

THE EXPLOSION
AT
MONONGAH NUMBER SIX AND
MONONGAH NUMBER EIGHT MINES
OF THE
FAIRMONT COAL COMPANY
DECEMBER 6, 1907
BY
FRANK HASS

THE EXPLOSION
AT
MONONGAH NUMBER SIX AND
MONONGAH NUMBER EIGHT MINES
OF THE
FAIRMONT COAL COMPANY

On December 6, 1907, an explosion occurred in two connected mines of the Fairmont Coal Company, known as Monongah No. 6 and Monongah No. 8. These are two of some forty mines operated by the Fairmont Coal Company in what is known as the Fairmont Region. The region is in West Virginia and is the southern extension of the Pittsburgh seam from the Connellsville and Pittsburgh region of Pennsylvania.

All of the mines of this company are in the Pittsburgh seam, which is of remarkable uniformity as regards height and pitch of seam. The seam is about 7-1/2 feet high with a general inclination towards the northwest, rarely exceeding 3 percent.

The coal is a strong block coal with butts and faces well defined. It is brittle and when reduced to small sizes has a tendency to go to dust rather than the granular condition which is the case with coals of the columnar structures. It is a gas and coking coal and would be fairly well represented by the following analysis:

Moisture - - - - -	1.50 pct.
Volatile - - - - -	36.50
Fixed Carbon - - - - -	55.00
Ash - - - - -	7.00

The Monongah Mines No. 6 and 8 are located on the West

Fork of the Monongahela River about six miles south of the town of Fairmont. The B. & O. Railroad is located on the east side of the river while the Fairmont & Clarksburg traction line occupies the west side and the same side as the mine openings.

No. 6 mine was opened in October, 1899, No. 8 in 1905. The panel system, room and pillar work, was used; both mines were projected with a view of developing a large territory and care was taken to provide sufficient airways for ventilation in future years when the workings will have covered considerable area.

The seam at No. 6 mine lies 60 feet below high water mark and is reached by a rock slope 740 feet long, driven on a 9 percent grade. At the time of the explosion the development consisted of the main entries driven on the butts of the coal, N.77 30W., from which four sets of face entries had been turned on the south side, making four panels for rooms, and two on the north side, making two panels. These panels varied from 800 to 2,200 feet in breadth. The main entries were on about the strike of the seam, the coal dipping about 1-1/2 percent to the south; they were made up of seven parallel headings, to-wit: Two haulways, one manway, and two pairs of air return courses, one pair for a return from the south side, the other for the north. The face entries had three headings, namely: Two haulways and a return airway. Room headings were turned from the face entries 450 feet apart, rooms were all driven to the rise, 22 feet wide, either 50 or 60 feet center to center, and when rooms had been driven 350 feet the pillars were drawn back.

No. 8 mine was opened by a slope on the seam from the outcrop; the main entries were 4,200 feet south of and parallel to those in No. 6 mine and were likewise made up of seven parallel headings. On the south side two face entries were driven making two panels; on the north one face entry composed of three headings, namely; Two haulways and an air course, connected with the third south headings of No. 6. These three headings, 7 1-2x10 feet in section, were the only connections existing between the two mines.

The development in both mines covered about 700 acres of contiguous territory of which in 62 acres the pillars had been drawn and the coal entirely exhausted; in 170 acres the coal was out in rooms and headings and 468 acres remained in developed coal.

At No. 6 the inside forces were in charge of a mine foreman, one assistant mine foreman and three fire bosses; at No. 8 there was a mine foreman and two fire bosses, all under the control of one superintendent.

Both mines were ventilated by independent fans located near the respective pit mouths. At No. 6 a Capell fan 8-1/2'x10' driven by a 22"x24" belted engine, was located on one side of an airshaft 60 feet deep, 100 feet south of the mouth of the slope. This fan, running 224 revolutions per minute with a water gauge of 3.4", produced 157,800 cubic feet of air per minute, drawn through two intakes and conducted through the working places in seven splits, as follows:

Split 1,	14,000 cu.ft.,	velocity 216 ft. per min.,	10 men working
Split 2,	13,500 cu.ft.,	velocity 208 ft. per min.,	16 men working
Split 3,	5,000 cu.ft.,	velocity 90 ft. per min.,	4 men working
Split 4,	15,500 cu.ft.,	velocity 240 ft. per min.,	32 men working
Split 5,	15,400 cu.ft.,	velocity 235 ft. per min.,	14 men working
Split 6,	20,300 cu.ft.,	velocity 310 ft. per min.,	38 men working
Split 7,	16,100 cu.ft.,	velocity 250 ft. per min.,	32 men working

At No. 8 mine a Lepley steel fan 22'x8' driven by a 26"x24" direct connected engine, was located at the outcrop 50 feet north of the main opening, opposite the pillar between two return airways. Running 77 revolutions per minute with a water gauge of 2.6", this fan produced 179,000 cubic feet of air per minute, which had been conclusively shown by tests. The air was conducted through the working places in ten splits as follows:

Split 1,	9,700 cu.ft.,	velocity 150 ft. per min.,	19 men working
Split 2,	20,400 cu.ft.,	velocity 310 ft. per min.,	16 men working
Split 3,	16,700 cu.ft.,	velocity 260 ft. per min.,	7 men working
Split 4,	33,200 cu.ft.,	velocity 450 ft. per min.,	24 men working
Split 5,	17,700 cu.ft.,	velocity 270 ft. per min.,	18 men working
Split 6,	16,100 cu.ft.,	velocity 250 ft. per min.,	8 men working
Split 7,	17,300 cu.ft.,	velocity 260 ft. per min.,	73 men working
Split 8,	16,700 cu.ft.,	velocity 255 ft. per min.,	5 men working
Split 9,	12,600 cu.ft.,	velocity 190 ft. per min.,	5 men working
Split 10,	13,100 cu.ft.,	velocity 200 ft. per min.,	1 man working

Besides the slope and manway, there were several places driven to the outcrop serving as intakes; for return air courses two headings connected with the fan, 70 feet from which a third was turned, giving a total area of at least 200 square feet. The three headings extended parallel for 1,250 feet, from which point there was, as in No. 6, a pair of return air courses on each side of the main headings, one pair for a return for the south, the other for the north side.

Permanent stoppings and overcasts in both mines were built of brick or concrete, the walls and top of concrete overcasts were reinforced with pieces of old steel rail, boiler tubes, wire rope, etc., and ample area was provided over the top to permit free passage of the air.

Both fans were run exhausting, the normal temperature of the return air was 60 degrees Fahrenheit.

In No. 6 mine a 13 ton and a 20 ton electric haulage motor were in use, the coal being gathered by horses. In No. 8, a 13 ton haulage motor and five 7 ton gathering motors hauled the coal.

No. 6 mine was unwatered from two pump stations, one at the foot of the slope, the other on the north face heading; from both stations duplex electric plunger pumps discharged the water to the surface.

No. 8 was unwatered by a centrifugal pump electrically driven, located on the north face heading from which the water was discharged through a bore hole. In both mines several small electric pumps were in use, discharging from local swamps. Altogether about 1,000,000 gallons of water per day were discharged from the mines.

The workings were wired throughout for electricity and the seam was undercut by electric chain machines; this cut was six or seven feet deep and four and one-half inches high. The coal was discharged by three shots, the holes for which were drilled by hand about six feet deep, the middle shot being fired first, after which the two rib shots were fired in turn. Black powder was used exclusively, the tamping was composed largely of coal dust and no shot firers were employed, each man drilling his own holes and firing his own shots. Most of the pillar work was done by pick men who undermined the coal from 3 1-2' to 4' deep before shooting. No "shooting off the solid" was permitted in either mine, but there was a tendency among pick miners to violate this rule unless closely watched. Open lights were used by all workmen.

Slight traces of gas were found from time to time in the advanced workings and it was the first duty of the fire bosses to see that this gas was properly diluted and driven off. Examinations were made daily, beginning not later than 3 a.m., of all the working places in each mine and careful tests made for gas, the fire boss leaving at the face of each place evidence of his visit there. Wolf safety lamps were used for testing. Such places as contained traces of gas were marked on the board at the mouth of the mine and the workmen were not allowed to enter such places until the gas had been removed, which was done either by canvass or wood brattice.

From careful tests repeated through several months, it has been determined that at No. 6, 172,000 cubic feet of marsh gas were driven off every 24 hours. This amounts to 0.67 percent. of marsh gas in the main return air current. At No. 8 there was only 35,000 cubic feet every 24 hours, amounting to .024 percent of the total return.

Both mines were more or less dust, especially during the winter months, but the haulways were systematically watered with water cars, although there was no attempt made to dampen the dust in the rooms. This watering was done under the direct supervision of the fire bosses and it was one of their duties to see that no considerable quantities of dust accumulated. Both mines had been working steadily, but for a few weeks just prior to the explosion there had been an occasional off-day on account of the market conditions; the day before undiminished speed. On Friday morning, December 6th, the fire bosses in each mine made their usual rounds and found nothing out of the ordinary. In No. 6 one place was reported as having traces of gas, and at No. 8 there were six places reported; this was an average day's report.

In No. 8 the mine foreman, one fire boss, 39 day men (Motor-men, drivers, trackmen, timbermen, slatemens, etc.), and about 160 machine men and loaders were at work. In No. 6 the mine foreman, two fire bosses, about 40 day men and 123 machine men and loaders were working, in all about 367 men. As far as is known, work progressed as usual until 10:28 a.m. when the explosion occurred which killed nearly all the men, wrecked the entire ventilating system, smashed motors and mine cars and destroyed the No. 8 openings, together with the boiler house and fan, but did little or no damage to the No. 6 slope and opening. The fireman at the fan boilers was caught beneath the debris of the boiler house and fatally injured.

