1898.
(SECOND SESSION.)

LEGISLATIVE ASSEMBLY.

NEW SOUTH WALES.

DUDLEY COLLIERY EXPLOSION.

(REPORT OF THE COURT OF INVESTIGATION ON.)

Printed under No. 4 Report from Printing Committee, 29 September, 1898.

REPORT OF THE COURT OF INVESTIGATION.

Sir,

On the morning of the 21st March, at 9 a.m., an explosion took place at Dudley Colliery, in consequence of which fifteen men lost their lives. A Coroner's inquest was held subsequently on two of the bodies which had then been recovered. The taking of evidence extended over fourteen days, and fifty-one witnesses were examined. The verdict of the Jury was to the effect that the two men, Thomas Dorrity and John Benson, met their death in the Dudley Colliery on the 21st March, 1898, from carbon mon-oxide poisoning, and that there was not sufficient evidence before them to determine the cause of the explosion. They added:— Coroner's Inquest.

"We consider the natural ventilation insufficient and unreliable, and that the artificial ventilation of the Dudley mine is quite sufficient to ventilate the said mine, providing air-courses are in thorough order and bratticing is carried up to each working-face.

"We consider that sufficient examination was exercised for the safety of the workmen, according to Rule 4 of Part 2 of the Coal Mines Regulation Bill (referring to the deputy's inspections); but we consider a greater margin should be allowed for a more thorough inspection of the whole mine at all times, and with station farther back from the working-faces.

"We consider the question as regards naked lights a matter between management and inspection.

"We are of opinion, according to evidence, that all precautions necessary for the safety and comfort of the workmen were attended to by the Management, with the exception of Rule 1 of Clause 47, Part 2, of Coal Mines Regulation Bill, referring to ventilation being constantly produced, of which we consider ourselves unable to interpret.

"We consider that the Dudley disaster was quite unexpected, as not sufficient reports of danger were made to the Management prior to the explosion."

Owing to a fire that manifested itself during the search for dead bodies, it was deemed necessary by those who undertook the management of exploring operations after the explosion to temporarily seal the pit down. This was done on 24th March, and it was unsealed on 17th June.

I received an appointment in June, under the hand of the late Secretary for Mines, Mr. Sydney Smith, to hold an investigation into the causes of the explosion, under the provisions of Section 23 of the Coal Mines Regulation Act of 1896. As the indications seen immediately after the unsealing of the pit pointed to a great confusion underground, and five bodies were not yet recovered, it was decided to postpone the opening of the inquiry until the hitherto unexplored districts had been opened up.

In the meantime, after the last body had been recovered, I spent the greater part of one day in the pit in company with Mr. Atkinson, Chief Inspector of Coal Mines; Mr. John Dixon, an Inspector of Collieries; Mr. Humphreys, Manager of the Dudley Colliery; and Mr. Turnbull, Manager of the A.A. Company's Colliery, who was then superintending the opening up of the mine; and I visited the chief points of interest in connection with the explosion.

Court of Investigation.

The Court of Investigation was opened on Monday, 15th August; and sittings for the taking of evidence were held on thirteen days, when forty-five witnesses were examined orally. I used as exhibits the depositions of various persons who had been called at the Coroner's Inquiry, but whose evidence was not of sufficient importance to warrant the expense of bringing them to the Court by summons. [*Appendix* C.]

The following persons appeared before me, representing various interests:—

Mr. W. H. Baker, Solicitor, appearing in the interests of Mr. Hugh Humphreys.

The Hon. Alexander Brown, M.L.C., appearing for the proprietors of the Dudley Colliery.

Mr. James Curley, Secretary of the Colliery Employees' Federation, appearing on behalf of that Federation, and also for some of the relatives of the deceased.

Mr. A. A. Atkinson, Chief Inspector of Coal Mines, appearing to watch proceedings in the interests of the Mines Department.

They were afforded the opportunity of cross-examining witnesses, and, at the conclusion of the evidence, of addressing me on any matter they might think pertinent to the inquiry.

No evidence was obtainable as to the circumstances leading up to the explosion, inasmuch as no person survived who was in the mine at the time of the disaster; but a number of witnesses gave evidence as to the general condition and management of the colliery; of its examination (immediately after the explosion, and also after the unsealing in June) as to the presence of fire-damp; the finding of the bodies of the men who were killed; and there is no reason to suppose that any evidence which is material to the inquiry has been withheld.

Upon the facts so disclosed, I have the honor to submit my Report, under the following heads:—

(1.) Description of the Mine.
(2.) The Management and Working of the Mine.
(3.) The State of the Mine just before the Explosion.
(4.) The Explosion and its Results.
(5.) Cause of the Explosion.
(6.) Conclusion.

(1.) *Description of the Mine.*

The Dudley pit is situated some few miles south of Newcastle, in the locality known as Redhead. Sinking operations commenced somewhat more than nine years

Shafts.

ago. There are now two shafts—the down-east, 624 feet below the surface, and the up-east or fan shaft, 553 feet deep. The coal is bituminous in character, and, as is

Seam.

general in the Newcastle district, it is the Borehole seam that is being worked. The height of the seam is 6 feet 3 inches, and it is worked to an extent of 5 feet 9 inches,

Roof.

6 inches being left in the roof. Above the coal is a band, 2 feet 6 inches in thickness, consisting of rotten shale and ironstone. In places where the shale has not fallen the roof is supported by props; but falls have occurred from time to time in spite of

Mine dry and dusty.

these precautions. The mine as a whole is dry and dusty, more particularly so in Nigger's heading and the headings to the right of the second right main headings. The district to the left of the lastmentioned headings is wet. The main roads are watered,

watered, but it was admitted to be done more for the sake of convenience in travelling, and it is obvious that to water the roadway and to omit the sides where the fine dust collects, would be useless as a check upon the spread of an explosion. There is a rise, generally speaking, in the pit from the down-cast towards the up-cast shaft. The area that has been worked up to the present is acres. The plan appended hereto, and marked "A," will show the main features of the mine; the crosses with figures denoting the places where the dead bodies were found; the pencil arrows showing the directions of force or flame as deposed to by different witnesses; the small ink arrows giving the direction of the air-current. The lines coloured blue are the intake airways, those in red the return.

