable to extract it. The plan or system which enables the miner to extract the largest quantity, per acre of land, with equal degree of safety is certainly the best and most economical method.

Classification of Fatal and Non-Fatal Accidents.

Causes of Accidents.	Fatal.	Non-fatal.
By explosions of fire damp,	10	27
By falls of roof and coal,	40	85
By mine cars, underground,	12	32
By explosions of powder and blasts,	4	12
By falling down shafts,	3	1
By miscellaneous causes in the mines,	6	17
By miscellaneous causes on surface,	6	16
Total,	81	190

In addition to the above, 135 slight accidents occurred which were not included as serious accidents.

There were five persons killed in the district, which accidents were not regarded as attributable to mining and were not included in the reports of fatal accidents, viz:

George Forney, who died from apoplexy on the floor of the screen room of the Parrish breaker January 25, 1899.

Patrick Kern, killed by a train of cars on surface at the Parrish colliery March 17. He was not an employe and was in his clean clothes at the time.

Frank Weisgale, killed in the mouth of an old opening used for an intake at Nanticoke March 29. He was not an employe.

Terrence Anderson, who escaped out of his home when delirious from sickness and jumped into the No. 4 shaft, Plymouth, about midnight of April 6, 1899, and John Conway, a boy who fell in the old No. 8 breaker at Ashley, while playing with other boys on June 7, 1899. The breaker was idle, and had been so for a number of years.

Mine Fires in the Year 1899.

There were three serious mine fires in this district during the year. One at the **Empire** mine, of the Lehigh and Wilkes-Barre Coal Company, which commenced on the night of June 9; one at the Maxwell mine, of the same company, originating from an explosion of gas on Friday morning, June 22, and one at the Dodson mine, of the Plymouth Coal Company, where the breaker was burned on Thursday, July 13, and the burning debris falling down the shaft set the mine on fire underground.

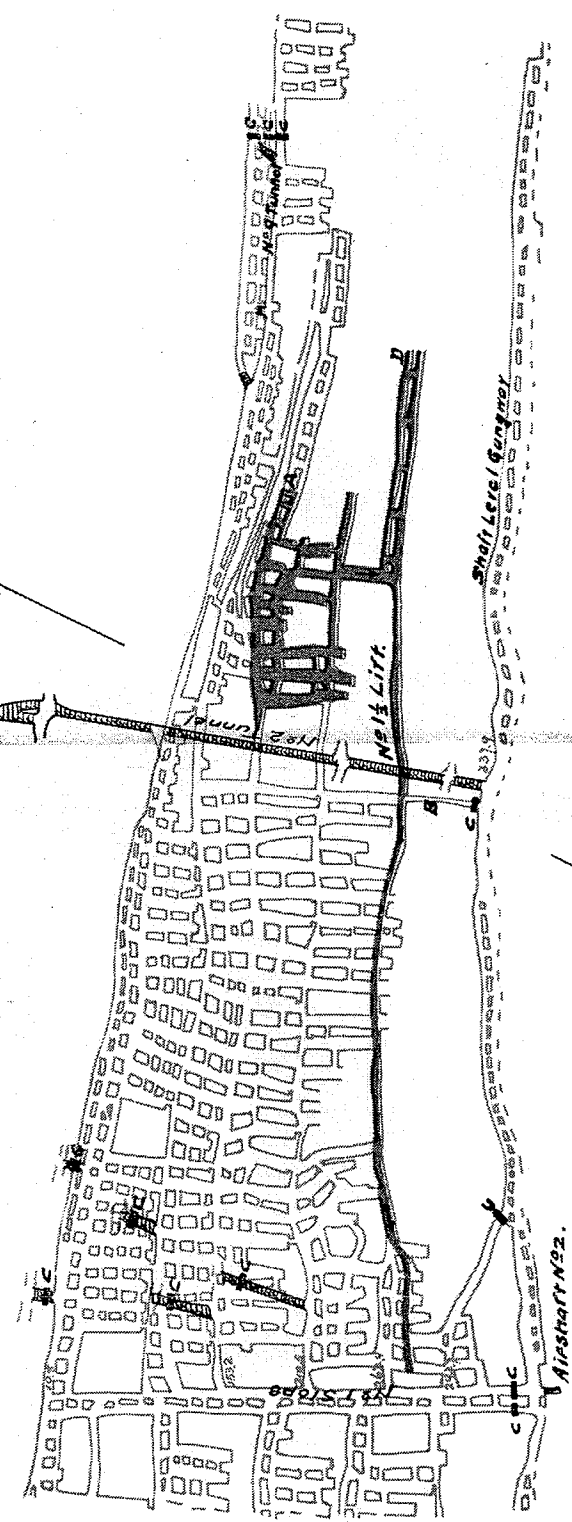
The **Empire** Mine Fire.

