

HISTORICAL DOCUMENTATION OF MAJOR  
COAL-MINE DISASTERS IN THE UNITED STATES  
NOT CLASSIFIED AS EXPLOSIONS  
OF GAS OR DUST: 1846-1962

By Charles M. Keenan



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# HISTORICAL DOCUMENTATION OF MAJOR COAL-MINE DISASTERS IN THE UNITED STATES NOT CLASSIFIED AS EXPLOSIONS OF GAS OR DUST: 1846-1962

by

Charles M. Keenan<sup>1</sup>

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## *Summary*

**T**HIS PUBLICATION lists and provides brief accounts of the major disasters not classified as explosions of gas or dust that have occurred in the coal mines of the United States from the earliest times to the present. Together with an earlier publication of the Bureau<sup>2</sup> it provides information on all the known major coal-mine disasters (disasters causing five or more deaths) in this Nation's history.

Sources of each account are given individually. In each account the actual words of the original publication are used unchanged, but sentences or paragraphs referring to details that are not significant have been omitted. In those few cases where conflicting data were reported in different publications the selected version is the one that appears most logical and which in general is in agreement with most of the other accounts.

## *Introduction*

This publication is a sequel to and supplements Bureau of Mines Bulletin 586, Historical Summary of Coal-Mine Explosions in the United States, 1810-1958, by H. B. Humphrey.

An effort has been made to keep the information presented here as simple and explicit as possible without editorializing. Any changes in the original statements are limited to removing irrelevant material and mention of personalities. In a few cases where outstanding bravery, courage, and heroism were shown, such statements were not edited because it was thought the commendable actions warranted recognition.

To assist in ready reference, the disasters have been divided into six categories by causes—Fires, Haulage, Roof Falls, Inundations, Explosives, and Miscellaneous Causes.

Although roof, rib, and face falls and haulage operations are consistently the major causes of fatalities in coal mines, mine fires historically have always been second only to explosions as causes of major disasters. Open flames, long the principal source of mine fires in the early years of coal mining, have

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<sup>2</sup> Humphrey, H. B., Historical Summary of Coal-Mine Explosions in the United States, 1810-1958, Bu. Mines Bull. 586, 1960, 280 pp.

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today been virtually eliminated underground. In 9½ years, July 1952-December 1961, the Bureau investigated 480 mine fires, most of which were initiated by electricity. Fortunately, however, only one was of major proportions.

Improvements in Federal and State mining laws and cooperation by management and labor in enforcing safety rules and regulations have greatly reduced the number of these major catastrophes in recent years. However, the continued frequency of minor mishaps, as illustrated by the prevalence of mine fires, indicates that the possibility of a major disaster is still very real and threatening if vigilance in the industry is relaxed.

### *Acknowledgments*

Appreciation is hereby expressed to the heads of state mining departments, coal company officials, newspaper personnel, and others who helped make these records available, including Bureau Health and Safety personnel, who painstakingly assisted in searching out this material.