Out of the entire number at work, all lost their lives but five, four of whom made their escape through an outcrop opening; the other was rescued. The four men were at work in a short crop heading near the face of the first south heading in No. 8. The heading had fallen through to the surface at the outcrop and the force of the explosion threw tons of rock and dirt into the air, making a hole 20 feet in diameter. The men, being in a "tight" place, were not injured, although they were blown about and their lights extinguished. They crawled out of the hole as soon as the force had passed. Watchmen had been immediately placed at all crop holes to guard against any rash persons entering the mines in search of friends. About 4 p.m. one of these watchmen heard moans coming from within. A man was let down the hole with a rope and about 100 feet from the surface found a foreigner sitting on the body of his brother, which was lying in a pool of water, life hardly extinct. The live man was at once taken out; his mind was affected and although not seriously harmed physically, it was many weeks before he regained his mental faculties. The body was brought out, but, although still warm, all attempts at resuscitation were fruitless.

For a time all was confusion, every local mine official was missing, and it was impossible to realize the nature and extent of the catastrophe, or to tell whether either mine was on fire and full of gas.

The No. 6 fan, being located to one side of the air shaft, was not seriously damaged, and as soon as the roof of the approach from the shaft to the fan could be temporarily reconstructed the fan was started. This was accomplished in 35 minutes after the explosion.

Volunteers were willing and anxious to enter upon the work of rescue and at both mines a crew of men with hatchets, saws, canvass and material for brattices were soon at work restoring ventilations.

The State District Mine Inspector arrived on the scene about two hours after the explosion and gave all the aid in his power to the work.

When the bottom of No. 6 slope was reached and the debris from a wrecked trip was found scattered for 250 feet along the heading. Cars were smashed and piled in all shapes, almost blocking the entry. This trip had, a short time previous to the explosion, been pulled up the slope and stopped at the knuckle. When the engine started to land it the coupling pin on the first car broke, letting the entire trip, consisting of 18 loaded two-ton cars go down the incline. These cars had scarcely disappeared into the pit mouth when the force of the explosion came out. At the coroner's inquest the bulk of the evidence showed that the trip had not reached the bottom of the slope when the explosion occurred. This was the most remarkable coincidence connected with the disaster.

At the foot of the slope in a small shanty, the bodies of the slope tender, a motorman and brakeman were found. One still had his dinner bucket in his hands; he had been in the act of eating a lunch. These bodies were not burned, nor did they show signs of violence. The men had apparently met instant death as no evidence of their having tried to make their escape could be seen.

A crew of men were put to work clearing the debris of the wreck so that passage could be had for material for brattices and the work of restoring ventilation was carried on with all possible speed.

The brick or concrete brattices were in every instance completely demolished, with the exception of about four brick brattices near the bottom of the slope which were found intact. The material had been blown in all directions, in certain cases large blocks of concrete weighing several hundred pounds had been carried over a hundred yards.

The general method of procedure was as follows: The place for brattice having been located, and the cross-cut cleaned out,

two upright posts were set and a board nailed across top and bottom. Heavy canvas was then stretched across and as soon as the air had swept the heading clear enough to allow the next cross-cut to be reached, the same operation was gone through. A second crew followed the first, building substantial wooden brattices over the canvass, and as they advanced, a third party followed up daubing all crevices and cracks with cement to make the brattices air-tight.

Advancing in this manner, by Saturday morning the ventilation had been restored 3,000 feet down the main headings, all the material for which had been carried by hand from the mouth of the slope down 750 feet, passed over or through the wreck and then carried over falls and debris of all kinds to the workmen. At this point the wreck of a motor and loaded trip was encountered; the motorman had been blown to pieces and parts of his body imbedded in the machinery. The brakeman was found along the entry, his arms, legs and head blown off.

By the night of the 7th, the main heading was cleaned up enough to allow horses and trucks to be used, and rapid progress was made. The face of the main heading was reached and all the air then turned up the third north; on this entry four bodies were found blown to pieces. Work was carried on without interruption until Sunday afternoon, when all were ordered out because of developments at No. 8.

When the fan at No. 6 was started, all stoppings between the two mines having been destroyed, air was pulled through the second north entries to No. 6, all openings at No. 8 serving as intakes.

Both empty and loaded tracks on the No. 8 slope were filled with wrecks of cars and were impassible, but the manway remained open. Searching parties made their way down this manway and followed the air down the No. 2 north heading, but the volume of foul air drawn from the first south face soon made them retreat.

Entrance was then made to the second right heading off the No. 2 north through a crop hole and this heading was all explored, five bodies being recovered. On going down the heading to the second north face the black damp was encountered so strong that further progress was impossible, and all were withdrawn and started down the main slope again. In the meantime fire was discovered in the first north heading, about 450 feet from the pit mouth. This was fought from 1 a.m. to 5 a.m. Saturday, December 7th, with water carried in buckets from the river and fire extinguishers brought from Fairmont. Several brattices had to be built to permit men to reach the seat of the fire, but after a hard fight it was finally gotten under control and extinguished.

On Saturday, a crew of men cleaned up the manway and laid down a track to the first south face in order that material could be handled, it being easier to lay down this new track than to clean up the wreck on the slope.

Before any advancement could be made down the second north heading, the No. 1 south and all the slope headings had to be bratticed off to keep back the foul air and gasses that were being drawn out. Work in the face of this "after damp" was almost impossible and before these headings were closed off all the men were sick and at least a dozen had been entirely overcome and had been carried outside where the physicians had established a temporary hospital. This work was finally accomplished, however, and progress down the second north was comparatively easy; the No. 6 fan drawing fresh air in No. 8 slope, all three of the second north headings serving as intakes. By 10 a.m. Sunday, the first right had been explored and about 1,000 feet of the first left when all were called to the surface and further efforts in this direction discontinued. After the first south face had been cut off, as previously mentioned, smoke was discovered coming out of crop openings south of the pit mouth, and this had become so threatening that it was decided to discontinue all work on the north side until this fire had been located and extinguished.

On Saturday night, the 7th, the Chief Mine Inspector of West Virginia and all the State District Inspectors arrived. Six were assigned to each mine, three for each shift. Acting in an advisory capacity, they watched the progress of the work and assisted in exploring and locating bodies.

The forces were organized on Saturday and everything was carried on systematically. The shifts in No. 8 changed every eight hours; those in No. 6 every six hours, but as the work progressed in No. 6 it took about an hour to walk from the surface to the working places so that it meant practically eight hour shifts at each mine. Each shift was organized into crews composed of searchers, brattice men, stretcher gangs, drivers, etc., all under control of one man. A leader and an engineer, accompanied by one or two others, all practical experienced mine men, kept in advance, exploring the workings and looked out for the safety of all employed; the engineer recorded on maps the progress made, brattices built, the direction of air currents and the location of each body found. He also placed a tag on each body giving all available information that might assist in identification. A competent man looked after all details, selected the crews for the various jobs, furnished all tools and materials, kept in touch with conditions behind and in front, and through messengers informed those in charge on the surface of progress and conditions in both mines. The workmen were divided into three crews of six men each and were composed

of volunteers from mines of the Fairmont Coal Company or other companies; a squad of four men under a leader did all the disinfecting; four drivers and a boss handled all material; a squad of six men carried food and drink from the surface to the men at work; several messengers were constantly employed carrying messages and materials from those outside to those in the mines. All told, from 40 to 50 men were employed on each shift.

A thorough system of checking men in and out of each mine was used from the very beginning. Every man before entering was furnished with a locked Wolfe safety lamp, his name was taken and he was given a tin check bearing his number. On entering or leaving the mine his number was recorded and under no circumstances was any person allowed to enter without a number, and no one was furnished a check unless he was either a workman or an official. None but practical mine men were employed.

The outside forces were thoroughly organized also and the crews changed regularly. A complete commissary was maintained, all approaches to the pit mouths were policed and everything done to enable materials of all kinds to be handled expeditiously. Private telephone service was in operation between both mines and the company's main offices and transportation facilities were of the best. A telephone was put in No. 6 at the foot of the slope giving service to the outside; and in No. 8 a telephone was moved along the main headings as the work advanced, making constant communication with the surface possible.

By Sunday a 7-foot Stein fan had been brought to No. 8 and set in place, brattices were built between No. 6 and No. 8 and all efforts concentrated on the first south face workings where there was supposed to be a fire. A water line was laid up the first south heading to fight the fire. All room headings were then carefully explored. No signs of fire were found; close watch was kept, however, and after completing the first south, the main slope, second south and third north headings were ventilated and searched. Smoke fumes were present all the time, but no fire could be discovered, and it was not until December 16th, ten days after the explosion, that fire was finally discovered on the first south face, second right, room No. 10. When found it was burning fiercely and had it had much more of a start very serious consequences might have resulted. It was fought successfully with water carried in buckets from the end of the water line.

After exploring the main slope headings, work on the second north was resumed. On entering the third right room heading, in room No. 3, fire was discovered on the left rib.

This had been smouldering for five days and nights, and when fresh air was turned in the heading the coal started to burn furiously. It was soon extinguished and the work went on without further interruption until completed.

The regular method of working was as follows: The various crews, under their respective foremen, would brattice, hang curtains, clear up falls, and make ready a heading for exploration, after which the leaders would explore the rooms and working places for bodies, using temporary curtains to ventilate the rooms. As soon as a body was located, it was disinfected with a solution of carbolic acid, prescribed by physicians in charge, and properly marked with all available information to aid in identification. The party was organized into stretcher crews, and certain men selected to handle the bodies. These, wearing rubber gloves, carefully wrapped the bodies in sheeting and placed them on the stretchers which were carried to a truck on the nearest available track. They were then hauled to the bottom of the slope by horses, notice was given to those in charge outside, and when ambulances were ready, the bodies were hoisted to the surface and taken to the morgue.

