THE KETTLE CREEK DISASTER

Mine-Inspector Roger Hampson Believes that Coal-Dust was the Chief Factor. [Inspector's Report, 1888.]

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

lost their lives. The mines are located in Clinton County, Pa., on the line of the P. & E. 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 bus-inces. 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 tim-bers 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 five hundred and fifty feet. To the right, two head-ings were being driven; in the first, there were seven rooms turned off, and in the other, nine rooms had been turned away.

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 very nat; 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 3d, to blast a ditch in this diagonal head-ing, and as they were considered capable men, and the bedien menered with water way 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 com-panions 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 the 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 noth-ing after this, but managed in some way or other to ing 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 parallel 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 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 gang-way 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 es-caped, while his mule perished. Now the question arises, was the amount of ex-plosives (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.

tendents Miller and Eddy, and Messrs. Anderson, Bolem, and myself went carefully through every 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 Rathmel, and Mr. Bate, of Biumen, old and experienced miners so far as gas is concerned, being with us; and, on Thursday, No-vember 8, Inspector Blick, W. Kelly, General Man-ager Kemble Coal and Iron Company, John Mitchel, Superintendent Kemble Coal and Iron Company, and Jacob Andergon mine-foreman of St. Marvia and Jacob Anderson, mine-foreman of St. Mary's, again went in the mine and could not find a trace of again went in the link of some other cause for the deaths of those miners in 1st and 2d 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 Ist and 2d 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 ask, is the high possible for such a concussion as resulted from the ignition of these explosives to raise all this fine 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 backing but also in bound 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 2d right, until it met a counter-current coming up 2d right, and through the

the bodies so recovered there were no traces, so far as could be ascertained, of any of them 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 395.
But here are several considerations opposed to this view of the necessity of the presence of fire-damp.
Although admixtures of coal-dust and air may not be readily inflammable (explosive) under ordi-nary 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 Campagnac an explosion oc-curred in 1875, although fire-damp had never been

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

Mr. Galloway quotes Mr. Vital as saying:

¹ Very fine coal-dust is a cause of danger in dry working-places in which shots are fired. In well-ven-tilated workings it may of itself alone give place to o disasters. In workings in which fire-damp exists, it increases the chance of explosions, and,



MAP OF DRIFT NO. 1. |KETTLE CREEK COAL-MINING COMPANY.-SCALE, 100 FEET = 1 INCH.

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 the last cross-cut in each room; and find it did not go up to the face of the main heading by sixty or seventy 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 the 2d 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 ex-plosion, 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 head-ings for quite a distance until driven back for a few minutes with a descenarios and sea resulting from what, then, was the cause of the death of the men in the 1st and 2d headings? Was it, as some of the miners suggested, fire-damp? I must say no, in answer for myself. Inspector Callaghan, Superin-i the bodies had been recovered from the mine. Of

vinen 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 minimum.

Mill increase the explosite trice of mines of Eng-mixture.³ Mr. W. Galloway, late Inspector of mines of Eng-land, and one of the greatest living authorities on the question of coal-dust explosions, contributed a re-markable paper to the South Wales Institute of Engineers, and this same article was reprinted in THE COLLIERY ENGINEER, of Scranton, Pa., in the July, August, and September numbers of 1888, and in the September number is the following remarkable para-

graph: The flame of great colliery explosions is found, as a rule, to have traversed the intake air-ways, the working-places, and the return air-ways, to a greater working places, and the return an ways, 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

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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 con-clusion that coal-dust alone had been the inflammable agent.'

For a full description of this peculiar explosion, I For a full description of this peculiar explosion, 1 would refer your readers to THE COLLERY ENGINEER for September, 1888, and in the same journal for De-cember, 1888, will be found copious extracts from the recently published work of Messrs. W. N. and J. B. Atkinson, H. M. Inspector of mines, in which is clearly shown the great influence exerted by coal-dust in an explosion. I quote the two 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 possibly owing to the compression of the air in front possibly owing to the compression of the air in front of the inflamed dust air mixture by the expansion of the air behind it by the heat evolved. The com-pression 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, condi-tions quite different to the ordinary conditions of a colliery would exist, which appeared to be sufficient to insure the continuance of both flame and violence over the whole of those roads containing an unin-

over the whole of those roads containing an unin-

terrupted supply of coal-dust. 'These conditions would be: 1. A wave of air preceding the explosion and filling 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 ac-cidents in this country in which it is claimed that coal-dust was the explosive agent; and the Poca-hontas, Va., disaster is the first case in point; and it is claimed in this case that the coal-dust was the de-structive 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 ex-plosion at Rich Hill, Mo., caused by a blown-out shot, or a "cylone," as the miners term it, and, soon after the Kettle Creek accident, we find one occur-ing at Pittsburg, Kansas, very similar in all respects to those above mentioned, and, taking everything into consideration—the extreme drypers 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 of the miners had fired their shots—everything seemed just in the right con-dition for a disastrous explosion, and only needing the flash of a large amount of explosive material to ignite it, and to carry death and destruction in its pathway.