TABLE 1.—Major disasters by mine fires

Date	Name of mine	Location of mine	Killed
1869: September 6	Avondale <sup>1</sup>	Plymouth, Pa.	110
1871: May 27	West Pittston <sup>1</sup>	West Pittston, Pa.	20
1872: July 3	Atwater Slope	Atwater Twp., Ohio	10
1884: August 21	Buck Ridge <sup>1</sup>	Shamokin	7
1890: March 3	Shaft No. 3 (S. Wilkes-Barre) <sup>1</sup>	Wilkes-Barre, Pa.	8
June 16	Hill Farm	Dunbar, Pa.	31
1893: April 1	Neilson <sup>1</sup>	Shamokin, Pa.	10
1894: August 24	Franklin	Franklin, Wash.	37
October 8	Luke Fidler <sup>1</sup>	Shamokin, Pa.	5
1897: September 20	Belle Ellen	Belle Ellen, Ala.	5
September 28	Jermyn No. 1 <sup>1</sup>	Rendham, Pa.	5
October 30	Von Storch <sup>1</sup>	Scranton, Pa.	6
1898: October 1	Midvale (Maffett Slope) <sup>1</sup>	Wilkes-Barre, Pa.	5
1900: August 21	Issaquah No. 4	Issaquah, Wash.	5
1901: February 25	Diamondville, No. 1	Diamondville, Wyo.	26
November 11-14	Pocahontas	Pocahontas, Va.	17
1902: January 13	Milby & Dow	Dow, Okla.	10
1904: May 5	Locust Gap <sup>1</sup>	Locust Gap, Pa.	5
December 4	Horton	Horton, W. Va.	7
1905: January 16	No. 1	Decatur, Ill.	6
October 13	Clyde	Fredericktown, Pa.	6
1906: June 7	Red Lodge	Red Lodge, Mont.	8
1907: May 19	Engleville	Engleville, Colo.	5
1908: August 26	Hailey-Okla. No. 1	Haileyville, Okla.	29
November 16	Pratt No. 3	Ensley, Ala.	8
November 20	Red Lodge	Red Lodge, Mont.	9
1909: November 9	Auchincloss <sup>1</sup>	Nanticoke, Pa.	9
November 13	Cherry	Cherry, Ill.	259
1910: December 14	Leyden	Leyden, Colo.	10
1911: April 7	Price-Pancoast <sup>1</sup>	Troop, Pa.	<sup>2</sup> 73
May 10	Boston <sup>1</sup>	Larksville, Pa.	5
1912: February 22	(Western) No. 5	Lehigh, Okla.	9
1914: June 30	No. 1	Cinderella, W. Va.	5
1918: May 20	Villa	Villa, W. Va.	13
1919: October 29	No. 2	Amsterdam, Ohio	20
1920: November 16	Arnold	Earlington, Ky.	6
1921: February 23	Kathleen	Dowell, Ill.	7
December 13	Satanic	Morrison, Colo.	6
1925: December 22	Webb	Bellaire, Ohio	9
1934: March 12	No. 10	Wheatcroft, Ky.	5

<sup>1</sup> Indicates anthracite mine.<sup>2</sup> Includes 1 Bureau rescue man.

## MAJOR COAL-MINE DISASTERS IN THE UNITED STATES: 1846-1962

TABLE 1.—*Major disasters by mine fires*—Continued

Date	Name of mine	Location of mine	Killed
1935: May 11	No. 41	Barrackville, W. Va.	6
1936: August 1	Kathleen	Dowell, Ill.	9
1943: January 8	No. 15	Pursglove, W. Va.	13
1944: June 7	Emerald	Clarksville, Pa.	6
July 5	Powhatan	Powhatan Point, Ohio	66
1948: November 4	Milt No. 1	Kitzmilller, Md.	5
1960: March 8	No. 22	Pine Creek, W. Va.	18



## DESCRIPTION OF MAJOR DISASTERS BY MINE FIRES

September 6, 1869; Avondale Mine, Plymouth,  
Pa.; 110 Killed

(From "90 Years Ago Today," by James J. Corrigan, Anthracite Industry Historical Researcher, published in "The Sunday Independent," Wilkes-Barre, Pa., Sept. 6, 1959)

One hundred and eight tragically-trapped men and boys inside the mine perished through asphyxiation when an uncontrollable fire, originating in a furnace at the bottom of the Avondale shaft, over which the breaker and works stood, flashed upward and destroyed the surface structures. It was the only means of entrance and exit. Two other men succumbed in a heroic rescue descent into the mine and numerous other men nearly met the same fate in rescue attempts. Avondale mine fire fatalities totalled 110.

The Avondale works were completed in September 1867, being considered "the finest in the valley." But the tragic neglect or abysmal lack of foresight was responsible for the construction of what proved a disastrous "one way ticket" into the mine.

On the morning of Sept. 6, 1869, (a blue Monday of tragedy) a hoisting engineer at Avondale was the first workman to discover the flames, mid-way between 11 a.m. and noon, shooting up the shaft to the breaker atop.

