

EVIDENCE

TAKEN BEFORE

THE CORONER'S INQUEST AT WIGAN,

RELATING TO THE

EXPLOSION OF GAS

WHICH OCCURRED IN

**THE INCE HALL COAL AND CANNEL CO.'s
ARLEY MINE PIT, FEBRUARY 18, 1854.**

WITH INTRODUCTORY REMARKS

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THE COMPANY'S MINING ENGINEER

(FOR PRIVATE CIRCULATION.)

**LONDON;
PRINTED BY M'CORQUODALE AND CO.
WORKS, NEWTON.
1854.**

INTRODUCTORY REMARKS.

The explosion of March 23, 1853, which was attended with great loss of life, having been followed by that of the 18th. February last, has attracted the anxious consideration not only of those connected with mining, but the public generally.

The first impression upon each mind must be, that some gross negligence, either on the part of the workmen or managers, or some radical defect in the system of mining, must have existed.

A result so disastrous, and repeated at a short interval, renders this impression not only popular but extremely natural.

Concurring in the impartial advice of eminent viewers, whose experience is of the most extensive character, and whose opinions are justly valued by the thinking portion of the public, I do not hesitate to submit to that public the whole of the evidence given before the Coroner's Court of Inquiry, and to append a plan of the working of the mine.

In this course I seek neither popularity nor undue favour. The subject in its best features must ever be one of painful consideration to myself; but it is set about with so much prejudice and misconstruction, arising from imperfect acquaintance with mining matters - the facts of this case in particular - that I deem it an obligation from what I ought not to shrink.

It does not concern the public to know any thing of the confident satisfaction I feel in the endeavours used to guard against and prevent these awful catastrophes - this is my own peculiar interest; but it is of the highest importance that precise information, both as to the discipline and system of working, should be circulated, to mark out what has been done well or ill, and to form an impartial basis on which practical men may build useful suggestions for the greater safety of mines of this character.

There is also a most grave inquiry suggested by the evidence given in this case - an inquiry that opens out a serious public question - one that will sooner or later, if left in its present unsatisfactory state, unhinge all mining enterprise.

By a recent Act of Parliament (13th. and 14th Vic.) inspectors of mines were appointed by Government, with general powers to inspect underground workings.

No manager or proprietor of mine is bound to adopt any changes suggested by the inspectors; but as they do not hesitate to pronounce definite opinions as to the system, discipline and arrangements of collieries, it necessarily follows that the former must occasionally, if not frequently, come in direct collision with the latter.

The magnitude of the responsibility involved, cannot be fully appreciated except by those on whom that responsibility rests.

On the other hand, the proprietors have a real interest in every feature of the mine - whether to the ventilation, the discipline, or the system. defective ventilation and lax discipline, are as ruinous to the owner as they are prejudicial to safety; for it is a notorious fact, that security and economy go hand in hand, and that an improper system is commercially ruinous and unwise.

On the other hand, the inspectors are irresponsible in every thing except as regards their duty to the public; and even in this it is possible that they may hold false and personal views, for which there is no little allurements in public life.

They need not care for commercial enterprise, the difficulties of locality or ownership, or the appearance of those hazards which may or may not develop themselves in the progress of mining. The advice and opinions of more practical men may be treated as prejudices to which they are wedded by habit - the financial requirements for carrying out this or that system may be derided, to gratify what at best may be more fanciful than practical - more dangerous than secure. In short, the ability and experience of those whose time and consideration have been chiefly engaged in directing a mining adventure, may be hastily and even thoughtlessly set aside, to give place to recommendations that may have been matured in an hour, a day or a week, or that may be best accord with any particular hobby in the ascendant at the time.

In tracing out the facts which follow, it will be seen that the system of working adopted is highly censured by two inspectors, and that the collision anticipated in the preceding remarks, has been realised on a scale of importance that has not yet appeared before the public.

As the impression of such fearful casualties is still forcibly on the minds of the public, and all who have taken part in this inquiry, it is not, I trust, to be for one moment supposed that my personal or vindictive feelings, or feelings of obstinacy, or the pride of reputation, or any considerations from previously expressed views, have influenced the inquiry.

The opinions of each, if received as the sober and impartial conviction of the person expressing them, and appreciated according to the ability and experience he may be known to possess, will enable the public to weigh those questions which will have excited differences of opinions, and materially assist practical miners to improve this sad event to the national good.

The Arley Mine pits belonging to the Ince Hall Coal and Cannel Company, principally owned by gentlemen now or formerly connected with Liverpool. The Company was formed in a period of great mining prosperity, 1846. A very large capital was expended, and extensive engagements entered into for leasing minerals, resulting in very inadequate returns.

For nearly four and half years I have been connected with the management, previous to which two or three explosions have occurred (one in the Arley mine), but not of such fatal character as those we are now considering.

The former happened under the management of a Late Government inspector. The leases of the Company comprise twelve separate mines, all of which are in work. They are all more or less produce carburetted hydrogen gas; but none in such quantities as the deepest seam, the Arley mine. Not one of these numerous seams did I find laid out upon the system of working urged by the inspectors at the late inquiry. The system adopted by my predecessor was that of the Newcastle system, by them so highly reprobated, and it had been continued by men as the most judicious; in short, as the only one by which the works could be satisfactorily carried on. With the exception of the Arley mine, where the inspector's system is more fully carried out than in any of the other seams, I am thankful to say there has not been a single life lost by explosion of gas, except that of a boy, who inhaled the chokedamp of a very slight explosion of gas in a blind end.

It has been said the profits are very inadequate; notwithstanding which, during the whole of my management I have never been refused any expenditure required for improving the safety of the mines, but have rather been encouraged to set aside many financial considerations to attain security of life.

This is referred to, fearing it might be presumed, either that the Company had divided large profits at the expense of the lives of the workmen, or that, having realised inadequate returns, the management had been parsimoniously conducted.

The Arley mine has its outcrop to the west, and is worked by two shafts on the same level, 414 yards deep and 33 yards apart. The south pit is the downcast and the north pit is the upcast. Their position is nearly central between two main faults running in a northerly direction under the town of Wigan. The south levels were at once driven to the boundary, and the pillars brought back towards the pit, thus far carrying out the inspector's system.

Inclines to the rise (west) were driven, and at intervals levels begun, out of which drift workings commenced.

The north side of the pit being under the town, pillars could not be removed; consequently, as the level proceeded, about one fourth of the coal was extracted. Many other leases having still to be arranged, the boundary to the north was not complete, so the drift work proceeded as shown on the plan. The north west side of the pit was opened out by inclines and level to the rise:- in the upper level, drifts were pushed on to the boundary, precisely on the plan urged by the inspectors; and at the time of the explosion, all the working places in this district were proceeding from the boundary back to the pit. The north side, in which the explosion took place, consists of mineral properties belonging to more than 100 different lessors, each of whom had been treated with, and as a natural consequence, required his own property realising in part.

The superincumbent strata in this district having to be permanently sustained, the plan adopted on the south side was manifestly impracticable. The Newcastle system, best suited in my judgement to the circumstances of the case, was adopted. The workings being multiplied, the subdivision of the air currents was needful, and thus the ventilation of the main north district was subdivided into three air splittings, as shewn on the plan.

The recent inquiry has been chiefly directed to five leading questions:-

- 1st. The cause of the loss of life.
- 2nd. The nature of the seam.
- 3rd. The discipline enforced in the pit.
- 4th. The ventilation of the pit.
- 5th. The system of working away the seam of coal.

1st. *The cause of the loss of life:-*

This was undoubtedly the result of an explosion of carburetted hydrogen gas.

2nd. *The nature of the seam:-*

The Arley mine is notoriously the most fiery in Lancashire. Wherever it has been worked, it has been more or less destructive to life. The numerous and very fatal explosion at the Burgh and Coppull colliery - those in Adlington and Blackrod - those at the Kirkless Hall colliery - and also at the Gidlow and Swinley colliery - all point to this seam as that in which nearly all the large explosions happening within the country have occurred.

In almost every case the system of working has been varied, without altogether avoiding explosion. Discipline and good management have done much for their prevention, and new precautions are being added very day.

The average thickness of the seam is four feet, and with the exception of the large district faults, the mine is not perplexed with many troubles.

“The coal when first perforated yields carburetted hydrogen gas freely, afterwards quickly drains, so that standing pillars give off little or none, and even blind ends left unventilated for weeks together, show no traces of it, unless they abut upon the virgin coal.”

The coal rests of a bed of soft warrant earth, several feet in thickness.

This is known to contain gas - the superincumbent strata being harder than the warrants, exerts a downward pressure, and causes it to rise up into the excavations.

In the absence of water (as in this seam), “the warrant lifts” less gradually. being dry, it is more brittle and liable to be uplifted suddenly - and in like manner to set at liberty the pent up gasses where such exist.

It very common to discover these rends in the floor - but in no case has a sudden discharge of gas has been observed. It is true the gas may have been liberated in dangerous quantities, and passed out of the mine safely. It may have taken place at a point away from the working places, the run of the air giving time for dilution below the explosive point before it passed into the working places, or came in contact with the furnace - it may have occurred in the night, in the absence of the miners, or have been insignificant in quantity, and passed harmlessly over the safety lamps without observation.

In no instance during the working of this pit, say five years, has it been observed to produce more than an ordinary quantity of gas in the floor, although perforated in a direct line for nearly 1000 yards. Neither has any sudden discharge been observed, except it be assumed that the two lamentable explosions have resulted from this cause. This assumption may not be ill-founded. The floor of the Arley mine of the Coppull colliery, when exposed to the pressure of the overlying stratification, is known to emit gas in such quantities, that it may be lighted along the floor when the rend first takes place. The mine being formerly worked with naked lights, this fact was, no doubt, accidentally discovered. It is quite possible the use of locked safety lamps, under the ridged discipline enforced in the Ince Halls Company’s Arley mine, may have rendered the detection of similar discharges less easy - as the powerful current could direct the liberated gas (unless the volume was large) along the floor below the lamp, until commingled with the current.

Several excavations have been made in the warrant up and won in the mine in the ordinary course of working, but without showing indications that any cause for apprehension existed. These facts, coupled with the general extraordinary absence of gas in the usual working, and the copious streams of air circulating throughout the pit, gave the best assurance that could be

desired, that the danger of sudden interruption of gas from the floor of the seam was reduced to the lowest possible point.

It will be desirable to bear in mind that Mr. Dickinson, the inspector of mines for this district, gave it as his opinion, that if a violent outburst of gas were the cause of the late calamity, he should attribute it to the floor rather than the roof of the mine; adding that it was quite possible for the roof to have given off sufficient gas to account for the explosion.

The roof of the Arley mine is formed of a layer of black bass - the thickness of which is very variable - decreasing as it progresses northward from the shaft, where it is about nine inches thick. A stratum of slaty metal, from ten to fourteen feet thick, next prevails, and this is overlaid by a hard post or rock of considerable thickness.

The latter has invariably developed sudden and large interruptions of gas. The Coppull colliery has been greatly troubled with these discharges when the post had been laid bare or fractured by the removal of the pillars.

In the instance at the Haigh colliery, a discharge of gas continued for several years; this was noticed after the post had been denuded either by a fall of roof or by the driving of a stone drift.

The gas known to exist in this stratum of rock was not the source of the immediate anxiety in prosecuting the north workings of the Arley mine. They extended under the town of Wigan and by the usual stipulations of the lessors, one half the coal will be permanently left to support the buildings on the surface.

The system of working the coal in the north district will shew that the floor is much more likely from its pliable nature to rise up into the drifts, than that the roof should descend so as to expose the post from which gas was apprehended. Every day's experience of the mine confirms this - as it is often needful to cut away portions of the uprisen warrant to maintain the height required for the pit tubs. In short, there has in my mind always been more anxiety from a descent of the roof than the upheaving of the floor.

In answer to a question by Mr. Dickinson, Mr. Peace stated - "He had never known gas come from a fall of roof like that in Woodcock's drift." This should not have been greater weight with the inspector than it was with Mr. Peace, however greatly he desired to overthrow the assumption of an interruption of gas from the roof as the proximate cause of the explosion. It accorded with his supposition, that it was more probable the floor had given off the gas suddenly than the roof; but he was unable to extract from Mr. Peace a recantation, or at least a qualification, of his definitely expressed opinion, that he believed the explosion resulted from a sudden outburst of gas from some source the most likely place to which he could refer being the fall in Woodcock's drift.

An attempt was the, and since has been made, to show that Mr. Peace destroyed his own argument by the admission, that he had not known an interruption of gas similar to the one he believed to have taken place in this instance. Few would venture to make a charge so idle. The Arley mine under Mr. Peace's management is situated in a different range, and wrought at about one half the depth. With numerous shafts sunk to it, and a stratification thoroughly broken down in a hundred places, and no restrictions in working off pillars, the case is quite different. The gas may exist in equal abundance, but there are numerous vents and outlets. But in this instance the Arley mine throughout the whole range has only been sunk to at two points two miles apart - the

roof has never been once fairly broken - the depth far exceeds that at which it had been worked in the adjoining ranges and any gas in connection with the roof must necessarily be still retained in it.

Mr. Dickinson asked pointedly - "What reason have you, then, for jumping to the conclusion that the gas came from the roof in this instance?"

The reply of Mr. Peace is significant.

"The absence of any assignable cause; the possibility of this being the cause; my observation shewing that the roof had not fallen since the time of the explosion; and seeing the effect of the explosion on the debris, coupled with the evidence that before the explosion the roof swagged."

Mr. Peace has worked in the mine for twenty-two years. He said it was the most fiery mine in Lancashire, and that the roof, floor, and coal all contained gas. It would be derogatory to him to offer any comparison between his experience of this mine, and of practical mining in general, and that of either of the inspectors; it may not be out of place to observe, that he was supported in his statement by men of the highest eminence and ability in the trade.

The seam of coal, as before stated, is four feet thick, and ranks with the first class household coals. It is perfectly dry. For gas purposes it is in great demand; the quality of gas yielded and its illuminating power, being only inferior to the famous Cannel coal.

The construction of the seam is favourable to the rapid draining off of the explosion gas contained in it. The leading galleries and drifts in solid or Virgin coal evolve it freely - perhaps in a greater degree than that of other fiery mine. Ample currents of air sweeping the faces will nevertheless dilute and carry it away.

The ventilation power has ordinarily been in such excess, that the most experienced eye could not detect its presence upon the return air after it had made its circuit through the mine.

That the seam itself effectual and entirely throws off gas it contains, after being drifted and ramified with numerous airways and intersections, has been demonstrated a hundred times, and on no occasion so forcibly as during the few days which followed the late explosion.

The action of the blast had burnt or thrown down the brattice in every working place in No.1 North Slant. many of the drifts extended nearly twenty yards above the last cross-cut or air-opening. The brattice not being renewed, an opportunity occurred for treating the quantity of gas emitted by drifts forming a *cul-de-sac* approaching workings at a higher level. In defiance of a demonstrated fact, and against the zeal of Mr. Peace in endeavouring to convince Mr. Wynne to the contrary, we found him stating:-

"I am of the opinion that the gas in the return air which was passing through these workings, *could separate from the air* sufficiently to foul these two rise places (Pilkington's drifts) if they were not ventilated," *i.e.* if they were not bratticed.

In this case, facts do not seem to influence the judgement. Moreover it is a novelty in the chemistry of gasses, I think, to find them separating when once mixed in a current of 33,000 feet per minute, rushing onward uphill and down, now at an obtuse then at an acute angle - now in one area then progressing through several - joining and separating continually, until last of all, as the current passes at the foot of the two fatal drifts, eleven yards long, the gases suddenly 'separate from the air enter the *cul-de-sac*, already full of quiescent something, and expel it. But the

coincidence is incomplete without the fact, that the brattice lay consumed in the drifts - also, that a prudent deputy had passed through these drifts that day, and at the foot of them several times - and lastly, had exposed a naked light at Pilkington's Shot, *not many feet on the explosion side of them!* Why need we pursue it further? The need is great and urgent. The authors of these fancies, opposed as they are to theory and practice, pronounce 'decided opinions' on weightier matters. "He that is unjust in little, is unjust in much." Reason knows no law but that of justice. It was an inspector who said, "I am very decidedly of the opinion that the fall came down after the explosion, and not before; and that it was consequent upon the explosion. The absence of dust is, to a great extent, my reason for coming to that conclusion." When reminded of Mr. Peace's evidence, given on oath, accompanied with an offer to take the inspectors to the spot, it was the same inspector who said -

"Mr. Peace's evidence as to dust being on the fall, has not shaken my opinion in that the fall did not occur before the explosion."

We all know the couplet of the man convinced against his will. But to return. Although these rise-drifts contained unventilated in any way whatever, it was found in practice that they did not charge with gas.

This was conclusive evidence that the passage of return air through No.1 slant workings had not and could not have fouled the two rise-drifts alone, nor increased the explosive nature of the air after it left the whole coal workings north of No.2 Jig. In other words, the quality of the air when it left the last man north of No.2 Jig, could not have been perceptibly altered by its passage thorough the drifts in No.1 Slant, for they had been drained a twelve month - in this all the witnesses agreed except the inspectors, who sometimes were at issue even with themselves.

It is quite unnecessary to say in details who joined issue, and in what, and how far, with the Inspectors; it is enough to say, all the evidence, whether given by the practical and observant miner, the intelligent overman and deputies, or the experienced viewers, whose judgement combined to the fullest extent the advantages of scientific education, natural ability and practical experience - one and all refused to entertain the possibility of the return air being fouled and in all perceptible degree by the natural and constant emission of gas from the working places to the north. But when we have it in evidence from Mr. Wynne, as just stated, that the absence of the dust of the fall from the roof, to a great extent led him to the opinion that the fall occurred subsequently, and that the return air had been fouled by natural and ordinary discharge of gas from the seam, although reminded by Mr. Peace that he had seen a sworn to the presence of dust on the fall, we cannot help thinking the judgement of the inspectors was formed in ignorance of a most important fact; and if so easily fallible on plain facts, how much more likely an opinion obtained without such facts? Further on, we find Mr. Wynne qualifies his expressions touching the effect the question of dust had in influencing his judgement, and admits that the moment he first saw the point of explosion, he made up his mind that a general fouling of the return had taken place, and had not since changed it. It will scarcely be believed that, without having seen the arrangements of the mine, or had five minutes' inspection of (possibly never seen) the working plan, he forms a conclusion from which he never suffers himself to depart, and has the ill-fated

confidence to add weight to his opinion with the public, by revealing the rapidity and precision of his judgement!

This, it is to be regretted, accords with his admission, that he has had little experience with fiery mines, and that he would do what no other prudent viewer durst attempt - "build off", or, in better words, construct magazines of gas in fiery mines. Well does it beseem both juries and the public to let opinions like these rise and end like distant smoke in summer drought - the semblance is that of a refreshing cloud without its virtue and its fruit.

Having remarked upon the character of the roof and the floor of the seam and of the seam itself, we pass to the next inquiry.

3rd. *The discipline enforced in the pit.*

When all are agreed, argument cannot be useful. Inspectors and delegates, pitmen and mine officers, managers and viewers, coroner and jurors all acclaim the perfection of discipline attained in this pit.

Mr. Dickinson shall be the exponent of the whole, because the public will not, after the perusal of the evidence, suspect that he could think better than it deserved of anything proceeding from a manager who deliberately and conscientiously rejects his system of working.

After a strenuous attempt to elicit facts bearing a contrary effect and aided by the indefatigable exertions of the leading miners' delegates, who directed the machinery of their unions to get up a case against the management, the inspector thus sums up all matters relating to discipline:-

"I believe that a very great improvement has taken place in the ventilation and general discipline of the mine since the last explosion; in fact every thing has been done that discipline can do. A small lantern had been brought forward to show that a boy could be allowed to use such a thing; but as we have so thoroughly sifted the question, turned it inside out as it were, and found nothing else to complain of, I think it only shows the perfection of management."

It reflects the highest credit upon Dobison, the head under-ground official, to have passed such an ordeal with so few scars.

It may, however, be useful to the trade, as well as satisfactory to the public, to know in what the discipline consisted. The head overman (Dobison) and deputy-overman (Peel, whose life was sacrificed) were in full charge of the pit. It was their duty to inspect the whole of the workings-places daily, exchanging districts with each other daily. By this means both inspected the whole every two days.

The workings were divided into districts, each of which was in the charge of a deputy, who examined the working-places before the men entered, and then returned to the shaft to take part in scrutinising the safety lamps, every gauze being minutely examined below and the lamps locked. This done, the deputy returns to his district with the miners and personally fires shots and sets up useful brattice until the day's work is done. No unlocked lamp is tolerated in the pit, and no naked light except at the foot of the downcast and at the furnace at the foot of the upcast. Any violation of the rules - such as smoking tobacco, removing lamp tops, continuing to work with an injured or

unlocked lamp, carelessly injuring the lamp gauze &c, &c. - was, in every case, visited either with legal prosecution, heavy fines or instant dismissal.

4th. *The ventilation of the pit.*

The down and upcast shafts are 11 feet 4 inches in diameter, and the ventilation is supported by the application of a furnace, 25 yards west of the upcast. The furnace is 6 feet wide and 9 feet long. A dumb drift communicates with the whole of the return air courses, and, by means of doors and other appliances, it is the work of a minute to isolate all, or any of the main return air courses, or to feed the furnace entirely with fresh air direct from the downcast, conducted by means of cast iron pipes.