This colliery had not been in operation since 1897, but a party of men was employed to keep the gangways in order and in doing the necessary timbering. A party of miners was also employed driving

20005

Empire No 4 Shaft.
 Map of.
 Bottom Split Workings, Red Ash vein.
 at the
 Empire No 4 Colliery.
 Lehigh and Wilkes-Barre Coal Co.
 in relation to
 Fire of June 1899
 Scale 1"=400'.
 G. M. Williams
 Mine Inspector.

A - Where fire originated
 B - Heading driven to Seal No 1 1/2 Lift.
 C - Walls built to Seal Bottom Split Workings
 Course of fire



the first east lift gangway (marked D, see map accompanying this report). On the 9th of June the repairmen were renewing timber on the third lift gangway, at A, working with naked lights. The pitch was about 60 degrees, and the timber was thick and exceedingly dry. The day's work was finished between 5 and 6 o'clock, and the timbermen went home, leaving everything apparently safe. That evening the fan engineer on surface, seeing smoke in the return air, notified the officials, who promptly repaired to the mine and found the timbering in the third lift gangway at A on fire. There was no water anywhere near, and the workings between that and the slope soon filled with smoke and the poisonous products of the fire. The upper lift was the main return airway, but the four upper lifts were connected by breasts and had more or less of the return air passing through, making all that side unavailable for fighting the fire. A line of hose was promptly laid from the water pipe on the fifth lift to the inside of the fire, and it was directly fought with water and successfully beaten back for about 150 feet, but the timbering having burned away, the top fell and closed the gangway, making it impossible to follow farther from that side. To attack it on the return side, the breasts along the right of lift No. 3 were closed by brattices as far as the reserved pillars left to sustain No. 2 tunnel (see map), and a current of fresh air was conducted to that point. The hole, B, was also driven down from the level gangway to that of the first lift. Seeing that it was impossible to fight the fire with water, an attempt was made to close all the gangways on the reserved pillar and confine it by stoppings within that space, so as to shut the air off, but before this was effected the fire passed to the outside of the reserved pillar on the upper gangway. But, notwithstanding that the fire had passed that point, the hole B was driven through and the gangway blocked with flushed dirt in the reserved pillar, dividing the fire. Then strenuous efforts were made to follow the fire and beat it out with water. There were three lines of hose in use, but the efforts failed to stop its progress. This was dangerous work, because the heat and noxious gases of the fire inside of the reserve pillar came out through the stoppings and followed the men so that they were between two fires and in danger of having their escape way cut off. By Sunday morning, June 25, the fire had got dangerously near the air bridge where the return air conveying the heat and noxious gases crossed under the slope to ascend the air shaft. It was evident that had it destroyed this air bridge there would have been no chance to check its progress into the workings west of the slope and up the planes, therefore, it was decided to withdraw the men from their perilous work at once and to confine the fire to the workings of the bottom red ash seam and seal it from the air by walling the five tunnels leading from the bottom to the top split, the fifth lift gang-