(2.) *The Management and Working of the Mine.*

The system of working is what is known as the "pillar and bord"; the wider oblong spaces on the plan indicate the pillars, and the narrow the bords. The mine, when working, has always given off fire-damp, more or less, especially in the winning places; and when the connection was being made between the two shafts, it was found advisable by the Management to introduce safety-lamps for that particular work. In recent years, however, naked lights have been used throughout the mine, except during the deputy's inspections, when safety-lamps are used. The working places have always been bratticed up to the face, even prior to the existing Coal Mines Regulations Act, and when it was not compulsory; but, nevertheless, numerous instances were recorded by witnesses of the presence of fire-damp in an inflammable state, manifesting itself by igniting at the naked lights of the men. The pit is ventilated by a fan situated at the mouth of the up-cast shaft, which usually runs when the mine is at work, at a speed of from forty to forty-five revolutions to the minute. There are five distinct ventilating districts, and the main intake current is distributed throughout the workings by means of splits. It has been the custom, when there were no men in the pit at the week end, to stop the fan on Saturday and Sunday, and, should all the men be going to work on Monday morning, to start it again on Sunday night. After the men had come out of the pit at 4 p.m., the fan would be idle daily until 9 p.m., when it would again be started—some hour and a half before the shiftmen went down.

Pillar and bord system.

Fire-damp.

Brattice.

Ventilation.

Stoppage of fan.

The method of inspection under Rule 4 was as follows:—

Inspection.

It appears that since 1896, in addition to the miners who were working on contract, shiftmen were employed on day-wages in getting coal at night-time. Rule 4 provides, for the purpose of inspection, that a station or stations shall be appointed at the entrance to the mine, or to different parts of the mine, and no workman shall pass beyond any such station until the part of the mine beyond that station has been examined in the prescribed manner.

Stations.

Section 46 of the Coal Mines Regulation Act provides for the division of a mine into parts, but there is no evidence that the Dudley pit has been divided in accordance with that section. As a matter of fact, at Dudley a station has been established at the bottom of the down-cast shaft, and beyond this point the miners on contract may not pass in the day-time till they receive the deputy's permission. The shiftmen and water-bailers, on the other hand, were in the habit of passing this station before any inspection of the mine had been made, and travelling with an intake current of air would wait at a flat or station in their respective districts for the deputy's report. At night the deputy would go down the pit half an hour before the men, and examine the working-places in each district where the men were to work, travelling with the air-current. If he found gas, his duty was to remove it before the men went in to that working-place; if all was safe, the practice was to mark the date in each bord or working-place. After this inspection he would meet his men at the station for that particular district, make a verbal report to them as to the condition of the district and set them to work, and subsequently make the prescribed entry in the deputy's book. Thus the men would very often be at work at their places before the deputy had made his report in his book in accordance with the Act. Later on, in the early hours of the morning, he would make a second inspection, as provided for in Rule 4, and would meet the miners going down at 7·30 a.m. at the station near the bottom of the down-cast shaft. The old workings were not examined unless the ventilation going through them subsequently passed through a district where men were at work. The deputy's duty was further to

replace

replace immediately all brattice that was disarranged, and convey to the manager all information which he had with regard to the presence of gas and other sources of danger. There was a corresponding obligation imposed on all persons employed in the mine by the Special Rules of the colliery to report to the person in charge of the works the existence of fire-damp. In practice, it would appear from the evidence that the deputies recorded in their book the place and circumstances of their finding gas in the course of their inspections, but the books do not show any entry of an ignition of gas having taken place during the ordinary working hours. Many of the miners admitted that they made no report of the presence of gas which they experienced from time to time; some, indeed, stated that they did report such ignitions to the deputies, but the latter when so informed seem to have neglected to make these matters known to the manager. I shall have occasion to refer to these matters in detail later on.

Reporting presence of gas.

(3.) *State of the Mine just before the Explosion.*

The places had been balloted for by the miners on March 17th, and Monday, 21st, was to be the first day of working under the new arrangement. Operations had been suspended in Nigger's heading since the previous October. On the 18th March some men had been at work laying rails in that part, in pursuance of the intention to resume work there immediately. In the second left district, Bob's heading had recently been worked by night and Star's heading by day. Work had also been carried on in the second right district. On various occasions since the beginning of the year fire-damp in a more or less inflammable state was proved to have been given off both in the face of the second right main headings and in the bords contiguous thereto; but in the previous ten days it had been detected in Bob's heading, in a bord opposite to the spot where the body of Hindmarch was subsequently found, and also in the last unholed bord, marked "AO" on the plan.

19th March. The men came out of the pit on Saturday morning, the 19th. Up to that hour nothing unusual was noticed, nor was there any indication of the subsequent explosion. The fan, according to the usual practice, remained idle from then until Monday morning; it was to start at 6 a.m. that day. There was, however, some uncertainty as to what hour it did commence to work, and I have come to the

21st March. conclusion that the time was undoubtedly later than usual. However, by 6·30 its speed was somewhere about 42 revolutions to the minute, thereby providing for a current of air to the extent of 100,000 cubic feet entering the mine every minute. And it was stated by several witnesses that this volume of air was sufficient to dilute and render harmless all noxious gases with which it came directly in contact; that although there might possibly be some accumulation of gas that morning in consequence of the fan having been idle for forty-seven hours previously, yet that current of air was ample, assuming that the brattice and ventilating apparatus generally were in proper order, to clear the mine of all noxious gases in less than one hour.