He told a newspaperman a short time later, he was "startled" by flames rushing up the shaft with great fury. So rapidly did the fire progress that he merely was able to blow the colliery whistle and arrange matters to prevent a boiler explosion. In an almost incredible short time everything combustible about the entire works was in flames—a line of fire extending from the Bloomsburg Railroad track below, along the bank of the Susquehanna, to the mine shaft high above a distance of not less than 800 feet.

A two-day coroner's inquest at Plymouth decided that "the fire originated from the furnace in the mine, taking effect on the wood brattice to the up-cast course leading from the bottom of the shaft to the head house."

The coroner's jury noted that it regarded the current "system of mining as insecure and unsafe to the miners," and strongly recommended "where practicable, two places for ingress and egress, and more perfect ventilation, thereby rendering greater security to the lives of the miners under any similar accident."

The Avondale jury's recommendation was fulfilled when, the following year, 1870, the Pennsylvania State Legislature enacted a law demanding that each coal mine must provide for two openings to the surface, "for the ingress and egress of the men employed therein."

May 27, 1871; West Pittston Brecker Fire; Pittston,  
Pa.; 20 Killed

(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1871, pp. 261-274)

Between one and two o'clock on the afternoon of Saturday, May 27, 1871, a wooden breaker constructed near the shaft caught on fire. No second opening for escape had been provided for men working underground. The men perished from inhaling the gases and impure air caused by the burning breaker.

July 3, 1872; Atwater Slope Mine, Atwater Township, Ohio; 10 Killed

(From "The Democrat" (weekly), Ravenna, Ohio, July 10, 1872)

The most extensive coal mine horror that ever transpired in Ohio occurred between one and two o'clock Wednesday afternoon, July 3, 1872, in Atwater township, Portage County.

In the construction and preparation of the mine for working, the company were [sic] liberal in all their plans and expenditures, seeking to do everything that would ensure the comfort of the miners, using only the most suitable material and employing the most competent men to direct the work. Up to the date of the accident, which sent ten employees to eternity, there had been very little embarrassment in prosecuting the work. 739 square yards of entry work has been put, and the miners were just ready to turn the rooms, and would by the present week have employed 50 to 60 miners and turned 150 tons of coal a day.

The coal mine is entered by a slope 170 feet long, running down an average, say of 33 degrees. This slope was divided into two sections—a car-way and a man-way. At the bottom of the slope was located the ventilating furnace, the fire in which from some cause, not now satisfactory known, made the mine a death-trap. Diverging from the foot of the slope are the entries in which the men were at work when the explosion came, and from which they sprang at the sounded alarm and rushed into the smoke filled slope to die of suffocation.

At the time of the catastrophe, there were sixteen men and a boy in the mine. Of these seven escaped alive (through heavy smoke) and ten perished. The mule which drew out the coal cars from the entry, was also on duty and of course died—those who escaped, getting out of the mine fifteen minutes after the alarm was raised—were more or less cut, bruised, and prostrated. The last man saved (nearly suffocated), states that in coming out he passed over the prostrate bodies of several men near the top of the slope, but who they were he did not know.

A steam fire engine and two hose carts were transported by rail from Ravenna on Thursday, and after considerable difficulty, the fire was extinguished about 10:00 p.m. Seven of the bodies were recovered along the slope by 9:00 p.m., Friday, and the final three were found under several feet of water in by the foot of the slope.

The verdict of the coroner's jury is stated in part as follows:

After having heard the evidence and seen the bodies, we find that the deceased came to their death by suffocation from fire and smoke in the slopes of said mine, communicated to the timbers of the slope from a fire arch or furnace located near the foot of the slope, for the purpose of ventilating the mine. The furnace was constructed by one of the deceased, who was "Pit Boss" of the mine. From the evidence we are unable to say whether fire was communicated to the wood-work by gas, or the furnace being in too close proximity of the timbers of the slope.