At neither inquiry has it been shown that the doors, air-crossings, or stoppings have been imperfectly and insecurely arranged. Nor has it been doubted whether the areas of the intake and return airways have been either limited or too small. All these have been carefully examined by the inspectors and witnesses, and it has been taken for granted that they have been perfectly satisfactory. As these arrangements constitute the most part of the ventilation of the mine it must be assumed that nothing was wanting or ill done in this respect.

Numerous inspections and experiments have been made, to test the quality of the air returned to the furnace during the ordinary operation of the mine. The aid of the furnace has been, in the absence of the miners, dispensed with, and the cages suspended in the shaft, to ascertain the effect they might produce upon the ventilation, and in what space of time the extreme workings and the returns at the furnace would begin to foul.

In every such case the extreme workings have fouled the first, say in twenty four hours; and it has required additional time, say thirty to forty hours, to make it perceptible upon the returns near the furnace, owing to the leakages of the doors, &c., &c.

The mine-book shows that the ventilation was 77,130 feet of Air per minute two days before the explosion. This was distributed in the following way:-

Top South Level	6,700
Lower do	8,200
Furnace up-brows, West	28,680
North	<u>33,550</u>
	77,130

The north current, of 33,550 feet per minute, consisted of three splits of air; viz. extreme north, beyond No.2 Jig, say 20,000 ft. per minute.

No.2 Jig, intake	10,000
No.1 Jig, fresh air	3,550 = 33,550

The quantities of this subdivision were not all ascertained by the anemometer. The first one was obtained, and the other two had to balance fairly apportioned between them.

The ventilation registered by Mr. Peace was considerably more; viz. 98,552 feet, arising from the difference of instruments used to gauge it, and the areas understated, more than from any excess of air going through the workings when he took the observation.

On both occasions the explosion took place in the north district.

A reference to the plan will show the working on the 23rd. March, 1853, those added since being shaded pink. The proximate cause of that disaster was traced to the south doors at the top of the No.2 Jig being left open for a shorter or longer period, thereby fouling the rise workings to the north of that Jig. It must be borne in mind that the explosion occurred at one o'clock. About nine o'clock a.m. the cage had broken the wooden guides, laying the pit idle for nearly four hours. During this interval work was suspended, and door-lads, colliers and drawers appeared to have left their posts and congregated together. Some had gone to the main level where the full current would in any case sweep past them, and others seated themselves about thirty yards north of the doors supposed to have been open in a sort of blind level, where no current traversed; they would not, therefore, be conscious of the mischief that was accruing. On the pit resuming work at one o'clock, it was assumed the doors had been hastily closed, thus directing the air in its usual course, and sweeping over the shot on Griffith's place the foul current from the north.

The north district was then ventilated by one current, which swept the face of every working-place in that district before it returned to the upcast. This current was measured to 15,903 feet a minute. Since that period, the workings have not been extended more than fifty yards further from the shaft.

Without having increased the number of miners, or perceptibly enlarged the area of mine excavated, the one air-current had been made into three, and the ventilation raised from 15,903 to 33,550;- in other words, 33,550 feet of air per minute in 1854, had no more work to do than 15,203 in 1853.

It is essential to bear in mind, that the north district comprises scarcely one-third of the whole, and that it had very nearly one half of the whole ventilation allotted to it.

This may at once explain the evidence of those connected with the pit as to the general excess of ventilation, and the absence of any appearance of gas, which evidence was unanimous with the exception of Barlow, who admitted he was a boatman and inexperienced, and had never before observed what he complained of.*

It is, at the same time, a conclusive answer to the presumption of a general fouling of the return air, and leaves the inspectors, and those who think with them, to prove either that the mine ordinarily throws off enough gas to foul the return, or that an accumulation was ever, at any time, permitted or known to exist in the mine. The evidence being directly contradictory to both, where could the gas exploded come from but a sudden interruption from roof or floor, both of which are known to contain it?

Mr. Forster remarks - "The ventilation was very good, and the air in the return-air courses quite clean; and, although the brattices were down and some of the places fifteen or sixteen yards up, there was not the slightest trace of gas to be observed."

Mr. Elliott not only found plenty of air, but approved its distribution. He says - "There is not increased demand for in the workings I inspected, which are those on the north side of the pit."

And again, - "The return air was fresh and pure. I consider the distribution of the quantities to the different districts judicious, and can suggest no improvement."

Mr. Peace was greatly surprised to find such ample ventilation; he had never met with so much in any pit in Lancashire. he states - "I should have no hesitation in taking a lighted candle through the workings."

Mr. Mercer had never seen as much ventilation in any pit; and, although he examined the returns when the furnace had been out two days, and the ventilation did not exceed 30,000 per minute for the whole pit, he could not perceive any gas upon the returns at the place where the explosion occurred. Nothing could so effectually dispose of the presumed general fouling of the returns maintained by the inspectors. He adds - "With regard to the general ventilation of the mine, I could not suggest any improvement in it. I think no fault whatever can be found with the management of the mine, which is fully equal, and indeed superior, to that of the generality of mines; and, so far as regards the ventilation, I have not been in a mine better ventilated in the whole course of my experience."

**The evidence of Dobison will shew that he at once went to examine Barlow's place on hearing of the complaint - every thing was found right and Barlow stated the gas was not the seen. The deputy has fired a shot only a few minutes before Barlow complained, in his place.*

5th. *System of working.*

It is necessary to view this chiefly as it affects the safety of the working collier; but there are important considerations of ownership, and of buildings upon the surface, which must not be passed over.

Taking the latter first, and referring to the plan, it will be observed that the south levels have reached the boundary, and that the pillars are being worked off backwards towards the pit.

Travelling up No.1 North Jig, it will be seen that the extreme north levels from the top of the Jig have also gained the boundary, and that the coal (which is underneath the town) is being drifted in the usual way.

The workings from some distance along the level south of N o.1 North Jig, have also reached the boundary. They have been lying idle some time - being adjacent to several cotton-mills in the surface.

The district between these and the shafts has not been perforated with drifts, the pillars have to be eventually removed, and the drifting will be done when required.

The only new work driven into fresh coal, since the explosion in March 1853, is that in the downbrows on the east side of the pit.

Out of these downbrows, north and south levels have been commenced. The levels are already driven some distance on either hand without any drift work, and it is apparent that the intention is to press these to their respective boundaries before any rise drifts commence.

The workings just referred to are, so far as I can discriminate, precisely arranged on the system so strongly urged by the inspectors.

Lest the public might indulge the fallacy that the inspectors are inaugurating a new system, it will not be out of place to observe, that it has been partially adopted in this country for many generations; but it would be a rare thing to point to a colliery proprietor, or manager with works of magnitude, who adheres to the system more rigidly than shewn in the down-brows and south side of this pit.

The Lancashire coal-field has been chiefly wrought by small winnings - a few acres of coal near the surface being sufficient to induce small capitalists to sink a shaft. The shaft is almost invariably placed at the rise of the mine in the lease, so as to work off the first rank or level of coal. The boundary being near at hand, the levels usually reached it by the time the pit and surface arrangements required an increased output. The situation of the pit prohibited more than one set of levels to each pit, so the natural operation was that of working away the coal backwards.

All shallow mines are more or less troubled with water - this difficulty obstructed the working of coal below the shaft level, and made it as far more economical to sink a pit upon each succeeding rank or level of coal, to the deep. Numerous air-pits by this means soon existed. The extraction of the rise rank of coal added the best of all 'gas drifts' to the deeper seam, and so effectual was the removal of the gas, that nature was usually the best and most unintermitting ventilator. Year by year the shallow mines have been disappearing and carried away with them a part of the system of working and nearly all the advantages connected therewith.

This change, nevertheless, is not effected without some natural necessity. Had the system been closely pursued, it would have dwarfed commercial enterprise, and railways and canals would have sought in vain the traffic they were made to develop.

Genius and enterprise have ramified hitherto neglected and unapproachable districts with railways and canals - and spurred on capitalists to open deeper seams of coals. The pit of 100, 200 or 300 feet, has given place to that of so many fathoms - production was required to advance like a ratio, to justify the capitalist, who heretofore adventured hundreds of pounds, where now he risks tens of thousands. To require a pit sunk for every hundred yards of dip coal, would be to postpone enterprise to an indefinite future, and seal up the country's resources.

A commercial necessity suggested the idea of working a hundred acres to each pit, instead of five or ten, and it was the ability of practical and scientific viewers that agreed upon a system commensurate with the difficulties involved. These viewers were the pitmen of Newcastle and Durham. Famous in generations past and present, it has been their pride as well as their misfortune to battle against the fatal hazard of deep and fiery seams; whilst other districts have enjoyed the immunities and limited anxieties of shallow seams, without being called on to put forth that energy and ability for which their northern brethren are so disgusted. Despite all that could be devised, accidents of the most fateful kind have from time to time occurred - and there is

scarcely a viewer of eminence who cannot count up, within his own experience, many sad misfortunes in connection with fiery mines.

The Wigan mines are approximating to the Newcastle in depth, developing many of their difficulties, none of which is to be dreaded as much as the sudden ebullition of gas. The mixed system of locked safety lamps, with open furnace and blasting, seems to fail there as well as here. Every fresh disaster impresses the mind with the needful through costly abandonment of all naked lights - of which blasting is the most objectionable.

An irruption of gas defies all systems of working (by these are meant the precise mode of taking away part or all of the seam); nothing but an altered system, of ventilation, and of mine arrangements generally, can offer any safeguard against gas so involved.

In this lies the errors of the inspectors. They have grasped the chaff, and dashed it in the eyes of the public. - Better to have assorted the wheat, and therewith strengthened and improved the constitutional weakness of the system.

The system of working is of great importance, and that adopted at the Arley mine having been supported by practical men, and denounced by less experienced inspectors, deserves a careful consideration.

The only parts of the workings encouraging a diversity of opinion, are those extending to the north of No.2 South Jig, No.1 North Slant and a portion of the No.2 North Jig. The inspectors' theory is simply to drive levels to the boundary in each direction, and bring back the coal so much as will keep the face of the pillars regularly progressing towards the pit; with this exception, the coal must be left solid and undrifted from face of pillars to the pit. This system, they say, should prevail where the pillars can be worked off. The south and north-west sides of the Arley pit, and the down-brow workings, have been very closely carried out on this system.

But on the north side it has been otherwise. Special considerations of ownership and erections on the surface, made it both unadvisable and unsafe to work it on the plan used in other parts of the pit.

Let it be recollected that more than one hundred distinct properties form this side of the pit; that each is only a few yards across by a many yards in length; that any one is sufficient in itself to obstruct the further progress of the levels and almost seal up the districts beyond; that each owner on making terms requires all or part of his particular property working off at once, or the treaty would not be entertained; that the length of the level from the pit on this side only extends 1000 yards; that it now stands at similar obstacles; that they cannot proceed without numerous leases being at once agreed for; that the lessors to be treated with have *their own idea of value*, and their own obstinacy, either in obtaining their own terms, or letting the coal lie unworked for an indefinite time; that the treat which the inspectors would have used has been often *foolishly* adopted, with just so much effect as the appeal of the Quakers to the Emperor of Russia. Let all these things, coupled with the annual consideration of rent or purchase, which these legion of owners are receiving, by duly estimated, and I feel quite sure no other person but an irresponsible inspector would have ventured so much exertion in trying to persuade practical men, that the north side of this pit should have been worked according to a theory of his own. The inspector has intimated his intention of putting the proprietors of this Company 'under notice' for continuing to

adopt the system pursued. I have communicated this expressed intention to them, coupling with it my undisguised resolution to rid myself of all responsibility, so soon as it is required of a manager to carry out the various and fallible requirements of the inspector contrary to his own judgement.

If this is to be tolerated, the inspector will be the honorary head consulting viewer of every pit in the district; and, as such, must be first tied to the responsibilities before his functions begin.

The inspectors and theoretical writers cannot agree as to the cause of the misfortune. The former say the exclusive adoption of the 'the Lancashire system' would have saved it. The latter say the use of gunpowder in a fiery mine produced it.

Let the practical public reflect that the pit was visited and approved by the inspector before the first explosion, and after it the same authority suggested certain precautions as to the blasting which were in no case neglected.

Assuming, then, that the north district is best with difficulties, which practical viewers would consider sufficient to warrant a departure from the system extolled by the inspectors - which is assuming a fact patent to the public - he have next to deal with the system to be substituted.

The inspectors admit, that this adopted is the Newcastle plan, and such as would be approved by the Newcastle viewers as a body. We shall be quite safe in assuming, the, that viewers possessing the practical ability and experience of the most advanced mining district in this country, if not in the world, approve that which the inspectors condemn. I hold a specimen plan of the system suggested, by an eminent mining engineer of the Midland district, for working this pit; which, though made after careful inquiry and mature deliberation, reveals no trace of the system urged by the inspectors.

The local mining engineers have also come to the aid of the public, but not without confusing the already confounded dogma.

Mr. Peace has a system of his own - one that differs from that adopted, more in the direction of the upbrows and the angle of the drifts than in any other essential. Has he worked this pit he would have used his own plan - nothing more natural. But his plan militates against the approved theory. He would not have gone to the boundary under these circumstances without having the upbrows at every 140 yards, and his horizontal drifts at intervals of 10 yards from upbrow to upbrow. As a matter of safety, system and ventilation, this would be an approximation to that adopted.

Mr. Peace says, - "We do not hesitate to drive pillars between the extremities of the shaft. We generally get the pillars when we can, and allow the roof to subside. We do not necessarily drive to the further end, and then bring back the pillars. If I were obliged to leave the town supported by pillars, and brought back the coal I got, *I should consider the open space behind me a constant source of danger*, and keep it carefully and abundantly ventilated. I do not think it possible to render the working of this part (the north) of the pit safer, except by taking warning of the explosion, and, when any depressions of the roof are observed, taking means either to bring the roof down, or tap it and draw off the gas."

Mr. Mercer would have drifted the north districts into blocks of workings as the levels proceeded; and why into blocks? "To prevent a subsidence of the superincumbent strata in working off part or all of the pillars, or what is locally termed 'a land weight.'" There is not a

word of the danger to be apprehended, except that he emphatically declares the system proposed by the inspector would be more dangerous than that adopted - for which he gives reasons as clear as they are practically correct. He says, "Under the system Mr. Dickinson has recommended, the explosion might have occurred at the far end. If the air got into the waste in such quantity as not to dilute the gas, but to drive out a portion of it into the workings, and that gas was fired, the blast would go back to the waste, and there would be a very severe explosion." Mr. Mercer's great experience could not refer to a single colliery in the Wigan district worked upon the system urged by the inspectors! And how did the inspectors meet the arguments and opinions of the whole of these men? One would create open magazines of explosive gas at every extremity; he would care nothing about the ventilation of the drifts left behind; he feared not the fact that a fall on the barometer acting on the daily increasing magazines might explode the whole at a damaged lamp; he feared not the warrant uplifting, not the roof falling, so as suddenly to decrease or altogether choke the air courses, leading fresh air upon the miners at work on the verge of the magazines, thereby sending the current outwards into the volume of gas and forcing it out on the miners! It is impossible to foretell what changes a day or night might effect in this way, with a notoriously bad floor, and an uncertain roof, acted upon by the impeding and creeping strata.

The other inspector rashly hurries of the horn of one dilemma to be transfixed on another. He would build off the magazines! He has seen the thick coal of Staffordshire built off - and he cannot see anything better. Truly, there is nothing new under the sun. - This 'building off' is an old antidote; but above all things it is a practice most objectionable to the working miner, and one that a manager or proprietor would most dislike to have in pits exposed to the transient visits of an inspector. It appears, however, to have been foolish dread, and that it is to be regarded by miners hereafter as a mark of good management!

Had Mr. Wynne ever known the anxiety of owning or managing fiery mines, he would have learned by experience that what seems so good in theory is not so in practice, and also that nothing affects the contentment of miners so much as a rumour of gas being 'built off.' In Staffordshire the wastes are built off because the atmospheric air requires to be *kept out*; but in building off gas the difficulty is to *keep the gas in*. That are two very different things. There is no danger of the inspectors advice being followed; the subject may therefore be left where it is.

The difficulty of drifting coal back from the boundary, with all the men working close upon the reservoirs of gas, and upon each other, is not to be disposed of; it must either be an open magazine, or a gasometer incapable of retraining its contents. The inspectors cannot propose to ventilate the standing waste without condemning the whole theory; for if it be culpable for a man to be working in the air which has passed by a dozen other men before it comes to him - if this man be working in 'return air', what name would be given to that current which came from the men on the boundary, after it had battled through ever-varying waste? If it be required to encourage the formation of reservoirs of gas rigidly to uphold a theory, the prudence of doing so must be very doubtful.

It was an earnest and discreet appeal Mr. Elliott made to Mr. Dickinson when in the spirit of kindness he entreated him not to let such questionable opinions go forth to the public, and afforded him a further opportunity for qualifying his statements. But it was made in vain. The

experience of the one, which began at twenty was not cowed by that which began the harder race at nine, although the latter was an older man.

He who spends a life travelling through cities and hamlets, gazing upon architecture and inspecting the variety of styles, may know less of what is really practicable than the builder who has reared but a single cottage, Yet the one seldom stoops to learn of the other.

The system of working leads to this conclusion:- A group of drifts have been placed *here*, they ought to have been *there* - so say the inspectors. After looking anxiously into the matter, half a dozen viewers say, Had they been *there*, the risk would have been greater, and the system less satisfactory - who will judge? When Mr. Dickinson said that a smaller area of upcast in proportion to the downcast was preferable* and when Mr. Morton also an inspector of mines, said, it was better to have those conditions reversed, who was the arbiter for the unfortunate managers and owners?

Had Mr. Morton (like Mr. Dickinson and Mr. Wynne) changed his district, would the public and the government have been insatiable in their requirements until the same manager had been placed under "notice" by *both*, and until he had bowed his reason to the fancy of each by doing and undoing, *ad infinitum* ?

My predecessor was subsequently appointed inspector of mines. Had he taken charge of this district, would he have repudiated the continuation of arrangements or systems begun by himself? If so, let inspectors be more practical and considerate, and less theoretical and severe; if not, let them agree to disagree, and be content.

**Charles Morton, Esq.'s Report to the Secretary of State, dated Wakefield, September, 1851. - "The united sectional areas of the air courses shall exceed that of the 'downcast' pit and that of the upcast should be greater; but it is not uncommon to find these conditions reversed."*

Joseph Dickinson, Esq.'s Report to the Secretary of State, dated Manchester, June 30, 1851. - "With reference to the proportional sizes of the upcast and downcast shafts, I have observed, in a majority of instances, that the theoretical arrangement in assigning a larger area to the upcast is not borne out by practice. In natural ventilation, when two shafts are of a similar height and depth, but of different area, the larger shaft is more frequently the downcast. With shafts of a similar area, and on a level at the surface, but sink to different depths, the deeper is more frequently the downcast; and when of similar depths, but of different altitudes, the higher of the two is naturally the upcast. With adequate ventilating power, and a larger area at the downcast, the draught appears, in a preponderance of cases, less liable to be baffled by adverse circumstances. Without attempting to specify the exact proportions in which such an area should be observed. I may remark, that of all the cases which I have observed, where the upcast shaft has good furnace power, and is not less than seven feet in diameter, and the downcast of a larger area, and the aggregate of the air-ways throughout a little larger than the area of the downcast, it has appeared impossible to define a limit to the speed of the rarefied current in the upcast shaft, and the result has always been successful."

Doctors have perpetually differed: and yet parliament has lived into the nineteenth century without being called upon, by public acclamation, to enact a law of agreement. Can the legislation or the public expect that viewers of education and large practical experience will act contrary to their best judgement at the bidding of an inspector, who may be less practical and less able, and whose position may have been gained by the influence of 'a friend at court', rather than by the sober consent of eminent practical men who can testify to his individual fairness? Can the inspectors themselves expect it? I am sure they cannot be so absurdly blind. Yet Mr. Dickinson thus assures the public - he says: "With the exception of the system of working, all my suggestions have been carried out. So long as the system of working is persevered in, explosions will happen."

Mr. Wynne thus transmits the echo:- "If this system of working pursued be carried on, explosions will happen as a matter of course."

Is the public prepared to reduce the diversities of judgement and practice to a legal enactment? If so, let them appoint inspectors who shall not only enforce its provisions, but bear the responsibility of failure. The world is full of complaining voices and cure-all theorists. These public unpaid inspectors tender advice unsparingly - their endless cadences never cease to fall upon the public ear - and a startled public will ever greedily devour the well-trimmed bait. Let not the inspectors swell this ignoble throng; let them convince, by patient reasoning and practical illustration, these whom their advice may serve, rather than pursue the character of an Old Bailey pleader. Their truest is a high one - let it bear its proper fruits; their opportunities are great and frequent - let them not be misapplied.

Further legislation seems imminent. There are many weighty considerations deserving attention. We may take care that every ship is well found, well manned and A1 on the register at Lloyd's, before she sails, but we cannot bring her in a legal pathway. Nature will defy the attempt whether applied deep down in the earth or on the 'organic wave.' She wields unseen and desperate elements above and below, and great will be the fame of the man that shall point out the infallible means of controlling the subtlest of her elements - that with which we have now chiefly to do. Great and good inventions need little controversy; their inherent virtues are their mightiest advocates.

There are many fixed and necessary requirements that legal enactments may and ought to secure. Within this range would fall those matters upon which all are fairly agreed; but there are many others, on which inspectors have no lack of confidence, if meddled with, would raise a general outcry. To dwarf commercial enterprise is to clog the wheels of a national industry, and to limit the country's resources - this cannot be more effectually secured than by incautious legislation.

To bring owners and managers of mines into direct collision with irresponsible inspectors endowed with legal authority, yet differing among themselves, would be to disgust them with the anxieties and fearful responsibilities of, at best, a very hazardous trade, and to make them seek a calling that has a greater share of the pacifications of life.