Duties of workmen. Young was the examining deputy for the day. His work would take him down the pit about 7 o'clock. Towards 7·30 the other men descended. Amongst them were Hetherington, the deputy, and Hindmarch, the underground manager. The two deputies carried safety-lamps when last seen at the pit-mouth that morning; the other men, including Hindmarch, had naked lights. Benson, the pumpman, had been engaged at the pump. Hetherington had charge of a gang of men in Nigger's heading. Young would be in charge of the three water-bailers, Rudge, Jones, and Cook, whose work was in the left of the second right-hand headings. In the second right return airway there was a fall of roof some four stentons inby of the up-east shaft. Haddon and Mowbray would be employed there filling skips, which M'Dougal wheeled round to Price and Dunn, who, in their turn, disposed of the contents in the stow-bord behind the up-east shaft. Hetherington would probably examine the district called Nigger's heading for his men. Young would first examine the district where the water-bailers were about to work, and according to practice place the date, in chalk, upon the working-faces. Having disposed of them he would probably proceed with the examination for the other men. After completing this preliminary inspection, Young had some work to do near where his body was ultimately found. There would be then, some hours later, a second inspection provided for by the Act. Hindmarch's duties took him nowhere in particular

on that morning. In all fifteen men were in the pit at 9 o'clock, and as far as is known there was to be no shot fired that day, nor has any evidence been obtained since to suggest that a shot was fired before the explosion took place. Two youths, Croker and Parsons, were down below for a short time that day, returning to the surface just before 9 o'clock. About 8·45 Green was seen by Croker at the cross-cut end, and Dorritty in charge of a horse at the pit-bottom. None of these fifteen men were seen alive again.

(4.) *The Explosion and its Results.*

Effect of explosion.

At ten minutes past 9 there was a loud report, and quantities of dust and dirt were forced up both of the shafts. These indications were noticed to proceed from the up-cast shaft some few seconds earlier than from the down-cast. At the up-cast the result was that the covering of the shaft was blown away and a door of the fan chamber was broken, and the timber baulks, on which rest the pulley legs, were plastered with mud on the underside. At the down-cast the cage, weighing 22 cwt., which was at the pit-mouth at the time, was thrown upwards some 23 feet, the chain of the cage was broken, some sheets of iron were blown off the roof, and dust and small coal were emitted in large quantities. The cage at the shaft-bottom was wrecked, and the guide-ropes were broken. The exploring parties descended the pit in the course of that same day. At the shaft-bottom there was evidence of very great force travelling outby; the ventilation was everywhere disarranged. Up to the 24th ten dead bodies had been recovered, but owing to the presence of what was deemed to be a fire it was decided to seal the pit down.

Up-cast shaft.

Down-cast shaft.

Up to that point the evidence indicated that the force had proceeded chiefly from the left-hand side of the mine, and it was thought by some that Nigger's heading was the initial point of the explosion. Since the unsealing of the pit in June, most parts of the colliery have been carefully and minutely explored, and further investigation has led the majority of the witnesses who offered an opinion on the matter to locate the starting-point somewhere on the right-hand side of the mine. Indeed, not only is there a difference of opinion as to the inference to be drawn from the facts disclosed, but in more than one instance there is a conflict as to the evidences of force. Moreover, thousands of tons of fallen roof were found after the pit had been reopened, and it was proved that many of these falls had taken place after the shafts were unsealed. The displacement of air so occasioned would have the same effect upon stoppings as the explosion itself. Care is therefore required in endeavouring to trace the course of the explosion to avoid attributing to the original force damage which has been caused subsequently.

After due consideration the following are the conclusions I have arrived at as to the indications of force:—

Evidences of force and flame.

Main narrow bords.

Stoppings.

Proceeding first along the main narrow bords intake airway from the down-cast shaft, we find a set of full skips near the overman's cabin, which had evidently been blown along the road some distance by a force travelling outover. At the first overcast the wall on the left-hand side was standing, that on the right bore evidence of having been acted upon by two forces, one travelling outby, the other proceeding from the back heading of the first right-hand heading. Of the stentons between the first overcast and the cross-cut, three were standing, the stopping of the second going inby being blown into the return, that is from right to left. Opposite that stenton a set of loaded skips were standing; some of these had been blown against the right rib, indicating a force from left to right. Opposite the third stenton, which was standing, was another set of skips. Some of the skips in the middle of this train were forced against the right rib. Three skips at the rear, that is on the inby side and just opposite to the first cut-through, were spread out and partly turned round in the direction of the down-cast shaft. At the cross-cut the door marked "D" on the plan had been blown inover. Here again was a set of skips standing; those actually opposite to the cross-cut opening being moved against the right rib as if a force had come outby from the cross-cut. The first skip of this set was tipped on end and blown outby. Either the sixth or seventh stenton was standing, but with that exception all stoppings between the narrow bords from the cross-cut, and as far as the faces of the main narrow bords, were blown into the return. Standing opposite to the second cut-through was another set of skips, the rear skips being turned round from right to left, in a similar manner to those at the first cut-through. The second

over-cast

Second over-cast.

over-cast shows a force from left to right, the bricks being blown outby, and the timber from left to right. At the entrance to the second left headings there is a drift of dust driven from the heading into the main narrow bord. Yet, again, Mr. Humphreys says that some of the timber has not yet been recovered, and the only part hitherto unexplored where it can possibly be found is the return airway of the second left-hand heading. The door of the first stenton inby of the second over-cast was blown towards the left, and its remains were found in the return of the second

Third over-cast.

left-hand headings. The third over-cast affords no clear evidence. We find the bricks are blown into the return towards the left, and some of the timber was found in the intake of the second right-hand headings to the right. Still travelling inby of the third over-cast, the stoppings to the right of the narrow bords are blown to the right; the first stopping has been blown to the right with some force, inasmuch as some bricks were found 44 yards away in that direction. The stentons further inby are fallen, but as no part of the stoppings has been found in the intake it is fair to assume that the force which must have displaced them was from left to right. Travelling along the main narrow bords return inby from second over-cast, the first two stoppings on the left are blown from right to left; the third was fallen.