In conclusion I would say, after the most careful examination of the mine, and of those who escaped from it, I am satisfied that, in this case at least, coaldust 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."

SKETCH HISTORY OF THE PITTSBURG COAL REGION.

BY MINE-INSPECTOR HENRY P. LOUTTIT.

[Proceedings of the Western Pennsylvania Mining Institute.]

The scope of the paper given me by your committee of programme is somewhat indefinite and it im-plies such an extent of territory as would make a lengthy paper, the contents of which would not perhaps interest you, and no doubt would crowd haps interest you, and no doubt would crowd out some other interesting work. Reasoning thus, I have confined this paper to that district known as the Monongahela Valley. Local history informs us that the first discovery of coal in the above named valley was in 1759 by Col. James Burd on Redstone and (what is now known) as Dunlap's Creeks. Col. Burd was a gentleman well calculated to give an opinion on the quality of this seam of coal, and he said in his numed of they were that it was the finget coal he ever journal of that year that it was the finest coal he ever saw. Subsequent events have proven that this opinion given one hundred and thirty years ago was correct. Since then what wonderful changes have taken place on this waterway. From a bushel of coal, that Col. Burd said he burnt on his camp-fire, millions of tons have been mined and shipped to market. Progress has been very rapid in the means market. Frogress has been very rapid in the means used in conveying the coal from the mine. There is an old mine located near the Castle Shanon tunnel known as the "Indian Pit" where tradition says raw hides were used to convey the coal. The hides were filled in the pit and rolled down the face of the

hill to the bottom land where the teams could get The hides were then carried back to the them. mine and the process repeated. After this crude method of transportation from the interior of mine, next came the wheel-barrow and afterwards the twelve and one-half bushel carts. The method used to move these was to put a strap over each shoulder, adjusted somewhat similar to those used by base adjusted somewhat similar to those used by base drummers, and to work in the shafts of the cart. Many persons working there had large dogs to assist them in drawing the cart. When there were dogs employed in a mine, fights occurred among them which sometimes led to encounters among the men; happily this was rare. But these methods of haul-ing are all abandoned now and supplanted with im-proved methods which it would be superfluous for proved methods which it would be superfluous for me to describe, but the output of a mine, formerly counted in hundreds, is run up to thousands of bushels per day. The means for shipping coal to the lower markets have also increased year after year. A boat in 1845 took down the Ohio River, a craft loaded with 3,000 bushels of coal, and that was at that time thought wonderful work, but to day the big "Jas. B. Williams" takes down some 750,000 bushels, or over even and one-half acres.

Some of the mines opened years ago show the handiwork of former managers in their thoughtless handiwork of former managers in their thoughtless mode of working, and I am sorry to say they have some imitators to-day. This institute was formed for the purpose of improvement in mining and min-eralogy. With this end in view papers on various subjects are read from time to time. These papers may not be as deep as some would have them, for they are not read by men who have graduated from colleges but by these who are a part of the world's colleges, but by those who are a part of the world's workmen. The opinion of the writer is that there is generally more information received from the discus-sion that follows the reading of the paper, than from the paper itself. Being satisfied that no man or body of men can do good without receiving a certain amount of good in return, we ought to be en-couraged and go on in this work of mutual advance ment and unselfishly do all the good our abilities will ermit.

The mineral resources of this valley constitute grand subject on which our great commonwealth has grand subject on which our great commonweatth mas spent a large amount of money from time to time for the benefit of all engaged in coal-mining. It is to be regretted that there has been so much talk in regard to the geological survey of the Pittsburg coalegion, and that some have gone so far as to say that region, and that some have gone so far as to say that the money expended was spent in-vain because so many mistakes have been made. To my mind we have received the full equivalent for the money spent in the survey, admitting (as charged) that mistakes have been made. My own observation is that they are right oftener than wrong. If the full advantage has not been gained from this survey the fault is not with the geologists. I know instances in which if has not been gained from this survey the fault is not with the geologists. I know instances in which if more attention had been given to the survey, mines would not have been opened in places which have given no end of trouble. If the geological survey has imparted the same amount of information in other regions of the State as it has in the Pittsburg coal-region, I cannot see why there should be any objections to the work going on. I know I am heartily in favor of it. In this valley there have been located some six anticlinals which cross it, and it is a re-markable phenomena that the nature of the coal is changed somewhat from the crests of them. There is quite a change in composition in part of them; in others, it is not so marked. The following analy-sis of coals illustrates this: Enterprise mine, Messrs. Hartley & Marshall.

Water	0.41	per cent
Volatile matter	84.10	per cent
Fixed Carbon	59.13	per cent
Sulphur	1.12	per cent
Ash	5.20	per cent
	00.06	

Upper mine, Joseph Walton & Co.

Water

	2.40	pe
ed Carbon	67*06 -97	pe
attie matter	20.10	pe

0.41 per cent

r cent r cent r cent r cent

Old Whitesville mine (now abondoned).

Moisture Volatile matter Fixed Carbon Sulphur	1.4298 82.0805 64.9191 .7090 1.6206	per cent. per cent. per cent. per cent. per cent.
	100.7090	

Hanna, C. T. Hanna & Bro.