To give the inspectors no more authority than they now possess, no doubt seems to them and the public insufficient. To attend inquests, and inquire into accidents after they have happened,

certainly is insufficient. We must look to more prevention of accidents by previous inspection. At present, so little time can be given to the inspection of a colliery, when such is made, that it secures no large amount of usefulness.

It is desirable, therefore, for parliament to confer absolute authority upon inspectors, whose judgements are seldom alike, whose districts are so large, whose calls are so numerous, whose judgement may be consequently hastily performed, and whose theories may not always be wise and really practicable? If so, surely we shall need a permanent court of arbitration in each mining county.

The uninitiated public will naturally place a value upon the opinions of their servants, the inspectors; but when it is remembered, that they often draw their conclusions from hastily made visits, made possibly, as in this case, after a casualty has happened, and that, from their numerous engagements, they are prevented from making beforehand those minute examinations which anxious managers will always desire, it does not require much judgement to conclude, that theirs must either be a theoretical deduction, or a view obtained by partial acquaintance with the nature and conditions of the mine.

It is ever easier to give a condemnation after a calamitous result has arrived, than to suggest a feasible precaution in anticipation of consequences not yet obtained. But it is an injustice to the respect due to their office, as well as destructive to their proper influence, if they constitute to themselves an arbitrary dictatorship to enforce special theories; or to visit upon any management that is so unfortunate as to come in collision with them on matters of engineering judgement, the force and anxiety of their unmitigated censure.

Better would it be to urge their suggestions in friendly interviews - better to find more fault when inspecting the mines - than to confuse the mind of an excited public after a fatality with observations of harsh and bitter import; or than to be so rash as to foretell what dispensations rest in the lap of the future, because managers have confidence in their own judgement and exertions, rather than in being blindly led by those in authority.

It is not my wish, nor is it within the scope of this statement, to discuss the merits of an inquiry which is now resumed from last session before a committee of the House of Commons - that tribunal will, no doubt, carefully glean all the information the country can command, and weigh very maturely any considerations submitted to its judgement.

But in this we cannot be too earnest, in pointing out seriously and calmly the danger of legislating over much on questions that are still matters of grave difference of opinion among able men, and of arming, individually, any inspectors with authoritative and arbitrary powers.

There is enough already known that is definite and desirable in mining matters; let all attempts at legislation pause at the confines of that which is indefinite and fallible.

EVIDENCE

TAKEN BEFORE

THE CORONER'S INQUEST AT WIGAN.

EVIDENCE.

Explosion February 18th, 1854.

WILLIAM ANDERTON, of Ince: I am overlooker on the surface of the Arley Mine and Cannel Pits. On Saturday afternoon, the 18th, I was at the works about half past two. I was about 100 yards from the mouth of the Arley Mine, and happened to be looking in that direction. I heard a report, and saw smoke coming out of both pits; the report was not very loud; the smoke was thick and black, and there was dust. Thomas Robson, the sub-manager was with me. I had seen Mr. Darlington near the pits; but he had left about three minutes before the explosion, saying he was going to Wigan. I knew an explosion had happened, and made off to Mr. Darlington in Wigan, but I did not find him readily, I got back again, leaving word that he should be sent after me. When I got back, I found Josias Dobison, the underlooker, Robson, and others, had gone down. The men were coming out of the south side workings very fast; and, as far as I heard, all came out safe on that side. I stayed at the top, as I was in charge there. Soon the men began to bring people up from the north side; they were more or less burned; one of them was Sherrington, who died on Friday morning. he was not burned, but seemed out of his mind, and almost raging, from the effects of the sulphur. Mr. Darlington came to the pit between half past three and four o'clock and went down in a few minutes, only waiting to put on my pit coat. Other men were sent down as soon as possible; for some who went down could not stop long and we got regular shifts. The first dead body brought up was that of Dobison's boy; no more were got out till late in the evening; they were all removed this yard, and by Saturday evening eighty-seven had been recovered, and so removed. Mr. Peace, Lord Balcarres' manager, arrived on Saturday evening, and sent for further help from his lordship's collieries, which was made use of. I remember nine men, uninjured, being brought up about ten o'clock on Saturday evening; I understood they were found in the north workings. During this time, Mr. Darlington was still down the pit, almost entirely. I understood that no stoppage was made in the search until the whole of the eighty-seven bodies had been recovered. I was in charge of the top all the time, excepting for a few hours on Sunday afternoon. I have occasionally been down the pit but I know nothing about the workings. I shall have been in my present situation for seven years on 10th April. Dobison, the present underlooker, succeeded Jones, after the explosion in March last. He had attended very well and laboured very hard. I have heard colliers complain about him being very strict, and, as far as I have seen myself, he had been strict in enforcing the rules. I can give no information whatever as to the cause of the explosion.

JOSIAS DOBISON, of Ince: I am the head underlooker of the Arley Mine, And have entire charge of the workings underground. I have been there since shortly after the explosion there in March last. At the time of this explosion I was sat my own house, about a quarter of a mile off, but being informed of it, I went to the pit directly, and went down with Henry Burrill, underlooker

of the cannel pits, and some others. The shafts were uninjured, and the cage itself was all right. On getting to the bottom of the downcast shaft, we went to the engine-house and lighted the lamps, for we had heard there was all right in the engine-house. Between the pits there were double-doors which we found close and uninjured. We had to pass through them to go to the north side, where I knew my boys and the rest of the men were, and where I knew from the state of the doors, and the air in the downcast shaft, the explosion had been. as soon as we were through the doors, I went on to the upcast or bye-pit, but could not get further on account of the sulphur. I found it impossible to get to the furnace that was, so I and others went up the No.1 north jig, and got round to the furnace. We then went round by the No.1 north jig, and came to the furnace by a roundabout way. We found traces of the fire; the doors and props were still on fire; the furnace was much damaged, and four or five yards of the brickwork thrown down. We got water and buckets, and put out the fire. Then we came along the main lower north level. we were stopped at the air crossing, over the foot of the No.1 north jig, which was blown down. We travelled on as well as we could, and found some bodies there. I went one way by myself, the air crossing having first been set right by putting up a few plank and a bit of cloth; and a party of men went another way. In No.2 jig, we found a boy lying alive, and several others dead. The air stoppings were all blown up there, and I could get no further than the second air crossing. I returned along the horse level. [At the request of the coroner, Mr. Dobison traced minutely on a plan of the workings which was produced, the route he and the others took in passing through the workings, repairing the stoppings, &c.; but it would be unintelligible without the aid of an intricate plan.]* On the north side of the two doors [these were pointed out] we found nine men, sitting and waiting for some one to get them out; they were very glad to see us. Those men told us of another man (Matthew Corless) they had left on the slant; Mr. Hewlett and myself went up, but found the man dead. I came back to the top of the jig and found twelve bodies lying dead. When we got back again, we found twelve dead bodies at the top of one jig. Gerard Fairbrother, a pony driver, was one of them; the pony was found alive a long distance up the slant, where he must have left it. If he had remained, he would have been safe. None of the doors in that level were injured, and after we had put up the air-crossing, the air was good, and I think the nine men we got out alive might have lived a considerable time longer, if we had not happened to get them. I cannot say exactly what time it was when we were there; it might have been nine or ten o'clock at night. I then went to the pit, and saw Mr. Darlington at the engine-house [the one in the pit the witness refers to.] I had seen him in the pit several times before. Mr. Darlington accompanied me along the main north level to No.2 jig. We got further than I had been able to get before as the air was better; but it was so good that we were able to get into the workings where the principle part of the men lay. I then went out of the pit and went home; one of my boys had been sent home. I went down the pit again soon after three o'clock on Sunday morning, and made at once to the No.1 slant workings, and managed to get through the greater part of the workings between No.1 and No.2 jig. Some of the men who had been extinguishing the fire in some coal had got into the slant before me. The air was not very good, but I could breath freely. Those workings were the principle seat of the explosion; all the bodies were found more or less burned, and in some places the coal had ignited. Many of the cloth stoppings, and some of the brick ones were knocked

down. In Woodcock's drift,[†] which is one of the centre places in the workings of the No.1 slant. I found a fall of roof, extending over 50 to 60 yards, all the breadth of the place, and covering the floor with about four feet of stone. It was a new fall; but I cannot say whether it fell in consequence of the explosion, or just before. I know it was not down on Friday, Some of the men's lamps were in their places; others had their lamps with them. John Brown's lamp was broken by the explosion, so was that of a man named Ashbrooke; but I never heard of any lamp having been found with the top off, or unscrewed. There were three or four points in the extreme south of the workings in No.1 slant, where the fire seemed to have been most severe. I have many of the lamps found in these places; they are all sound. Jas. Pilkington worked in the southernmost place; all the return air from the north main level passed close by the end of that place. Pilkington had that morning holed through into the return-air course at the bottom; he had not completed it, but the hole was about a yard long or four feet long, and eight or nine inches high. The lower air passed through the hole out of the return air course. In the bottom of the cut-through, was found the remains of a shot which had not gone off; there were the remains of a fuse, showing it had burned; but the powder remains in the hole now. *It is the business of the fireman of each district to fire shots; and it would be John Brown's duty to fire this one. The men have not been allowed to fire their own shots since the last explosion; some men have done so, but in eight or ten cases that we have discovered, I have fined the man 5s. or 10s. Men have been taken before the magistrates for smoking; and one of them is now in prison. A furnace-man was also imprisoned for a month for neglect of rules.* If the shot in Pilkington's place was lighted, I believe it was done by John Brown; his body was found driven fast into a corner, almost directly opposite the back-side of the cut-through. It was covered with dust and rubbish blown out of the workings. Brown's lamps was near him; it was much damaged, but the screw was all right. From the position of Brown's body, I think the force of the explosion had taken a direction from the No.1 slant workings, towards the furnace of the upcast shaft. I expect that Brown

*See Plan †See Plan

waited near the corner, after lighting the fuse, until the shot went off; it was the last he would have to fire that day; and he might have been injured by the coals, if he had not waited as he did, but had attempted to pass on directly to the cage so as to come out. I never heard any complaint of Pilkington firing his own shots; and from the position of Brow's body, I am sure he did not fire this one. It was about the time to finish and all the men to leave the pit, when the explosion happened. I don't think it was likely Pilkington had fired his own shot because brown, the fireman, was so near at hand to do it. I never had any complaints about Pilkington; I believe he was about forty or fifty years old, and a very careful man. Supposing the fuse to have been lighted by Brown, that would be sufficient to ignite the gas, if there was any quantity of gas in the place; I have seen a fuse blaze. *In Woodcock's place, I found a newly fired shot but it had gone off and the coal was down; the fall of roof had occurred just below this.* Woodcock's body was found not far from the coal he had got down, but on the north side; his slop and cap were at the coal; and I think, therefore, he went to the spot after his shot went off, and was there when the explosion occurred. *I believe that Brown fired this shot on his way to Pilkington's place; he must have*

passed through that place to get to Pilkington's and Pilkington's would be the next shot he would fire after Woodcock's. He could not have passed, I think, without seeing the fall mentioned, if it had occurred when he went through Woodcock's place; and at any rate, if he could have escaped seeing it, Woodcock would be sure to have mentioned it as it would be considered an important fall. In fact, Brown would have had to pass over a part of the fall, supposing it had occurred; and I do not believe he would have fired the shot if he had known such a thing had occurred. I think it is quite evident, from all these circumstances, that the fall did not take place until just before the explosion, or as a consequence of it. I had much confidence in Brown as a fireman; he was about thirty years old, and was the best man I have ever had in the district. I feel quite certain he did not proceed from the furnace; all the dust &c., was blown towards the upcast; and I feel confident that the fire originated somewhere about the southernmost point of the No.1 north slant. I believe that the explosion was not caused of the light of a lamp but from the fuse of the shot fired by Brown in Pilkington's place. I do not think Brown would have lighted the fuse while there was gas in the place. I have much confidence in him, that he would have ascertained if there was gas before lighting it. I can only suppose that there was a sudden outburst of gas between Pilkington leaving his place and the lighting of the fuse; and I think the gas must have come from the fall of the roof in Woodcock's place. There is a sufficient fall in Woodcock's place to account for the rush of such a quantity of gas as to cause all the effects of the explosion."

BY A JUROR; I believe the roof must have sunk previously, and the gas to have accumulated in the cavity; and this gas was liberated when the roof fell. There was no timber supporting the roof.

BY THE CORONER; The fall was of blue 'metal' [shale]. The shock of the explosion was quite sufficient to bring down a fall of roof; and, therefore, it is possible the explosion might have brought this roof down; but I do not think this is likely. If the roof had been supported by timber, I think such a thing would have been more likely. If the gas did not originate as I have mentioned, I can offer no other suggestion. I know of no fault near that could at all cause it, and the pit does not make much gas in that neighbourhood. I was in the pit on Saturday morning, and did not come out until ten minutes before twelve o'clock. I had no complaint of gas or sulphur having been found in those workings, either on Friday or Saturday. If the fireman find gas they stop the men from going into the places near, and report the circumstance to me. I don't remember any complaint of that sort since the 9th. instant, on a Thursday. *Brown then told me that a man named Thomas Barlow had complained of gas in his place; but when I went I found the place perfectly clear. I took two colliers and Brown with me. Barlow was in the place at the time, and all he said was, "It's gone." He said it was so bad that it had burned with an inch and a half 'top' on the light of his lamp, but that I proved was a lie. Brown examined the place as soon as Barlow told him, and the he came to me and I went with him. Brown told me he was in the pit and fired a shot five minutes before Barlow reported gas to him, but he saw no gas; and could find none. Barlow's place was all right, with the brattice within four or five yards of the face (of the coal), and there was good air right up to the face. I asked the men (colliers) if they were satisfied, and they said they were perfectly satisfied. I did not like such complaints being made, and believed that Barlow did not know when there was gas or not. I ordered him to draw his coals up and stop away; but he went away directly, without drawing his coal to the pit shaft. I then left the pit to report to Mr.*

Darlington. A little gas is made at the further end of the workings, at some distance from the seat of the explosion, but it is trifling, and not sufficient to explode at the lamp.

[A JUROR here made inquiry as to the extent of the workings.]

Mr. DARLINGTON said that the north workings were about 1,000 yards long, and about 500 yards wide; on the south side 750 yards long and about 450 yards wide. The rule that no man shall fire his own shots is a new one since I came. It is not expressly stated in any of the rules; but it is implied in the 11th. of those of the men, and the men have all been informed of it.

BY Mr. DICKINSON: (Dobison said;-) I was through the No.1 slant workings the day before the explosion. Pilkington was working in the cut-through, and a man who was his helper (I don't know his name), was working in the drift. I feel perfectly certain that Pilkington's helper was at work on Saturday in the drift near the cut-through I have mentioned; he was found dead, but I did not see him, and cannot tell whether he was burned or not. His wagon was left standing in the drift filled with coal. These two drifts showed traces of fire very strongly. I cannot calculate the number of cubic feet of gas that might have come from the fall in Woodcock's place, supposing the roof had subsided as I suggested. I do not know how many cubic feet there would be in the quantity were equal to the fall. The fall is about 50 yards in length, the average width is about 10 feet, and the average depth about 4 feet.

Mr. DICKINSON: So that there might have been 6,000 feet of stuff. Do you think that, if there were 6,000 feet of gas escaped that would account for the effects of the explosion?

WITNESS: Yes, I think it would, quite

Mr. DICKINSON: Have you calculated how much gas these extreme south drifts would hold?

WITNESS: No. I have not made a calculation of that kind. - [Mr. DICKINSON then elicited from the witness the length, breadth and height of each drift, and said they would contain nearly 4,000 feet of gas.] - WITNESS: Those drifts are where the fire was the most severe. The mine is extremely dry and dusty, and the dust would aggravate the intensity of the explosion, - it would both fly and fire. *If those places had been full of gas before Brown fired Pilkington's shot, he must have exploded the gas with it; but I do not believe he would have attempted a shot under such circumstances.*

Mr. DICKINSON: Now, with regard to the general working of the mine, can you give the jury any explanation how it is you are working the coal so near the shaft? [pointing to the cluster of workings at the south end of No.1 slant.]

WITNESS: I cannot give a reason.

Mr. DICKINSON: You are taking one half the coal before you.

WITNESS: No, We are not taking half. I should think we are not removing more than a fourth.

Mr. DICKINSON: Do you not know that the most improved system of working mines in this district is to drive levels out to the extremity, and then to begin to work the coal backwards, and not to get the coal from the bottom of the pit, as you are doing in this instance?*

WITNESS: *I am not aware of it. I did not know that there was any objection to the course I have taken.*

Mr. DICKINSON: *Are you not aware that Mr. Darlington has laid down as an axiom - as a fundamental rule - in working the collieries in this place?*

WITNESS: *No.*

Mr. DICKINSON: By whose orders was that coal worked?

WITNESS: *I had general orders from Mr. Darlington, and he has never complained of what I have done.* - [Mr. DARLINGTON: *I endorse the system that has been pursued. It is in accordance with my evidence, and the rules I have laid down.*] - Cross-examination by Mr. DICKINSON, (Josias Dobison) continued; I have no estimate of the quantity of air circulating through the workings, where the force of the explosion was most severe. *A measurement that I made on the Thursday before the explosion, showed*

**Excepting Pilkington's drift, which was needful of an air-way, the nearest collier was about 300 yards from the shaft.*

showed that there were 77,130 cubic feet of air per minute for the whole mine. - BY THE CORONER: *I make a return on that subject weekly to Mr. Darlington; and I generally do so on Thursdays.* - [Mr. Darlington having made some calculations from the witness's report on Thursday before the explosion, said it showed the following division as to the air supplied: Top south level, 6,700 feet per minute, bottom south level, 8,200, up-brow places, 26,680, forming the return-air current from the north west part of the south district; north district, 33,500.] - Cross-examination continued by Mr. Dickinson: I cannot say how much of the 33,550 feet would be fresh air and how much would be return air; there is a hole about nine inches square to admit fresh air into these particular workings, in order that it may mix with the return air; I cannot say what quantity of air would pass through the hole per minute, but there was a very strong current. - [Mr. Darlington said that the removal from the hole of a cloth which was hung against it at the time of the previous explosion, which had much improved the supply of air.] - I cannot say whether there would be 1,000 feet per minute passing through or not; the current was strong one, but I have never measured it. I have been accustomed to measure currents of air, but I cannot give an opinion as to this one, not having measured. There might have been 1,000 feet per minute, but I should not like to say whether it was or not. With the exception of that 100 feet, the whole of the air passing to those three places where the explosion was the most violent, was the return air from the north and north-west districts; it had been through the workings on the face of the coal, where most of the gas is liberated.

Mr. DICKINSON: I will draw your attention to the latter part of the 17th. rule for underlookers and officers -

“The main current of air shall be split and subdivided as frequently as it really practicable, the return air being prevented as much as possible from passing through the working places of the mine.”

Do you think the return air was brought back in a way specified here as being the most advisable?

WITNESS: I have never found any gas mixed with the return air.

Mr. WYNNE: The pit was not in a condition to carry out that rule when I came; but I have altered and extended some of the bratticing, to get rid of some of the gas that existed. The return air is all brought into one air-course now.

Mr. DICKINSON: What is the distance from the pit shaft of these workings where the blast had been the most keen?

Mr. DARLINGTON answered, that the distance was about 150 or 160 yards to Pilkington's drift.

Mr. DICKINSON to the witness; Might not this explosion, which brought down these arches, have brought the fall of earth down?

WITNESS: It might; I cannot say - By the Coroner: There has been no complaint of gas except that made by Barlow. I have never heard of an Irishman leaving his place on account of gas, nor of any other leaving, or threatening to leave, because of gas. - [A common-looking japanned-lantern or lamp was handed to the Coroner by Mr. Swallow, who explained in an undertone how he became possessed of it.] I never have heard of such a lamp produced being used in the Arley pit. There are other lamps besides safety lamps used in the mine. We have stationary lights along the main way for some distance. There was one glass lamp that was used further up, but it was lighted by a fireman, carried by him to the spot, and locked and secured there. - By Mr. Mayhew: I think that from the time when Brown left Woodcock's place, and got to Pilkington's to fire his shot, not more than five minutes would have elapsed, if Pilkington was ready; but if not, half an hour might pass before Brown would attempt to fire the shot. *I am quite sure the roof could not have fallen when Brown passed from one place to the other.* I cannot give any opinion as to the cause of the fall, whether the roof itself gave way, or whether the blast of the explosion brought it down. I have known falls of roof as extensive even where there is no apparent cause.

Mr. Mayhew: Knowing the treacherous nature of the Arley mine, and the quantity of gas that lurks in the roof and sides, do you think such a fall would be sufficient to cause and account for the explosion?

Witness; Yes, I do. I was five years an underlooker in the north, have been connected with mines since I was ten years old, and am now thirty eight years old; I can form opinions as to the cause of the explosion, than the liberation of gas by the fall of roof. Bromley, Harrison and Brown - three of the four firemen in the district of the explosion - are dead; there were all steady and trustworthy men. The fourth fireman, Graham is alive. *I have never, since March, found any accumulation of gas at the ends of the workings of the face of the coal, or any where else, that has caused me uneasiness or a feeling of danger, at least not since I got up the bratticing to clear out the old places I have mentioned.* When I got to Barlow's place, after his complaint, there was no 'top' on the flame of my lamp, although he said his had an inch and half long; I was there within half an hour of the complaint being made. Barlow was an inexperienced man and was taken on soon after the strike, when we took almost anyone who applied. I understood from him, after he was engaged, that he had been a boatman.

