

lock, superintendent of mines, for the Fall Brook Coal Company, who owns and operate the mines. Mr. Bollock must be congratulated on having put in such a model plant, and one that works so successfully.

#### Fatal Accidents.

*Accident Xo. 1.*—James Malloy and James Kennedy, miners, were killed in Adrian mine, No. 1, March 2, 1888. These men were at work undermining, when the whole body of coal parted away from a slip running right across the back of the coal they were mining, up to a spar on right hand side, and settled right over the sprags they had under the coal, upon the men, causing their deaths. This accident was entirely unforeseen, the men having taken all the precautions necessary for their safety.

*Accident Aro. 2.*—James Ryan, aged twenty-three years, employed as a driver in Rochester mine. DuBois, while coming out with his loaded trip, and standing on the end of the rear car, was struck by a heavy piece of fire-clay which fell from the roof, and he died in seven or eight hours after the accident, which occurred August 6, 1888. The tire-clay had been pulled down in the heading up to the point where the accident happened, and it was just at the beginning of the jog that the tire-clay fell. The clay was covered by a false roof of coal and was not perceptible.

*Accident Xo. 3.*—Gus Magnuson, a Swede, fifty years of age, was killed in mine No. 1, Antrim, October 2, 1888. Deceased had been working a loose end place, and had fired a shot about ten feet from the loose end, which had brought some of the coal and rock down, but left the loose end still staying up, and he lay down under it to mine it deeper, when the rock came down upon him killing him instantly.

*Accident Xo. J.*—See Kettle Creek explosion.

*Accident Xo. 5.*—John Fisher, aged — years, a miner, and employed in Arnot mine, No. 3, was instantly killed in working place, December, 1888. Fisher, in company with a companion, was at work and had fired one shot on the fast side, and Fisher was just finishing the mining on the end, when the coal fell on top of him with the above result. There were no sprags under the coal, which had a loose end and a smooth top, and the accident seemed due to pure negligence.

#### **The Explosion at Kettle Creek Coal Mine.**

On Saturday afternoon, November 3, a disastrous explosion occurred at No. 2 mine, belonging to Kettle Creek Coal Company, by which sixteen men were almost instantly killed and one other died on November 7, making seventeen in all who lost their lives.

The mines are located in Clinton county, Pa., on the line of the P. & O. R. R., and distant from Cook's Run station two miles, and at an elevation of about 1,800 feet above tide water. The mines

were opened in February of this year, and were doing a good business. In putting in this No. 2 mine, a fault had been met with just on the outcrop of the coal, and the drift had been made by over-casting, and when the rock fault had been reached the legs of the timbers had been set on the fault, and as soon as this was passed the drift went under cover.

As will be noticed from a glance at the map, the main heading was only driven for a distance of about live hundred and fifty feet. To the right, two heading were being driven; in the first, there were seven rooms turned off, and in the other, nine rooms had been turned away. About half-way to the face of the main heading a heading had been driven for a distance of nearly one hundred and twenty feet, and it had gone to the dip very fast; and so to strike the bottom of the dip and to drain it, a heading had been started just inside the drift timbers, and, passing under the air shaft, had been driven diagonally until it had intersected the dip heading spoken of, and to further drain the heading, and to make the water-way more uniform, four Swedes had been set to work, on the morning of November 3, to blast a ditch in this diagonal heading, and as they were considered capable men, and the heading was covered with water, dynamite was given to them to blast with, and they had fired three shots and were getting ready for the fourth when one of the men, Carlson, went outside to the store for a fresh supply of dynamite and fuse, but could not get any fuse, but brought in six more sticks of dynamite and a box of cartridges, and as one of the survivors of the explosion, Anderson, states, he and his two companions were just commencing to drill the hole, Anderson holding the point of the drill down, and his two companions turning the crank of the machine drill, when Carlson came in with dynamite and box of caps, and seeing the drill post giving way, he hastily put the dynamite and caps down and tried to hold up the post, but it fell over and the explosion immediately occurred. Anderson remembers nothing after this, but managed in some way or other to get out of the mine, as also did his brother, while Carlson was hurled up the air shaft and over the stack built on top of it, his body not being found until the next morning. The other man was hurled up the back heading, which runs pallel to the main heading for a distance of one hundred and fifty or one hundred and sixty feet. Two miners at work in the drift making a ditch, were hurled out with terrific force on to the slate dump, a distance of about one hundred and seventy feet, and instantly killed. An Italian boy, who was employed as a trapper at the door on main heading, where the air is turned up into the first right heading, was hurled away from his post almost to the mouth of the drift, just outside some timbers that had been blown out, and instantly killed.