There are indications of flame in the stentons, both inby and outby of Star's heading.

Star's heading.

Going along Star's heading there is a general indication of force and flame in the bords on either side of the heading, having travelled from the main narrow bords. In some bords the brattice has been blown up against the left rib, and has been subjected to great heat. The flame has travelled down the bords on the left towards the second left-hand headings. From the end of Star's heading to where Hindmarch's body was unearthed there is no evidence of flame, as the roof has fallen. In the bord to the right of Hindmarch the brattice-cloth is torn. Some props in the bord to the left show signs of flame having travelled towards the second left headings. From this point, generally speaking, there is evidence of flame, as seen by scorched props and coke-dust travelling towards the second left. In the going bord at the fourth pillar, down from Star's heading, a full skip has been driven some distance off the

Second left-hand headings.

flat in the same direction. In the second left-hand return, the first stopping inby was standing, the second has fallen, and the third was blown into the intake.

In a bord directly opposite to the third stenton, and contiguous to the intake, some bricks were found which had been blown 20 yards from that stenton. Between the second and first left headings, coke-dust and other signs of flame are to be met

First left-hand headings.

with. The stoppings between the first left-hand headings have been blown from right to left with great force, the bricks of the first, second, and third being embedded to a depth of 3 or 4 inches in the opposite pillar.

Returning again to the junction of the second left headings with the main narrow bords, travelling outby, in each of the three cut-throughs there is evidence

First cut-through.

of flame, and in the first cut-through inby of the first over-cast the tram of a skip was found close to the main narrow bords, some 20 yards inby the skip itself was found. There are indications that it had been loaded, and coal was lying about in the vicinity. Just inside this heading were also found the bottom of some empty casks, the other portions lying on the inby side of this skip.

Second right-hand headings.

Taking the second right main headings, going inby, the stoppings between the two headings are all blown from right to left, with four exceptions—that is, the third, fourth, seventh, and ninth, which are standing. The fourteenth stenton shows very strong force from right to left, the bricks of the stopping being embedded in the opposite pillar. The stoppings on the left-hand side of the intake do not present an uniform appearance. As far inby as the fan-shaft they are blown from left to right, inby of the fan-shaft many are standing; those which have been displaced are blown from right to left. On the flat at the first going bord on the left side of

First going bord.

these headings a skip has been blown inover. Of the stoppings in the first going bord to the left, the first on the left is standing, that on the right is blown to the right. The stoppings on either side of the next two headings are blown right and left

Second going bord.

respectively. Further on inby of the second going bord a skip has been blown outover. In the going bord the stoppings of the first and second headings have all been blown to the left. In the third heading the left stopping is blown left, and the canvas stopping on the right is standing. From the main narrow bords the force has been towards the first going bord, and from the face of the second right headings the force is also towards that bord. In the whole of this district there is no evidence of flame, and the force is only slight.