By the Coroner: he did not work like a man who had been brought up as a collier.

By Mr. Mayhew: Barlow was directed by me, on Mr. Darlington's order, *to meet him, and state what he had complained of, but he did not come. I have made a daily report as to the state of the mine ever since I came; and I have measured the air through the workings per minute.* One of my

deceased boys was a taker-off; the other was driving on the day of the accident. their lives, as well as mine, of course depended upon my care with regard to the north workings I have had nine firemen in the whole mine, being more than in any other place in this district. There were twenty two boys as door tenters altogether, ten being on the north side. There as a boy to each of the doors blown away; in one case there was a boy to two doors, but they were only fifteen yards apart, and pretty near the main air-course. The only exception to the use of safety lamps was the fixed glass lamp in the No.2 Jig; it is in the main air course, and it would be difficult to find gas there. In the last pit I worked in the north, it was two miles to the pit eye to the extremity of the workings, and there was no pit shaft, and there were no means of communicating air except from the shaft. The seam of coal in that pit is two feet four inches in one part, but thickens to six feet; and it was 150 fathoms or 300 yards deep. I worked about seven years in that pit, and during that time there was no explosion there.

The Coroner: Was the mine a fiery one?

Witness: It made about as much gas as this (the Arley Mine).

The Coroner: Was the dip of the mine as great?

Witness: No; it was rather flatter than this.

The Coroner: Do you consider the dip of this mine very great?

Witness: No, I have worked in pits where the dip is greater.

Mr. Mayhew: As to you working so near the shaft, is it not a regular and proper working?

Witness: I consider it a very proper working.

Mr. Mayhew: You do not anticipate any danger?

Witness: I don't anticipate any danger there.

The Coroner: Were you under Mr. Forster at Newcastle?

Witness: Yes, Sir: By Mr, Mayhew: After I had entered upon my duties, I had written instructions for Mr. Darlington. This you have handed me, I believe to be a copy of these instructions. Mr. Mayhew read the document as follows;-

April 23, 1853.

I send you ten books of instructions for your own guidance in the management of the pit entrusted to you. You are requested to peruse them often, and carefully, and not to fail in your attention to any of them, unless relaxed by me in writing. You are desired to give a copy of them to each fireman and responsible officer, also a book of the general rules, and to read both of them at the same time. In all cases encouraging the men to report to you any breach of the rules and in every case give them 2s. 6d. for so doing. You are hereby instructed to make a cross-cut or opening every thirty yards and arrange them systematically. I send you a book for noting down observations taken by you in accordance with rule 10. You are desired to produce the same to me every fortnight, whether asked for it or not. At all other times it must be lodged with the machine clerk at your pits. So soon as you can find careful, sober men who can read and write, it will be your duty to discharge those fireman who cannot - unless you think the latter particularly valuable officers; in this, you are desired to use you best exertions to persuade them to learn to do

so, offering them a reward of 10s. when they can read a write. On application at my office you can have as many books of rules as you require.

JAS. Darlington.

I have acted upon these directions. - By Mr. Darlington: I have made several alterations by means of stoppings, cut-throughs, &c., to keep the return air from the whole coal workings. I ordered Pilkington to make the cut-thorough, not so much for the purpose of getting coal, as to straighten one airway and so improve the ventilation generally.

Mr. Wynne: You have adopted the term 'treacherous' as to this mine; what do you mean by it?

Witness: if gas comes off like this, I should say it is treacherous.

Mr. Wynne: Do you find the gas is given off chiefly when you are making new cuttings? -

Witness: Yes.

Mr. Wynne: Supposing you found gas higher than where Pilkington and Woodcock worked, would it not have to pass over them to get to the shaft? - Witness: Yes, but I think it would be diluted with fresh air.

Mr. Wynne: Do you think it prudent to have the men working in places where 30,000 feet of return air is passing over them? - Witness: *I consider the places were safe..*

Mr. Wynne: *Do you think there is no danger from men working in return air?* Witness: *Not in air such as we have it.*

Mr. Wynne: Not when the air is fetched back from new explorations? Witness: The new workings, I think.

Mr. Wynne: You say you passed under the place where the large fall took place on the day before the explosion. Was there much 'sagging' of the roof? Witness: There was sagging.

Mr. Wynne: Had it dropped a foot? Witness: It might have done.

Mr. Wynne: Then the sagging would be all that could contain the gas? Witness: I cannot say exactly how that could be.

Mr. Wynne: Do you give it as your opinion that the explosion was more likely to be caused by the gas from the fall of roof at the far end, brought by the return air? Witness: There would be a good deal of gas in the roof; and I dare say it would sag a foot before it gave way.

Mr. Wynne: But do you think that gas would cause the explosion, rather than that from the far end?

Mr. Mayhew: The man Graham, who was at the far end, is alive; and he could best tell us to what gas was in that quarter. - The Coroner asked whether the gas from the far end would be likely to burst into any workings at a particular moment.

Mr. Wynne: Do you not think that having drifts 15 yards long and using the return air, is likely to cause gas to accumulate in those drifts? Witness: No; It has not accumulated any.

Mr. Wynne: But do not think it is likely to do so? Witness: I never feared it.

Mr. Wynne: Then you think, do you, that there is no danger in getting coal so near the shaft as you have done, and using return air for the purpose of doing so? Witness: No. I do not think there was any danger.

Mr. Wynne: Then this 17th. rule, you think, is totally useless? Witness: I had no fear at all of what I did.

Mr. Wynne: Is what you have done in conformity with this rule? Witness: No, I do not think it is; but I do not think there was any danger.

Mr. Wynne: You say there is no gas in those particular workings now. Are there any fresh cuttings going on at the far end at present?. Witness; No.

Mr. Wynne: Does not that account in some measure, for there being no gas in the return air?

Witness: That can be tried, sir, now: for you can walk through the level. - By Mr. Mayhew: Two

men who were working at the far end are living. - By Mr. Dickinson: The mine where I said had

before worked pillars as close to the shaft as in this case, was in Newcastle. I do not know that

this is the system recommended by the Newcastle viewers, and not the one commonly adopted in

Lancashire. No one said any thing about it to me; and I consider it safe as far as my ability goes. -

By the Foreman: I have heard that there was a little - very little - gas in the 'goaf': but it never

comes back into the workings to do the men any harm. The gas made in the goaf does not

interfere with the north working. - [Mr. Darlington here said that the workings were driven within

a few yards of a barrier dividing them from a district where the coal was got for several years - as

many as four years before, and that was the reason there was no gas met with].

Mr. Darlington to witness: Could you have doubled these air returns without having the men

working in the places? Witness: No.

Mr. Dickinson: But you were getting the solid coal. Witness: Yes, I think there was no danger.

Mr. Wynne: That is the question.

ROBERT BANKS, collier, Wigan. - I work in this pit on the north side in the drift next to Woodcock's, and was at work on Saturday, the day of the explosion. It would be about half past two when I came out of my place; my drawer left before me. I had been in Woodcock's place about eleven o'clock. I has not seen any thing wrong in my place, and the air was very good. I had only worked in it three days, having commenced on Wednesday, but played me on Friday as my hands were bad. *I saw nothing wrong. When the explosion happened, I had got to the pit eye, and had been sitting in the engine-house at the bottom of the shaft, with my little boys, for three or four minutes.* The reason I did not go up directly after I got to the pit eye was, because the rule says, eight of us must go up on the cage at a time, and there was only five. Andrew Mulroy, who is living, but injured, was one of those with in the engine-house to go up, and 'Throp' as they call him (Thomas Lee), was the other. When the gas fired, I heard a noise, and there was rush of wind, and I lay down: them another rush of wind, not so much as the first, and I rose up, and there was a wind greater than ever. I was out of my senses for a while, and when I came to myself the blast had taken us away through the south pit, and I found myself lying there, near the downcast shaft. My boy was lying there not much hurt, but he had got a blow on his thigh; my other was not hurt. Anthony Mulroy was hurt. There was no injury done to the engine-house that I could see. *When I came out of the place, past Woodcock's, I heard him drilling a hole for a blast, and I consider it would be about ready to put powder in; I had heard him fire a shot in the morning. I saw John Brown that morning; he fired me two shots in my place, between ten and eleven o'clock. I never fired my own shots; it was against the rules. I have been a colliery for thirty years, and have been used to gas; I am positive there was none in my places, and there was very good air, as much as I required. I had not heard of any fall of roof in Woodcock's place that day; I must have heard it if*

*there had been a fall towards the bottom end on the place. I saw Dobison on Thursday, and he told me to cut down to the level, and let more air come up. By Mr. Mayhew - I understand that the place where I worked is the place where Thomas Barlow had worked, the man who, I heard, had complained of there being gas in his place.**

HENRY LUDSFORTH, of Wigan, collier: I was at work of the day of the explosion at the top of No.1 Jig. I was one of the nine got out alive. At the time of the explosion, I was in my own or No.4 drift, but did not see anything of the blast. I felt the air come strongly against me when the explosion happened, and called to my brother, who was working in the next drift, that I thought the gas had fired. My brother and I made our way towards the south, but meeting the sulphur, we turned back. We returned the same way, and next tried to go along the air level, but we met the sulphur coming through a cut-through about 200 yards down, and we were obliged to return again. For fear they should turn on the air, and send the sulphur towards us, we went back to the door, so that we could go down the jig brow. We found a man lying there groaning, and took him about twenty yards, but could take him no further. I said, if we stopped with him and tried to take him to the level, we should have all been lost. We had lighted lamps, and the sulphur did not appear to affect our lights, which kept very good. I cannot say whether it was sulphur that made our head ache, or running about. We lay down besides the door until we were got out about ten o'clock. Dobison and several others found us. - By Mr. Mayhew: I worked in the pit five days before the collier's strike, and ever since the main body of the men went in. *I never was troubled with gas, or had any complaints to make. When I had a shot to fire, I told the fireman, who either fired it, or examined the place and stood by while I fired.* - By the Coroner: *I cannot tell whether it was a proper opening where we saw the sulphur coming out, or a stopping blown down; we could see it coming out as out of a chimney. I have never seen any gas in my place except when the fireman had fired a shot, and then sometimes there has been a half inch in the roof.* - By Mr. Wynne: *I never saw any flash of gas when a shot was fired.* - By the Coroner: *I had quite as much air as I wanted - sometimes too much. I never heard any complaints about gas from those who worked near me.†*

**See Plan.. †See Plan.*

JAMES MURPHY, collier, Ince. - I worked in the furthest place at the top of No.2 Jig north, and was in it at the time of the fire. I saw nothing of the explosion, but I felt the air singing in my ears. I dropped my pick and was examining by brattice when it came a second time, and then I said, 'O Lord, It's fired!' The first time I was not sure the gas had fired. I put on my clothes, and called the two lads who were my drawers, and went out. I met a man, who told me they were all lying dead in the jig, and that it was getting bad with the sulphur there to. It was Samuel Worthington; he is dead. The sulphur came to us and I said to him. "Well, if we don't get some place, we'll not be for long." He said, "There's better air at the back of the jig." I said, "Let us go down the jig." He said, "It's no use going there, where there's a man lying dead." I sat down and considered a bit, then he said, "In the name of God, let us go down this here jig, for I don't know no other way to get out of it." Well, he got up with me, and we went some way down the jig; but

he said, "*I can't stand this hear no longer, I will go back.*" and he did. I never stopped, but went on, and the two boys who were with me dropped down somewhere or other on the jig. I had a tin bottle [tea can] and put it against my mouth and found benefit from it. After I had lost the lads I kept on for some distance, and then I fell, and how long a time I laid there I cannot say; but after I came to myself I went along the north level, thinking I was still going to the shaft, until I came to a cloth hanging up, and then I knew I was going wrong, I turned and went back to the pit, and I fell in with the searchers who sent me up. The air was good deal better in the level and I could manage to live there, but I went very slowly and kept stopping. *My own place was quite on the outside of the workings, and I had very strong air there; I never saw any gas there.* I have never been in any other workings except in the place next to me. I had worked there for ten weeks. One of the two boys who were with me, one died, and the other was got out safe; he had gone back to the top of the jig, and was found alive there. - By Mr. DICKINSON: I have never seen any gas fire in my lamp when he (the fireman) has fired my shots, but when he went in to fire I generally went pout of the place. - By Mr. MAYHEW: I had had two shots fired that morning - David Harrison fired one, and Bromley the other. James Bentham, the man who worked in the next place to me, is dead. I have worked twenty-two years in coal-pits. I never saw any gas in my place, but if I had not had a brattice up, no doubt there would have been. - By Mr. WYNNE: I think it would not be safe to leave it without brattice, even for half an hour. In one place near mine, the gas came when the cloth was s down; that was a fortnight ago. On my level, there were nine or ten colliers, all cutting out new work; some of the places would make more gas than others would. I remember Mr. Darlington coming to my place about a fortnight since.

The FOREMAN: What did Bromley generally fire your shots with?

WITNESS: He generally unscrewed the top of his lamp and lighted the fuse with the light; and so did the other men.

AMOS BROMLEY, an intelligent-looking lad, son of the fireman of than name who was killed, was the examined as to the lantern or lamp produced by Mr. Swallow, and about which Mr. Dobison had been questioned. The boy said - the lamp is mine. I worked in the pit with it for four days, or a week together, when I had no safety lamp. Mr. Dobison saw me with the lamp below ground, at the bottom of the jig brow [No.1 jig, south, marked on the plan], in the fresh air. I have gone up the jig brow with it. Besides this, I have never seen any lamps in the pit except safety lamps, and the glass lamps which are fixed up. The man who gave out our lamps said, That Mr. Dobison told him that I could do without a safety lamp. A few days after I told Dobison, and he said he never told him so, and he told me I must tell the man to give me a lamp. Dobison had the lamp in his hand once when down the pit, and asked me what I gave for it.

Mr. SWALLOW: Did not he say, *It's a nice little lamp* ? WITNESS: Yes. - By The Coroner: It's my own lamp, I gave half a crown for it. My father knew I had it, and that I took it down the pit. *I used to take it going to my work from home.* - By Mr. DICKINSON: Dobison has seen the light lighted in the pit, in the first jig on the south side; there are gas lamps where he saw me with it. I don't think he ever saw it where naked lights are not allowed. I asked Robson, the fireman, if it was fit to take it up the jig, and he said he thought it was fit to take where there were glass lamps. - [Mr. DARLINGTON: The glass lamps are open lights in the fresh air.] - By Mr. MAYHEW: I

never had it in the north workings, and it's a month since I last had it in the south working. My brother told me I might come here today, and bring the lamp with me. Gas lights were burned at the bottom of my jig [No.1 Jig south]. The CORONER to Mr. MAYHEW: The question is not whether this lamp was only used where it was safe but whether using such a lamp was permitted contrary to the rules. - Mr. MAYHEW: Pardon me, the lamp is brought here apparently for some purpose or prejudice today, not having been used in the workings. - The CORONER: But supposing it has only been used on one occasion, it proves the same departure from the rules. - In answer to Mr. MAYHEW, the witness further stated that his work was taking off and putting on the tubs at the bottom of the jig.

Mr. DOBISON: I never saw the lamp but once, and that was in the office.

Mr. SUPERINTENDENT FOWLER said that he had not hear of any thing about the lamp before now, and wished it to be understood that the police had not used any improper means to bring the matter before the coroner and jury.

Mr. DICKINSON to the witness: What was there to stop you taking the lamp into the workings? - WITNESS I should not have thought it safe.

Mr. DICKINSON: Did you think this was point which should be left to the discretion of a boy like you? The witness made no answer.

Mr. MAYHEW said there was no doubt it was most desirable that evidence should be given on all points touching the cause of the explosion and indirectly bearing on the general management at the mine; but he confessed that to his mind this matter as to the lamp had exceedingly little bearing on the question, for it was never used on the north side of the pit, and it was a month or six weeks since the boy had it on the south side.

The CORONER answered, that one of the principle points urged in favour of the Company was the rigidity with which the rules prohibiting any but locked lights was enforced. If it was proved that this boy was seen in the pit with the lamp, if only once, it would make a considerable difference in the appearance of the case. At the same time it is a matter affecting his (the Coroner's) inquiry; still it was a matter of inquiry for Her Majesty's inspectors, and it was his duty to render them assistance.

THOMAS GRAHAM, of Wigan said, I was fireman of the district at the far end of the main north level. I left that district about half past one o'clock on the afternoon of the explosion; and the air was then particularly good.* *I met with no gas that day, except a little at the back of the cutting, but nothing that would do harm; one quarter of the air was sufficient to remove it directly.* The number of men and drawers in that district was twelve, and all I had to do was look after them, and go into the No.2 slant where one man worked. - By a JUROR: I always fired my shots with touch paper and a fuse. I did not allow any man here to fire his shot; but Robert Blackledge, who worked at some distance in the No.2 slant, was allowed to fire his shot occasionally. I was in Blackledge's place on the morning of that day, to put the brattice up, but he fired his own shot that day. He was an experienced man, and I had confidence in him. Dobison knew that Blackledge fired his own shots. [Mr. Darlington: He told him to do so.] I left Blackledge in the pit when I came up, but I believe he came out before the explosion. All the men in my district worked with locked lamps; but I, as fireman, had a key. There was no objection to

my lighting lamps in these places, if there was no gas. I lighted one that day at the 'face' because the air was so strong in the level that it would have blown out both lights if I had tried to light it there. I never lighted the fuse by a naked light - only with touch paper, made up so that it could only smoulder. - By Mr. DICKINSON: I kept the brattice about three yards from the face in the levels, and not more than four yards in the up-brows; *but sometimes in the up-brow brattice props were out up without the cloth being hung, because the colliers complained that, when they were cutting, the dust flew into their eyes.* The height of the seam in that place was about four feet. By A JUROR: I never knew of a brattice cloth being broke down for any length of time. I do recollect a small fall of roof which broke the brattice down in a place where no one worked, and before I put the brattice up I went to the face and examined it but found no gas. I do not know how long it had been down, but I had not been away from the place more than half an hour. By Mr. DICKINSON: I think it would have been safe to leave one of these places half an hour, or even an hour without a brattice. I believe it would take all night without brattice to fill one of these

**See Plan..*

places with gas, there was so little; in the levels it would be still faster. I never saw any gas in these up-brows, but I dare say the coal makes a little gas. By the CORONER: The air could not be got into the small cuttings I have spoken of; and if they were filled with gas it would do no harm. By Mr. MAYHEW: I was made the fireman of these workings since January last, but have worked in the north workings as a day-labourer off and on during the last two years. Blackledge has been employed as a day wageman in setting the air course right. He was the cutting an air course. The brattice I have spoken of fell about two or three bays before the explosion. I believe a brattice might have been down a whole night in one of these up-brow places without fouling it with gas. I have been in every one of the places in my district on the morning of the day on which the explosion happened. Bromilow was reduced from full fireman to assistant fireman, because he allowed a man to fire a shot in these workings, which he had charge of before me. By the CORONER: Blackledge was working as an ordinary collier on the day of the explosion. [Mr. DARLINGTON: Dobison had instructions from me to allow Blackledge, and him only, knowing his good character, to fire his own shot; he was nearly working the coal in his place for the purpose of relieving the ventilation.]

ROBERT BLACKLEDGE, collier, Wigan, was next called and said: I have been 'coaling' in the No.2 slant for six, seven or eight days, but I worked there several weeks timbering, and such like. This is the only coaling I have done for the last ten months, having been working on the day wage in the pit the rest of the time. I was brought up as a collier. I have been in the habit of blasting my own shots, as I worked 'metal', and worked all hours of the night and I had sometimes to see that the night furnace-man was doing his duty. After I went to coaling I had privilege given me by Mr. Dobison to fire my own shots if the fireman was not there, and I have

examined my place and found all right. I have worked in the coal pits since my infancy and as a day-wagemen and collier in the pit for three years. *My drawer and I went up out of the pit only five minutes before the explosion and I was sharpening my picks on the brow when it happened. Up to the time of my leaving the pit, I had seem no change in the air. I did not find a mite of gas that day, and there was plenty of good air in my place.* I had fired a shot that morning. I light my fuse with a wire. In that place my lamp was locked. By Mr. DICKINSON: As 'metal' man during the last ten months I have had to blow down the walls and roof and never saw the roof give off any gas. I never knew gas come from any 'swag' in the roof, nor hear of any. - By The FOREMAN: I don't think the levels could be driven above four or five yards without a brattice, before the gas would show in the lamp; these places get very warm. - By Mr. MAYHEW: I never was offered the situation of fireman: *but I think I might have been made fireman if I had wished.* I recollect taking away props about two months since in the drift on the south side of the No.1 slant, where there was a fall of roof sixty yards in length at least, and four or four yards wide; I was on the wrong side to see any gas given off. I never saw any gas given off from any fall, but the roof varies and at some places gas might be given off from a fall. I have seen gas made in the roof, in some pit I have worked. I never saw a great fall of roof in this pit except the one I mentioned. I do not believe there is anything in the northern workings past me, that would explain the cause of this explosion. *I think there is not a man in existence who can mend Mr. Dobison's work for the safety the mine.* I have seem Mr. Darlington in the mine many times; the last time I saw him near my place was about eight or ten days before the explosion. - By Mr. WYNNE: The air in my place was cool and good when I left work on the day of the explosion. There are only six to ten places beyond mine. When the air passes over thirty men, of course it will be warmer, and contain gas, if the mine gives off any. I do not think the roof of the Arley Mine gives off as much gas as other mines do. If the roof was tender, or not well propped, it would be brought down by an explosion; and, if there had been a fall in the pit, the blast may have brought it down. By Mr. DAVID SWALLOW: *It is the duty of the fireman to lock the lamps. They are cleaned, and taken down, and the fireman examines the gauze, and if it is all right the lamp is lighted, and he locks it. I have worked in the No.1 slant, through which all the air passes to the shaft. It is very warm there, but there is a big wind there;* I did not find any difficulty in breathing. Before the explosion I did think it safe to work in the return air in the No.1 slant. - By Mr. WYNNE: Knowing what I know, I don't think it would be safe to fire a shot in the return air, when it gets near the shaft. In answer to the Coroner: Mr. Dobison said that since he was last examined, he had remembered that he once saw the boy Bromilow with the lamp in the mine. It was lying besides his dinner, in the office in the mine. I asked him what he did with it and he aid he brought it from home to light himself in the pit. - The FOREMAN: I believe the boy was not asked whether he had alight in the lamp when the underlooker saw it. Mr. DARLINGTON: The underlooker told me, immediately after the last inquiry, what he has now told the jury, and I said it was a pity he mad not mentioned it. The lamp was never seen or heard of by me before that day; but even if it was taken in, it did not affect the general safety of the mine at all. Open glass lamps are fixed on the road where the boy worked, and he had nothing to do to lead him into the workings. The only think is, that it is inconsistent with the system of discipline.