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way, the top of the manway, slope and slope airway with brick walls. The location of each wall is marked on map by C. This was all effectively done in twenty-four hours after it was decided upon. The Mine Inspector was present, watching the work day and night, and rendered all the assistance in his power, and, fortunately, although dangerous work was done, no one was injured. There is an immense area of workings closed in with that of the fire area, but the fire was of sufficient extent to produce enough non-combustible gases to fill the whole in a few hours. The complete combustion of one ton of coal produces more than three and a half tons of carbonic acid gas, which, at the mean temperature of 60 degrees and mean pressure of 30 inches, would be about 56,564 cubic feet. Besides this, 154,757 cubic feet, of nitrogen is released, producing for each ton of coal consumed, about 211,321 cubic feet of non-combustible gases. Where a fire is large and burning freely, every part of the workings is soon filled with the non-combustible products of the fire and as it is filling, the air is being driven out. Carburetted hydrogen gas is also non-combustible when not mixed with air, and serves to smother a fire as effectively as carbonic acid or nitrogen. When the carbonic acid is all driven out and the workings filled with carburetted hydrogen gas unmixed with air, the fire cannot burn for the presence of this gas proves that the fire has ceased burning, and that carbonic acid is no longer produced, but there are good reasons for believing that a mass of red hot coals retain heat enough for several months to rekindle it on the admission of air in a mine where its surrounding gases are stagnant. There is nothing to absorb or carry the heat away, therefore the air should not be admitted for at least five or six months after a fire has been isolated and enclosed from the air. At this writing the **Empire** fire has been shut in for eight months and it is not yet opened. If this method proves effective to extinguish the fire at the Empire, of which I have no doubt, it would certainly prove effective in all mines excepting workings near the outcrops or surface, where air may be forced in through the earth by the pressure of the atmosphere.

At the **Empire** mine, a vast area of workings had to be enclosed with the fire, and there is only a small quantity of carburetted hydrogen given off in the workings, both being highly disadvantageous for effective suffocation of the fire. So far the indications are that the workings are densely filled with non-combustible gases, but there is no heat nor any indication of the fire burning, and no indications of the existence of fire has been seen since it was sealed in.

The Maxwell No. 20 Mine Fire.

At about 8.30 A. M., June 22, 1899, a small body of gas was ignited in a breast on the red ash seam of the Maxwell mine, and two men

to bar it back to the loading chute. At the same time the car runner was running three more cars on the same track. The rails were wet and muddy and he could not bring the cars to a stop before they slightly bumped the half-loaded car, causing it to start and run over the victim. The car runner called loudly to the victim to look out but he evidently did not hear him.

By Machinery

Theodore Tucker, slatepicker, at the Red Ash No. 2, was sent by the screen boss to start the coal running in the chute leading from the elevator to the rolls. There is a hole in the side of the chute to allow a person to go into the chute to start the coal running when it blocks. The hole is 25 feet from the elevator. He was next seen on the floor of the screen room at the foot of the elevator, the supposition being that he had come through the elevator. He was injured about 4 P. M. and died at 11 P. M. at the Wilkes-Barre City Hospital.

Thomas McDonald, laborer, at the Hadleigh colliery, outside, was shoveling coal into the scrapper line along with six other men when a rush of the bank started. He became confused and instead of standing still, he ran into the conveyor line. The other men who were much nearer the line than he was, when the rush occurred, stood still and escaped injury.

IMPROVEMENTS DURING THE YEAR

LEHIGH AND WILKES-BARRE COAL COMPANY

Hollenback No. 2 Colliery

Outside.—Five hundred horse power battery B. & W. boilers completing plant of 2,000 horse power.

Inside.—No. 11 tunnel, bottom split Red Ash to top split Red Ash, 50 yards.

No. 12 tunnel, bottom split Red Ash to top split Red Ash, 50 yards.

Empire No. 4 Colliery

Outside.—Machine, smith and car shops to replace shops destroyed by fire April 18, 1903.

