Crystal Colliery.

The report of Seth W. Geer, Esq., master in the case of Mine Inspector Gay *vs.* Joseph Brady, was filed in court. The master finds that the inspector was right in closing Crystal colliery, which the defendant was operating. In accordance with his recommendations, the injunction was dissolved on the following conditions: *First*, That the defendant furnish an adequate supply of pure air, as provided by the act of Assembly. *Second*, That the gangway on the "Mammoth" and "Four Foot" veins be driven eastwardly as far as it is proposed at present to take out coal, and that the pillars be removed only in robbing back from the eastern terminus. *Third*, That whenever the gangway on the Mammoth vein shall have advanced through a pillar of coal of more than thirty feet, said gangway shall not be further advanced until it is ascertained that there is no dangerous opening below said gangway. *Fourth*, That during the working a proper and safe second outlet shall be kept open through which persons may escape to the surface. *Fifth*, That the defendant pay the costs of these proceedings.

SUDDEN OUTBURST OF GAS AT THE OTTO COLLIERY SEPTEMBER 9, 1885.

Under this heading, arises one of those phenomena which, in our judgment, requires more than ordinary notice or insight, from the fact that its source is a concealed one, and when the gas bursts forth, it is generally with overwhelming violence, (for seldom are the ventilating currents found to be sufficient to cope with the dense volume of explosive mixture evolved,) making it one of the greatest dangers encountered by those engaged in mining. It is a well-known fact that hundreds of colliery employés are destroyed, annually, by this uncontrollable element. Notwithstanding this, however, we are of the opinion that many of these disastrous explosions have been charged to sudden outbursts of gas, when, in many instances, if the facts of the case could have been brought to light, the cause would have been found chargeable to the neglect or ignorance of those officials who were superintending the mining operations, the theory of sudden outburst having been advanced to conceal their ignorance or guilt.

But on the other hand, the public and the press are always ready to go to extremes in passing judgment, condemning the unfortunate mine official in charge of the place where the calamity occurred, and frequently without even waiting to ascertain whether the accident was really due to willful neglect, or whether it was wholly unavoidable and beyond human control, a class of mishaps to which sudden outbursts of gas belong.

Hence it is very important, before passing judgment on questions of such serious character, that the subject should be carefully investigated, and the responsibility placed where it justly belongs.

We are willing to confess that in the case of this accident at Otto colliery, what we have said in regard to public sentiment is applicable to ourselves, because, when the accident was reported to us by one of the colliery offi-

cials, who stated that it was the result of a sudden outburst of gas, we intimated our doubts to him, and at the same time told him that we believed many explosions were charged to sudden outbursts that were due to neglect or ignorance. However, after we had investigated the matter and found that over twenty-two (22) feet of the solid face of coal had been displaced, we were fully convinced that there had been a fearful outburst of gas over which human skill had no control; and we are pleased to admit that in this case our suspicion of neglect had not been correct.

The Otto colliery is one of the oldest and one of the most extensive in this region. The main openings consist of three slopes, but those to which we particularly desire to direct the attention of the reader are slopes marked A and B on sketch No. 1, sunk on the Holmes vein and Primrose vein, respectively, and connected at the different lifts by means of tunnels. Slope A is sunk down fifteen hundred feet, on an angle of 35° south dip; the last three hundred feet are sunk in the solid, and the same distance below the old workings on the Mammoth and Primrose veins. Three hundred feet of gangway west, from which point two tunnels (marked E and F on sketch) were driven, one cutting the Primrose vein and the other the Mammoth vein.

The work under way at the time of the outburst, which caused the accident, was the driving up of an air-way (G) in the Mammoth seam to be connected with the level above, thereby establishing a permanent air-course.

From the time of the commencement of this airway, considerable trouble was encountered from the large quantities of gas given off, quite sufficient at times to charge the ventilating column to an almost explosive point notwithstanding that the current circulating through the tunnel was about five thousand cubic feet per minute. The parties engaged in driving the airway were composed of two men—a miner and a laborer—on each shift. In order to better secure the safety of these men, as well as the mine workings, no open lights were used, and a special fire boss was employed on the night shift, whose duties were confined to this one section of the mine.

In the morning, about one o'clock, the men noticed that the face of coal was working more than usual, and at the same time indications began to show themselves of some great force which was disturbing the solid coal. The miner, fearing that the face would rush out, sent the laborer down to the tunnel, (where the fire-boss was standing,) thinking as he afterward stated, that if a large volume of gas should suddenly be discharged while he was alone in the air way, his chances to make his escape down to the tunnel would be much better. This conclusion was not reached a minute too soon, for the laborer had just gotten down into the tunnel by the side of the fire-boss, when both heard a rushing noise similar to escaping steam, and immediately thereafter they saw the miner tumbling down into the tunnel followed by a rush of coal and gas. The three men began to retreat toward the tunnel mouth, the fire-boss with his safety-lamp in hand,

watching the progress of the volume of gas as they moved back, the air current having been reversed by the force of the body of gas when it rushed out. This condition of affairs continued thus until the tunnel filled with gas for a distance of two hundred and twenty-five feet back from the face, at which point the gas began to recede. According to the testimony of the men, it was about fifteen minutes from the time when the outburst occurred until the gas again receded to the face of the tunnel. Returning, the men found the air-way impassable from the loose coal carried down by the rush.