The boy Bromilow was again called, and in answer to a question said he told the lamp-man he had this bull's eye lamp, and would use it if he (the lamp-man) did not find him a safety lamp.

JOHN OCCLESHAW, lamp man, was then called into the room and sworn. He said: I am sure the lad had a safety lamp every day he worked in the pit, except on one day, when he came to me and asked me to lend him a lamp, as he had left his lamp top at home, and I told him I had not one to lend him.

Bromilow adhered to his statement, that he had worked with his lamp for about four days together. He said: I told the underlooker I had no lamp, and he told me to go to Occleshaw, and say I must have one. That was not the day he had seen my lamp; he saw it before. I did one day leave the lamp at home. -By Mr. MAYHEW: My brother told me to bring the lamp here; he told Henry Hurst and Allan Tetlow about it.

A brief conversation ensued as to how the lamps was brought there, and the motives of the parties who caused it to be produced, but it was unimportant.

THOMAS BARLOW, the man who was discharged was called. He said: I worked in the north workings until the Wednesday before the explosion. When Brown, the fireman, came to my place to see about the gas, he went on shamefully about it. He brought Mr. Dobison but before he came I had banished the gas out. I mentioned the gas to Rigby, who worked in the next place, and it was he who mentioned the gas to Brown. It was the first time I had found gas in the place. There was two and half inches shown on my lamp wick (?). There was not much air then. I have worked in this pit when the colliers were on strike. I am sure it was the Wednesday before the explosion.

Mr. JAMES DARLINGTON was next sworn and examined. He said; I live at Ince and am manager of the whole of these works and have been so for the last four years and a half. The workings were commenced in 1848. I left the workings about ten minutes before the explosion happened, and came back about twenty minutes afterwards. I put in the underlooker's coat and went down immediately, and, with the exception of half an hour, was engaged in the mine for all that time till Sunday night, when eighty-seven of the bodies had been found. No time was lost; so soon as I got into the pit I found the coal had been ignited for some distance by the explosion. As it would be useless to anything until we had put out the fire, whilst we were so engaged there was another party of men exploring the workings. There was also fire in the north workings, which, no doubt, had been ignited by the explosion. After the extinction of the two fires, the erection of the two crossings, and the replacing of some stoppings on the way, the air resumed its natural course, so much so as to allow us to go into any part of the workings. The north workings are divided into two districts, north and north-west. The whole of the men in the north-west district who lost their lives died from suffocation, caused by the derangement of the crossings and stoppings. Those in No.1 slant were burnt. I have been through the whole of the workings several times since the explosion, not only by myself, but with other parties. I think the point of the explosion has rightly been fixed by the other witnesses. In one of my inspections subsequent to the accident, I found Brown lying near the seat of the explosion, and therefore I think he had been doing his duty by firing Pilkington's shot, which I think caused the explosion. It does not follow that there was gas in Pilkington's place when Brown fired the shot; we have no proof that there was, but to the contrary. If the explosion had taken place immediately upon Brown lighting the shot, he would

have been killed in the place; but instead of that he was found about twenty yards from it, on his way to the shaft. Pilkington appears to have been waiting longer near the opening at the bottom of his drift, the place where he should wait whilst the shot was being fired. I considered Brown a competent, trustworthy man. I removed him from the Cannel pits at the time of the last explosion. I considered he was the best man I had from this neighbourhood; the other firemen I had from the north. I have no reason to think differently of him now. Ten days before the explosion I had an application from the underlooker of the Cannel pits to allow Brown to return thither, I refused it, knowing the carefulness of the man. From the effects produced, the quantity of gas does not appear to have been large, but highly explosive. It seems to have only extended over two or three drifts. I cannot conceive that the air came in such a very explosive state far along the air course. I believe the gas has been liberated suddenly, at a point somewhere not far north of the place where it fired. I draw that conclusion from its not having been seen by the firemen when a shot was fired a hundred and fifty yards from the place. Not many days before - on the 14th. of February - I inspected the workings on the north side of the pit, and went into nearly all at the seat of the explosion. I went through all the workings where the gas would come, and that day I met with no gas whatever, and heard of none, I have never seen gas in the pit in my life, not as much as would show at a lamp; that is, in the ordinary working of it, when no derangement occurred. Gas would be given off, but the ventilation was so ample, that it was diluted by the fresh air to such an extent as to prevent its being seen. I had daily reports from each underlooker, and it was the duty of the underlooker to report to me when there was any gas. I have had reports of gas from other underlookers, but never from Dobison. It would be a neglect of duty not to report to me any gas found, except if it was caused by the fall of brattice. Dobison made a written report to me of Barlow's complaint. [Mr. Darlington read the report which was dated 9th. February and not the 15th.] Dobison reported the matter to me personally, and said that he thought Barlow's object was to cause dissatisfaction amongst the men, and he had told him he need not come again. I told him it was not desirable to dismiss the men in that way, but he would rather encourage them to make complaints to him. I told him to bring Barlow to me, and he warned Barlow twice to come, but he never came. Subsequently to that, I had a conversation with John Brown on the subject, and he reported to me to the same effect as Dobison. It is impossible for me to point out definitely where the gas may have come from, but the apparent cause is the fall of the roof in Woodcock's place. I am satisfied it was a sudden outburst of gas, from some cause not usual; I draw this conclusion from the fact of Banks not having seen gas north of Woodcock's place not more than five minutes before the explosion. I am quite satisfied sufficient gas might have been liberated in Woodcock's place to cause the explosion, supposing the fall was connected with a fissure in the roof. I am satisfied the ordinary protection of gas from the whole of the faces would not in any way account for the explosion. The roof is not simply rugged; the fissure I refer to may still be out of sight, which may in some say, be connected with the fall of roof. I believe the Arley Mine is particularly subject to gas in the roof. In several mines where the Arley coal is worked, gas is known to be produced in the roof more than the coal. We have not detected a fissure in the roof where the fall took place that I can point to. I conceive that the gas existed in the roof, and when the props were removed from underneath it, the gas caused the roof to bag. I conceive the roof would hold

sufficient gas, under pressure, to cause the explosion; when liberated it would greatly expand. There is a post or rock about fifteen feet above the coal, and it is known to contain immense quantities of gas, and the fissure might have been connected with that post. I attribute the explosion to some extraordinary outburst of gas, adjacent to the seat of the explosion and the fall is the only clue I can give to such an outburst. There has been no interruption whatever to the air. The quantity of air passing through the mine, has been increasing weekly, since the explosion last March, when 40,000 feet per minute passed in the pit. The increase is owing to there having been an increase and doubling of the air courses, the friction it met with being reduced, the splitting of the air in one or two places, and greater furnace power. In the Thursday before the explosion, Dobison reported to me that the quantity of air was 77,130 and I believe that report correct, having tested the ventilation. I am satisfied that 10,000 feet of air was sufficient to ventilate the whole of the lower north level workings, which has now 33,550 feet of air passing through them; that is, supposing there was no sudden outburst of gas. I continue to work with locked safety lamps, solely to provide against a sudden outburst of gas. After the evidence given at the last explosion, my Directors wished to know from me if the mine could not be worked with naked lights, Mr. Peace and Mr. Foster having stated that it could; and I reported that I thought locked safety lamps were necessary as a precaution against any sudden outburst of gas from the roof, as the Arley mine was treacherous in that respect. Since the previous explosion the same rules have been acted upon, but they have been more rigidly enforced. The men were then allowed to fire their own shots, but this has since been prohibited. I considered the firing of a shot tantamount to taking the top off a lamp; and all the miners, being entrusted with the firing of their own shots, equal to the privilege of opening their lamps. Nine men were appointed, to attend to the firing and bratticing. The number of firemen at the time of the former explosion was four. In addition to the nine firemen, Blackledge and Wane (who worked with him) were specially instructed to fire their own shots - they were merely air-course men. They had both frequently been asked to become firemen, but we never could persuade them. They were two of the most intelligent men in the pit. I am not aware of any other day-wagemen who have fired their own shots. There had been eight or ten complaints of smoking, and neglect of rules; and three men had been sent to prison. Since the previous explosion, I have prosecuted two persons for having their lamp tops off. Bromley, who has been spoken of in the papers as an intelligent man, permitted a man to fire his shot at the top end of the north level; and I desired Dobison to stop him, and send him up to me. It was nothing but his respectability that prevented me from taking him before the magistrates. He is no longer employed as a fireman, but merely assistant to another man, and has his wages reduced as punishment. It would be right for Hayman, the hooker-on, to have a lamp-key, as he was employed at the bottom of the downcast pit, where there is no danger. - [The CORONER: A key was found upon him.] *Since the explosion in March last, every man had the rules read over to him on being engaged, and has then been required to sign them; and the rules have also been read once a fortnight to the men in a body. Since that explosion we have had two boys to each pair of doors, so that if one boy was away from his post, there was still a boy to look after the doors. We have doubled the number of door-tenters throughout the pit, and at doors where we previously thought boys unnecessary, we have them since the last explosion.* In addition to the

improvements mentioned, the gauze of every pit lamp has been examined by the fireman before being taken into the mine. - By the FOREMAN: The doors are hung so as to close themselves. The distance at which a cut-across was to be made has also been shortened since the last inquest. Dobison has been instructed to make cut-troughs systematically every thirty yards. The cage of the upcast shaft has also been reduced in size, to prevent the possibility of impeding the ventilation.

Mr. DICKINSON: *With the exception of altering the system of working, everything recommended at the last inquest appears to have been done ?*

Mr. DARLINGTON: With respect to the system of workings, the air has been split since then, although the workings have not been extended more than fifty yards further from the shaft. We are bringing back pillars on the south side; but the north workings are under the town, we cannot bring back pillars in them; our proper course there is to reduce the pillars to the size they have to be left.

Mr. DICKINSON: Had you driven those three levels out to the extremity of your boundary, and then taken the coal backwards instead of forwards, would it not have simplified the workings very much?

Mr. DARLINGTON: explained that the coal worked in the pit belonged to several lessors, and they could not all be treated with in time to admit of the coal being got in the manner suggested; one of the owners might stand out for years. He pointed out on the plan two or three blocks of coal which could not be got; and added, that the system spoken of was impossible in regard to the north workings.

Mr. DICKINSON: Would it not have been most in accordance with the most approved system of working coal in Lancashire, to have driven these three levels to the boundary, and got your coal backwards?

Mr. DARLINGTON: Answered, that the system of working was varied according to circumstances.

Mr. DICKINSON: Does not this style, of workings very much complicate the ventilation of the mine?

Mr. DARLINGTON: I consider it does not.

Mr. DICKINSON: You have some hundreds of drifts through which the air has to pass.

Mr. DARLINGTON: Possibly you do not know that in this district only one man will work in a place - it is not so in the north. The air splittings, made since the last explosion, have materially benefited the ventilation. - Are you aware that Mr. Peace in his new workings, that the Messrs. Knowles, the largest coal proprietors in Lancashire, and many others, are adopting to their new workings? - I heard Mr. Peace tell the Coroner on the last inquiry he was working the coal that way, not with a view of improving the ventilation, but to have good drawing roads. - No doubt that was a great advantage, but would not that system in this case have simplified the ventilation very much? I do not know that it would. Have you not stated - I will use your own words, which are in print - *that the most prolific source of all explosions was not driving out the levels to the extremities ?* - I made that statement in reference to goaves. I explained that before the Coroner on the last occasion, and think it ought not to have been brought into question again. - The

Coroner was of the opinion there ought to be no further allusion to it. - Mr. DICKINSON said this was an very important point. *It appeared from the evidence, and he believed, that every thing had been done in maintaining discipline in the mine, and every thing recommended had been attended to. except the system of working; and, so long as that system was preserved in, it would continue to result in catastrophes.*

Mr. DARLINGTON repeated, that they could not bring the coal back under the town of Wigan; they were obliged to make drifts. In answer to other questions he said, it was not possible that the three drifts, which were the chief seat of the fire, were foul at the time Brown fired Pilkington's shots. The day of the explosion was boisterous, but not more so than two or three days before. It was not possible the return-air course could have been foul. He could not account for the outburst of the gas in any other way than by a fall of roof.

Mr. DICKINSON: Are you not aware that the whole of the mine is besmeared with dust, blown down by the blast, except the top of the 'metal' which has fallen from the roof showing that the fall must have been after the blast, and not before?

Mr. DARLINGTON: Since I made my first inspection, pieces of shaley metal have fallen from the roof, and partially covered the first great fall. By. Mr. WYNNE: I have no other reason for supposing that the roof 'swagged' or bagged, except the evidence of Dobison. I have not detected any crevice in the roof, but there may have been one

Mr. WYNNE: Do you suppose this accident would have occurred if you had taken the return-air to the upcast shaft, without carrying it over the men in the No.1 slant, according to the rule laid down by you, which runs thus:-

"Lastly, that the main current of air shall be split and subdivided as frequently as is really practicable, the return-air being prevented as much as possible from passing through the workplaces of the mine."

Mr. DARLINGTON: *I conceive the return-air was passed through its natural course. I answer to another question, he said, I consider this was, under the circumstances, the most advisable way of bringing the return-air to the pit.*

Mr. SWALLOW: Is it not the opinion of mining engineers that a man ought not to work in the return-air, or a separate split of air?

Mr. DARLINGTON: *There must always be a class of man working in the return-air, or a separate split to each man..*

Mr. GEORGE ELLIOTT, of Houghton Hall, in the County of Durham, was next examined. he said: I am manager of the Marquis of Londonderry's collieries. I made an inspection of this pit, at the request of the Directors of the Company. I have no difficulty in stating where the fire has been most severe, but there is a doubt about the point where the gas fired.

The CORONER: I suppose you have no difficulty in stating that it did not fire at the furnace?

Mr. ELLIOTT: That is a point on which I have very great doubt in my own mind; I am not clear about it. I think there is no conclusive evidence that it did not take place at the furnace. I was down the pit on Monday and Tuesday last. As far as my observation goes, and from my

examination of the traces of the blast, the action of the blast appears to have radiated from the point where Pilkington worked. The indications of the direction of the blast appear rather to jar with my own judgement - they seem to show that the gas fired in that place. I would rather give it as my opinion that the gas fired either at one or the other point (Pilkington's place or the furnace), but I cannot say which. I think it very possible, if the gas evolved from the roof or the floor, it might go on to the furnace, which is a short distance from the seat of the explosion. Had there been a stream of lighted gas from the furnace to the point, it must have passed Brown, whose body was found in the line. It is a matter capable of a great deal of consideration, whether Brown tried his lamp as he would do on ordinary occasions. It must be remembered that Pilkington had holed through the return-air course, and there was a quantity of wind passing into his place. Knowing that there was this current passing through, I do not know whether I would have tried with the lamp to see if the place was clear of gas. If Brown did not do it, it would be perfectly excusable; he had the plain evidence before him that the place was holed through. It is my opinion the stream of gas which ignited came out of the No.1 slant workings. It is very difficult to say where the gas would come from. I could account for the accident in several different ways. In the first place, unless there was evidence that the ventilation was so good, I could account for the accumulation of the gas by supposing that it was collected in the progress of the air through the pit, and, on its return to the shaft, came into contact with the shot in Pilkington's drift, this being the last place; - that is, that the whole of the return air was foul. But I think that very unlikely, from the manner in which this pit seems to have been conducted. The next supposition is, that there was a quantity of gas set free by this fall of roof (that in Woodcock's place), which I examined with great care. It is quite possible for a sufficient quantity of gas to have come from the fall to have caused the explosion. I have known gas come from a fall like steam. I think no weight ought to be placed upon the fact, that there is a large quantity of dust round the fall, and very little on it. The first fall need not have been so thick at the time of the explosion, and since then pieces of the roof may have continued to fall and cover the 'metal' which originally fell. There is a large extent of workings and if gas was pent up in the roof this would be the only safety valve (where the fall occurred), as it were, that would give off the gas; it might have been a receptacle of gas from a very great distance. In answer to a question from Mr. DICKINSON as to gas in the mine, Mr. ELLIOTT said: "*The mystery is, you cannot see any gas. I would take any jurymen who might like to go, into every part of the mine with a naked light. There is not a particle of gas to be seen - that is the melancholy part of the thing; you cannot grasp it.*"

Mr. ELLIOTT, of Houghton Hall, Durham, who gave evidence, commencing at the point where he left off on the previous Thursday evening. He said: The explosion might have been caused by a suspension of the ventilation, a sudden interruption of gas, or a blower being cut in the coal. On the first supposition that the workings were fouled from stoppage or check being given to the ventilation - I think that if you have the evidence to the effect that the pit was ordinarily ventilated up to the time of the explosion, then that demolishes the supposition altogether. As to the state of the ventilation then was, I may state that I had not heard any of the evidence, neither had I read it, therefore I cannot say any thing about it. I found nothing at all constituting such a check. If the state of things at the time of the explosion were like what I found,

or anything approaching to it, the supposition as to the fouling of the pit from a suspension of ventilation would be out of the question. As to the quantity of air, it appeared to me to be quite abundant; and, as a proof of that, I was very particular in examining the air after it had done its work, when it returned to the furnace, and I do not think it possible for any man of the most acute practice to have discovered the difference between the 'intake' and the 'return' air, from simply looking at it, it was so clear and pure. There was no perceptible evidence of foulness in the return air - it was warmer; I did not test the difference in temperature. When I saw it, of course there was nothing like the number of hands at work that there was at the time of the explosion. The air must be fouled to some extent by the man working in it; the respiration and firing of the shots tends to vitiate it, but the difference caused by the number of men at work, at the time of the explosion and the number I saw, would not be great. No alteration for the better in the laying out of the workings occurs to my mind. *As to the ventilation, I think the quality of the air was abundant for the workings, and I think that the apportionment of it to the different divisions was judicious. At present, I do not think I can make any suggestions for improvement..* Such a roof as this is likely to 'swag' before it bursts down by gas. If the gas had been known to be lodged above it, it might have been drawn off by boring a hole. I have frequently known holes to be bored where there was gas made in the roof and the drawing off of the gas makes the roof better; for where gas is lodged in a roof, it makes it unsafe. In a great majority of cases, the roof does swag or fall if unsupported, whether there is gas or not. If it be ascertained as a fact that gas is in the roof, probably the most judicious thing would be to put these boreholes up at certain points, for the purpose of easing the roof of the gas, and there was reason to suspect that such was the case; it would be a very inexpensive process, and would be the means of determining the point; but that, probably, is not a natural thing to occur to a person seeing a bad roof falling. If I knew that the roof contained a large amount of gas, and I saw indications that a large fall was about to take place, probably I would take some steps for the purpose of seeing whether the gas could not be taken off by artificial means. I did not measure the quantity and the whole of the north workings appeared to be swept with the current of the air passing through them. There is no increase of air demanded in the workings I inspected, which are those on the north side of the pit.

The CORONER: It has been suggested than another pit should be sunk solely for the purpose of ventilation, do you think, as far as you can see, that such a step is required?

Mr. ELLIOTT: I have no doubt whatever, if that you enlarged your air-ways and furnace you would double the quantity of air now passing through the pit, however superabundant it is at present. I mean that the ventilating power of the existing shafts is more than commensurate with the requirements of the mine.

The CORONER: Are you aware that the furnace shaft is sunk on the dip of the coal?

Mr. ELLIOTT: No, I am not. - [Mr. DARLINGTON: There are workings as much below as others are above.]

The CORONER: You are aware of the dip of the mine?

Mr. ELLIOTT: Yes, five or six inches to the yard.

The CORONER: Do you think another shaft is required?

Mr. ELLIOTT: I do not think one at all necessary. I should not sink one if I was conducting the colliery. - By Mr. DICKINSON: *I stated that I thought the distribution of the air was judicious an the return air perfectly clean. I stated before, that I was not so minute as to measure the currents of air passing through the workings, but from daily observation is appeared to my mind that the quantities were sufficient.* I do not profess to say known many thousands of cubic feet per minute were passing because I had no anemometer with me; but there was a strong current, and the return air way was very fresh and very pure. I consider the distribution of the quantity to the different districts judicious, and can suggest no improvement. Eight days had elapsed from the time of the explosion to the day on which I first went down, and the men had not been working; but I think the quantity of gas to be met with in the return air would not be appreciable to any extent on this account.

Mr. DICKINSON: If you apprehend that this mine might give out sudden outbursts of gas, would you consider it prudent to fire shots?