**August 21, 1884; Buck Ridge Colliery; Shamokin, Pa.; 7 Killed**

*(Excerpt from "Mining Herald and Colliery Engineer" dated Aug. 30, 1884, V. 4, page 447)*

Buck Ridge colliery is located about the center of the Shamokin coal basin, and about a mile and a half southeast of the borough of Shamokin, Pa. The colliery was opened about twenty years ago. The present workings consist of two slopes sunk on the north dip of what are known in the Shamokin region as the Twin seams, which are the two divisions of the Mammoth. The seams are designated as Nos. 9 and 8, the latter being the underlying seam, and average about six and a half feet each in thickness. The slope on No. 8 seam is sunk to a depth of nearly 1,500 feet from the surface, and has an average pitch of about 32°. The workings are very extensive and complicated, the present bottom lift being the fourth lift below the water level, which was worked with eight drift openings.

When the colliery recently changed hands its officers found the system and method of ventilation inadequate and crude, and at once set about improving it. The fan by which the colliery was ventilated was located at the top of the lower lift of No. 8 slope, which was the upcast. No. 9 slope, on No. 9 seam, located a short distance northeast of No. 8, being the downcast. Work was begun at once to change not only the system of ventilation, but to remodel the colliery throughout. To this end an accurate survey of the workings of Buck Ridge and Greenback collieries were obtained. Greenback colliery is located about 1,400 yards east of Buck Ridge, on the same dip, is worked in the same manner, but having been opened a few years later is not quite so extensive. The slope at Greenback colliery is about 600 feet deep, but having an average pitch of about 48° its lower level gangways are only about 300 feet above the level of the lower workings of Buck Ridge, which, as above stated, are 1,500 feet deep. The map of the workings of Greenback shows that the west gangways are driven a distance of 600 yards to the boundary line, where a solid pillar of coal is left standing between the workings of both collieries. This pillar, according to the measurements, is 90 feet in thickness, and the company decided to drive an air course from the lower lift of Buck Ridge through the center of this pillar to the surface, that it might, if necessary, be eventually used to ventilate both collieries. The air-course was driven to a point about 25 yards below the water level workings when a shot shattered the pillar on the Greenback side, owing to the last breast in the first lower lift of that colliery having leaned considerably into the pillar and weakened it. It was then decided not to drive the air-course further in the pillar, and a shaft from the surface to connect with it at the point where it was stopped, was projected and is now being

sunk. We give this description of the collieries here that the manner in which the accident occurred and its causes, as far as they can be ascertained, may be fully understood.

We stated above that No. 9 slope, or rather the slope on No. 9 or the overlying seam, at Buck Ridge was located but a short distance from No. 8 slope, on the underlying seam. The workings of the two seams are connected in numerous places by short tunnels, the slate or rock between them being not more than from 30 to 40 feet in thickness. No. 9 slope was in a bad condition, the timbers being badly crushed. The company's officials decided to re-timber this slope for hoisting purposes, and abandon No. 8 to pumping of water & c., and to this end began to work. These improvements had been in progress so long that they were nearly completed when the fire which is now burning in the colliery broke out. On Tuesday evening, August 19, there were ten men working in Buck Ridge, eight of whom were timbering No. 8 slope, the other two being engaged below loading rock. These men left the mine about 2:15 o'clock Wednesday morning, and at 4, when the engineer went to the mouth of the slope there was issuing from it a large volume of smoke which indicated the presence of a strong fire somewhere in the interior of the mine. No. 9 being a downcast, was emitting no smoke, and the engineer immediately started down there to discover, if possible, the location and cause of the fire. He descended without much difficulty to what is called the fifth lift, which is the top of the lower lift, but from this point he was driven back by the smoke of the burning timbers, which was then so strong that it was forcing its way back against the air current. He returned and gave the alarm, which brought the superintendents and many of the miners to the ground in a short time. A gang of men went down No. 9 slope for the purpose of erecting a battery between the two slopes, at the fifth lift. The smoke and gas, however, were then so dense that they were driven back up to the fourth lift, and before they could accomplish anything they were compelled to recede up to the third lift, where they finally succeeded in erecting a battery.