The explosion seems to have spread itself as follows: Up the air shaft, out of the drift, up the main heading and up the first and second

right headings, and it was in these two headings that twelve men lost their lives as they were endeavoring to escape from their places, some of the bodies being found on the gangway and some in the rooms. Three miners, who were at the face of the second right, escaped from the mine, as did also another miner, and a driver who was in the first room in second right also escaped, while his mule perished.

Now the question arises, was the amount of explosives (for in addition to the dynamite and caps there were two half kegs of powder in the Swedes' boxes) great enough to cause this terrible loss of life and destruction in the mine, for, in addition to the timbers being blown out at the mouth of the drift, every door and brattice in the mine was blown away, and even the stack on top of the air shaft was badly wrecked?

From the evidence adduced at the inquest it appears that the men must have had four sticks of dynamite in the morning, and allowing them to have used one stick for the three shots. then with the six sticks Carlson brought in, there would have been nine sticks, but two sticks were subsequently found in the water ditch heading, so we can only say that seven sticks, the box of caps and two and a half kegs of powder exploded.

What, then, was the cause of the death of the men in 1st and 2nd headings? Was it as some of the miners suggested—firedamp? I must say no, in answer for myself. Inspector Callaghan, Superintendents Miller and Eddy and Messrs. Anderson, Bolem, and myself went carefully through every working place in the mine with safety lamps, and could not find the least trace of fire damp, and the next day we again went through the mine with the same result. Mr. Lyle, of Rithmsl, and Mr. Bate, of Bituman, old and experienced miners so far as gas is concerned, being with us; and, on Thursday, November 8, Inspector Blick, W. Kelly, General Manager Kemble Coal and Iron Company, John Mitchel, Superintendent Kemble Coal and Iron Company, and Jacob Andeison, Mine Foreman of St. Mary's, again went in the mine and could not find a trace of gas, so we must look for some other cause for the deaths of those miners in 1st and 2nd Right; and, in spite of the fact that I lay myself open to ridicule and misrepresentation, I now state it as my earnest and sincere belief that it was the coal dust that lay along 1st and 2nd Right headings, and in the rooms of the same, that ignited and caused the death of these miners in the headings spoken of; and here I may ask, is it not possible for such a concussion as resulted from the ignition of these explosives to raise all this line dust in a cloud, and then for the flash of the same to have ignited the dust, and the consequent explosion of it and the resulting carbonic-oxide to have caused these deaths? For, commencing at room No. 1 in 1st Right, we first find the traces of the burnt dust, not only along the heading, but also in the 1st room, and find the current passed on and up through the cross cuts

in every room until the top room is reached, when it comes out and joins the current that had come up the heading, and then, passing down and into some of the rooms in the 2nd Right, until it met a counter current coming up 2nd Right, and through the rooms of the same, and in no case do we find any trace of the burnt dust for a distance of from 20 to 24 feet beyond the last cross cut in each room; and we find it did not go up to the face of the main heading by 60 or 70 feet.

One peculiar feature in the path of this explosion was noted, viz: That wherever there had been a bend made in driving the heading, and the rib was of a convex shape, the current was deflected from its course and it then struck the opposite rib and so passed on. Another feature noted was that the burnt dust was thickest on top of the props and along the top of the ribs, while near the bottom very little could be noted. Three miners were at the face of 2nd Right, and one of the men at the moment of the explosion looked down the heading, and he says he saw the *heading full of sparks*, and not a flash. Another Swede gave the same testimony, and the mule driver says the same thing. All these men who thus escaped did so by crawling on their hands and knees to the drift mouth.

That there was no fire-damp present in the explosion, we point to the fact that in a few minutes after it, Mine Foreman Meehan and others went in to the mine with naked lights and went up the headings for quite a distance until driven back for a few minutes by the dense smoke and gas, resulting from the burnt dust, and in less than an hour's time all the bodies had been recovered from the mine. Of the bodies so recovered there were no traces, so far as could be ascertained, of any of them being burnt, but they appeared to have been suffocated, and none of them showed any signs of having been hurled around, so we must conclude that these men were killed by the explosion of the coal dust. And now let us see if there is any ground, or have we any well authenticated cases of coal-dust explosions, and let us first see what Dr. Chance says in his work on "Coal Mining," page 305.

"But there are several considerations opposed to this view of the necessity of the presence of fire-damp:

"1. Although admixtures of coal dust and air may not be readily inflammable (explosive) under ordinary conditions, it seems probable that when suddenly and violently set in vibration by a powder blast, an otherwise non explosive mixture may become explosive.