Mr. ELLIOTT: My opinion on that point would depend, of course, upon the extent of apprehension I had on the matter. If I thought there was great risk by such quantities if gas being given off from the roof as would render it possible for it to be ignited on the firing of a shot, I think I should hesitate a good deal in permitting shots to be fired.

Mr. DICKINSON: As to the furnace?

Mr. ELLIOTT: As to the furnace, that would be a matter of no difficulty. Supposing this accident happened at the furnace, it would not be difficult to prevent such a firing of gas in the future, either by the use of a seam jet, or fan blast, or perhaps a better way then all would be to feed the furnace with fresh air, and that without diminishing the quantity required for working. If I had apprehended such an outburst of gas as would have been produced such a casualty as the present, I should have done this.

Mr. DICKINSON: Would you have prohibited the use of gunpowder entirely?

Mr. ELLIOTT: That is a mater which requires a great deal of consideration. Some mines cannot be worked without powder; and I would measure the amount of risk against commercial contingency of having the use of powder entirely abandoned.

Mr. DICKINSON: Is this not such a seam as can be worked by wedges instead of gunpowder?

Mr. ELLIOTT: That depends very much on the workmen. In our part of the world, the north of England, the pitmen are accustomed to wedge the coal; there is not much coal they cannot work that way, but whether miners here are or would be so expert in wedging I cannot say; probably it might be attended with great inconvenience and loss.

Mr. DICKINSON: Have you not abandoned the use of gunpowder in certain mines under your own management, in consequence of explosions?

Mr. ELLIOTT: I unfortunately lost nineteen men in one of my pits five years ago by a shot, and my mind has since been very much employed in devising some other means of working the coal so as to dispense with the use of gunpowder; and I have had recourse to hydraulic, pneumatic and chemical appliances fro bringing the coal down. I have contrived to reduce the number of shots very much, though firing cannot be abandoned altogether on account of the working of stone and other things. *It would be a very great matter, and would be worth a considerable premium, even if*

the coal-owners paid it themselves, if some scientific man could hit upon or devise some means of working coal without the use of gunpowder; the scientific will probably hit upon it some day, and a great blessing it will be. - By Mr. WYNNE: As a rule I would not place men to work in the return-air course; but what I should do would depend very much upon the state of the return air. If the air is pure I should not hesitate to do it; but if it were found to be vitiated by what it had done before, I should devise some means to give the men fresh air if I had them working in the return air-course. I do not know that the men have been working in the return air in this case. I have not come to the conclusion that the fall in Woodcock's place gave off a large quantity of gas. I think it would be very premature to state where the gas came from. It would be a very good thing if we could arrive at a correct conclusion as to the precise point where the gas came from, in order that some steps might be taken to guard against such calamities in future. If I have an opinion which preponderates in favour of any one of these three suppositions, I have given as to whence the gas came, I should incline to think it proceeded from the roof; but I do not give this as my decided opinion, and I wish that to be distinctly understood. *I do not think the men in No.1 slant were working in the return air.* If they were, it was unnecessary, except so far as to enlarge the air courses to improve the ventilation. If men were working on those places [pointed out on the plan by Mr. Wynne] I think it was right, because they were working in fresh air. I believe it will be to the advantage of the directors of this company to probe this matter to the bottom; for I believe it will be shown that what has been done is a credit to them. - By the FOREMAN: It would be worthy of consideration of the company to see how far the use of gunpowder could be discontinued. - By another JUROR: It is desirable to curtail the use of gunpowder as much as possible; and I think it would be well to supply the furnace with fresh air by means of a dumb drift; this could be done without suffering any inconvenience from diminished air, and certainly it would be safer, for I am not without any apprehension that the gas fired at the furnace.

A JUROR: If blasting is to go on, what is to prevent another accident when they are so liable to falls of roof?

Mr. ELLIOTT: That is one of the reasons which leads me to make the suggestion, that it would be well if some means could be devised to do away with such a source of danger.

The JUROR: Then you would suggest that the use should be avoided as much as possible?

Mr. ELLIOTT: *The rules and instructions as to the use of gunpowder seem to be stringent, and appear to have been carried out with so much minuteness, that when we find such an accident as the present occurring, it leads one to doubt the possibility of escape, unless the blasting be done away with, to a greater or lessor extent.*

Mr. MAYHEW: Standing perfectly connected with either company, and never saw Mr. Darlington and giving your opinion from great experience, is there any thing in the system of working this pit which is injudicious, and likely to lead to accidents?

Mr. ELLIOTT: I am not connected with the company, and never saw Mr. Darlington until a week today, and of course my opinion, whatever it may be worth, is free and independent. I am aware there is, in this part of the country, a notion that it is better to go to the extreme part of the workings, and bring the coal back; but in this case it would be perfectly impossible to adopt that plan where only part of the coal could be got. *If the system was attempted in this case, the effect*

would be to transpose the danger, which, I believe, would be greater than as the pit is now worked. I do not believe that the imaginary advantage of this system of working back could be at all realised here. The system adopted in this mine is that which has been used in Northumberland and Durham from time immemorial. There is nothing with which I can find fault in the management of the Arley Mine; not do I think that the most fastidious man could pick a hole in the way in which the work has been done. - By Mr. WYNNE: If you ask men, as an abstracted question, whether it would be better to take the return air direct to the shaft, instead of mixing 30,000 feet of it with 3,000 feet of fresh air, and supplying it to the workings between No.1 and No.2 Jigs, I could readily give you an answer; but if you ask me the question as bearing upon this case, I cannot answer it, because I say that such a state of things does not exist. - [Mr. WYNNE repeated the question several times.] We are at issue on this point entirely. You had better go down the pit and satisfy yourself whether I am right or wrong. It is of no use now to press your question, for I cannot answer it. I do not care whether the plan shows that those workings where the explosion occurred were supplied with 30,000 feet of return air to 3,000 feet of fresh air, or whether it does not: I have seen the pit, and say that such is not the case; and, if you will pay as much attention to it as I have, you will find that I am right. - By Mr. DICKINSON: We have not, perhaps, as much to contend with in the north, as to the inclination of the seam, as you have here, on an average, our inclination is not more than 1 in 12. My knowledge of the Lancashire collieries is very limited; but I believe that, whether the Lancashire system to be better or worse than in the north, *it is clearly inapplicable in this case*. By 'Lancashire System' I mean driving out levels to the extremity and working back to the shaft; *and I believe that in this pit that system would be much worse than the one now adopted, both as regards safety and economy*. I do not know that all great explosions here have been in the pits where the Newcastle system is adopted.

Mr. SWALLOW: Can you give an opinion what it would cost more to get coal by wedging as compared to blasting?

Mr. ELLIOTT: Will you guarantee that the men will not dislike me from telling you? Is it a fair question?

Mr. SWALLOW: I do not think the men would be glad to know the difference of work and cost.

Mr. ELLIOTT: No doubt your men might work by wedging, if they are right-minded.

Mr. SWALLOW: I think they desire to work in that way if they can.

Mr. ELLIOTT: Well, then, I should consider that if it had been done in the Arley mine seam to work in the County of Durham, and had some pitmen that I know to do it, for working with wedges instead of gunpowder, an extra payment of 3d. to 4d. per ton would be ample compensation.

Mr. SWALLOW: Supposing there had been an additional pit on the side of these workings, would not every man who was suffocated have escaped?

Mr. ELLIOTT: I think if you were to have a third pit on the rise of the mine, and there were to be an explosion, the chance of a fatality would be much increased; for the blast would go left and right, destroying all the stoppings, and the air would naturally take the shortest course between two pits, and would thus leave nearly all the workings untouched.

Mr. T. EMMERSON FORSTER, of Newcastle-upon-Tyne: I am the manager of the Seaton-Deval (*Deval*), and several other collieries in the neighbourhood of Newcastle, and am consulting viewer of the South Hetton (*Hetton*) Collieries, in the County of Durham. I made an inspection of the Arley mine in the company of Mr. Elliott; and made a similar inspection and gave evidence on the occasion of the explosion in March last. I was down the pit on Monday and Tuesday, the 27th. and 28th. of February. The ventilation was very good, and the air in the return air-courses perfectly clean; and, although the brattices were down, and some of the places were fifteen and one sixteen yards up, there was not the slightest trace of gas to be observed. The places had been without brattices from the day of the explosion. It was quite evident this was the seat of the explosion (the places next behind Pilkington's cut-through in No.1 slant workings), because the coal was very much charred. By the seat of the explosion, I mean the spot where the fire was most severe, not necessarily the point of first ignition. My opinion is, that the gas took fire in Pilkington's place. The fire would from there to the furnace, both by the return-air course and the horse road. I think, from the quantity of fresh air which was coming from the split near the doors, it would dilute this air (that returning from the north) so as to prevent its firing at the furnace. The gas itself was evidently brought to Pilkington's place by the return air from the north workings. We tried to ascertain if possible where the gas came from; *and I came to the opinion that it must either have come from the fall (in Woodcock's place) or from some part of the warrant. I think the great probability is, that when the fall occurred, the gas passed into Pilkington's place, and was ignited by the fuse which had been lighted.* I think the fall in Woodcock's place, supposing it to take place at the right moment, to be quite sufficient to account for the explosion. We saw some cracks in the warrant, but they might be caused by the weight of the pillars; we could not make out whether there was any recent crack or fissure through which the gas could have burst. I account for there being no dust in the fall in the same way as Mr. Elliott. After the first fall and the explosion, the roof must have continued to fall, and covered the dust. I do not think anything is to be inferred from the absence of dust, either one way or the other. *If the ventilation of the part of the pit at the time of the explosion was in the same state as I found it, then there is no other way of accounting for the explosion than by supposing it was caused by this fall.* There are no circumstances connected with that fall which would lead me to believe it to be anything but to be an accidental one. I think that, in these workings, I would not have taken any notice of the swagging, or done anything to have relieved it; but I might have done so when exploring workings. If the roof had been suspected, and the gas eased off, perhaps this might not have happened; but no practical man would suppose that the swagging of the roof would liberate such a quantity of gas as to cause an explosion. *I have no connection with these works, either directly or indirectly.*

The CORONER: Having inspected this pit both last year and this, what is your opinion of the management of it, including the working of the drifts?

Mr. FORSTER; *The pit was in the same satisfactory state as it was last year when I examined it, and I think I stated at the time, and I now repeat it, that it reflects great credit on the management of Mr. Darlington. The works are laid out properly, and the mode of ventilation is good, and, if I had to take the management, I would not deviate one iota from the system laid down.* I think the

rules have been more stringently enforced than before the last explosion, and I think it right to state, that at the request of Mr. Darlington, that I would send a man to take charge of the pit, I did send him Dobison. I have known Dobison for 14 years; and for seven years he was under me at Seaton-Devail (*Deval*) as what you call here, head fireman. I consider him every respect qualified to be under-looker; and I am convinced he would never leave the pit without doing all that was in his power to fully satisfy himself that everything was in good condition and proper order. This explosion has not the slightest degree changed my opinion as to Dobison's ability or general character. - By Mr. DICKINSON: I have made no report to the directors of the Ince Hall Coal and Cannel Company as to the explosion in March last. I believe I did state in my evidence, that if the pit was under my charge in the north, I should have no hesitation in working it with naked candles; and, but for the interruption of gas from the fall in Woodcock's place, I see no reason why that should not be done now. I believe that was sufficient to warrant the inference of the manager, that I recommended the use of naked lights. Now I think I should hesitate at adopt such a course; but, after what has been done since the last explosion, I really don't see what the directors or managers can do further, except it to be a discontinuation of the use of gunpowder. - Mr DICKINSON pressed the witness as to whether he and Mr. Peace had made a recommendation to the directors that naked lights should be used; and Mr. Peace said that, he had done no more than state to the jury that the thought such a course would be safe. - Mr. Darlington read the following minute referred to him by the directors:

As Mr Forster had stated in evidence that the rules at the collieries under his charge are rigidly enforced, the directors authorise Mr. Darlington to seek his advice, or that of another person, if he think proper, upon any point connected with the general working arrangements of the Company's pits, it being the particular desire of the directors to place at the command of their engineer the best and most efficient means of preventing such frightful accidents in future. Evidence having also been given at the inquest by Mr. Peace and Mr. Foster (both mining engineers of eminence), that it would be safe to work the Wallsend (Arley Mine) pits with naked candles, the directors request Mr. Darlington to make a special report on the desirability or otherwise of adopting the plan of working in the Wallsend pits.

Mr. Darlington added that some three years ago, Mr. Dunn, the then mining inspector for the north of England, made a similar recommendation, and stated that he would have a large saving by adopting it.

The CORONER: The workings were not so extensive then.

Mr. DARLINGTON: Very nearly so.

Mr. FOSTER: Upon my word, the working are not extensive; they are but little ones in my opinion. Cross-examined he resumed; I think that, after this explosion, I would recommend the directors to entirely prohibit the use of gunpowder. by colliers in getting coals, except it might be in some special cases on the levels, which are filled with fresh air, and where the coal would be more difficult to get. There would be stone to get rid of, which would require gunpowder. - By Mr. WYNNE: *I think the 17th rule, which you have read to me, has been carried out since the*

last explosion [The rule has reference to the splitting of the air; we have given it twice before] As to the stone, I should certainly blast in the night, when the men were not in; if the levels are being worked, the time for blasting must be left to the discretion of the manager. By Mr. DICKINSON: I think that the Gosforth Colliery they have workings very nearly a much above the bottoms of the shaft as here; and when I examined it two years ago, the face of the coal was at a considerably greater distance from the shafts than here. They have had explosion there. - By Mr. MAYHEW: *I agree with Mr. Elliott, that an attempt to drive levels to the extremity and work back would be a more fertile source of explosion than the plan now adopted; men would much more decidedly have to work in the return air.* - By Mr. SWALLOW: I never heard it said that, if an explosion takes place in Gosforth Colliery, it will be a miracle if any one escaped.

Mr. JOSEPH DICKINSON: I am the Government inspector of coal mines in this district. I last explosion in the Arley mine, I inspected the pit on Tuesday, 21st. February, and also on Wednesday, the 1st. instant. Mr. Wynne was with me both times. Mr. Mercer and Mr. Darlington accompanied us on the first time; on the second occasion they were accompanied by Dobison, the under-looker. I am still of the opinion, as after the first examination, that the seat of the explosion was that described by the previous witnesses; that it commenced near Pilkington's place, and spread through the workings, in each direction between Nos. 1 and 2 Jigs, and to the main drawing road. I think it is more likely the gas was fired at Pilkington's shot rather than at the furnace; it is certainly possible that the ignition was at the furnace, which is not more than 150 yards distant - but all the circumstances lead directly to the inference, that Pilkington and the fireman had been in the act of firing a shot at the moment of the explosion. I think there is no question that the flames spread from the furnace, for coals and some doors were ignited there; but the two points were so near together, that I cannot say positively that it did not fire at the furnace, and I repeat my opinion that the gas fired at the shot. The blast must have been very violent at the furnace, the furnace-man having been blown straight through the furnace. There are three ways in which, as it appears to me, it is possible the explosion could have occurred. The boisterous weather possibly affected the ventilation, and so caused a temporary cessation, although the effect would not be so great here as in shallower pits. The return air might thus have been fouled; for there was a great number of men at work in the farther workings, all driving 'fast ends,' which would give off more gas than would have been caused by pillar work. The witnesses having stated that they felt no appreciable diminution of the air; but it is quite possible that there might be a diminution, and that the workmen might not observe it; and as the underlooker has stated that in no part would the gas make more than one and a half inch top on the lamp, it would seem that the presence of gas might not be detected until it was near the explosive point. The second supposition is, *that the two 'rise' places above Pilkington's cut-through were filled with gas;* they would contain about 3,500 cubic feet - and although that seems a small quantity to produce such effects, the force of the explosion would be aggravated by the dryness of the mine and the great quantity of dust in it. Those places were more extensively charred than in others in the mine I have seen or heard of. I have been through the whole, I believe, that were in any way affected by the explosion. All the men found in the neighbourhood were badly burned, and the coal was ignited at the corner; so that I think the two places might have been set down as the centre whence

the blast radiated. Had anything happened to the brattice, those places were very likely to be filled with gas; we could not judge after the explosion whether the bratticing was down before the explosion or not, as it was much burned. It was stated by some of the witnesses that Pilkington had a helper, and that he was at work in the neighbourhood at the time of the explosion; I have endeavoured to ascertain his name, so as to see whether he was burned, but I have not been able to succeed. The third supposition is that adopted by some of the preceding witnesses as the most probable - that there was a *sudden* interruption of gas, which was carried by the return air to *the point of explosion*. There were several holes in the floor of the mine in that district, apparently caused by the heaving of the strata - although there might (but with much less probability) have been caused by interruptions of gas. I tried my lamp at some of those holes; but whatever might have taken place in connection with them, there was not sufficient gas coming off to fire at the lamp. I am not prepared to say that I did not meet with some gas in the workings; if I had done so I should not have noticed it, for it was what must be expected. There was an audible discharge of gas at the face of the level, which if not removed by the ventilation, would soon accumulate; but there is nothing extraordinary about it, as it may be met with in a large number of Lancashire mines, especially the fiery ones. I have known cases in which sudden outbreaks of gas have taken place from the roof or the floor; but I do not regard it a likely here. I have examined the fall in Woodcock's place very minutely; my last examination. I feel satisfied that, if there was an interruption of gas, it did not come from this fall, but that the fall took place after the explosion. The traces of the blast, both in the fall and in the cavity, are entirely enfac'd; they might be enfac'd over a part of the fall, by subsequent small falls; but I do not believe they could have been en so completely enfac'd if the fall had taken place before the explosion. The roof and the coal in the neighbourhood are completely set-in with coal dust; but there are no signs of such thing on the fall in the cavity. On the Monday, I tried with my lamp whether any gas was coming out of the cavity, but there was none. If gas had come from the 'post' above, as has been suggested, it is not likely that it would have ceased at once. I did not particularly observe that there was dust upon the fall when I was down on Monday after the explosion; but not anticipating that an attempt would be made to account for the explosion by a fall, I did not examine it so closely as I should have otherwise done. There was very little change in the general appearance of the fall on my second examination; I do not suppose there was a waggon-load of additional rubbish at this point; but in one place there was a hole about a yards deep where there had been searching for Brown's body. On the first occasion, I crept over the fall; and on the second, I examined it at the bottom, and where the cut-through holed into it. Supposing the fall took place at the precise moment required by the other circumstances, it is possible that a sufficient of gas would come off to account for the explosion. It is very common thing for falls to be caused by explosions; and in this case some arching was blown down at a considerable distance from the seat of the explosion. *The system of working this mine is not what I consider the best system of getting coal in Lancashire; it is not what I call the 'Lancashire System'; and I think I have been in as many mines in this country as any person.* The result is, that the workings are more intricate and the ventilation more difficult; and more gas is given off from those workings than would otherwise be the case. I have tested the instrument with which the air was measured in this mine;

and the result is, that I find it necessary to reduce the 33,000 cubic feet of air reported to pass through the north workings by Dobison, by some 3,000 or 4,000 feet. *I do not know a mine in Lancashire through which so much air passes as the Arley mine - I believe there is none through which so much passes; I measured up to 60,000 feet.* I met with no gas during my examinations, but the mine would give off much more gas when the men were at work than at the time I was there. I do not think that the stormy weather would have interrupted the ventilation sufficiently to cause the explosion, had there not been some interruption, so as to get the air up to explosive point, in the course of the ordinary working arrangements. I believe that a very great improvement has taken place in the ventilation and the general discipline of the mine since the last explosion - in fact, that every thing had been done that discipline can do. A small lantern has been brought forward to show that a boy could be allowed to use such a thing; but we have thoroughly sifted the question - turned it inside out, as it were - and found nothing else to complain of, I think it only shows the perfection of management. It is only in the mode of working that my suggestions at the last inquest have not been adopted. I believe that all the great explosions in Lancashire have resulted under this system from Newcastle, where their seams are much flatter, and yet great explosions occur; here, we have had explosions in the Arley mine in March - that of Bent Grange, Oldham in July - and now the one into which we are inquiring. I do not know of anything like a great explosion under what I call the 'Lancashire System' and which I strongly recommend for general adoption. I know of nothing to prevent the adoption of the Lancashire System here; there may be freeholds which cannot be bought up; but I think that if the coal was worked back from the extremity, it would be the best possible argument for the owner - *If you don't sell to us now, you will loose the value of your coal. For we are back to it, and no one can possibly work it hereafter.* I consider the Arley mine should not be carried a yard further towards the 'rise' than is now reached, without another pit being sunk; they are now on the verge of safety. - (Mr. Darlington said the extreme rise boundary of the property had been reached.) I have no doubt that the directors are obliged to leave one half of the coal ungot, in consequence of the workings being under the e town; but I know no reason therefore, why the Lancashire system should not be applied. - I know it is applied in such cases; in those cases each pillar-space is treated as a 'goaf' and not ventilated more than a goaf.

Mr. FOSTER: In either case, whether you call it a 'goaf' or a 'waste', would there not at times be a constant discharge of gas into the return air?

Mr. DICKINSON: said that there might be an occasional discharge; but he believed that it would be speedily mixed with choke damp, and rendered quite innocuous as far as explosion was concerned.

Mr. ELLIOTT expressed total disagreement with Mr. Dickinson; the result of his plan would be to leave behind the men a constantly increasing magazine of gas.

Mr. DICKINSON said he knew that the Newcastle viewers did not agree with his views; but he believed they were thoroughly approved of by the Lancashire viewers and owners. The only thing was that some time would elapse before much coal could be got out.