It was decided to put stoppings in all the intakes as far as possible, for the purpose of cutting off the air and turn water into the slope. The mouth of the burning slope was then closed, and a stream of water turned in. The steam pipe which conveyed the steam to the pump below was broken and the steam turned on the fire. All this, however, did little to check it, and the openings being high on the mountain side, it was difficult, if not impossible, to get a large quantity of water to the fire.

Early Wednesday afternoon, it was decided that a hole should be driven from the face of the lower lift west gangway of Greenback slope through the line pillar to the air course, above referred to as having been driven up past that point from the lower workings of Buck Ridge. This would enable them to turn the water into Greenback and down into Buck Ridge and facilitate the extinguishing of the fire, and for this purpose three men were sent into Greenback at 3 o'clock Wednesday afternoon. It was known then that the fire was generating large volumes of carbonic oxide gas, the most dangerous enemy with which miners have to contend, but it was thought that every measure necessary for the protection of the men going into the mine had been taken. The superintendents went with them to the face of the gangway, where the hole was to be started, and gave explicit instructions to keep a drill hole twelve ft. long in advance of the heading as they went. They also made a diligent search for escaping gas from the burning mine but failed to discover any. The orders

were when the drill hole opened to the airway if any gas came through, the hole was to be plugged. The heading was then to be carefully driven to within four feet of the airway and the remaining coal blown out with powder or dynamite. A strong battery was also to have been erected in the gangway a short distance from the face, with a trap door in it, to serve as a protection for the men. The superintendents remained with the men, who were laying the track preparatory to starting the heading in the pillar, until a late hour in the evening. The three men who went in at 3 o'clock in the afternoon were to be relieved at 11 o'clock at night. One man went to the slope a short time before the other men, but having fallen asleep in the boiler-house was not discovered by them, and they went down without him. He awoke about one o'clock, and not knowing whether they had gone down or not, returned home. In addition to these five there were then in the mine a pumpman and his 15-year-old assistant.

About six o'clock Thursday morning, as the fireman was descending the slope, he noticed that the car upon which he was riding passed over the body of a man which was lying on the track, a short distance below the water level. He immediately signalled the engineer to stop and got off to investigate, but finding that he was being overcome by gas, he again mounted the wagon and rang to be hoisted, when he fell over unconscious. He was taken from the wagon on the surface by the engineer, and being resuscitated related what he had seen and what had occurred to him. The alarm was immediately given, and crowds of people collected at the mouth of the slope, but the volume of gas issuing from it was so strong that it was impossible to enter. The experience of the fireman, who narrowly escaped asphyxiation by the gas, admonished all others to not attempt to go down the slope until the gas had been driven out, yet there were those who would have attempted to do so were they not prevented by the others who fully realized the danger of such an undertaking.

The air battery on the west side of the slope was removed, the water level intake closed, and a brattice built in the center of the slope, thus making the east side a downcast and west an upcast as far down as the water level, where an air battery was again built across the west side of the slope. This made the whole slope a downcast from the water level and the west side an upcast from that point. The current was then readily changed and with the aid of the fan a large volume of air was driven down the slope and in the gangway, thus forcing the large body of gas out. About two o'clock Friday afternoon the gas was so far removed that volunteers to rescue the victims of the disaster, were asked for, and they promptly responded. Six men were lowered into the deathpit while the breathless, anxious crowd watched them from the surface. Before reaching the bottom a signal to stop was given, and in a few minutes the signal to hoist was heard. Then the crowd on the top watched with bated breath until the lights of the rescuers came in sight, when a sigh of relief went up from the crowd, that they too had not perished. The exploring party brought with them one lifeless corpse, although several of the brave fellows were almost suffocated themselves. Another party volunteered immediately and rescued the bodies of two others, and then the remains of the boy were brought to the surface. Two bodies were found in the slope, showing that the poor fellows died when they were but a short distance from the pure air, and that if an engineer had been at the colliery to hoist them their lives would have been saved. One body was found at the bottom of the slope in a position that seemed to indicate that he was in the act of signalling to be

hoisted when he fell over and died, and the body of the boy was found by the pump, where he had lain down and died as if he were going to sleep. One was discovered in the pumpway, only about 50 yards below the water level, or about 70 yards from the surface, and the others were found at the face of the gangway, 600 yards from the bottom of the slope, but stout hearts and willing hands were abundant, and although several of the explorers were overcome by the gas and had to be taken out by their companions, the dead bodies of the two unfortunate miners were rescued at two o'clock on Saturday morning.