All carcasses of horses when encountered were treated either with a very strong solution of carbolic acid or with a half barrel of slaked lime on top of which chloride of lime was sprinkled. These carcasses were covered with canvas and left until all the bodies had been recovered. The fact that there might possibly be some men in the mine somewhere alive was never lost sight of and efforts were made to explore all parts of the workings with all possible speed, leaving unnecessary work for another time.

The difficulties encountered were the foul air, the great pile of debris from falls and wrecks; the heat and the stench. Advancement ahead of the ventilating current was impossible, the effect of the after damp being instantly noticed by a stinging sensation in the eyes, a severe headache and nauseating pains. All props and timber had been blown down, causing heavy falls of roof; this was particularly true of No. 8, where the roof was not so good as at No. 6. It was necessary in certain headings to carry material for brattices and afterwards carry bodies for 2,500 to 3,000 feet over falls which would have been very difficult to crawl over, unhampered. In places, whole trips of empty or loaded cars were piled up, which so completely blocked the headings that it was necessary to cut a passage through with ax and saw.

The heat left by the explosion was intense, and the stench from the decaying bodies of men and the carcasses of horses and mules, with the necessarily poor ventilation, made the work at times almost unbearable.

All bodies of men employed on the main haulways had been blown to pieces. When the faces of the rooms were reached, however, bodies were found in all conceivable positions and conditions. Some, neither burned nor bruised, were found lying in the act of making an undercut, pick in hand; some in sitting posture with head bowed, resting in their hands. One driver was found underneath a loaded car completely covered, only one foot sticking out, his horse lying nearby, stripped completely of harness, which was found 100 yards up the heading lodged in a pile against a pillar fall. The entries in practically all cases showed evidence of extreme violence, one body being blown against the face of a heading with such force that it was mashed flat and left sticking to the coal.

The fifth right entry off the second north face in No. 8 was an exception to the general rule. In this entry the last four wood brattices were not destroyed. In the rooms the props were not blown down nor the cars derailed or smashed. Watches in coats hanging on props were not broken and picks and shovels were found leaning against props or cars where they had been left. Twenty-six bodies were found on this heading, twenty-two on or near the heading and only four at the working faces; it appeared that the workmen were not injured but after the force abated had lived long enough to travel 300 or 400 feet before being overcome by gases.

In direct contrast to this, on another heading pieces of a horse were scattered for a distance of 500 feet, torn so badly that the remains had to be gathered together with a shovel, while in a small hole in the rib of this heading the body of a trapper boy was found in a sitting posture without a mark or scratch of any kind.

Despite all difficulties, the work progressed without ceasing, from 25 to 100 bodies were recovered each shift and the first search was finally completed, No. 6 mine on the morning of December 12th, No. 8 in the evening. The ventilation had been re-established and the tracks in five and one-half miles of main headings cleaned up to allow hauling. Eight miles of room headings had been ventilated and searched and 550 rooms explored. Three hundred and thirty-seven bodies had been recovered and removed to the surface.

A second search of both mines was immediately begun and the work of removing the carcasses of horses and mules taken up. Tracks had to be cleaned up to the carcasses which, after being thoroughly disinfected, were pulled on trucks by block and tackle, wrapped in canvas, and hauled outside. Where it was impracticable by reason of falls of roof to clean up tracks to get trucks up to the carcasses, the block and tackle was attached and they were skidded for hundreds of feet, sometimes over falls and through crosscuts, to the track, occasionally necessitating the sawing off of a leg or head in order to make progress possible.

On the second search seventeen bodies were recovered; these were found either partly under water or completely covered under falls that had to be cleaned up before the bodies were discovered.

The second search extended over a week, after which the local mine organization was resumed and the work of restoring the mines permanently was begun. As this permanent restoration proceeded, the large falls were cleaned up, and eight more bodies were recovered, making in all 166 taken from No. 6 mine and 196 from No. 8.

Normal conditions were restored and shipments resumed in February.

A hasty examination of the two mines immediately following the explosion convinced the officials of the company that a great majority, if not all, of the persons working therein at the time of the explosion had been killed. Preparation was made to take care of the bodies of the dead and prepare them for burial. A large room was obtained as convenient as possible to each of the mines to which the bodies were to be taken as they were brought out and there prepared for burial, and a room adjoining was procured to be used as a morgue, to which room the bodies were taken after they had been prepared and placed in caskets, after which all persons were admitted in order to identify the bodies.

The work of preparing the bodies for burial was in charge of three undertakers who had the assistance of some twenty-five or thirty expert embalmers and undertakers. After the first day or two these embalmers worked in relays of about eight hours each, thereby giving the squads or sections not working a chance to rest and eat. As fast as the bodies were brought to the mouth of the mines they were placed in ambulances and wagons and hauled to the rear of the work-room. As each body was placed on a work-table it was given a number by means of a card attached to it. A record of each body was kept both by the coroner of the county and the company. The bodies were numbered serially, and as fast as they were brought in and given a number, these numbers were placed on the records. One of the two pay-roll clerks at these mines, who were well acquainted with the men employed there, was always present in the work-room for the purpose of aiding and identifying the bodies.

As the bodies were undressed care was taken to find and preserve every article found in the clothes or on the body; these articles were turned over to the coroner and the names and description entered on the records. In addition to that, any peculiar markings on the body were noted and entered on

the records. By means of the cards attached to the bodies by the rescuers showing where they were found, the articles found on the bodies, the peculiar markings and the familiarity of the pay-roll clerks with the men, most of the bodies that were not too badly mangled were identified. The bodies were washed, embalmed, dressed and put in a good quality of casket and then placed in the morgue, many of those not identified in the work-room were recognized by their friends in the morgue.

As quickly as the friends of the dead could arrange for their burial, or make preparation for caring for them at their homes, the bodies were removed from the morgue by the undertakers and their assistants and were either buried or taken to their homes and from there taken in due time to their grave.

The card showing the number of the body was carefully preserved while the body was being prepared for burial and when it had been dressed the card was again attached, and as the body was identified the name was written on the card. When the casket was finally closed for burial this card was attached to the casket and at the cemetery (except in instances where the bodies were shipped away for burial) another record was kept, showing the number and name of the body and where buried.

As the bodies were identified, the names were entered on the records kept by the coroner and the company. In addition to the number of the body and the name of the person, if known, these records also showed the mine the body was from, whether No. 6 or No. 8, his nationality, age, as near as could be ascertained, whether married or single, number of children, in what capacity employed, by whom identified, where the body was first taken and where buried.

Owing to the stupendous amount of work to be done in properly caring for these bodies and the lack of experience of everyone in handling such an undertaking, the work of the first two days, while it was well done, was done at a very unnecessary sacrifice of strength and effort. After that the work was systematized, the embalmers were divided into squads or sections and worked in relays or shifts of about eight hours each; from that time the work was done much more satisfactorily, and very much more easily. At the beginning there were so many embalmers and helpers they were in each others way.

Each section or squad was comprised of six embalmers, the same number of washers, four persons to take the bodies from the ambulances and place them on the work tables, and four persons to bring in empty caskets and take out the caskets with the bodies and place them in the morgue for identification or to await the wishes of relatives.

There was also a squad of men, in charge of the county health officer, who kept the work-room as well as the morgue, clean and disinfected as far as possible, and took away and destroyed the clothing from the bodies of the dead.

In order to expedite the work of caring for the dead and to prevent unnecessary confusion, the work-room was at all times guarded and the public, especially the morbid and sight-seeing, were refused admission, but the most kindly consideration was at all times shown those bereaved and they were given every opportunity to identify their dead and see that they were properly and satisfactorily cared for. No reasonable effort was spared, nor opportunity neglected, to see that each body was properly cared for and suitably prepared for burial in accordance with the station in life in which the deceased had moved.

All bodies were embalmed, except those too badly mutilated. That every reasonable sanitary precaution was observed in handling the bodies, both in the work-room and at the morgue, is evidenced by the fact that no unknown serious sickness or death resulted either to the workers or to persons residing in that vicinity, and it must be remembered that over 350 bodies were handled through the morgue. While a considerable portion of the bodies were badly mutilated, some dismembered and entirely beyond recognition, yet the greater portion were in good condition; some had evidently been burned, while others appeared as if they had been subjected to intense heat without flame.

The work of preparing and burying these bodies was almost beyond comprehension, but in spite of its immensity, it was well done and done with every consideration for the feelings of the bereaved relatives and friends.

At the time of the explosion both the Italian and Polish Catholic Churches had cemeteries immediately adjoining, separated by a wire fence. At the very start, the men at work in these cemeteries were admonished by the representatives of these two churches to be very careful not to allow any member of the Italian church to be buried in the Polish side, or vice versa, and again, later, not to allow a Protestant to be buried in either of these cemeteries. For this reason a new cemetery was located, adjoining the Polish, to be used as a burying ground for Protestants and unknown. This fact made it necessary to have representatives of the Catholic Churches present who had lists of the members of their congregations and whose advice was followed in determining the cemetery in which each body was interred.

The men in charge of the work of digging graves, thought it advisable to dig trenches in which to place the bodies,

but it was finally decided that each casket should have a separate grave, these to be 6 feet 6 inches long, 3 feet 8 inches wide, 5 feet deep, and should be dug end to end in rows, ten inches between each. The rows were dug 3 feet apart. In the beginning graves were numbered consecutively, commencing at the first row in each cemetery, following it to the end, and carrying the number on up the second row, but after one day's trial of this method, it became apparent that it would be impossible to keep an accurate record, as three or four rows were often commenced at one time, some of these rows containing twenty graves, while others contained but seventeen or eighteen. The system was then changed, giving each row a letter, numbering the graves from the foot of the hill consecutively. This method made it possible to extend any row, and allow stricken families to select a place for the burial of their dead above the regular line of graves.