Mr. FORSTER: And if man meets with 'faults', he may get to the bottom of his pocket before he gets to the far end of his levels.

Mr. TICKLE (a jurymen) confirmed Mr. Dickinson as to the Lancashire system, and described the state of things as he knew them to exist some 40 years ago; *where buildings were to be supported, he did not see how a different system could be adopted to that followed at the Arley mine.* In reply to a question, Mr. Darlington said that when he took charge of the management of the pits he had sunk, and the levels driven about fifty yards, under the management of Mr. William Lancaster, late mining inspector.

Mr. DICKINSON, cross-examines by Mr. MAYHEW: The only work of the five workmen who have given their evidence As to the ventilation, who mat be said to have worked in the real return air, was Banks; and I think, as I have stated before, that it is quite possible that he might have worked on for some time while the air was fouling without perceiving it. *As far as the observation of these men is concerned, my first hypothesis is certainly not supported;* but that must be taken with the limitation I have before given. I have no doubt that Pilkington's two 'rise' places were filled with gas; but how long they had been filled, or how they were filled, I cannot say. As the most probable solution of this accident. I am disposed to think the return air was foul. We find that collieries worked on the Lancashire system under towns, not perhaps so large as Wigan, but under buildings requiring as much precaution as those here; and that such extensive explosions do not take place. The circumstances of the Newcastle mines are different from those of this pit, the dip there being much less than there. But at Newcastle very great and sweeping explosions have taken place, and may again take place. *With one exception - an alteration of the system of working the pit - all my suggestions at the last inquiry have been carried out.* I would now recommend the abolition of the use of gunpowder, and the feeding of a furnace by a dumb drift; and I would not allow an naked light. I would also alter the system of working, for I think so long as the system of working is preserved in, the mine will be liable to explosions. I do not know anything which could have induced Mr. Darlington to work on this block of coal [No.1 slant] so near the shaft, unless it be the unprecedented demand for coal, otherwise, from his knowledge of mining, I cannot think he would have done.

The CORONER said that such a statement should not be made without a question having been put to Mr. Darlington during his evidence; and Mr. DICKINSON answered that he did put some general questions but was so stopped. In may last some correspondence passed between Mr. Darlington and myself. - Mr. MAYHEW then read a paragraph from a letter addressed to Mr. Dickinson, which was as follows;-

“I do hope you will insect every working pit we have without loss of time, as I think the public require some assurance respecting the system of management which has latterly been so unsatisfactorily reported upon to you. At any time, night or day, I will place myself an the pit at your service, and shall be ready to adapt any desirable change or improvement which in the course of your inspections may be suggested.”

Mr. DICKINSON, in reply to Mr. Mayhew, said that he did receive that letter, and did not make an inspection of the pits in consequence. He added: I have not merely got Ince Hall Colliery in my

district, but I have got 420 collieries. There is no colliery in my district to which I have given the attention which I have given to Ince Hall. I have been in this identical pit about six times.*

*Mr Dickinson has visited two mines out of twelve; the rest of the visits have been either during the inquests or to test steam jet experiments.

To have made such a minute inspection as that proposed by Mr. Darlington, would have necessitated the neglect of their collieries, which I think would be more dangerous; and to show that I have not been idle during the past year, I may state that I have inspected 138 pits, besides attending 19 inquests. The latter which you (Mr. MAYHEW) have read, was in answer to one of my own, which I will read:-

“I am sorry to see such a succession of accidents taking place at Ince Hall. My attention has just been directed to the case of a boy apparently run over by tubs, and which is, I think, the second accident of the kind within a few months and had the third since the explosion.† Will you be kind enough to let me know the age of the boys, as such unusual fatality among waggon boys may arise from their being too young to work.”

This letter from Mr. Darlington was occasioned by one from himself in which he complained of the unusual fatality to waggon boys; and Mr. Darlington's offer gave him no more power than he possessed under the Act of Parliament. He considered, in fact, that he had made sufficient inspections of these pits; and he believed that nothing he could have stated to recommend would have had any effect on Mr. Darlington, after what he (Mr. Dickinson) had stated so solemnly at the previous inquest. - Mr. FOSTER asked, whether Mr. Dickinson had complained to the Government that he had too much work. - Mr Dickinson said that he certainly had not. He did not consider it to be an inspector's duty to inspect pits that he considered to be in good working order. In all the recommendations he had made, it had always been with the belief that more good would be by a thoroughly searching investigation when an accident took place, and by holding the manager of the colliery responsible for what occurred. *In the course of it, Mr. Elliott said he should like very much to give Mr. Dickinson an opportunity of qualifying his opinion as to the mode in which he considered the pit ought to be worked. So far as his (Mr. Elliott's) judgement went, and it was so formed from a more extensive practice in connection with coal-mines than Mr. Dickinson's, he thought it was a great mistake to leave such large pillars behind, and work backwards towards the shaft; it would be leaving a magazine of gas.* - Mr. DICKINSON replied, I have only to say that the most general system of working coal in Lancashire is the one which I have recommended, and that all sweeping explosions that have taken place in this district since the act of inspection of coal-mines came into operation, has been under this system - two at Bent Grange and two at Ince Hall. I am perfectly aware this is not what the Newcastle viewers recommended, and I do not wish to call into question Mr. ELIOTT'S great experience. He is certainly an older man than me by four years. We were both pupils under the same mining engineer, and since that time I have been constantly, uninterruptedly engaged in coal-mines for a period of fourteen years, a term sufficiently long, and one would suppose, to give a

person a knowledge of the matter. Perhaps in that time I have visited as many collieries as many mining engineer in the kingdom, having been in North Wales, South Wales, the Midland Counties, Lancashire, Cheshire and Scotland as well as having visited those in Germany, Belgium and France. - *Mr. Elliott said, that he asked the question in perfect kindness to Mr. Dickinson. They were, as had been said, pupils in the same office, but he went down the pit about nine years of age, and Mr. Dickinson at twenty.*

In answer to the CORONER, Mr. DICKINSON said that he thought that the Lancashire system was more suited to the Lancashire district than the Newcastle system. In some districts in Lancashire there was as good, careful and well-disciplined men as in any part of the country; but in others this was not the case, the men being uneducated. Here was a large concern without any schools being attached to it. Taking the Newcastle viewers as a class, there were the cleverest class of viewers in the country. They were wedded to their system; but where an attempt had been made to introduce it into other districts, it had failed.

Mr. WILLIAM PEACE, of Haigh: I am the manager of the collieries of the Earl of Crawford and

† Mr. Dickinson is in error as to the number of fatal accidents from tubs.

Balcarres, and made an inspection of this pit on Saturday, by request of the Coroner. I went down with Mr. Darlington and the underlooker, and examined the seat of the explosion; but previous to doing so I tested the quantities of air passing through the workings, which I found there to be as follows:- 6,842 from the top south level, 7,786 from the lower south level, 31,948 top north west and part of the south, and 51,976 lower north return; total 98,582 cubic feet per minute. Having ascertained the quantities of air, I proceeded along the north level of No.1 slant, and there went through the doors and got to the seat of the last explosion. I traversed the workings in various directions, and examined the roof in Woodcock's drift. In the drifts about here (pointing to the drifts in the lower part of the No.1 slant) *we found obvious marks of the fire having been very severe, the sides being charred;* and at a distance from the immediate seat of the explosion, we found large quantities of adhering to the top and side of the drift as is usual after explosions; but the main seat of the explosion appears to be about four drifts. I traversing the district, I found nothing whatever wrong with the air; it was perfectly free from gas. *I examined it minutely both in the air passages and the drifts past the air passages.. One of them was fourteen yards long, with the brattices completely burned out; and there was not the slightest vestige of gas. In fact, I should have no hesitation at all in taking a lighted candle through the workings. I did not see any indications of gas in any part of the workings I was in.* I agree with the other witnesses as to the seat of the explosion being in Pilkington's drift and those immediately adjacent. The main force of the explosion, and the main heat proceeding from it, seem to have been developed there, and it may have originated from this point (directing attention to Pilkington's drift), where the man was 'holing' through. The indications on the sides of the gallery, and other things, show that the force of the explosion came backwards towards the workings rather than forward; in fact, there was more room for development in that direction. My opinion is, that it did not and could not have

fired at the furnace, and my reason for thinking so is, that so large a quantity of air was rushing in three other directions towards the furnace, that the air from the north level could not have obtained access to it so as to have fired; so that it would have been driven back towards the dumb drift. *I do not, by any means, think that it would require a large quantity of gas to produce an explosion like this; but the air must have been in a highly explosive state. I should not suppose it came from any great distance, and it must have been given off suddenly, for this reason:* There is such a large quantity of air passing through these workings, that if it had not been given off suddenly, it must have been diluted below the explosive point *I can conceive no cause of an outburst of gas, so probable as that produced by a fall of the roof in Woodcock's drift.* That roof, I am told, shortly before the explosion, had subsided, so as to form an inverted arch, so that there was a corresponding cavity between the part sunk and that not sunk, which would act as a reservoir for any hydrogen there might be in the roof, and the gas might exist under some compression, so that when liberated it would expand, and occupy a larger space. In my opinion, that fall would be quite sufficient to account for the explosion. I believe it has been stated in evidence, that the roof had subsided a foot; but I will assume it subsided six inches only; and on that assumption, I find its length, it would contain 1,300 cubic feet of gas, supposing it was not under compression; but it might contain more. This would require 13,500 cubic feet of atmospheric air to explode it effectually; that, added to the quantity of gas, makes the total 14,800 cubic feet. All that would completely de-oxygenise, or render irrespirable, a cube of 90 yards, or be equal to the contents of a drift 1,239 yards long, by 15 feet wide and 4 feet high; and that would sufficiently account for any loss of life by suffocation. I made a particular inspection of that fall, and I found that on the roof on which I ascended there was no dust at all; and *I was inclined to think, at first sight, that it had fallen subsequently to the explosion, for I found the upper portion of it presented no appearance of dust like the side; but I removed the top, and about six or eight inches under it I found a stratum or layer of dust about the eighth of an inch thick.* The roof is shattered and broken now, and I have no doubt it falls constantly during the twenty four hours. I examined that fall at the end, and then I obtained access to it at different openings; I believe there are two. We did not traverse it the full length; it is scarcely possible to do so. I have no doubt whatever in my own mind that the explosion has passed over it since the first fall came down. *The thick layer of dust I found on the fall, was identically of the same kind as the layer of dust in other parts of the mine. In my opinion, the fall is the only apparent cause of the explosion, which possesses any great degree of probability. I am certain that there must have been a sudden outburst of gas to cause it. had the ventilation been anything like what I found it, a gradual fouling would have been utterly impossible.* I attach very little importance, indeed to state of weather, and the less so from this circumstance: at top of one of our pits [Haigh Colliery], we have a self-acting indicator, had I got a report of the state of the atmosphere at three different periods of the day. Had there been any sudden derangement of the ventilation of pit during the day, I think the indicator would have shown it, but I found no such derangement occurred at our pits that day. Where you have a furnace so powerful as this [at Arley mine], and a current of air so buoyant. I attach very little importance to the fall of barometer. *There is no obvious cause of the explosion other than the fall of roof. If this fall of roof had not taken place I should have been*

driven to suppose, for want of some other probable hypothesis, that the heaving of floor had liberated a quantity of gas from the stratum below the coal; coal itself evolves very little gas - the gas originates either in the roof or in the 'warrant' - The Coroner called the attention of Mr. Peace to the second supposition of Mr. Dickinson, namely, that, whether the return air was fouled or not, the two drifts above Pilkington's were decidedly foul at the time of the explosion. - Mr. PEACE: All I can say in answer to that is, that when I went into them on Saturday, *the work had ceased a fortnight, and there were no brattices in hem; but they did not betray the slightest symptoms of gas.*

The CORONER: But if the brattices had become damaged during the working of the pit, might not gas have accumulated there?

Mr. PEACE: It is possible that if the brattices had become damaged, a small quantity of gas might have accumulated there, but it would have been a very small quantity. In answer to other questions, Mr. Peace said: I have no doubt that explosion radiated from this point, and these drifts would naturally be full of gas from the fall of roof, supposing the fall to have liberated gas. *I have to do with exactly the same seam at works under my office; it lies about 240 yards below the surface of our colliery, and at this it is 414 yards.* In some cases the dip is the same at our pits, and in other cases it is rather flatter. In three out of four of our Arley Mine pits, it is quite as steep. Our Arley Mine gives off perhaps three times as much gas as is given off in the Arley mine of the Ince Hall Colliery. At the Bridge Pit of our colliery, which contains about half the extent of the workings than this does, our air varies from 54,000 feet in the afternoon, when we rake the furnace, to 70,000 feet in the morning, when the men go down to work; it is more air than we want. The lowest quantity of air we have is about 70,000 feet per minute at six o'clock in the morning, 60,000 feet at noon, and 50,000 feet in the afternoon. In the Bridge Pit the dip is about 1 in 20, which is not so great as this and the upcast shaft is about 400 yards to the rise of the downcast, which would give about 30 yards of rise. *The Arley mine is the most explosive seam of coal in Lancashire. It gives out gas from the strata above the coal, from the coal itself, and from the warrant below.* At one of our Arley Pits we had a rock roof, and for several years a jet of gas issued out of the roof, which we could light at any time. I do not see anything at all censurable in the mode of working this [the Ince Hall Company's] pit. *I do not altogether work the pits under my management on what has been termed the 'Lancashire system'. We do not hesitate to drive pillars between the extremities and the shaft. We generally get the pillars when we can, and allow the roof to subside. If we leave the pillars standing, which we do occasionally, we then of course are under the necessity of ventilating the goaf.* Our system of working would be this; we drive a pair of up-brows about a very 140 yards, and then cut horizontal drifts out of those from one to the others, and work these off in sets of six or eight each. *We do not necessarily drive to the further end, and then bring back pillars. If I were obliged to leave the town supported by pillars, and brought back the coal I got, I should consider the open space behind me a constant source of danger, and keep it carefully and abundantly ventilated.* To do this would require a great quantity of air, and of course the pit would need a greater supply of air in consequence. *I do not think it possible to render the working of this part [the north] of the pit safer, except by taking warning by the explosion, and when any depressions of the roof are observed, taking means either to bring*

the roof down, or tap it and draw off the gas. I use gunpowder in our Arley pit; but, under the circumstances, I must say I should now hesitate to use it in this pit, there having been two explosions; although it is consistent with safety and good mining to go on with the use of gunpowder combined with proper care and vigilance.

Mr. DICKINSON: In the course of your experience in working this Arley Mine, which you appear to have done very extensively, have you ever known such an interruption of gas from the roof as you suppose in this case?

Mr. PEACE: No, I do not know that I have.

Mr. DICKINSON: What reason have you then, for jumping to the conclusion that the gas came from the roof in this instance?

Mr. PEACE: *The absence of any other assignable cause; the possibility of this being the cause; my observations showing that the roof has not fallen since the time of the explosion; and seeing the effect of the explosion on the first debris, compiled with the evidence that before the explosion the roof swagged.*

Mr. DICKINSON: Might not the explosion which blew down the arches also bring down the roof?

Mr. PEACE: No, except where props have supported it.

Mr. DICKINSON: If you were giving advice as a mining engineer, is the system on which the pit is worked one which you should recommend?

Mr. PEACE: I should recommend my own; I should prefer that which I have carried on for 22 years, and found successful so far; but although I prefer my own, I should not say that this was unsafe.

Mr. DICKINSON: Have you got any pit where you have the rise workings so far above the bottom of the shaft?

Mr. PEACE: I have not at present, but I have had. In the Aberdeen pit some of these workings were as much as 110 yards above the shaft. - In answer to other questions, Mr. PEACE said: I consider it very desirable, if such an arrangement can be carried out, to have a furnace pit on the 'crop' of the coal where the dip is at all great. I should not hesitate to work this pit as it is, but I should prefer to sink a pit in the crop if circumstance would permit it; *but I may add, that a pit on the crop would not have prevented this explosion, or two pits on the crop; probably the effects might have been less disastrous, but it is impossible to predict even that. I consider it impossible for the return air to be foul with the quantity of gas given off in this pit and the ventilation. It is one of the best ventilated mines I ever saw in my life.* - By the CORONER: The necessity of leaving half the coal for the support of the town would preclude the working of the pit on this system. - By A JUROR: If the pit were mine, after these two accidents, I should discontinue blasting on the usual system of getting coal.

Mr. DICKINSON: I have made no recommendation or report as to the working of the pit by naked candles, nor have I been solicited by any one to do so, but I stated to the Coroner and jury at the last inquest that I should have no hesitation in working it with naked lights.

Mr. WYNNE: Do you think it advisable that these four or five men [in the No.1 slant] should be working in the return air?

Mr. PEACE: *Certainly I should think, with the quantity of air which ventilated the north workings, they would be just as safe in what you term the return air, as a man sitting at the bottom of the down-cast shaft.*

Mr. Wynne called attention to the rules as to the slitting of the air, and not carrying return air over man as far as possible.

Mr. PEACE answered: *I do not think it possible to split the air more efficiently as it is now.*

It being seven o'clock when the examination of Mr. Peace was concluded, it was agreed to adjourn the inquest to Thursday morning at ten o'clock; when previous to any evidence being given. Mr. Mayhew stated that in regard to the discrepancy between Dobison's and Barlow's evidence, as to the time the latter made the complaint of the presence of gas in his place, it had been discovered from the colliery books that Barlow was right in stating that the day was the 15th. of February. and Dobison was wrong as to it being the 9th. It appeared that on the day Barlow made the complaint, Dobison reported it personally to Mr. Darlington but when Mr. Darlington received his written report for that day he found the complaint was not referred to in it, and directed him to add this to it. A number of daily reports were lying on the desk, and Dobison took by mistake that of the 9th. and added the complaint to it.

The Coroner said that he was glad the discrepancy had been at length explained; but the statement was not so satisfactory as he could have wished, inasmuch as not only had the report been put in evidence, but it had been positively stated on oath by Dobison, that the duty Barlow made the complaint was the 9th. and that had been corroborated by Mr. Darlington.

Mr. Darlington said that the impression upon his mind was influenced by Dobison's report, but he had since satisfied himself, by a careful reference to the colliery books, that the date fixed by Dobison was not correct. *The facts were in no degree altered by the difference in the date; there was a man present named Thomas Lee, who could speak to the fact that Barlow had been sent for by him, and had refused to come.*

The Coroner remarked, that there was this one material fact, that there was the difference of a week as to the date, bringing the complaint made Barlow within three days of the explosion.

After a little further conversation, the subject was dropped, and the inquiry was to the cause of the accident was proceeded with.

Mr. JOHN MERCER; of St. Helens, was the first witness called. he said: I am a colliery surveyor and manager, on Monday, and again on Tuesday, after the explosion, I inspected the Arley Mine. On the Monday I went down with Mr. Darlington, and on the Tuesday with two of the Government inspectors, Mr. Darlington, a man from our own colliery, very well acquainted with gas, and several others. I believe the gas must have taken fire at the shot in Pilkington's place, and not at the furnace. *I am quite of the opinion that the explosion may have been caused by an outburst of gas at some point in the workings.* I think there is not appearance to show that it fired at the furnace. *I do not believe there could be a general fouling of the air; for if there was I think the explosion would have been for more severe.* I think it quite possible that the gas would come from the fall in Woodcock's place, and if it occurred at the right time it might account for the explosion. I did not minutely examine the fall, but I travelled over it. I did not observe the absence of dust upon it; but I consider that a point of very little importance. There might not be

any appearance of dust upon it if the fall had occurred before the explosion, for a fall like that perhaps never comes down altogether. If the gas was liberated by the fall of roof in Woodcock's place, it would most likely to fill the rise drifts next to Pilkington's place; and therefore it is not necessary to account for their being full of gas by supposing that the brattice was down in them. I have been extensively engaged in surveying coal pits in St. Helens, Rainford, Wigan, Bolton and Bury, in fact, most parts of Lancashire; and I am proprietor of a colliery adjoining this. *I think no fault whatever can be found with the management of the mine, which is fully equal and indeed superior to that of the generality of mines; and, so far as regards the ventilation, I have not been in a mine better ventilated in the whole course of my experience: I consider the ventilation quite ample.* If it could be proved that the gas had found its way out of the roof, I think means might be adopted to prevent the possibility of any such outbreak in future. I have advised many parties having charge of coal pits, to drive to the lower level of a pair of levels wide, so that the roof would fall, and drain off the gas from the rest of the roof. I first advised the adoption of this plan at the Broad Oak Colliery, where it has been successful, and since at Senley Green, where the mine is fiery and great precautions are required. I do not think that there would be any danger in blasting, if that plan were adopted in that case; but if the present system of working is unaltered, I certainly would not continue blasting. There would be more difficulty in abandoning blasting than in the adoption of the plan I suggest. I do not think the men in this district would like to work with wedges instead of blasting, because they would not be able to do any thing like the same amount of work they can now do; and they would have great objection in the first instance on account of price. I do not think the men could be got for less than 6d. per ton, in addition to what they are now paid, that is, at present; if the plan became general, or if this colliery were ten miles from any other, they might be got to work with wedges for 3d. per ton extra, as was mentioned by Mr. Elliott; but I do not think the plan will be generally adopted in this district. What has been termed the 'Lancashire system' of working coal has been very much applied in the St. Helens district, more, perhaps, than in any other part of the country; *so far as I have seen, I do not believe the system is commonly used in Wigan, and in the neighbourhood of Bolton and Bury it is only partially carried out. I should adopt the system as far as possible; but if coal has to be left under buildings, I should work it as I go on.* The Lancashire system might be applied to those portions of the pit where the coal has to be brought out. - [Mr. Darlington: The buildings in Scholes cover the whole of the north district.] *The Lancashire system could not be carried out there.* - By Mr. DICKINSON: If I were to advise the proprietors of this mine, I do not think the principle adopted in it is the one I would recommend. It is difficult to ventilate this intricate series of workings, having air courses of several miles in extent; *but there would be greater difficulty in ventilating the large waste which would be left behind, if the coal was all brought backwards. If the air got into the waste in such quantity as not to dilute the gas, but to drive out a portion of it into the workings, and that gas fired, the blast would go back to the waste and there would be a very severe explosion.* If I wanted to get a block of coal I would ascertain whether there was gas in the roof by boring, and after drawing off the gas by boring, I would get the coal and let the roof fall, and it would drain the surrounding roof of gas, perhaps to the extent of fifty yards. If all around this block of coal has been worked for four to five years, it is very unlikely a place to expect an

outburst of gas. - By Mr WYNNE: I believe it is impossible, with the strong current of air in the mine, that gas could have accumulated in the drifts next to Pilkington's cut-through. *It is not possible for those places to have been fouled as to cause an explosion.* - By Mr. MAYHEW: I think a general fouling of the pit is next to impossible, and the results do not show that there has been such a fouling. *With regard to the general ventilation of the mine, I could not suggest any improvement in it.* I did not hear the evidence given at the inquest, and do not know whether the explosion in Marsh last was caused by the firing of a shot, but I am decidedly of opinion the gas in this case fired at a shot. I do not mean to say that blasting cannot be safely continued. I think it might, if means were taken to carry off the gas by means of tapping the roof, and bringing down falls by widework. I am not aware whether the Kirkless Hall Company, after an explosion, worked their coal with wedges; but after a time returned to blasting, and now blast their coal. In getting coal under the town, as is the case in the northern workings, I would not work the whole of the coal back. If the system Mr. Dickinson has recommended, such an accident might have occurred at the far end. I think the fall of roof is the only apparent cause of the explosion; if the gas had come further it would have been so much diluted as not to have exploded. It is well, where it can be done, to carry the return air through the dumb drift. I am certainly fond of a pit on the crop of the coal, and the proprietor of a colliery where probably to the 'rise' is a little greater than in this pit had, by my advice, sunk a pit on the crop. I think the ventilation is more simple by not having the return air brought down to get to the shaft. - By Mr. SWALLOW: A pit on the crop would, by simplifying the ventilation, make the pit safer in the case of an explosion; and I think it advisable in all cases where it can be done to have the upcast pit as near the rise as possible; but as the workings in this pit have progressed so far, it may be a question whether other means of safety cannot be found.