Returning

PLAN

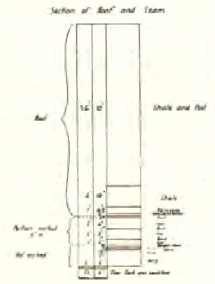
Shewing Workings and Ventilation

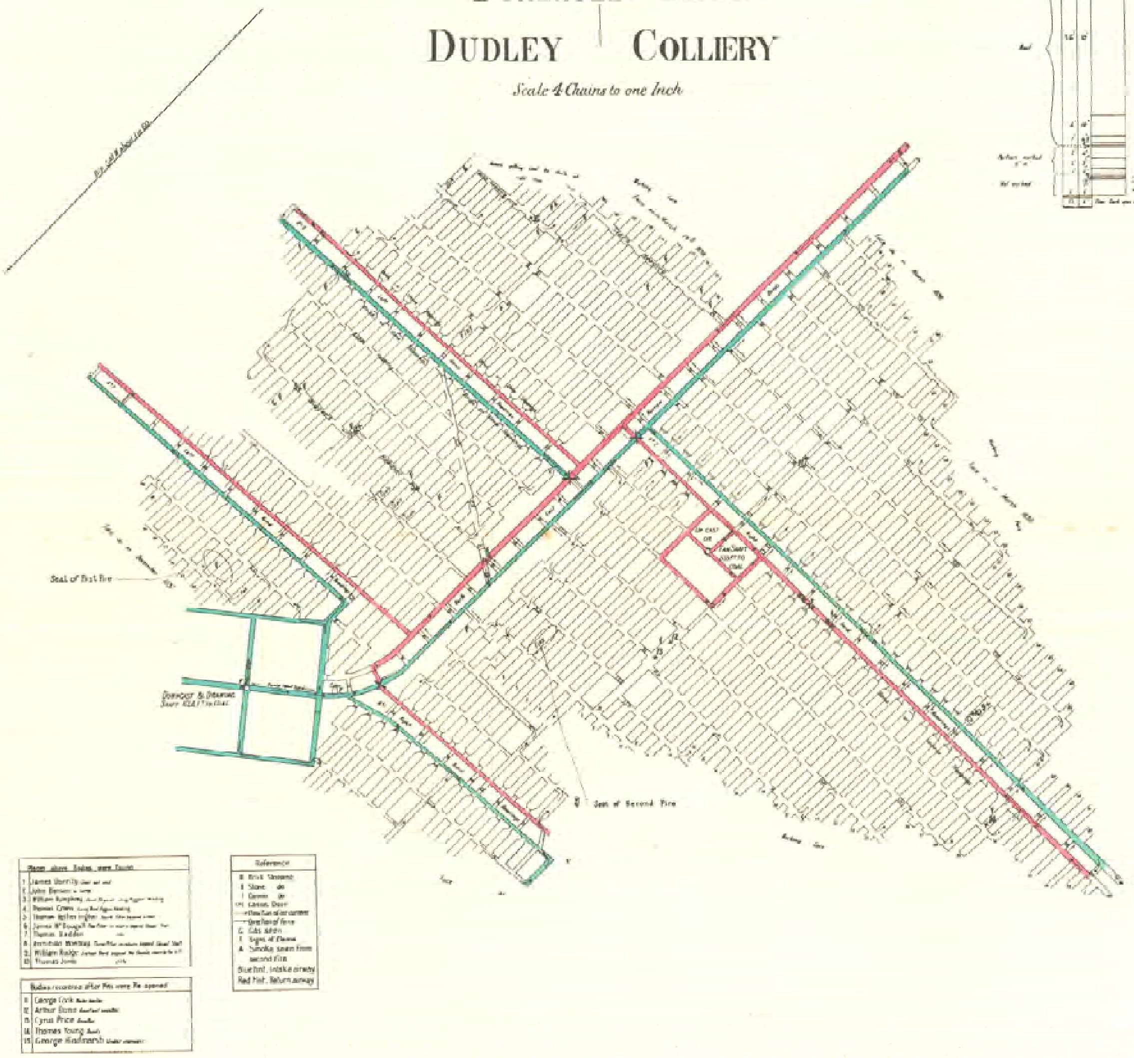
IN THE

BOREHOLE SEAM

DUDLEY COLLIERY

Scale 4 Chains to one Inch





Seal of First Fire
Seat of Second Fire
Places where Bodies were found
1 James Sterrit
2 John Benson
3 William Humphrey
4 Thomas Crews
5 Thomas Kelley Higher
6 James McDougall
7 Thomas Madden
8 Jeremiah Worsley
9 William Rudge
10 Thomas Jones
Bodies recovered after Pits were Re-opened
11 George Cook
12 Arthur Dunn
13 Cyrus Price
14 Thomas Young
15 George Rushmarsh
Reference
Brick Stopping
Stone do
Canvas do
Canvas Door
Direction of air current
Direction of force
Gas seen
Signs of Flame
Smoke seen from second fire
Blue tint. Intake airway
Red tint. Return airway

Returning to the third over-east, and traversing the second right-hand return, the first, second, and fourth stoppings on the right inby are blown into the return, and a door on the second pillar behind the up-east shaft has been blown towards the return. The first stopping on the right inby of the up-east and such others as can be traced have been blown into the return. Second right return.

Taking next the bords off the second right-hand return, at the inner bord inby where Young's body was found, a skip has been forced inover. From this spot to the face of the heading there is no sign of force or flame, and there have been no falls. Travelling along the face, there are no indications between where Young's body was found and bord 21, as the roof has fallen. In the neighbourhood of the latter bord a skip has been tipped in the direction of the main narrow bords, and props in that vicinity indicate that flame has travelled outby. Between this point and the stow-bord the directions of force and flame are very conflicting—sometimes inby, at other times outby, and occasionally travelling opposite directions in two parallel bords. Going from the stow-bord towards the main narrow bords, the same conflicting evidences of flame are encountered. Stow-bord.

The body of Cooke when discovered was lying a pillar's distance from his water-tub. Haddon, Rudge, and Jones were found nearly 70 yards away from their respective working-places, and Mowbray some 35 yards. The rest all died close to their work. The immediate cause of death of every man whose body was examined *post-mortem* was attributed to carbon mon-oxide. In some instances the bodies were burnt or injured by falls of roof, which injuries might in themselves have brought about the death of the individual in the course of a few days had not the effects of after-damp immediately supervened. A detailed account of the circumstances surrounding the death of each man will be found in Appendix "D."

(5.) *Cause of the Explosion.*

All the witnesses were in substantial agreement that the explosion has been caused by the ignition of fire-damp at a naked light; that the quantity of gas was probably not large; but that the explosion has been intensified and extended by the action of coal-dust. The initial explosion must have stirred up some fine dust, which in its turn has been inflamed and exploded, thus leading to a series of almost simultaneous explosions. As to the seat of the explosion, there is much difference of opinion. Messrs. Atkinson and Humble make Hindmarch's light the starting-point; Mr. Croudace agrees with them—that the mine fired on the left-hand side, but does not actually say where. The Brothers Dixon, and Messrs. Humphreys, Henwood, Ross, Brown, and Mason say it originated on the right-hand side, the witnesses varying in making Young or Haddon or Price the initial point of the disaster, or leaving the matter entirely at large. Messrs. Turnbull and Thomas declined to commit themselves to either side. So long as it is established that this was a fire-damp explosion, the fixing of the exact point of ignition becomes a matter of secondary importance; and although there are difficulties in the way of adopting either theory, the balance of probability to my mind is in favour of the explosion originating at Hindmarch's light. From Hindmarch the general direction of the explosion was across the second and first left-hand headings, through the pump-drift, and up the down-east shaft. Portion of this force was diverted when meeting the second left headings, and after driving the stenton stoppings into the intake, it it has travelled along the intake and blown the second overcast into the main narrow bords. Here the force has again subdivided after striking against the fast wall of the main narrow bords, part of it travelling inby has blown the door in the first stenton into the return, as described, thus allowing a portion of the explosion to travel along the return. As the force travelled along the main intake, it found a partial escape into the third cut-through. Continuing inby, it has distributed itself left and right through the stoppings on either side, thus reaching respectively Star's heading and the headings to the right of the main narrow bords. As it approached the face the force was gradually dying out, and in its last effort travelled against the air from the face of the main narrow bords to where the two air-currents met in that bord (No. 54). Returning now to the main narrow bords at the second over-east. At this point the remainder of the force of the explosion took a direction outby, finding a partial escape at the second and first cut-throughs. In these headings to the right of the main narrow bords, the explosion has travelled in different directions, Fire-damp explosion. Coal-dust. Seat of explosion. Left side most likely. Course of explosion.

directions, finding an outlet partly at the first right headings, partly at the up-cast shaft, and also through the stoppings off the return of the second right-hand headings, eventually crossing these lastmentioned headings somewhere near the spot where Rudge and Jones were found; then travelling with slight force against the air and along the working-faces as far as bord 54, and outby as far as the second going bord.