The morgue number was also stenciled upon the lid of each rough box. The card was placed inside the box on the lid of the coffin, and at the morgue, if the body was identified, the name of the victim was placed on the card. When a body was brought to the cemetery for burial, a record was taken from this card as follows: Morgue number, name (or unknown), mine in which found, cemetery, row, and number of grave in which buried, also under head of "remarks" any information relative to place found in the mine, house number, or any other information which could be given regarding deceased by friends or relatives at the cemetery. In several cases, especially after health officers had limited the time of holding bodies before burial, identifications were made at the cemetery by opening the caskets and from data obtained from these cards. In the haste and confusion it was neglected to put these cards in water proof envelopes or boxes; as it was, the writing in many cases had become totally obliterated by mine water or dirt.

In order to facilitate the burying of bodies, it was found necessary to use two gangs of men, one to take the casket out of the box and carry it to the grave assigned, where the lid with the morgue number stenciled thereon was placed at the side of the grave and the box lowered. The casket could then remain until friends and relatives had viewed the remains, after which the second gang carried it to the grave, which was easily determined by the box lid on the ground.

Identifications at the cemetery were greatly hindered by the ignorance of some of the bereaved. Several of these people, thinking to save funeral expenses, would allow relatives to be buried "unknown". This was discovered by sticks and other marks found nearly every morning beside newly made graves. Many of these marks were destroyed by the workmen,

but in every case the next morning another mark appeared such as notches cut in fence posts, or another stick or cross beside the grave. It was also found, that among the foreigners some would claim as their own a body which had been fully identified otherwise by relatives, insisting that they be buried in a certain grave, and when this request was not granted, these graves would also be marked with a name other than the name of the occupant. One thing, which more than any other, aided in the dispatch with which work was accomplished, was the fact that nearly all funerals were conducted at the church, thus keeping away from the cemetery many who would otherwise have come there, interfering with the work.

Altogether, two hundred and eighty-four bodies were buried at this place, one hundred and forty-two in the Italian cemetery, seventy-five in the Polish, and sixty-seven in the new cemetery. Rain or sleet continually interfered with the work, making the earth extremely wet and heavy. A grave completed one night was nearly always found the next morning half full of water; one of the workmen would have to go into it, sometimes waist deep, to bale it out. Many times, especially during rain, it was impossible to keep men at work, and only for the fact that the Ladies' Aid Society furnished hot coffee and sandwiches every few hours, was it possible for the men to stand the ordeal. On Tuesday following the explosion, seventy-eight bodies were interred, and on this day for not one moment did snow or sleet cease falling.

The emotional excitement among the women, especially among the foreign element, made it necessary that immediate provision be made for caring for and feeding the children as well as the women themselves. Several volunteer committees were hastily formed, one of these being headed by the mayor of the town of Monongah, and made up of the councilmen. Other committees of ladies were made up in Fairmont, and emergency supplies were sent from Fairmont and distributed among the families. In the meantime the coal company had directed and organized different parties to canvass among the stricken families to ascertain their needs. Each party was headed by a coal company official, and accompanied by interpreters. As soon as the needs of each family were ascertained the Coal Company supplied, through its store, the groceries, meats and vegetables and also renewed the supply of wood and coal necessary.

In many cases the stricken women did not regain their composure until several days had passed, and spent their time at the morgue waiting for the bodies of their husbands, sons or relatives to be brought out. Their younger children, for the time being, became a charge upon the community, and these the different committees endeavored to look after. Trained nurses were provided where sickness existed.

The relief afforded the stricken families was prompt and effective, and continued until arrangements more or less permanent could be made.

On December 11th, the Secretary of the Carnegie Hero Fund Commission, arrived at the scene of the accident with an assistant, and, noting the necessity for a wider range of work than was being carried out, effected an amalgamation of the different relief committees into one committee, which was designated The Monongah Mines Relief Committee. This committee, on December 14th, sent forth an appeal to the general public for funds and succeeded in collecting a total of over \$154,000.00, which it is at this writing engaged in distributing among the dependents as fast as the dependency in the foreign cases can be proven.

The Relief Committee, shortly after January 1st, from funds it was receiving, made an allowance for each of the families at Monongah on a basis of \$2.00 per week for the widow and 50 cents additional per week for each child in each family, and vouchers have been distributed among the different families on this basis each week, all of which advanced payments were charged to the family receiving them and are being deducted from the final allowance, which has been fixed at \$200.00 for each widow and widowed mother and \$155.00 for each child and dependent brother or sister of the victims under sixteen years of age at the date of the explosion.

Many of the widows have, with the assistance of the Relief Committee, moved to other localities and are buying and erecting homes; others have purchased lots and are erecting homes at Monongah.

The funds in the hands of the Relief Committee are being paid over to the widows both for themselves and children, where it is found safe and advisable to do so, with instructions that the money allowed on account of the children be used to assist in their upbringing and schooling and that it must not be laid aside and held until the children become of age. In some cases, where necessary, the money is being deposited in banks with instructions for the banks to pay over to the families a certain amount each month until the fund is exhausted.

The Coal Company, in addition to a contribution of \$20,000 to the Monongah Mines Relief Committee, and to the supplies and free house rent which the widows remaining at Monongah are still enjoying at this date, settled upon each widow \$150.00 and upon each child under sixteen years of age, including children as yet unborn, \$75.00.

As soon as the mines were sufficiently cleared of foul gas for safety (which was practically the case the Tuesday following

the Friday of the explosion), several parties were formed for the purpose of determining the cause of the explosion. These parties consisted of the West Virginia State Mine Inspectors, the Ohio State Mine Inspectors, the Pennsylvania State Mine Inspectors and the party representing the Fairmont Coal Company. Each of these four groups worked more or less independently and each submitted as a body a report to the coroner's jury with the exception of the Fairmont Coal Company party, who were individually summoned and orally gave their opinions.

The report of the Ohio State Inspectors, filed at the coroner's jury, was as follows:

"Both mines were indisputably equipped with modern fans and machinery capable of furnishing more than double the amount of air current necessary to make all parts of the mines perfectly safe from a standpoint of ventilation, but on account of the general destruction, accumulation of wreckage and falls of roof, it was practically impossible to decide whether on the day of the explosion, and prior to that, the ventilating current was properly conducted and distributed through the inner chambers of the mine and the old abandoned workings where the elements of greatest danger are usually lurking.

"In a number of instances we noted that working places both rooms and headings, especially in No. 8 mine, were driven long distances beyond what is known as the 80 foot limit between the break-throughs. We understood also that the mines were not in operation the day previous to the explosion.

"It is reasonable to assume that in the quiet of the mine, especially if the barometer was low and weather conditions favorable, gas would generate and ascend to the highest and most favorable points and would remain there undisturbed by the action of moving bodies and diluted by a mixture of common air.

"About the time of the explosion, it is said a trip of 15 loaded cars, liberated by the breaking of an iron coupling pin, ran back 1,200 feet on an 8 per cent down grade and wrecked at the bottom of the No. 6 slope, tearing down the electric wires and causing a short circuit, instantly throwing out the circuit breaker.

"We made a very close inspection of this wrecked trip, and of its surroundings, and failed to find any evidence of fire or of any justification for the belief that the explosion originated at that point or by contact of the electric wires. Had the explosion started there it would have been demonstrated by a wreckage at the outer end of the No. 6

slope being close to the mouth of the opening, and by far the point of least resistance. There was no evidence of force between the outer end of the wrecked trip and the mouth of the slope, as three men were found dead in a tool shanty close to the outer end of the wreck without bearing any marks of violence.

"If the runaway trip occurred just previous to the explosion, which seems to be the general statement of those present, then we have no hesitation in saying that it may have played an important part in making the explosion possible. It can well be imagined how 15 loaded cars, weighing four or five tons each, running uncontrolled 1,200 feet down an 8 per cent grade into a mine opening which was the inlet of air, would cause such an extremely abnormal force as to raise the dust in the air and dislodge the latent gases in the most remote parts of the old workings in all sections of the mine, and drive these elements of danger on the open lamps of the miners in their working places. It is evident, too, from the report on the fire boss bulletin board at the mouth of No. 6 mine that traces of gas were found in several places on the morning of the explosion, but during our whole investigation we found very few traces of gas in either mine.

"If the runaway trip and the explosion were simultaneous, the wreck almost blocking the No. 6 opening might have prevented the destruction of the mine opening, but as at No. 8 mine the force of the explosion could have found relief in a destruction of the return airway and the No. 6 fan, which remained intact, only slightly disarranging the fan house by the concussion. Remembering that there is a gradual rise of the coal vein from the No. 6 to the No. 8 mine and that the elevation of the No. 8 mine is said to be 50 feet, it is but natural to assume that any light gases and fine dust disturbed by heavy falls of roof or high speed haulage system would drift in the direction of No. 8 workings and lodge at the highest available points in every part of the mine.

"Interior of each mine is reached and developed by seven (7) parallel main headings running west, the distance between the two sets of headings being about 4,000 feet, and south headings. The connection is said to have been closed by stoppings and doors, each mine having an independent system of ventilation.

"Notwithstanding that every person in No. 6 mine was lost, the terrible fierceness and destructiveness of the explosion is much more apparent in No. 8 than in No. 6 mine, the greatest force coming from the inner workings and leading outward,

increasing in force, and volume as it swept the dust laden headings leading to the No. 6 opening.