About twenty minutes after the occurrence, and while the men were discussing the event and the miner's escape, they were again startled by the shock of an explosion, but did not think it was the gas that had just passed away from them; but upon investigation, they found such to be the case, that one person had been killed and twelve more men injured, but fortunately none of the latter were seriously hurt, and but a small amount of damage done to the mine.

It is at this point of the subject that any doubt of the accident resulting from a sudden outburst of gas would be likely to arise, when taking into consideration the large volume of explosive mixture suddenly evolved, and compare it with the small amount of destruction caused by the explosion. If the whole body of gas had exploded, (which result would be very reasonable,) then the statement that a portion of it might have been fired without setting off the whole body would seem incredible, and it naturally raised doubts in our own mind previous to investigating the matter, but we found it to be a fact, that only a portion of the whole volume had exploded. We base our belief on the following facts: First, the quantity of gas given off was not less than fifty thousand cubic feet; hence, had such a volume exploded, the destruction to life and property would have been fearful. In fact, not a person in the mine would have escaped, and the cause of the accident would have been much more difficult to explain. Second, notwithstanding the large quantity of gas given off when the explosion took place, the damage done to the mine was comparatively small; in fact, its force and effect were confined to the point where it had been ignited. Therefore, we are of the opinion that the main body of the explosive mixture had passed off through the regular air-channel, (K K;) and we furthermore believe that the gas which exploded was the portion which filled that part of the gangway (I) between the head of the tunnel (H) and door (X,) a distance of about twenty-five (25) feet.

The fatal accident occurred in the following manner: The unfortunate men were working on the night shift, timbering the workings east of the door, (X.) The men had finished their work for the night, and were on their way to the foot of the slope. Instead of walking, the twelve men got into a car, and rode out with the driver, Linn, who stood on the car bumper to drive his mule. When they arrived at the door (X) he stopped the mule

and opened the door, when the gas pent up between the door and the tunnel (H) rushed through, and, being ignited by his naked light, instantly exploded, killing him, and burning all the men in the car, but none of them seriously. We believe that if the men had arrived at that door a few moments earlier, the whole body of gas would have been fired with more disastrous results; but if they had gotten there a few moments later, there would have been no explosion, because by that time a natural diffusion would have taken place, or the gas would have escaped and passed the door through leakages.

Let us again consider the probable quantity of gas evolved by this sudden outburst. We have said elsewhere, not less than fifty thousand cubic feet, but without doubt the quantity was much greater; however, we do not desire to convey the idea that we have sufficient data to fix a given quantity with any degree of certainty. Nevertheless, we have taken the following basis for our calculations, upon the testimony of the miner, laborer, and fire-boss, which, in our opinion, was verified by facts connected therewith. Under oath, these men stated that the gas filled the tunnel back from the face for a distance of two hundred and twenty-five feet, which length multiplied by the area, seventy-five feet, would equal sixteen thousand eight hundred and seventy-five cubic feet. But it must be borne in mind that, during this time, a greater quantity of gas was passing off in the same ratio as that of the ventilating current previous to the outburst; or, probably, we may arrive at a more correct conclusion by taking the velocity of the current, and multiplying by the time it took to fill up the tunnel until it receded; hence, if we take this as a basis, we have these results: Quantity of air in circulation, five thousand cubic feet per minute, and (according to the testimony of the men) the time it took to fill the tunnel, and recede fifteen minutes, the quantity would be seventy-five thousand cubic feet. To many this quantity will probably appear large, but it is quite evident, beyond doubt, that the volume of the explosive mixture, when it reached the fatal point, was much greater than the above given amount. Notwithstanding that this body had traveled fifteen hundred feet, and on its way met and intermingled with two other air-currents, which increased the total quantity of air circulating through the tunnel (H) to nearly twenty thousand cubic feet per minute, yet it is very evident that the whole volume must have been charged to an explosive point; had it not been so, there could have been no explosion.

Hence, it appears, first, that the gas was in a pure state, as it passed from tunnel (E) to the upper tunnel, (H,) and second, that it was only when it had met and intermingled with much larger volumes of air that it reached an explosive point. Therefore, we are inclined to believe that not less than two hundred thousand cubic feet of inflammable mixture passed through the upper tunnel, (H.)