The fact of dust issuing from the up-cast shaft earlier than from the down-cast does not assist us, for that is equally consistent with either theory. Again, the evidences of force and flame in the second right district are so contradictory as to afford little help in themselves.

Right-hand side theory. Difficulties.

The following seem to me strong objections to accepting the view that the mine fired on the right-hand side :—

(I) The evidence of force having moved the second over-cast from left to right, and having carried a skip and casks along the first cut-through, is inconsistent with the idea that the explosion entered the main narrow bords from the right-hand side, and no explanation that has been offered has removed that difficulty from my mind.

(II) If the explosion had originated on the right, one would expect a greater exhibition of force than the evidence affords, in the stoppings between the second right main headings; and some evidence of flame or force at the faces of the same headings.

(III) The fact that all the men on the left-hand side were found close to their work, whilst on the right-hand at least five had travelled some distance from their places before they succumbed, suggests that those in the right heard the sound of the explosion, and, being alarmed, had dropped their lamps, and had had sufficient time to travel, in three instances, as much as 70 yards before they were overcome. Such an occurrence would not be probable if the explosion originated some 200 yards away, when the sound and force would reach them almost simultaneously.

On the other hand, the left-side theory presents a difficulty. If Hindmarch's light initiated the explosion, one would expect the flame to branch out in all directions when first seeking an outlet. It may be that Hindmarch, before being overcome by after-damp, travelled some short distance towards the second left headings, and that the explosion, after splitting at the second over-cast, has returned almost to the starting-point. It was suggested that, although Hindmarch entered to the pit with a naked light, he would be carrying a safety-lamp at the time of his death. To settle this question, I adjourned the Court for a week to give the Management an opportunity to make full search in the vicinity of his body and Young's, but up to the last day the Court sat no trace of any lamp or light in either spot had been found.

Cause of gas accumulating.

There was, undoubtedly, some accumulation of gas upon which the ventilating current was unable to properly act on that morning. This may have been brought about by a fall of the roof liberating a quantity of gas, or the fall may have disarranged the brattice, and thus caused an accumulation of gas shortly before the explosion, or the brattice may have been disarranged on the previous Saturday in some bord where gas was exuding, and the accumulation of those forty-seven hours may have been uninfluenced by the air-current on Monday morning up to the moment that the naked light came into contact with it. There is no evidence upon the matter, and I can only say, judging from the history of the mine, that the last alternative seems the most probable.

Conclusions.

I find that—

(I) The explosion was caused by the ignition of fire-damp at a naked light.

(II) The explosion was intensified by the agency of coal-dust.

(III) Evidence did not show what was the approximate quantity of fire-damp, or what the circumstances were under which it assumed an explosive character.

(IV) Ventilation was not "constantly" produced in accordance with the terms Section 47, Rule 1, of the Act.

(V)

(v) Inspections were not conducted in accordance with General Rule 4.
(vi) There was in the mine a quantity of fire-damp, which rendered the use of naked lights dangerous.
(vii) Locked safety-lamps should have been used at the time of the explosion.

Ventilation. It is manifest, according to the decision of the English Courts in the case of Knowles *v.* Dickinson (2 E. and E., 705), that it is the duty of the Management to keep the fan constantly at work each day in the week, and whether the men are actually in the mine or not, so long as it is being worked as a going concern. The circumstances of that case are very similar to the present one, and the decision seems to me to be directly in point. A prosecution for a breach of the Act in this respect is at the present date barred by statute. However, the following remarks are noteworthy in this connection :—

(i) The evidence proved that the stoppage of the fan from Saturday till Monday was not the cause of the gas being in an explosive state; on the contrary, that the volume of air was sufficient to dilute all noxious gases (assuming the brattice was in proper order so as to enable the current to reach all places where gas did exist).
(ii) The practice of stopping the fan at the week-end has been common for years to Dudley and other pits without any protest on the part of the colliery inspectors. In fact, the wording of the report of Mr. Inspector Humble, of 31st October, 1896 (Appendix E), reads as if he was then under the impression that the fan need not be worked unless men were actually in the mine.
(iii) A notice has been issued by the Chief Inspector of Coal Mines since the conclusion of the Coroner's inquest to Mr. Humphreys, drawing his attention to the duty of keeping the fan at work during any temporary suspension of work; and the Manager, since that notification, has complied strictly with the terms of Rule 1.

Inspection. As to the method of inspection (Division V, page 24) : A station with a deputy bord in accordance with Rule 4 and Special Rule 11, has been established at the bottom of the down-cast shaft. Beyond that no person may pass until the part of the mine beyond that station has been stated by the deputy to be safe (see Rule 4).

The practice with regard to inspection before the miners enter in the morning, as above mentioned (see page 3), is strictly in accordance with the rule; but the system in connection with the night shift is undoubtedly not only irregular, but a breach of the rules. The deputy precedes the night-shiftmen down the pit by some half hour; they in their turn pass the station at the entrance to the mine and wait at different places or stations as they have been termed, till they see the deputy. My view of the provision as to stations is as follows :—

Station at entrance to the mine, or to different parts of the mine. Where a mine is worked as a whole with one system of ventilation, then one station only is allowable—that is, at the entrance to the mine. If, however, a mine is divided into parts, under the provisions of Section 46 of the Coal Mines Regulation Act, so as to make each part a separate mine within the meaning of the Act, then a station may be established at the entrance to each different part. I find confirmation of this view in a passage of the judgment of Mr. Justice A. L. Smith, in Wales *v.* Thomas (16 Q.B.D. 340, page 348).