"We noticed many evidences of great want of skill or practical experience in the locating and drilling of holes, as well as the want of judgment in the use, and in many instances the very excessive use, of blasting powder, and in two particular instances blown out shots were found where all the surroundings would justify the opinion that an explosion had taken place at both points, namedly: A point known as No. 1 right air course to main west heading. In the face of this heading a seven foot cut was made in the coal and one blast had been fired, the hole having been drilled very high and pointing upward, the blast blowing off a portion of the coal, leaving two feet of the hole and failing to break down the coal which it was intended to remove. The coal from the blast was thrown back a distance of 25 or 30 feet, and the coal charred and much dust in evidence around the face of the heading, as if an explosion had taken place. There was an entire absence of any sign of anyone having been in the place after the blast. The miner's tools were lying in the break-through leading to the parallel headings about 25 feet back, just as if they had been placed there by the persons for safety while firing the blast. The heavy iron track rails with parting through the break-through were twisted and torn and thrown outward for 12 or 14 feet and the body of the miner who had evidently been in the break-through waiting for the blast was scattered around in the break-through to the parallel entry and outside of the break-through, in a dozen or more pieces, and had been overlooked by the exploring party one week previous when they found the body of a man in the face of a parallel heading 25 feet inside of the break-through, who had been shielded from the force, but died from concussion or after-damp. All indications were that the force was outward from the face of the heading where the blast had taken place.

"Another blown-out shot had occurred in room No. 51 of second right off first south heading. The hole was drilled towards and bearing on the left rib of the room. The front of the coal was blown off, but 3 feet 9 inches of the hole remaining. The coal was somewhat charred on the side of the room near the outer end of the drill hole. The coal from the blast was slashed against the pillar opposite the neck and the room two feet back and coal on pillars greatly charred showing signs of fire from explosion. On the same heading at 27 room neck, a 5-ton gathering motor and a number of empty cars were thrown across the track and piled up by the force of the explosion, which was strongly in an outward direction. The

motors and cars supposed to have been going in at the time undoubtedly met the force of this explosion. The above are only two out of a number of instances showing that blown-out shots are rather a common occurrence, and that life and property are always in danger under such conditions and circumstances. There will, no doubt, be many theories as to the cause of the explosion, all more or less sustained by facts, but none left to tell the tale or give any reliable information as to the conditions of the mines or defects of the ventilation in the inner working places, or the dangers that existed on the morning of the explosion resulting from roof falls or other causes during the previous day when all the work in the mine was suspended. It is more than doubtful if ever the real or original cause will be known.

"It is our opinion that the explosion may have occurred in either mine, and could have been caused by a miner's lamp coming in contact with gas, or by a blown-out shot, raising and igniting the gas, but the effect of the greater force is most visible at the heading of the leading heading on the No. 8 side. At a point near the connection of the two mines there has been a whirlwind of force and destruction and a division of the force is evident, going toward both No. 6 and No. 8 territory, increasing in volume by series of new explosions or reinforcements fed by great accumulations of coal dust spreading destruction in every part of the mine unless where its force was diminished by the presence of water or dampness, or the absence of coal dust.

"Whatever may be the conclusion of theorists and experts, suffice it to say that from a practical standpoint, at the time of the explosion in West Virginia and in other states or wherever they may occur, they cannot occur except where there is an accumulation of these destructive elements sufficient to cause such appalling results and a favorable opportunity for setting them in motion. In olden times, such awful catastrophies were looked upon as a visitation of the vengeance of a Supreme Power, and yet some people at this day say they are unavoidable. It is impossible for such things to occur with a proper knowledge of the accumulating dangers possessed by those in authority looking after the inside of mines and they exercise the necessary diligence to steer clear of that point of danger, if the necessary facilities are provided for doing so.

"We feel that the sacrifice of over six hundred lives by mine explosions in Pennsylvania, West Virginia, and Alabama during the present month ought to stir the loyal sensibilities and teach a never-to-be-forgotten lesson to those connected with mines, prompting every possible

precaution against such calamities. We are not disposed to criticize, and particularly not in an unfriendly way, but we are not clear as to the advantages to be derived from the system of driving seven parallel main headings. It is clear, however, from what we have all seen, that in the Monongah case they acted as storage chambers for mine dust, which we consider is one of the greatest sources of danger at those mines. The great evil of connecting mining properties is also forcibly presented in this case by doubling the number of the dead. In the annual report issued by the Department in 1904, we wrote a rather strong comment against the dangers and evils incident to the connecting of mining properties, and closed with the following paragraph:

"We fear that if there is not some check in this direction and more care exercised about the connection of mining properties, that the time is not far distant when the subject will be presented to the people in such a serious aspect that a prohibitory law will be enacted."

"Close observation and striking recent events justify the further prediction that if the general conditions of operating mines in the various states is not soon covered by adequate Federal laws that the sacrifice of human life in the mines has merely just begun."

The Pennsylvania State Mine Inspectors' report was submitted to the coroner's jury, but was not entered as testimony in the records.

The Pennsylvania State Mine Inspectors' report:
"***We spent one week in making the examinations, which gave us sufficient time to travel through all the principal working places of the said mine, thereby familiarizing ourselves with the conditions therein, as they now exist, which enabled us to arrive at a reasonably accurate conclusion relative to the cause and the location of the initial point of the explosion.

"Our observations revealed to us evidence of the awful power of the explosion. We noticed the iron and concrete work of the tunnel leading into the powerful fan and the massive timbers adjacent thereto, at the entrance to No. 8 mine, forced hundreds of feet from their position. Inside of this mine we saw overcasts of concrete, strengthened with steel rails and wire ropes, blown to fragments and some pieces of them nearly 2,000 pounds in weight moved many feet from their proper locations; concrete and wood stoppings practically all destroyed; mine cars, loaded and unloaded, torn to shreds and forced into every conceivable position and in every direction; electric wires blown down and motors disabled; timbers displaced and general debris scattered hither and thither about the mine. Intense heat was manifest in rooms and headings in many locations

posts charred; coked dust on roof and coal walls and cones of soot adhering thereto; solid coal pillars spalled or blistered and actually on fire. We saw evidence of coal having been shot out of the solid wall face by the miners; bad judgment used by them in placing of the holes in the coal seam and shots had been fired without doing the work they intended to do and much dust everywhere in the rise workings.

"From a very careful examination of the existing conditions of these mines and calling into requisition all of the known evidence, such as the abrasion of the sharp projections of the coal pillars along passageways, the unmistakable fine dust deposits or dust eddies at sharp pillar projections and crossbars and the dust eddies formed and floor swept clean of dust along the blast's path and carrying of heavy material in well defined directions, the forcing of coke dust in corners of coal pillars, the bending of T iron rails and switches, etc., which would guide us in arriving at correct conclusions as to the initial point of the explosion and the direction of the primary forces developed by it; we are of the opinion that the ignition of the explosive elements was either in No. 2 or 4 headings of No. 3 right north face heading off the south main headings in No. 8 mine and caused by the flame projected into the dusty atmosphere with great velocity from shots fired there. However, there are well marked evidences of an explosion having taken place in No. 3 left butt heading off No. 2 north face heading, possibly simultaneously (or it may have preceded it, which is not easily determined), with the one in No. 3 north heading, but of much less intensity. The greatest factor in the explosion was the extremely fine dust raised into the atmosphere by the concussion, superinduced by small quantities of explosive gas. We have no doubt that the exploding of black powder in some sections of these mines, added to the destructive forces materially.

"The compression developed at the initial point of the explosion reached through all the ramifications of the two mines in a very short time, the power being tremendously accelerated as the blast proceeded along its pathway. The coal gas and the carbon monoxide produced from the dust extended the flames and when the mixtures encountered were of an explosive character, they developed local explosions of great force in many other portions of these mines and in many instances showing opposing forces, thereby making it very difficult for the inexperienced investigator to correctly follow the true trend of the primary forces. The energy developed from the seat of the explosion outward divided itself at the main south headings. The major portions proceeding down these headings and right air courses and the minor went almost directly to the second left south face headings and to the butt headings therein; then rebounding back to join the major portions, and all proceeding down the seven passageways and the two No. 1 headings on the left, toward the mouth of No. 8 mine. Again the

rapidly moving blast divided itself into three divisions at the overcasts at the junction of the No. 1 south face and No. 2 north mouth of No. 8 mine, one part going along No. 2 north face headings, invading all the workings of No. 8 mine therein and all those in No. 6 mine, gaining power as it proceeded on its journey from local explosions to the mouth of No. 6 slope. The other divisions reached the workings to the south and went out at the two points of exit there.✓

"The evidence seemed to be of an unmistakable character at these main overcasts as to the direction and division of the reunited blast. The great violence of the explosion displayed in many of the butt headings were local in character with no well defined direction, which was to have been expected in such extremely dusty mines. The intense heat so marked in many sections of these mines, showing the charring of the room posts, the manufacturing of the dust into coke, the blistering and spalling of the coal and the soot, etc., were produced in rather acquiescent atmosphere and out of the range or line of the very rapidly moving forces.

"So far as our observations went, together with the conditions now existing, could guide us in determining the true character of the Monongah Nos. 6 and 8 mines, it is our opinion that very little explosive gas is being generated therein. We only found a trace of explosive gas at two points. One of these was on top of a roof fall in No. 14 room in No. 3 butt heading of No. 1 south face headings and the other in a roof cavity at the face of the fourth heading in No. 3 north group of headings in No. 8 mine, both were found at points where the ventilating currents had not been fully restored. There may have existed explosive gas in No. 6 mine in portions of it where we were unable to visit through lack of time and some of them being inundated with water. We have no doubt, however, that explosive gas is being produced in limited quantities as the newly cut wall faces are being exposed and especially is this true where local faulting of the coal seam occurs.

"These two mines are extremely dusty, and fine coal dust, especially that of a bituminous character, is highly explosive where the dust is raised by the concussion from an overcharged or blown-out shot when flame is projected into the dusty atmosphere with violence, especially is this true when the air of the mine is mixed with a small percentage of explosive gas. This danger has been known to all intelligent mining men for many years.

"**Shooting the coal out of the solid should be prohibited by law and not allowed under any conditions and the coal of such a height as that found at the Monongah Nos. 6 and 8 mines should be shot down in two benches.