"2. It is a well known fact that flour and other fine vegetable powders may cause violent explosions.

"Explosions have occurred in some collieries, notably one at Berandine in 1877, when no fire-damp had been detected for long periods (twenty two years), and in a colliery at Oampagnac an explosion occurred in 1875, although fire-damp had never been detected.

“It is evident that the danger from this source is confined to comparatively dry mines, and is greater in dry than in wet weather.”

Mr. Galloway quotes Mr. Vital as saying:

“Very fine coal dust is a cause of danger in dry working places in which shots are fired. In well-ventilated workings it may of itself alone give place to disasters. In workings in which fire-damp exists, it increases the chance of explosions, and, when an accident of this kind does occur, it aggravates the consequences.

“But, while these conditions are doubtless correct as regards the dust of bituminous coals, it is certainly questionable whether anthracite coal dust will form an explosive mixture with air alone under ordinary temperature and atmospheric pressure, or whether it will increase the explosive force of an explosive mixture.”

Mr. W. Galloway, late Inspector of mines in England, and one of the greatest living authorities on the question of coal dust explosions, contributed a remarkable paper to the South Wales Institute of Engineers, and this same article was reprinted in the “Colliery Engineer,” of Shenandoah, Pa., in the July, August and September numbers, and in the September number is the following remarkable paragraph:

“The flame of great colliery explosions is found, as a rule, to have traversed the intake airways, the working-places, and the return airways, to a greater or less extent; that is to say, it has passed through those regions of the workings which contain pure air and coal dust, as well as those which contain a mixture of air and fire-damp, together with coal dust. Hence it is that, ever since serious attention has been drawn to the inflammable nature of mixtures of fire-damp, air and coal dust, and of air and coal dust alone, differences of opinion have existed as to how far the fire-damp, on the one hand, or the coal dust, on the other, may have contributed toward the production of the results observed in the case of any particular explosion. Altoft's explosion is, however, a remarkable exception of recent occurrence, in regard to which, all who examined the mine after the explosion, the author included, *came to the conclusion that coal dust alone had been the inflammable agent.*”\*

For a full description of this peculiar explosion, I would refer your readers to the “Colliery Engineer” for September, 1888, and in the same journal for December, 1888, will be found copious extracts from the recently-published work of Messrs. W. N. and J. B. Atkinson, II. M. Inspectors of mines, in which is clearly shown the great influence exerted by coal dust in an explosion. I quote the two following paragraphs as bearing directly on this subject:

“What is the reason of the change from inflammation unattended with violence to inflammation with violence, the writer can only conjecture. It is possible, owing to the compression of the air in front of

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\*The italics are mine.

the inllamed dust-air mixture by the expansion of the air behind it by the heat evolved. The compression of the dust taking place in air so compressed, would be assisted, as Mr. Galloway has pointed out, by the heat evolved during compression, and it is possible that in compressed air, even at ordinary temperatures dust would burn more readily."

"After the explosion was fairly established, conditions quite different to the ordinary conditions of a colliery would exist, which appeared to be sullieient to insure the continuance of both flame and violence over the whole of those roads containing an uninterrupted supply of coal dust.

\* These conditions would be: 1. A wave of air preceding the explosion and tilling the air in the road with coal dust. 2. Flame following instantly into compressed air charged with dust."

Let us now see if we have had any similar accidents in this country in which it is claimed that coal dust was the explosive agent, and the Pocohontas, Ya., disaster is the first case in point; and it is claimed in this case that the coal dust was the destructive agent, and it was finally contended that fire-damp had not been seen in the mine previous to, or after, the explosion.

Coming down to more recent cases, we find an explosion at Rich Hill, Mo., caused by a blown-out shot, or a "cyclone," as the miners term it, and, soon after the Kettle Creek accident, we find one occurring at Pittsburg, Kansas, very similar in all respects to those above mentioned, and, taking everything into consideration—the extreme dryness of the mine, and the large amount of very fine dust lying along the roadways, and the fact that it was near quitting time, and most miners had fired their shots—everything seemed just in the right condition for a disastrous explosion, and only needing the Hash of a large amount of explosive material to ignite it, and to carry death and destruction in its pathway.

In conclusion I would sty, after the most careful examination of the mine, and of those who escaped from it, I am satisfied that, in this case at least, coal dust played the most important part; for I firmly believe that the deaths of Curran, Donley, Carlson, Pearson and the Italian boy, were due to their being thrown around by the concussion of the dynamite caps and powder, and the death of all the others was due to their being suffocated by the gas and smoke given off from the burning coal dust ignited from the explosion of the dynamite caps, and powder.