Therefore, to appoint stations in the various districts of Dudley, as deposed to in evidence, is a violation of the Act in two respects, for

(1) Only one station is permissible as the colliery is at present worked.
(2) That station must be at the entrance to the mine.

With the removal of these various so-called stations from the various flats, the examining deputy will then make a complete inspection of the working-places, &c., and will meet the shiftmen at the entrance to the mine, and sign his report in the same manner as he now does when the miners on contract go to work.

Safety-lamps. As to Division VII (page 9)—the use of safety-lamps : The evidence shows that from its earliest history the mine has always been giving off fire-damp, and to deal with it effectually it has been necessary to brattice the working-places. The history of the mine during the eleven months prior to the explosion shows that gas had been reported by deputies on sixteen different occasions in various parts of the

 mine.

mine. Miners had experienced ignitions of gas in the faces of the second right headings generally, in the first left, and, during the week previous to the explosion, in Bob's heading and in the bord next to where Hindmarch's body was found. After the explosion a quantity of fire-damp was discovered in the faces of the second right main heading. This might be due to the circumstances attending the explosion, yet since March 21st, we find that, though the faces of the coal have been undisturbed, gas was being still exuded as late as August 20th from the faces of the second right-hand main headings, and up to the end of the same month in the bords abovementioned in Bob's heading.

The deputies' books some years back, and after the fan was introduced, show that in different parts of the mine gas was found daily for periods extending over a fortnight (Appendix F). From the evidence it is clear that it was necessary to have both the fan at work and the brattice erected in order to prevent accumulations of gas. On different occasions when the fan has been working and the brattice disarranged gas has been discovered, and *vice versa*. Some twenty witnesses gave evidence of ignitions of fire-damp, which they had experienced. These ignitions may be divided into the following classes :—

Causes of gas lighting up.

(1.) Those caused by the bratticing being damaged, or not being sufficiently close to the face.
(2.) Those caused by the firing of a shot.
(3.) Those caused by workmen going to the face with a naked light too soon after firing a shot.
(4.) Those caused by a workman's light when drilling a hole.
(5.) Cases of which no explanation is forthcoming.

Referring to these individually, the first may be dealt with by properly enforcing the provisions of Rule 1 as to ventilation. The means for detecting the presence of fire-damp require the constant attention of those in authority. In many instances the insufficiency of the brattice to carry off the gas should have been found out by the deputies, or, if discovered, should have been remedied. The necessity of strict attention to this part of their duty should be impressed upon the officials.

As to (2) : Possibilities of that kind may be avoided by strictly adhering to the conditions of General Rule 12.

(3) : May be obviated by more care on the part of the workmen, who, in more than one instance, admitted that they knew they were taking a risk in returning to the face with a naked light before the smoke had cleared away.

A number of cases unexplained.

There remain, however, a number of instances where an ignition of gas has taken place which could not be accounted for by any temporary defect in an otherwise perfect system of bratticing. These ignitions occurred sometimes in the early morning when the miner first entered his working-place ; on other occasions after a temporary absence during the shift. In these cases there was no shot-firing, and the brattice was well up to the face. In most cases the flame was of small extent, with the exception perhaps of Harrison's, the flame in his bord ran back along the broken roof a distance of 12 yards. Nobody hitherto had actually been burnt. Several witnesses treated these flares-up, as they were styled, with great contempt (the Manager saying that 99 cases out of 100 there was no necessity to make a special report as the quantity was infinitesimal). The underground manager did not consider a flame 4 or 5 yards long dangerous to workmen. As illustrating the danger attending

Danger of fire-damp.

the lighting of a very small quantity of fire-damp, I will refer to the report for 1892 of Mr. Stokes, one of Her Majesty's Inspectors of Mines for the Midland Counties. Referring to fire-damp, he says : " With regard to what quantity might be considered dangerous, a clear proof of what might be the result of igniting a very small quantity of gas is given in the lists of non-fatal explosions, in which is recorded the ignition of a very small quantity of fire-damp at a gate-end lip by a naked light held by a workman. The quantity was so small that the man who ignited the gas was in no way injured, but the flame from the ignited gas passed along a break in the roof and exploded other gas in the goaf and burnt two men working 56 feet away from the point of first ignition. This accident clearly shows that a quantity of gas so small in itself as when ignited not to injure the person igniting it, is yet sufficient to prove dangerous to the mine and persons working some distance from it, due to its flame being extended by gas lying unknown in breaks in the roof."

The

The above extract shows that a small quantity of inflammable gas may be a danger to workmen if there are surrounding circumstances of an aggravating nature.

Coal-dust.

Another element to be considered is the question of coal-dust. The Manager says that the whole of the left side of the second right is damp, also Bob's heading and the lower portions of the second left and first left; but the remainder of the mine is both dry and dusty.

Increased danger from fire-damp.

The Royal Commission on explosions from coal-dust in mines, in their Report published in 1894, are of opinion that the danger of explosions in a mine in which gas exists, even in very small quantities, is greatly increased by the presence of coal-dust; that air and dust with a very small quantity of fire-damp, such as practical people perhaps could not find with the ordinary safety-lamp, would cause violent explosions. Thus what might be a local explosion of a simple character is transformed through the medium of coal-dust into a widespread disaster.

Falls of roof.

Moreover, it appears that, from time to time, falls of roof may take place in the Dudley pit, which may either liberate some fire-damp or derange the brattice and cut off from the influence of the ventilating current those parts of the pit contiguous to the damaged brattice. The falls have not hitherto been frequent, yet, as Mr. Humphreys says in his evidence, "the falling of the roof on the brattice is a possibility that has to be reckoned with in the mine. The roof, as it is generally in the mine, is liable to fall at any time in spite of precautions."

Up to the time of the explosion no measures had been taken by dumping the coal-dust to check the spread of a possible explosion.