***Two mines of such extent as these of the Monongah Nos. 6 and 8 should never be connected, especially where marsh gas is being generated or when such fine dust is being produced. The number of persons to be employed in single operation inside should be regulated by law.

**The general plans to admit of the circulation of large volumes of air in the Monongah mines Nos. 6 and 8 are excellent; the ventilating fans were of the very best type and of ample power, and the volume of air they were producing, if properly distributed to the face of the interior workings, was sufficient to have kept these mines in a healthful condition, but powerful fans and the circulation of large volumes of air will not prevent dust explosions, hence to prevent a repetition of such a disaster as happened at the Monongah mines recently, we advise all persons engaged in official capacity to give more serious attention to the dust problem and the dangers it involves and to deal with it in an intelligent way."

The West Virginia State Mine Inspectors were not unanimous in their opinion. One report bearing the signatures of ten out of twelve deputy inspectors is as follows (exception, however, was taken by one inspector, which will be noted at the end of the report.)

***After a thorough and careful examination of these mines we find them very dry and the principal part of the coal was being mined by electric chain machines, which created a large quantity of coal dust and this being conveyed to all conceivable parts of the mine by a high velocity of air, and under these conditions we do think this explosion was caused from coal dust. The probable point of origination we believe to be at the face of the third left entry off second north in No. 8 mine, which was followed by a series of explosions throughout the two mines. We arrived at this conclusion because of the conditions existing which are as follows:

This entry was exceedingly dry and dusty. A shot fired at the face of the entry had been fired, 4 feet 8 inches of the hole remaining. Two feet 8 inches of the hole had blown down, two feet of the remaining was in the solid coal and was practically a blown-out shot.

"A shot had also been fired in room 23, which room was 25 feet deep, the coal being down. The bodies of the men which had worked at and near this face of this heading were found at mouth of room 20 and 21. Five of these bodies were found at the mouth of room 20 and two at the face of said room. Six bodies were also found in the neck of room 21. The finding of these bodies at this point would indicate that they had retired there while their shots were being fired. The evidence in this entry is

conclusive that the force came from the face towards the south north entry, which is fully demonstrated by the round corners of the coal on the inby exposures. A motor trip of 12 loaded cars at 18 and 19 rooms seems to have offered resistance to the force, diverting it into the rooms above the trip, where it appears to have been supplied with additional force, coming out the said rooms, derailing the said cars against the north side of the entry.

"At the mouth of this third left on the second north entry shows indications of gas having been ignited. The conditions at the face show the effect of great heat over the roof and sides, only half way down to the pavements. In the roof at rear end of a machine standing on the right hand rib there existed a large cavity where gas might have accumulated and which might have been ignited by the machine man setting rear jack. The machine truck was thrown across the track from the face and indications show that the force traveled right and left through break-through to numbers 21 and 23 rooms, throwing the track in No. 23 room toward No. 24 room and debris being thrown through break-through towards No. 21 room; the force continuing its course down the lower rooms toward the mouth of the entry. A trip of loaded cars with motor attached standing on the entry at Nos. 16 and 17 rooms was thrown against the north rib of entry, indicating that the force had been reinforced in said room.

"Second, at the face of the main north airway, approaching the third north entry, a serious disturbance occurred which seemed to be due to an overcharged shot. The man working at this place was literally torn to pieces and the tracks torn up and strewed along the entries toward the mouth. This man was probably standing in the last break-through near the face.

"The body of a man which was nude and burned, but not mutilated, was found at the face of the entry parallel to the one in which the shot was fired; he was evidently protected by being out of the line of force. Judging from the condition as to the mutilated body of a man, the direction of the wreckage, etc., it would be reasonable to conclude that the force had its origin in these entries, but on following its course outward we come in contact with evidence of greater force coming from the other directions.

"Third, on second right entry off first south in mine No. 8 a trip of cars with motor was badly wrecked at 26 and 27 rooms. The indications were conclusive that the force wrecking this trip came out the entry.

"In room 31, which was only driven off the entry about 12 feet, on the extreme left of face, a drill hole which was improperly placed, having been fired, 3 feet 9 inches of the

hole remaining. A man was found in this room. Rooms below this point show evidence of intense heat and charred dust. No where in the two mines was such heat in evidence as in rooms on this entry. At the time of exploring the mines after the explosion, we found fire damp in several places in these mines, but only found it after the ventilation was restored in the third north heading and sixth left air course off E face entry.

"A large piece of concrete, which had been in part of the overcast at the junction of the first south with main entries was carried by the explosion 60 feet towards the south right entry off first south, which was evidence that the explosion had gone in that direction.

"The conditions in each of the three places would warrant the opinion that the initial explosion may have occurred in either, but upon tracing the direction of the forces we are met by evidence of greater forces moving in one general direction along the main heading. This is not the case at the mouth of the third left off second north where, as heretofore mentioned, the evidence goes to show that the force coming out of the third left divided, part going to No. 6 mine and the other to No. 8. The switch lever at the mouth of fourth left off second north and spreadrail are bent toward No. 6 mine. The post which supported the door separating the two mines was found standing in such position that no force could have thrown it toward No. 6 without breaking it, while the last force exerted would have thrown it toward No. 8 mine. This evidence we deem conclusive that the force of the explosion travelled from No. 8 mine into No. 6 mine, which was pronounced in the following sections:

"At the face of H face entry a body was blown to fragments and all other conditions indicated a violent force here, which continued on its course to the mouth of H face and up G face heading where it gained additional force, and returning down G face entry, thence down third, second and first right entries off G face through rooms connecting to the face of E face heading, where evidence existed of violent force; evidently it was reinforced at the head of sixth left, E face, causing a terrific force to go down to and out E face entry as evinced by the dismembered and mutilated bodies of men and animals found on E face and the demolished cars, and the destruction of the overcasts at the mouth of the butt headings and the overcasts at the junction of the main entry. The forces coming out of E face joining with the force coming down the main entries continued its course on out the headings and airways, exhausting itself in the left hand workings, intake and outlet airways.

"We are of the opinion that the trip of loaded cars which broke away and ran down the slope was merely a coincidence with

the explosion and bore no relation to the explosion, except that it could have caused only a slight compression of air. A thorough investigation of the wreckage of the runaway trip and the surroundings at this point fail to disclose any evidence that the explosion originated at this point.

"In our judgment, dust being the principal factor in the fearful explosion, causing great loss of life and destruction of property, we believe that the loading out of the dust as far as practicable, and the keeping of all parts of the mine well watered, especially at, and near the working places, would minimize the probability of an explosion. And by the adoption of safety explosives, the danger of an explosion would be much less probable.

"It is an undisputed fact that the condition of a mine as to moisture is governed largely by atmospheric conditions and temperatures, a mine which through the summer months may be moist throughout, by sudden lowering of the temperature, becomes dry, especially where large volumes of air is circulated through the mines, and in the absence of mechanical wetting of the mine.

"The ventilation in these mines was produced by two large fans propelled by steam power, and conducted principally by brick and concrete overcasts and stoppings, was in our judgment generally good throughout both mines, and the system and modern plans of the mines were of the best and second to none in the State."

The exceptions to parts of this report filed by the Deputy Inspector of District No. 2 were as follows:

"***First, on page one it reads as follows: 'The probable point of origination, we believe, to be at the face of third left entry off second north, in No. 8 mine. It should be read: "The origination of the explosion, we believe to be on the third left butt entry off the second north in No. 8 mine."

"Second, in addition to the description of the conditions found on examination of this entry, the following should be inserted:

"In crosscut, separating rooms 13 and 14, on this entry, a violent explosion of powder had evidently taken place, as two exploded cans of 5 lb. capacity were found therein, with sufficient evidence of a former violent internal explosion in each. Tracks, props, and debris were violently hurled in opposite directions from this point. Two bodies were found near this point badly burned, which we believe were in the crosscut at the time of the explosion of this powder occurred. Either of the above described conditions might have caused this deplorable accident and one or the other of them, in our judgment, did cause it.'

"Third, on page second of the report the reason assigned for the

force coming out of the rooms, I think, illogical, as it is my judgment that the original heat caused by one or the other of the above described conditions, ignited the dust, distilling therefrom the hydro-carbons it contained, and at the same time consuming the overplus of oxygen contained in the normal mine atmosphere, and had probably travelled some distance from the initial point along the entrance and in the rooms, in the form of flame, before an explosive mixture of gas and air were combined. This, I think, a reasonable solution of the place mentioned. As proof of the above I cite you to the position and condition of the three bodies found underneath the two loaded cars, which stood directly in front of room 20. These bodies were found with no lacerations. The cars were derailed and hurled toward the north rib of entry, which separated it from the air course. I think it would have been impossible for these bodies to have been blown under these cars if they were standing or even sitting at the time of the explosion, without great laceration. The position and condition would indicate that they saw the flame approaching and had lain down for the purpose of having it pass over them when the explosion occurred, which blew them under the cars.

"Fourth, the description of the conditions found in the main north air course, No. 8 mine, of course would have to be stricken from my report as I did no visit this section with the party on official examination on account of serious sickness."