Fixed Carbon	58-340 83-800 6-800 1-060	per per per	cen cen cen
	100.000		

The above (except the Hanna mine, which is lo-cated in the Lisbon basin) are situated on the west-ern slopes, and near the crests of the Washington, Roaring Run, and Waynesburgh anticlinals respec-tively. Faults in this vein of coal known as "horse-back" or an anticlinal for a state of the state of tively. Faults in this vein of coal known as "horse-backs" appear quite frequently, but change their posi-tions as we proceed up the river, for instance when

they are met within Pin Hook and Roaring Run anticlinals they are found as a general thing in the roof and reach down in the face of coal in the shape of a V till they nearly cut out the coal. They vary in size as they do in length. Now from the latter anticinal to the Waynesburgh, they are generally in the roof and do not reach into the coal, and when in this position they are called "flat" horsebacks. Then again when the creat of the Waynesburg is reached they are found in the bottom members and extend-ing in some places, as high as three feet into the coal face. Opinions are in order why this change of position.

LIGHTNING ENTERING MINES.

BY DAVID SMITH.

[From Proceedings of the Mining Institute of Scotland.]

Drumsmudden Colliery is near to the Ayr and Muirkirk Railway, one and one-half miles above Drongan Station, and consiste of two pits, each 200 fathoms deep, and forty yards spart, having a large pumping-engine and coupled winding-engines, both under the one roof, and built on a stone seat. The height of chimney is 120 feet, and it is fitted with a lightning conductor, made of copper seven-eighths inch diameter, about five feet long, with copper wire three-eighths inch diameter attached. The pumping pit is ten yards from the boiler stalk, and has a pit-head frame forty feet high, over which two pulleys are fixed, guiding the haulage ropes to the pit bottom. There is also a Guibal exhaust fan connected with this pit. On Wednesday morning, 21st November, 1888, a thunderstorm of unusual and alarming severity burst overhead, and a flash took place at a time when the ascending cage was within twenty Drumsmudden Colliery is near to the Ayr and severity burst overhead, and a flash took place at a time when the ascending cage was within twen'y yards from the surface. The engine-man was made powerless by the electricity, but, fortunately, had the presence of mind to throw himself on the brake lever and so stop the engine. When he recovered, he folt pained in arms, neck, and shoulders. Probably the fluid ran along the beam of the pumping-engine, which see connected to then down to the steam-pipes which are connected to the winding-engine, and along which it would find its way to the throttle-valve handle. A heavy charge descended the conductor on the stalk, uplifting the earth and ashes at the bottom, but otherwise doing no damage. The pit bottomer of the winding-pit heard a loud, cracking noise, and saw a clear, bluish fiame on the crowns on the roof at the pumping-pit. flame on the crowns on the root as the pumping pro-The signal boy was terrified, seeing fire running and leaning between the haulage-rope and the rails. The leaping between the haulage-rope and the rails. The chainman was engaged at the time taking down the chainman was engaged at the time taking down the empty race, and was sitting on the last hutch, with his feet on the chain. When about forty yards down he felt a shock through his legs, and was pitched on to the road, and lay stunned for a time. Twenty yards beyond the foot of the slope dook, or 320 yards from the pumping-pit bottom, and 240 fathoms from the surface, two boys were standing, one having his feet on the rails and his head almost touching the electric bell wirse. He got a shock turning bin reet on the rails and his head almost touching the electric bell wires. He got a shock, turning him round about, and both were terrified by seeing fire flying between the rails and wire. They ran off to find the oversman, when they found him they were white with fear, and said fire was flying all through the pit. Fortunately, no serious injury was done to any of the workmen or property by the above strange occurrence.

DISCUSSION

The President said they had had a case at Swin-hill Colliery, which Mr. Ralph Moore had brought before them, when he produced the miners affected by the shock.

The Secretary said there were cases that had occurred in England referred to on the same oc-

Mr. Atkinson said there was several cases reported Art. Atkinson said there was several cases reported in the Transactions of the North of England Institute. An explosion of fire-damp in a disused lead-mine near Hexham was thought to have been caused by lightning. The Risca Colliery explosion in 1880 co-curred during a heavy thunder-storm, and it was suggested that lightning had entered the mine and isided for during the several cases of the several case

suggester use ingressing of the Institute the Secretary At the next meeting of the Institute the Secretary read the following communication from Mr. J. B. Dalzell:

Dalzell: The details regarding the lightning which passed down the pumping-pit and along the dook in Drums-mudden Colliery possess some points of interest intimately related to an occurrence that happened several years ago in Italy. Minute particulars of it have been given by Father Secchi, the able director of the Observatory of the Roman College. In both instances, the lightning followed a traceable course underground, ran along water pipes, and at points of its progress emitted light, thus favoring the possiits progress emitted light, thus favoring the possi-bility of a thunderstorm effecting an explosion of gas in pits. During the night of 2d November, 1872, a violent

burning the night of 2a November, 1672, a violent storm broke over the town of Alatri in Italy, the Cathedral of which was struck thrice by lightning. The first and second discharge did no damage, but the third, after fusing more than an inch of the light-

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