

Another observation upon the air-current at the Camerton collieries adds to this part of the subject. Between the point of origin of the disaster and the downcast shaft there were seven violent disturbances, in several of which the falls were each estimated to measure from 600 to 800 tons of rock and shale. These falls were in the main-intake airway, the last one being 2,838 ft. from the downcast shaft, and the road for this distance approximated to a straight line. During the occurrence of the explosion the onsetter was standing at the bottom of the downcast shaft, and neither felt nor heard anything unusual. He observed that the flame of his open light was momentarily reversed towards the shaft, but insufficiently to arouse a suspicion that anything was wrong. Another man was standing in the intake at an intermediate point 1,848 ft. from No. 10 explosion, and he did not feel or hear anything of the explosions beyond a puff of wind that put out his candle; he attached no importance to this, as it often occurred, the air-current travelling at a high velocity.

The absence of appreciable mechanical force in the movement of the atmosphere between the shot and the first disturbances in the spaces between the successive disruptions and at the end of the propagations, with the phenomena of intermittent exhibitions of explosive violence, amount to demonstration that a series of local explosions occurred at the *loci* of the disturbances, in which disruptive forces were exerted in all directions and expended in their immediate vicinity.

The foregoing phenomena in the atmospherical movement admit the element of time antecedent to each disruption for the destructive distillation of the coal and the production of the explosive gaseous mixtures, to the ignition of which the local explosives were due. The author has therefore described the lengths of undisturbed road that are observed antecedent to each explosion as gas-generating spaces.

Observations made at the *loci* of the disruptions disclosed the fact that they occurred at the junctions and sidings, where large cavities existed in the roof, at sharp angles in the road when the path of the explosion was against the air-current, and where a door formed a cul-de-sac. One condition common to these *loci* was a larger provision of atmospheric oxygen than could be obtained in the antecedent spaces.

Another branch of evidence was the deposition of coked coal upon the timber, trams, and floor of the workings, which appeared to be deposited in these places under special conditions, and not in the general progress of distillation. In the immediate vicinity of the shot at Camerton collieries the floor was covered with a crust of coke, and the faces of the timber fronting the shot were thickly coated with coke to a height of 12 in. above the floor; above that point there was very little deposit.

At Timsbury collieries a tram was standing between No. 4 and No. 5 explosions, from which the author took the following observations: Tram loaded with shale, standing upon the rails, had not been disturbed. Coked coal-dust upon the end facing the course of the explosions. The buffer-ends, measuring 12 in. above the floor, covered with coked coal-dust $\frac{3}{4}$ in. thick. Many patches of coked coal upon the wooden end of the tram, thinning off to nothing at 21 in. above the floor, the upper 9 in. of the wood being clean. No trace of coke upon the angle-irons, draw-bar, link, wheel, or axles, nor upon any other part of the tram.

An obstruction in the path of the explosions will therefore retain a deposit of coke if it present a surface at the necessary height to which intumescent coal-dust can adhere. The evidence at this tram, which is confirmed by many other observations, shows that the coal-dust upon the floor is subjected to distillation, the particles rising to a height in this case of 21 in. The coal-dust on the sides and the upper parts of the timber is, no doubt, attacked by the hot educts; but in the intervals between the explosions the author observed coked coal near the roof in one place only, and that was at a sheltered flank which had flakes of coked coal lying upon it. In the vicinity of explosions coked coal was observed upon the opposing faces of timber on opposite sides of the disruptions, and it is not difficult to conceive how the hot, pasty coal-dust would be projected against these opposing surfaces by the forces of the explosions, which moved in radial lines.

Where propagations were arrested, with small coal left in suspension in a semi-distilled condition, it is also conceivable that with the atmosphere in front at normal or greater tension, and the atmosphere behind in an attenuated condition, due to the chemical changes that had taken place, the suspended pasty coal would retreat, and be deposited on the faces of timber, contrary to the course of the explosions; and this deposition was observed at Timsbury collieries.

The deposits of coked coal on the timber lying next to the roof over the tram between No. 5 and No. 6 explosions at Camerton collieries will present no difficulty when it is known that the distillation was going on in the face of the incoming air-current, and consequently the chemical action was energetic, and the globules of coke were carried upward with the educts. The committed coke at the tram beyond No. 6 explosion at Timsbury collieries was in a receding air-current with the supply cut off; hence only a small quantity of coal was distilled, and the action was not sufficiently vigorous to carry the globules of coke in resistance to gravitation. The positions in which the deposits of coked coal were found are explained by the hypothesis of local explosions with antecedent gas-generating spaces, and the condition of the air-currents.

Observations were made upon the nature of the atmosphere that filled the workings after the disasters. The roads had collapsed locally at many of the disruptions, and the circulation of air was suspended. The products of the gaseous explosions with the residual gases filled the roads in the fields of disaster, and were imprisoned between the falls, forming a series of still atmospheres that could only be displaced by diffusion until the final obstruction was reached and removed and the circulation of the air restored.

The exploring parties frequently advanced into the stagnant atmosphere more rapidly than diffusion was effected to make apertures through the falls, and had favourable opportunities of observing the effects of this atmosphere. Their open lights burned brightly, and disclosed the absence of the small percentages of carbon-dioxide and of the inflammable gases that are appreciable