The existence of these three sets of circumstances, namely,—

(1.) The ignitions of gas in spite of proper and perfect ventilation;

(2.) The liability of the roof to fall and derange the ventilation;

(3.) The presence of coal-dust ready to transmit and intensify a fire-damp explosion,

suggests the question: Was the use of naked lights likely to be dangerous to workmen in the mine about the time of the explosion, and should safety-lamps have been used? My answer is, undoubtedly yes.

Royal Commission, 1886, opinion as to safety-lamps.

The Honorable A. Brown, on the question of safety-lamps, referred me to the Report of the Royal Commission on Accidents in Mines of 1886, where it appears, on page 117, they refrained from prohibiting the use of naked lights in mines giving off fire-damp. But it will be noticed that whilst the Commission do not advise safety-lamps merely because a mine gives off fire-damp, they assume that their adoption is essential when fire-damp is associated with coal-dust; and certainly the trend of expert opinion and legislation during the last ten years in England is to enforce the use of safety-lamps in every mine where fire-damp is found.

Opinion of Mr. H. D. Greene, Q.C.

Mr. H. D. Greene, Q.C., in his Report in 1890 on the Llanerch Colliery Explosion, advocates legislative prohibition against allowing or using naked lights in a mine where inflammable gas has been reported within a period of twelve months.

Mr. Robson.

Mr. Robson, Her Majesty's Inspector of Mines for the South Wales District, in his Annual Report of 1890, states that in his opinion all mines known to produce fire-damp should be worked with safety-lamps of the best description, and all other lights excluded.

Mr. Martin.

Mr. Martin, another Imperial Inspector, holds equally strong views.

Coal Mines Regulation Act, 1896.

Our own local Act, the Coal Mines Regulation Act, 1896, makes it compulsory under Rule 4 to conduct all inspections of the working-places with a locked safety-lamp unless the mine has been absolutely free from inflammable gas for a period of twelve months.

Explosives in Coal Mine Order, 1898.

The explosives in Coal Mines Order, 1898, supersedes the rule in England which corresponds to Rule 12 of the Coal Mines Regulation Act of this Colony, and indicates that in any mine in which inflammable gas has been found within three months in such a quantity as to be indicative of danger, or which is not naturally wet throughout, no explosive, other than those specially authorised by that order, shall be used, Statistics further show that whereas in Great Britain 1,561 persons lost their lives through explosions caused by a naked light between 1873 and 1893, during 1897 there were only fifteen deaths from the same cause, when 720,000 were engaged and the output of coal was 200,000,000 tons.

The

Opinions of witnesses called.

The Inspectors of Coal Mines, who up to the time of the explosion had not heard of these ignitions of gas detailed in evidence before me, stated that those facts demanded the use of safety-lamps throughout the Dudley Colliery. Mr. Turnbull says: "If you find gas and it lights up you ought to have safety-lamps." Mr. Croudace says: "If gas is given off and the ventilation working and the brattice well up, one should increase the ventilation or use safety-lamps." Mr. Henwood says: "If Harrison's evidence is true, the gas is a danger to workmen."

Manager ignorant of the ignitions of gas.

Mr. Humphreys swore that with the exception of Harrison's experience he had no knowledge of gas igniting at naked lamps when the ventilating appliances were in proper order. And in justice to himself, it should be mentioned that many of the men who gave evidence of these flares-up admitted that they failed to report them to the proper authority, and, further, when the matters were reported to a deputy, they were not recorded in any way. Thus the probabilities confirm the Manager's testimony. However, I think that the incident Harrison spoke of, and the other circumstance peculiar to this colliery, should have put him upon inquiry and prompted him to use safety-lamps in compliance with Rule 8. Such a matter as a prosecution for breach of this rule is now out of the question, as it is statute-barred after three months (see Section 62).

Prosecution.

Nor do I think I am justified in making any recommendation as to a prosecution for manslaughter, for the jury at the Coroner's Inquest had before them all the facts of the case and decided that no responsibility was to be attached to the Manager for the consequences of the disaster. In the first place I cannot say that such a finding was unreasonable, and secondly, I do not think it lies within the scope of this inquiry to suggest criminal proceedings for any offence other than what may be dealt with under the Coal Mines Regulation Act itself.

Future working of the mine.

For the future, the use of safety-lamps is entirely a matter for the discretion of the Management; responsibility in this respect is removed by Section 20 from the shoulders of the inspectors and transferred to the mine officials. And I have no doubt that they will show the same regard for the interests of all associated with the mine as has been exhibited in the past.

Coal-dust.

Side by side with the precautions taken to prevent the ignition of inflammable gas, strict measures should be adopted to prevent the possibility of a small local explosive becoming extensive through the agency of coal-dust, and some method either of removing the dust or of damping it, or both, is essential where the dust exists in any quantity.

Importance of reporting presence of fire-damp.

However, the true interests of the mine cannot be effectually safe-guarded unless all concerned strictly comply with the requirements of the Act and the Special Rules. Special Rules 15 and 71 impose upon the deputy and the miners respectively, the duty of informing those in charge of the existence of fire-damp whenever found. The tendency seems to have been for the individual to constitute himself the judge of what should be reported and what not. Mr. Humphreys said that in 99 cases out of 100 there was no occasion to make a special report as the quantity of gas was insignificant. A manager should clearly understand and likewise impress upon those under his control, that every discovery of gas of any quantity must be reported in compliance with the Special Rules under pain of instant dismissal. Had this course been universally adopted throughout the mine, it is possible that we should never have heard of the Dudley explosion.

I have the honor to be,

Sir,

Your obedient Servant,

C. G. WADE,

Sole Commissioner,

19th September, 1898.

The Honorable Joseph Cook,

Secretary for Mines and Agriculture.

Sydney: William Applegate Gullick, Government Printer. – 1898.

[9d.]