Deputy Mine Inspector of the Third District submitted a separate report as follows:

"***In my judgment this was a dust explosion with some gas and powder which added its force as the explosion proceeded through the mines. It is my opinion that the cause of the explosion was a trip of loaded cars broke loose from the rope as they were being drawn out of No. 6 slope mine and when near the top of the slope the coupling pin broke and let the entire trip of cars back down the slope and wrecked at the bottom of the slope, thereby causing an immense cloud of very fine coal dust in suspension which was exploded either by open lights or an electric flame produced by a short circuit of the electric wires. I am inclined to believe it was the latter, and from the bottom of No. 6 slope it continued down the main headways and spread through the headings on the left of the main and in the direction of F face heading. Also down the main heading to F face heading and spread through all the butt headings on E face with the force in the direction of No. 4 north face heading, as is evident by the overcast being blown up the butt heading in the direction of No. 4 north face heading. Also overcast in heading to the left of main heading was blown in the direction of F face heading. The explosion continued up F face and into the air course of No. 3 left heading off No. 2 north heading in toward the loaded track. In my judgment there was some gas in some of the rooms of the headings at the time of the explosion. The explosion gathered force along its course from the

bottom of No. 6 slope and when it reached the third left off second north heading No. 8 mine almost instantly became a mass of explosion and would naturally seek the line of least resistance, which was out the opening of No. 8, and out of the several holes fallen through the surface in No. 8 and at that instant a very small part of the explosion returned down F face toward No. 6 and went out of No. 6 opening. It is evident that the part of the explosion returned down F face heading last. There must have been several hundreds pounds of powder exploded which would add force to the explosion, but owing to the most excellent ventilation that I have reasons to believe was maintained in these mines, I do not think that there was any great quantity of gas present at the time the explosion occurred. This was simply a dust explosion, and a similar calamity is liable to occur in the future if the dust is not properly taken care of."

The Deputy Mine Inspector of District No. 1 which is the district in which these mines are located, submitted an individual report as follows:

"***In my opinion this accident was caused by nineteen loaded cars breaking loose at the top of the incline at mine No. 6 and running down a none percent grade into said mine, a distance of nearly one thousand feet. This trip of cars, which contained between forty and fifty tons of coal, jumped the track at the bottom of No. 6 slope completely wrecking all of the said 19 cars, closed up the entrance of mine No. 6 at the point of wreck, and produced, in my opinion, not less than ten tons of coal dust, which was ignited at this point by a short circuit in the electric current--the system of electric wires being torn down at this place by the wreck. This explosion extended into the interior of the mine, causing the greatest mine disaster in the annals of American history, destroying all the lives in both mines except those of five men. The dead, in my opinion, will number 360 persons.

"You will observe by examining the maps of these two mines that they are connected near their centers by three small openings, each covering the area of 70 feet.

"You will also observe by my former reports to you of these two mines, that they were in first-class condition at the time of my inspection.

"This accident has been caused by a violation of my orders, namely, that of not keeping a man at the throw-off switch at the mouth of the entrance of mine No. 6, and not keeping the coal dust properly watered down at the bottom of No. 6 slope and along the headings leading from this point into the interior of the mine.

"There is nothing plainer in the history of mine explosions than the fact that the above mentioned wreck caused this great disaster.

"In regard to ventilation, there is about 90,000 cubic feet of air entering this slope per minute; the velocity is about 14,000 feet per minute."

In addition to the Deputy State Inspectors, the Chief of the Department of Mines of West Virginia made a separate report, as follows:

"***I fully realize that there is a considerable diversity of opinion among educated mining men in regard to explosions in coal mines that may be attributed to dust. From the condition of these mines and the reports made on them by persons who have testified in this hearing, I am led to believe that they were mines that were well ventilated so far as taking care of and properly diluting any explosive gases that might be liberated or generated in the mines. In reference to the runaway trip that occurred, I am satisfied that this is a remarkable coincidence. If the theory advanced and accepted by the authorities in foreign countries including Belgium, Germany, and France, should prevail, more consideration might be given to the theory of the runaway trip having been an important factor in the explosion.

"In reference to the atmospheric conditions affecting this explosion, it is well known, and has been fully sustained by evidence given, that the humidity of the air and temperature are large factors in reference to physical conditions of any accumulation of dust that might be in the mines, or in suspension in the air of the mines at the time of the explosion. There is considerable yet to be learned in reference to the factors that enter into dust explosions and as to the various means of propagating the explosions throughout the mines. The accumulation of dust in coal mines is due to various causes. First, to the mining of coal, the blasting of the coal, the breaking up of the coal, the transportation of the coal and its breakage and pulverizing by animals and man treading on it. There is considerable diversity of opinion among mining men existing on the efficiency of watering the dust on the entries and in the rooms.

"It is contended by some that there is no necessity of putting water in the rooms where men produce the greater quantity of coal, but the evidence at hand and by my own observations after an explosion have been to the effect that the evidence of greatest heat is usually observed in the rooms of mines rather than on the entries. Conditions in the rooms appear to be more favorable for the generation of heat while the mechanical effects are more in evidence on the entries

"The propriety of watering a mine may be many fold: First, the dampening of the material with which the water comes in contact; second, that it may answer the purpose of evaporation adding to the humidity of the air of the mines; and third, having a tendency to reduce the temperature of any explosive gas that might be enflamed.

"Important factors tracing the evidence of mine explosions may be one of heat against the mechanical forces. It is clear in the evidence that has been given so far, that either the heat evidences have been ignored or the mechanical forces have been ignored to a large extent. Another question to be considered is in reference to the recoil of an explosion, such as, for instance that might occur in what is known as a tight end, or near the head of an entry, some people call it the back-lash. It has been stated that this recoil has been very violent. It is contrary to the law of physics, that the back-lash should exceed 14 pounds pressure per square inch, it should not exceed the atmospheric pressure. From my observations in these mines it appears that there has been an explosion originating in one particular section of the mines, by the enflaming of dust and that both dust and chemical forces demonstrate that there has been reinforcements by local explosions.

"These local explosions may have been caused by one of the following means: the dust in its agitation may have been ignited by flame; it may have been ignited by incandescent carbon that may have been floating through the air; the dust and the air may have been ignited by an open light carried by a miner. The dust and the hydro-carbons liberated may have been ignited by compression due to the force of an explosion in some other part of the mine. I take no exceptions to that part of the theory advanced of the formation or distillation of gas from the charred coke. We well know that coke can not be formed without the generation of explosive gases.

"The evidence of the force of travel of an explosion may be observed from the rounding effect of the exposure of the coal. This may be brought about by means of what may be called first, a sand blast, or second, heat blast. The effect of a small percentage of methane gas is well known to be a source of danger in the presence of dust where there may be a temperature sufficient to ignite it. The gas found after an explosion in which dust has been an important factor may be carbon monoxide, ethylene gas, acetylene, methane gas, and possibly some oxygen and some nitrogen and carbon dioxide. As evidence of the distillation of these gases as found in these mines is a substance that has been called stalactitic carbon or asbestos carbon, known by some, that is partially in evidence by the burning of the distilled gases from the coal. There is some diversity of opinion in regard to the velocity of explosives per second, but the authorities I have consulted give 75 percent dynamite at 15,000 feet per second, marsh gas with oxygen 6,850 feet per second! There seems to have been few practical experiments made with the gases other than the laboratory tests with oxygen to determine the velocities. In reference to black powder the information is exceedingly meagre, however, the authorities conferred with assign to black powder a velocity of 4.6 feet per second, that might be strung along a board. These have some bearing on the velocity or ignition of an explosion of gas or dust and air.

"An important factor of dust explosions is the limit of the

inflammability of the mixture. It is well known that gases of certain percentage will explode and when these percentages are lowered or increased by certain agencies, you do not get an explosion. That is true of a mixture of dust and air or dust in the presence of explosive gas that may have been distilled from the coal. The evidences throughout these mines seem to confirm this idea, as indicated by the presence of charred dust and blistered coke at various points. That might be brought about by the travel of the accumulated dust and the air, by reason of the fact that at some particular point some obstructions may have interfered and caused a mixture to be made at that point that would permit of an explosion and the plastering of the charred dust or coke against the wall or the plastering of the dust that might be in suspension against the wall. The important factor in connection with the danger of dust explosion is that coal when broken or ground up fine liberates a certain amount of explosive gas. This gas might not be sufficient to be ignited by an open lamp or detected with a safety lamp, but upon chemical analysis it is found to be present. That, in connection with conditions, favorable for the ignition of coal dust, would easily favor and add to the explosive force.

"This propagation of an explosion by inflammation of coal dust may be by reason of a flame being transmitted from one point to another by the particles of dust that may be in suspension. It may be propagated by means of flame itself and may be propagated by the local explosions in transit that I mentioned, as well as by the incandescent carbons.

"No practical experiments have been made in reference to pressures that may be given off in a mine by explosion for reason of the fact that it is impractical to make a test on a large enough scale to be of actual benefit. Theoretically, methane gas with oxygen gives about 13.6 atmospheres when exploded at atmospheric pressure. Another reason I may mention to account for there being a lack of information on higher pressures in explosions in mines is that the pressure is probably reduced by dissection of products formed at high temperature, very little is known of what the actual conditions are, especially as gases under high pressure and high temperatures often times change their specific heat, which changes are large factors in matters of this character. At least 95 percent of the explosions that I have come in contact with occurred in mines in which electricity is used, consequently I think it would be well to give attention to the probable formation of ozone, which is a high oxidizing agent, in connection with dust explosions.

"As to preventative measures for dust explosions, I believe in a liberal supply of water throughout the mine and the adoption of safety explosives. In reference to my ideas to the origination of the explosion in these two mines, as I previously stated, the runaway trip is worthy of serious consideration. I can see where there would be a possibility of an explosion having originated at

that point which may have produced favorable conditions in different parts of the mine and caused local explosions at these and other points. There are several points at the face of the workings where evidence of considerable heat and violence is manifested. It is not necessary, according to my observations, that you have evidence of great heat or violence at the origin of a dust explosion. A dust explosion usually accumulates in power as it travels, causing destruction on the intake air course, where it has free access to a supply of oxygen.