Inside.—No. 24 tunnel, extended from top split Red Ash to Ross, 70 yards. Hoisting shaft enlarged to standard size.

South Wilkes-Barre No. 5 Colliery

Outside.—Duplicate 35 foot Guibal fan, No. 1 air shaft. Barn and carriage house. Inside and outside foreman's office.

Inside.—No. 8 tunnel, Kidney to Abbot, 160 yards. No. 10 tunnel, top split Baltimore to top split Baltimore, 140 yards. No. 11 tunnel, Kidney to Abbot, 90 yards. Tunnel airway, across basin

Ash to Ross; rock plane, Hillman to No. 17 tunnel; tunnel, Abbott to Abbott, 1st East; No. 22 tunnel, Top to Bottom Red Ash; tunnel, Ross to Top Red Ash, and No. 23 tunnel, Abbott to Kidney vein. Extended No. 17 tunnel to Kidney. Drove 10-inch bore hole to the Baltimore vein.

Sugar Notch No. 9 Colliery.—Completed No. 31 tunnel. Twin to Hillman, and a tunnel from Station to Five Foot vein.

Maxwell No. 20 Colliery.—Completed a tunnel from Red Ash to Red Ash, and No. 31 tunnel, Red Ash to Ross vein.

Empire Washery.—Installed pea and chestnut spirals.

LEHIGH VALLEY COAL COMPANY

Dorrance Colliery.—Inside: Two electric motors were placed in service in the Lance, Cooper and Bennett veins. A 4-inch drainage bore-hole was drilled from the Baltimore to the Red Ash to drain silt water. No. 26 tunnel was driven from the Bowkley to Abbott vein, 210 feet long. No. 27 tunnel was driven from No. 21 tunnel into Lance vein. No. 24 slope, in the Red Ash vein, was graded and tunnel commenced through the anticlinal at the foot of the slope, in order to facilitate haulage. Completed No. 24 haulage, Cooper to Lance vein.

Outside: Installed an additional 300 horse power boiler in boiler plant. A spray system was placed in breaker, and a pump installed, and pump line laid from pump to breaker, and pump house erected near reservoir. The construction of a steel fuel conveyor was continued. A fence was built around tracks, and bridge constructed over tracks near head of shaft for traveling way and safety.

Prospect Colliery.—Electric cables in shaft were renewed. Considerable grading was done at the head of Nos. 26 and 29 slopes in the Skidmore vein. A 15-degree rock slope, 80 feet long, was sunk through fault from Lower Baltimore to Upper Baltimore vein, for a return airway. Two bore holes were drilled from the Five Foot vein to drain water from Prospect Hillman slope workings to the Oakwood pump. Edison electric safety lamps were purchased for use in the Red Ash vein. Concrete and steel timbering at foot of Red Ash shaft continued.

Outside: Steam lines were recovered. The fuel line from breaker to boiler house was rebuilt. A new roof was placed on the boiler house. The supply yard was rearranged. Steel bents were put under main conveyor from the Prospect shaft to the head of the breaker. A condenser was placed in the river pump-house. The old boiler house at Oakwood shaft was remodeled for a washhouse and lamphouse.

Henry Colliery.—No. 74 tunnel from the Hillman to the Bowkley vein was completed, and a 30-degree rock plane 152 feet long was driven for a second opening. A 45-degree rock plane was driven from the Five Foot to the Hillman vein, the Wyoming Five Foot slope, for a return airway, and to improve the ventilating conditions. The concrete hospital at the head of No. 11 slope was completed. A concrete roof was constructed over the barn in the Red Ash vein, west of the shaft. A 10-degree rock plane, from the Five Foot to the Hillman vein, was started. An air shaft was sunk and concreted to the Hillman vein, Prospect slope, for an intake. Considerable rock grading was done on No. 39 slope in the Skidmore vein, to improve haulage conditions. The Henry shaft was abandoned.