A long conversation as to what might be the effect of an explosion, supposing there was a pit on the 'rise' of the coal

Mr. DICKINSON (who did not arrive until Mr. Mercer had been sworn) said that during his absence the report stated to have been written by Dobison on the 9th. was admitted to be incorrect. A number of these reports had been read, and as one had been allowed to be incorrect, he wished to know if these reports were withdrawn.

Mr. Mayhew answered that nothing would be withdrawn which had been submitted for the better elucidation of the circumstances connected with the explosion. he then repeated the explanation he gave in the early part of the morning.

A discussion followed.

Mr. THOMAS WYNNE, of Longton, Staffordshire: I am government inspector of coal mine in Staffordshire, Shropshire, and Worcestershire, and was also a few months inspector for this district. I have accompanied Mr. Dickinson in his inspection of this pit. I consider the seat of this explosion to be Pilkington's place and thereabouts, and that the gas fired at the shot. My opinion is, that the gas was made *at the end*. [this was afterwards qualified by Mr. Wynne to the general workings north of the No.1 slant], and brought by the return air to the two places adjoining Pilkington's cut-through. *That was my first impression, and I still adhere to it.* The principle ground I take is the circumstance that at the point of the cut-through there was no ventilation of

fresh air, and the return air passing through the No.1 slant cluster of workings. It is proved that the far end makes gas, and I consider the same cause which produced the last explosion, has produced this; and that the explosion is owing to all the return air, after being gathered together, being brought through the working places. I am decidedly of the opinion, that if Mr. Darlington's rule as to the splitting of the air had been carried out, the explosion would not have occurred. - The Coroner remarked that the rule was qualified by the words 'as far as possible' - Mr. WYNNE altered his answer to the question put to him so as to assume this form: Had the return air been carried up the upcast shaft after being gathered together, without being passed through the men's workings-places, I think the explosion would not have occurred.

The men should not have been working at all in those places, unless they had fresh air to feed them.*

The Coroner said the effect of the evidence has been, that the men were fed with a split of fresh air.

Mr. WYNNE: My opinion is, that the split of fresh air was brought to the point where it ought not to have been. If the return air passed in this way, and the men are set to work this coal, the same will occur again. I consider the general ventilation was highly charged with gas at the time of the explosion. Having heard all the evidence, I do not attach any importance to the supposition of a sudden outburst of gas; I do not think it likely in this case, although such things do occur. I believe that is not the cause of the explosion. I am very decidedly of the opinion that the fall came down after the explosion, and not before; and that it was consequent upon the explosion. The absence of dust is, to a great extent, my reason for coming to that conclusion; and also my knowledge that fall is often a consequence of an explosion. I do not see anything to find fault with in the management of the mine, except the cutting out of these places at a time when there was a large quantity of work going on at the far end, and giving the men return air. I think the general discipline of the pit is excellent. As to blasting, I believe it is dangerous; but I would prefer making no recommendation. I cannot say it would be dangerous, if the system pursued at the far end is fully carried out; but if work is carried on here, explosions will happen as a matter of course. If no change is made to the ventilation, I would not recommend blasting to continue. - By Mr. BYRHAM: I am of the opinion that the gas in the return air, which was passing through these workings, *could separate from the air sufficiently to foul these two rise places*, if they were not ventilated. I cannot make the amount of fresh air from the split, and the mixing of the return air, into more than one or two thousand feet, and do not think it is sufficient to dilute the volume of gas coming off from the workings. When I say volume, I mean what was regularly coming off the coal. - By Mr. MAYHEW: In our inspection we met with some gas at the ear end, *but not of sufficient quantity to be perceptible in our lamps*. We knew gas was coming from the coal by the noise we heard; what we heard could not have been by anything but gas, as the coal was quite dry. I do not say it is impossible the fall could have produced the explosion, but I say there is another for more probable; it is the pleasantest way of accounting for the explosion. Mr. Peace's evidence as to dust being on the fall has not shaken my opinion that the fall did not occur before the explosion. I think the ventilation ample, but consider it was injudicious to bring the return air to this point where the men were at work. The most advisable was of working the coal is to go to the

far end, and bringing back the coal, but there are circumstances which would alter a man's plans, and if I had got this coal I would have done it when there was a less quantity of work done. I do not think any of the gentlemen who have given evidence on this point would work the pit as it is. *I should not ventilate the waste behind.* If the return air-course is kept as simply as such, it would prevent the waste being dangerous. *I would build of the gas in the wastes left behind.* This is frequently done on the thick seams in South Staffordshire, where half the coal only is got. - Mr. Wynne was pressed by Mr. Mayhew to give the name of any colliery in Staffordshire where this was the case, but declined to do so, saying he would not be justified in doing so on account of the position he holds. - At this point Mr. Wynne was closely examined by Mr. Hall of Newcastle, Mr. Peace and Mr. Mercer, *who dissented from the opinions he had expressed,* in a long and animated discussion. - In answer to Mr. Dickinson, he said that he had been in some of the largest of the Newcastle collieries and the dip of the seam was not so great as in this case. He did not consider the Newcastle system was applicable to the Lancashire district, and it was the belief that it was so which was leading to the evil: it was adopting the system without the means.

*See Mr. Elliott's evidence as to the men being at work in fresh air.

**CHARLES EDWARD DRIFFIELD, Esq., COUNTY CORONER,
TO THE JURY.**

The CORONER commenced by saying: I think, under the circumstances of such importance as this explosion has proved itself, not only to the public at large, but to the management of such undertakings, you would scarcely be fulfilling the whole of your duty if you did not return a special verdict, - not merely a verdict that the deceased died accidentally, but one giving you opinion as to one or two points which have been raised in the course of the inquiry. The first question you will have to consider how and by what means the accident occurred. It seems agreed by all the witnesses, that the seat of the explosion is in Pilkington's cut-through. The gas which exploded there had evidently come out of the workings behind it - that is shown by the effects produced. As to the mode of ignition, there are three possibilities to consider; *first*, the shot; *second*, the furnace, and *third*, some naked light of which you have no evidence, nor under the rules of the pit you can suppose the probability of such a thing. As to where the gas exploded, there is a doubt expressed by several of the witnesses; but all agree that the more probable of the three is, that the fuse ignited the gas. From the circumstances of the place where the body of Brown, the fireman, was found, and the evident probability that he had just left the fuse which had been lighted, you can have little doubt that the gas ignited at the shot. All the witnesses seem to regard the furnace as a bare possibility, and nothing more. It is evident that when Brown left the place there was no gas in it, therefore not admitting of time for the gas for getting to the furnace. The next question is, where the gas came from, and whence it emanated. You have proof that it came through a certain opening, it must have taken a certain track to get to that point. The main part of the evidence states that the gas was a not a large quantity, but it was in a highly explosive state, as is shown by the effects produced. The conclusion following this, in the minds of most witnesses, is, that the gas must have been given off suddenly, and at no great distance, not having been diluted, but in a highly explosive state. I am speaking of the bulk of the evidence, which is to the effect that the outburst of gas must have been unlooked for and sudden, coming from some crevice in the roof or warrant. The other supposition, is that there was general fouling of the air passing through the workings, owing to some check being given to the ventilation, which is the only ground on which such a supposition could have been possible. Mr. Dickinson can only suggest, as to the probable cause of such a check, changes in temperature. The effect of that, the other witnesses deny, as far as their judgement goes, of course. It is admitted by Mr. Dickinson, that the reduction of the ventilation to cause such a fouling, is inconsistent with the evidence, of the men who had been examined. Another supposition given by Mr. Dickinson, which is not corroborated, is, that the two drifts were fouled at the time of the explosion, giving, as his reason, that the fire had evidently radiated from those drifts; and, to account for this fouling, he presumes that the brattices were disarranged. It was for the jury to say whether, with Pilkington and his drawer working close to, and Brown passing close by, the brattices would have been so disarranged. On the other hand it has been stated, that supposing the gas came from the fall, it was necessary that the outburst, supposing the gas came from the fall, it was necessary that

the outburst should pass through the drifts in question, and would more than fill the two drift at the time it ignited, and so account for fouling them. It is also stated in evidence, that for a considerable number of days subsequent to the explosion, if not up to the present time, the brattices were destroyed, and no trace of gas was discernible. Then to the question of a sudden and accidental outburst of gas. If it was the source of gas which exploded, it seems to be agreed that it came from no distant point of the workings in question. The general supposition is, that a fall of roof liberated the gas. The only fresh fall met with in Woodcock's place: is that sufficient to account for the explosion? The only dissenting voices on this question are the two Government inspectors, Mr. Dickinson objects to the probability of this. From his cross-examination, he seemed to think that the fall could not be sufficient to account for the explosion; but it is not stated in his evidence. His second objection is, that the roof had not known before to throw off large quantities of gas; but in his evidence he seemed to say, that such a circumstance was not improbable. The third objection was, that he considered either of the other suppositions he had given more probable than that the explosion was caused by the fall. The fourth objection was, that from his own and Mr. Wynne's inspection, he is satisfied in his own mind that the fall occurred subsequent to, and not before the explosion; and he states, that the fall was not covered with dust like the workings around it. Against these arguments of Mr. Dickinson's, with which I may join Mr. Wynne's, we have the evidence of Mr. Peace, who minutely examined the place, and who states that under the crust of the fall he found the same amount of dust as in other parts of the mine that he tried in three places, and the result was the same. He gives as evidence that the fall did take place before the explosion, and not afterwards. The only way to get behind his evidence is, that subsequent to the question being mooted here, the management went down and removed the crust, and then laid on the fall a coating of dust, similar to that which was in other parts of the mine. It is for you to say whether such a supposition is probable. But had this dust not been found, all the witnesses, with the exception of the inspectors, agree that it would have made no difficulty to the probability of the fall occurring before the explosion. It is proved with respect to this fall, that it could not have been down long before the explosion; it was there immediately afterwards that is, it was found by the first men who got to the place. That the explosion and fall took place almost at the same moment, appears probable for the position in which Woodcock's body was found. It appears that after the fall he had time to get away from his coal, where he was working, and was going towards the shaft when he was stopped by fire. Supposing the objections of the Government inspectors are answered in respect to this fall, it would be necessary to go further into the evidence upon it: it all seems to point to this fall, not only as the readiest, pleasantest (as stated by one of the inspectors), but the most probable, if not only, solution of the mystery in which the explosion is involved. There are one or two points necessary subjects of your inquiry, which have been inquired into at considerable length - the management and general working of the pit. On these points I shall ask you to express an opinion. With respect to management, since the last lamentable explosion great precautions have been adopted, with the view of making this mine as safe as it could be. Nobody doubted that it has been their endeavour to carry out the result as far as they could by any means. The only fresh precautions any witness has been able to suggest are, the doing away with the use of gunpowder, and the feeding of the

furnace with fresh air. With respect to the workings of the mine great discussion has taken place. Mr. Dickinson complains that the pit is not sufficiently worked on the Lancashire system, and Mr. Wynne thinks that if it had been more so the explosion would not have occurred but states that the only fault he can find is the cutting out of the new workings near the pit, and bringing the return air over the men in them.

The evidence of every witness except the inspectors is, that this was not return air at all, but fresh air owing to an accession given to it from a split. Mr. Dickinson has, no doubt, his partiality for one system of working above another, and probably has reasons from arriving at the opinion he entertains; but what right he has for supposing that his and his only can be made use of in any pit, and under any circumstances, I am at a loss to see. In the present instance, perhaps as great an amount of evidence has been taken as at any former inquest, and, with the exception of the inspectors, the evidence has not been confined to the Newcastle men; but some of the witnesses have been your own viewers. The result they have all come to without exception is, that the workings have been commenced and carried on to the present time in as proper and scientific a manner as circumstances permitted.

The Coroner then concluded by again calling the attention of the jury to the points he wished them to embody in their verdict.

THE VERDICT.

“We find that the deaths of the eighty nine persons under consideration was occasioned by an explosion of fire-damp, within the workings of the Arley Mine of the Ince Hall Colliery, on Saturday the 18th. ultimo. We find the explosion occurred in or close to Pilkington’s drifts, and was ignited, as we believe, at Pilkington’s shot. The origination of the gas which exploded, we verily believe, from a sudden and accidental outbreak from some point not far from the seat of the explosion, and we point to the fall in Woodcock’s place as the only likely source shown from the emanation of such an outburst. We give it as our opinion that the general management and ventilation of the mine in question, from the time of the former lamentable explosion to the present, has been satisfactory, and the system of working, under the peculiar circumstances of the pit, uncensurable. Under the circumstances of these awful explosions, we would strongly recommend to the management, that, as far as possible, the use of gunpowder in the working places within this mine should wholly be discontinued.”

After the jury had delivered their verdict, the CORONER:- said “My own opinion is entirely in concurrence with the whole of the verdict. I beg to congratulate you on the result of your inquiry, and particularly to congratulate the management of these works on the result also. I think under all circumstances they have shown themselves entitled to all consideration, and I hope they feel they have met it as far as possible in a court of this nature. Another point I would congratulate them on is, that all the bodies were brought out of the pit so soon after the explosion. The Coroner then thanked the jury for their patience and attention.”

Mr. MAYHEW wished to be allowed to state, that there were several mines of great extent and some worked under circumstances of peculiar difficulty, and during the four years that Mr. Darlington had the management, there had not been a single death from explosion in them.

The inquiry was brought to a close about half-past six o’clock.

THE END.

THE VICTIMS OF THE 1854 DISASTER.

William Dobison aged 13 years, rolley hooker, son of the underlooker of Ince Green Lane.

Richard Jones aged 29 years, married with a child, horse tenter of School Lane.

Henry Peet aged 54 years, head fireman of Ince Green Lane who was married.

Robert Webster aged 23 years, drawer, married with a child of Queen Street, Wigan.

Richard Dickinson aged 15 years, rolley hooker of Broom Street.

David Harrison aged 35 years, fireman, married with four children of Wagon and Horses Yard, Millgate.

James Webster aged 14 years, a helper.

Thomas Dobison aged 15 years, pony driver, brother to William.

Nicholas Sullivan aged 12 years, door tenter of Whatmough's Yard.

Joseph Thompson aged 13 years, pony driver of Lowe's Square.

Thomas Walker aged 14 years, drawer of Britannia Bridge.

Thomas Chatterly aged 19 years, drawer, married of Bridge Street, Chapel Lane.

William Houghton aged 23 years, drawer of Vauxhall Road, Scholes.

John Cassidy aged 15 years, door tenter of Black Swan Yard.

Thomas Down aged 20 years, drawer of Boy-Well Lane.

James Gregory aged 20 years, collier of Rigby's Yard.

James Kelly aged 23 years, drawer of Cooper's Yard, Scholes.

George Jolley aged 15 years, drawer of Chapel Lane.

John Alpine aged 16 years, drawer of John Street, Scholes.

James Whittle aged 30 years, hooker-on, married with two children of Warrington Lane.

William Hayman aged 25 years, married with three children, colliery of Barrack Yard.

Edward McGowan aged 11 years, driver of Greenough's Row.

John Hesketh aged 28 years, collier, married with one child of Barrack Yard.

James Robert Nelson aged 10 years of Ince Green Lane.

James Pilkington aged 35 years, married collier with three children of School Lane.

William Rotherham aged 30 years, collier of Orrell.

John Mather aged 15 years, pony driver of Lyon Street.

William Leicester aged 50 years, collier married with a child of Bridgewater Street

William Horrocks aged 22 years, collier of Wallgate.

Edward Preston aged 17 years, drawer of Lyon Street.

William Gerrard aged 12 years, pony tenter of Warrington Lane.

William McClennan aged 35 years, collier, married with four children of Bull Yard, Scholes.

William Scott aged 18 years, hooker-on of Club Row.

John Marsden aged 19 years, drawer of Cooper's Yard.

James Sharrock aged 10 years, pony driver.

John Atherton aged 19 years, collier.

Gerrard Fairbrother aged 14 years, drawer of Lyon Street.

John Fletcher aged 13 years, drawer of Lyon Street.

William Fairbrother aged 11 years, door tenter, brother to Gerrard.
William Mulderig aged 18 years, drawer of Greenough's Row.
Mark Shore aged 24 years, collier, married of School Lane.
William Waddilove aged 32 years, married of School Lane.
Nicholas Fletcher aged 25 years, collier of Wigan.
Peter Roscoe aged 33 years, married, plate layer of Well's Yard, Wigan.
Thomas Bald aged 20 years, drawer of Stanley Row.
Thomas Mitchell aged 22 years, drawer of Nicholas Nook.
James Rigby aged 28 years, collier, married with one child of Nicholas Nook.
Joseph Rigby aged 26 years of Frankfort Street.
John Ashbrook aged 24 years, collier of Stanley Street.
Patrick McCormick aged 25 years, collier of Stanley Street.
Richard Woodcock aged 37 years, collier, married with three children of Stanley Street.
Robert McAllister aged 25 years, drawer of Nicholas Nook.
James Bentham aged 30 years married with two children of Back Ince Lane.
John Balderstone aged 22 years, collier of Bridge Street.
James Balderstone aged 17 years, drawer brother of James and John.
Thomas Balderstone aged 11 years, drawer, brother of James and John.
James Goldring aged 11 years, drawer, of Lowe's Square.
George Barlow aged 24 years, married with one child, collier of Victoria Street, Wallgate.
Matthew Corless aged 29 years, married collier of Hallgate.
Stephen Rowe aged 33 years married with two children of Club Row.
Francis McNaught aged 11 years, pony driver of Ince Green Lane.
John McGowan aged 19 years, drawer of Greenalgh's Row.
Thomas Baxendale aged 29 years, married collier of Ince Green Lane.
Michael McDonough aged 22 years, drawer of Nicholas Nook.
Owen McDonough aged 20 years brother of Michael.
John Markland aged 24 years, collier married with two children of Wellington Street, Scholes.
Edward Lindsay aged 33 years collier married with five children of Wellington Street, Scholes.
James Markland aged 22 years, collier brother of John.
Richard Graham aged 10 years, door tenter of Ashton Street.
William Gerrard aged 10 years, door tenter of School Lane.
Henry Dawber aged 24 years, married with one child of School Lane.
Richard Jackson aged 22 years, drawer Redhouses, Wigan.
Michael Farley aged 22 years, drawer of Black Swan Yard.
Samuel Worthington aged 26 years, married with one child of Frankfort Street.
William Dauber aged 21 years, collier of Schofield Street.
William Yates aged 10 years, door tenter of Birket Bank.
Jonathan Dyson aged 10 years, door tenter of Britannia Bridge.
Martin Tunstall aged 25 years, drawer of Frankfort Street.
Samuel Holding aged 33 years, plate layer, married with one child

Thomas Marsden aged 25 years of Coopers Yard, Scholes.

Charles Benson aged 10 years of Nicholas Nook.

Patrick McCabe aged 20 years of Black Swan Yard.

Edward Fairhurst aged 21 years, married collier of Ince Green Lane.

Richard Bromley aged 50 years, married with six children of Ince Green Lane.

Michael Cunningham aged 20 years of Greenalghs' Row.

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