"In formulating my judgment, and this is the first time I have expressed it, I am constrained to corroborate the idea that this explosion may have originated in third left entry off second north in No. 6 mine. The conditions in there were favorable for the inflammation of the coal dust that may have been in suspension in the air, or of the fine coal dust that may have been on the ribs. There was evidence of some coal having been recently blown or blasted down. That coal disengaged fine dust and put into suspension fine particles of methane gas, which in turn were all taken into the intake air current and carried towards the head of the third left entry. The blast at face of entry seems to have done its work only partially. Some two feet of the hole remained in the solid coal, giving evidence of an overcharged shot. That, in my opinion, would have been sufficient to have inflamed the dust with its accumulation of these gases that may have been generated by the mining and the blasting of the coal.

"***The atmosphere under certain conditions and temperatures, has the ability to hold in suspension a certain amount of moisture, and when it has all in suspension it is capable of holding, it is said to be saturated; that is, it can hold no more moisture in suspension. By a change in temperature of the air, by increasing the temperature of the air, it is able to hold a greater percentage of moisture. By decreasing the temperature of the air, it is not able to hold all the former moisture, and so the moisture is precipitated, or drips, when it comes in contact with the surface or exposures, or whatever it may come in contact with. In summertime, the air outside being usually of a warmer temperature than that of the mine, it may go into the mine holding a larger percentage, but on coming in contact with surfaces or exposures such as the roof, sides and pavement of the mine, its temperature is reduced, consequently it deposits a part of its moisture on all surfaces with which it may come in contact. In the winter time the conditions are different; usually the temperature on the inside of the mine is warmer than on the outside. The air coming into the mine at a lower temperature has in suspension a certain amount of moisture, and in going into and through the mine it is heated and then has the property of taking up more moisture, and if there is any opportunity of taking up moisture (and all substances contain more or less moisture), it absorbs additional moisture; and thus the moistures of the surfaces and exposures of the

coal are absorbed by the air as it travels through the mine.

"I have, as evidence of the above, conditions taken at No. 8 mine a few days ago. Just inside the main return airway, about 30 feet, we found the humidity to be 93 percent while on the outside of the mine the humidity was only 48 percent. At No. 6 mine I found the humidity outside to be 45 percent, and about 1000 feet inside the mine, near a steam pump, probably 15 feet from the pump toward the outside, on intake current there was a humidity of 48 percent. There was some little steam escaping from a drainage pump, and about 50 feet beyond the pump there was a humidity of 66 percent, showing that the escaping steam had added about 12 percent to the humidity of the air."

The observations and conclusions of the Fairmont Coal Company engineers as submitted in evidence before the coroner's jury are, briefly, as follows:

After the first hurried and preliminary tour through the mine they found that there had been more than one explosion, and the usual method of tracing to the origin by following the manifestation of force could not be relied upon. It was concluded that the conditions resulting from several or many rapidly succeeding explosions would be an oscillating motion of the air current and the final indications of force would be the result either of the greatest or the last but unlikely to be the first.

Direction of force was not entirely abandoned, but was considered of secondary importance, while the principal object was the location of various local explosions. These areas were distinguished by the blistering of the side walls and roof or the coked coal on sides, top or floor. A map was constructed on which these areas, which they chose to call "flame area," were plotted.

The flame areas received further and more critical examination under the assumption that the original explosion occurred in one of these. Probable locations for the accumulation of fire damp, blown out, windy and tight shots, and the location and condition of explosives were carefully sought for.

From previous knowledge of the mine, fire damp was entered as a possibility but hardly probable, neither of the two mines made any considerable quantity of gas, and subsequent careful tests on the gas generated in these mines show that, considering the area under development, the amount is too meagre to be considered as an important factor. The possibility of a "blow out" of gas still remained but such had never occurred in this region before the explosion, or since.

Blown out shots were found in several places within the flame areas, but none of these appeared to satisfy the conditions necessary for an originating explosion. Blown out shots are

comparatively common occurrences in the mines of this region and the possibility of coincidence is therefore large. The location of men in relation to shots fired just previous to the explosion is not conclusive evidence. More than one shot per minute is the average in these two mines, so that probably 10 or 15 shots were either in the process of being fired or had just been fired, in which case coincidence would again be a strong possibility.

At only one place in the mine did they find where powder had exploded. This was the crosscut between rooms 21 and 22, second right, Monongah No. 8 mine. Two of the regulation 5 pound powder cans evidently placed in the crosscut by the miners were found exploded.

This point, of all places, in the two mines showed the greatest temperature and most heat. It was also surrounded by the largest flame area of intense character throughout.

From the lack of more positive indications elsewhere this point was taken as the origin of the explosion. It seems that elsewhere in the mine, powder cans were not exploded and that the explosion passed over them without effect. As further argument of this being the origin it was assumed that it required a local explosion of some magnitude to start the series of explosions; again, as dust was a large factor in the propagation it required an explosion which would stir up a considerable amount, which an ordinary windy or blown out shot could not do, both from lack of force and location of holes, which are far above the loose coal and accumulation of dust on the floor of the mines and finally the explosion of powder was the only unusual circumstance that could be found, excepting of course the runaway trip. They do not attempt to state how the powder was ignited, whether accidentally or maliciously.

There remained to be explained the propagation of the explosion from one flame area to another. The flame areas were almost without exception limited to room workings, only occasionally were they found in entries and then only to lap from one room to another, between which no crosscut had been driven. These flame areas occurred where men were working, in rooms where no one was working, in old abandoned rooms that, outside of fire bosses with safety lamps, had not been entered for many months, and in rooms wet and damp by the natural accumulation of water. This indicated that an entirely foreign source of ignition than is usually found in mines such as open light and electric wires, was in force to ignite the explosive matter occasioned by the original or immediately preceding local explosion.

In the second south heading of No. 8 mine, where it was assumed the original explosion occurred, analyses of coke and charred coal

were made and the quantity of coal so affected was estimated in order to determine how much volatile and combustible gas had been liberated.

A minimum estimate showed the equivalent of 52 tons of coal had been volatilized which would produce not less than 225,000 cubic feet of explosive gases. Conditions existed for the ignition or explosion of these gases, but not the entire quantity, as there was but 1-3 enough air in this particular heading for complete combustion. All flame must, therefore, have been extinguished in this heading from lack of air to support combustion.

The excess gases, that is, both the unconsumed explosive and noncombustible, were forced out to other parts of the mine by the increased pressure occasioned by the powder explosion and such gases as were consumed or exploded.

These gases traveled along the lines of least resistance; the ventilating system having been destroyed by the first series of explosions allowed them to escape in all directions.

The gases were without flame in the headings from the fact that they could not mix with air, but pushed it straight ahead, but in entering side headings with rooms and crosscuts, opportunities presented themselves for making a mixture with air which may or may not have resulted in explosive mixtures.

If sources of ignition were present at the point of such explosive mixtures a second explosion would produce more explosive gas, making a repetition of the second explosion possible. In each case the oxygen was entirely consumed and the flame extinguished.

If the trend of the explosion had been entirely in one direction or course through the mine the successive explosions would have become weaker and weaker and possibly entirely eliminated by the constant increase of carbon dioxide and inert gases.

But from the originating point they spread in several directions; making the explosions parallel rather than in series, giving each of the splits a separate source of air to draw from.

As has previously been noted, some of the secondary explosions occurred in abandoned sections of the mines and, therefore, could not have been ignited from open lamps of miner. The gases themselves must have conveyed their own source of ignition. Through the mine there was found on posts, cross timbers, and even side walls occasional deposits of coke, evidently deposited by accumulation of small particles. As these were almost always agglomerated, it indicated that they were hot or semi-fluid when deposited.

There must have been from the evidence, hot particles of coke

in transit, coincident with the explosion. These particles travelling in noncombustible gas would not be incandescent but contained sufficient heat to burst into flame as soon as they came in contact with air.

These particles, originally incandescent, travelling at a terrific speed, would not have time to lose their heat in their transit from point of origin to an explosive mixture but retained sufficient temperature to act as the igniting agent.

The coroner's jury, after deliberating several days on the evidence of witnesses examined, and reports of experts both individually and collectively, rendered the following verdict:

State of West Virginia
County of Marion, to-wit:

An inquisition taken at Fairmont, County of Marion, State of West Virginia, beginning at Monongah, December 7th, 1907, and concluded at Fairmont, West Virginia, on the 14th day of January, 1908, before E. S. Amos, coroner of said county, upon the view of the bodies of A. H. Morris, Chas. McCane, John M. McGraw and about three hundred and fifty other bodies then lying dead.

The jurors sworn to inquire when, how and by what means the said A. H. Morris, Chas. McCane, John M. McGraw and about three hundred and fifty other persons came to their deaths; upon their oaths do say that we find from the evidence in our possession that A. H. Morris, Chas. McCane, John M. McGraw and about three hundred and fifty others (whose names are made a part of the record herein), came to their death on the sixth day of December 1907, by means of an explosion in Monongah mines numbered six and eight, owned or operated by the Fairmont Coal Company, which was caused by either what is known as a blown-out shot or by the ignition and explosion of powder in mine number eight.

As to which caused the initial explosion, the evidence and opinion of mine experts and other witnesses, was conflicting.

We further find from the evidence that the traces of gas in these mines were slight, and not considered dangerous, and dust which was created was removed or kept watered down as far as was deemed practical, and that in operating these mines the company complied with the mining laws of the State.

RECOMMENDATIONS

As there are many other unsolved problems connected with mine explosions in the United States, we recommend that Congress make an appropriation for the establishment of a Bureau of Investigation and Information to aid in the study of the various

conditions under which explosions occur, and as to how they may be prevented.

We also recommend the more general use of "safety or flameless" powders which we believe would tend towards greater safety in coal mining and that the firing and handling of explosives used in coal mines be placed in the hands of experienced and competent persons, and also that clay, or some noncombustible matter be used in tamping.

Owing to the fact there are over six thousand persons now employed in the mines of West Virginia, we further recommend that four (4) additional District Mine Inspectors and two (2) Inspectors-at-Large be appointed.

In testimony whereof, the said coroner and jurors set their hands, this 15th day of January, 1908.