It is not definitely known yet how the gas escaped into the Greenback workings. One theory is that it found ingress through the cracks in the line pillar heretofore referred to and another is that the pillar above water level is broken. Three streams of water are now being run into the slope, but the workings are so extensive that much time will be required to fill it. Meantime the fire is rapidly advancing upward, and the difficulty of subduing it after it reached a height above water level will be almost insurmountable. The mouth of the slope is at least 100 feet vertical height above water level, and this increases the difficulty of turning the streams into the mine. The origin of the fire is unknown, but the theory of the officials and miners at the colliery is that the dry and rotten timbers of the slope were accidentally ignited by some one of the timbermen who left the mines less than two hours before the fire was discovered.

### March 3, 1890; No. 3 Shaft, South Wilkes-Barre Colliery; Wilkes-Barre, Pa.; 8 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1890, pp. 128-133)*

The No. 3 shaft was the hoisting way for both coal and men. This shaft was also the inlet for the ventilation. The air-current after descending this shaft, passed in through the tunnel and in the gangway to where it was split, a part going up the outlets and down the rock plane to the Stanton fan, and the other split passing into the face of the gangway and returning through the air-way to the fan at the No. 5 shaft. This shaft also had a cage in to hoist the coal worked from the Baltimore seam 300 feet deeper than the Hillman, which was worked from the No. 3 shaft. Thus it may be seen that there were three available openings for No. 3 shaft working; one leading down the rock plane into the Stanton mine; one in the No. 3 shaft; and one in the No. 5 shaft. It was a gaseous mine and exceedingly so at some points. The rock plane was driven from the Baltimore seam in the Stanton mine on a rise of 18 degrees for the purpose of working the Hillman seam above, but it proved so gaseous that it was found impossible to conduct sufficient air up through one opening, and to avoid driving another passage through the rock from the Stanton, connection was made to No. 3 working of South Wilkes-Barre, undoubtedly (sic) a costly error. On February 2, after making this connection, the inspectors had to notify the company to suspend operation in both the Stanton and South Wilkes-Barre mines, because in consequence of the opposite effects of the ventilating fans of South Wilkes-Barre and Stanton mines. The air-currents became unreliable and fluctuated so that they became explosive at frequent intervals making both mines dangerous. In a few days this was remedied so that a reliable system of ventilation was established.

On the third day of March, 1890, a party of six men was started to work in driving a gangway and

air-way near the head of the rock plane leading down to the Stanton mine. Shortly before 5 o'clock p.m., three other men were repairing the track on the passage driven up to connect with the rock plane when the foreman passed them on his way out.

At the same time, the footman and a driver were going out towards the No. 3 shaft with a trip of cars, and when a short distance outside of the tunnel, the footman stumbled and fell with his head against the rib where a large gas blower was issuing from the coal, and this ignited from his lamp and caused several other blowers to ignite. The foreman was coming outwards on the gangway and smelled something burning in the air-current. Hurrying out, he found the two boys about to try to extinguish the burning blower with a patent fire-extinguisher which they had procured from the bottom of the shaft. The place was thickly timbered and a current of 80,000 cubic feet of air per minute was passing inward and conveying the smoke into the workmen. The patent extinguisher proved useless, and under the circumstances it was only a waste of valuable time to try it. The foreman sent the footman in to warn the men and tell them to come out, and immediately went to work to attach hose to the water pipe already convenient, so that a stream of water could be poured on the fire. The night men descended the shaft at this time and joined in to help, but despite their efforts the fire continually gained.

The footman ran in and told two men who were working in the airway, of the fire, and they went out through the No. 5 shaft. Then he ran by the trackmen telling them as he went by on his way to tell the others.

The trackmen were the last persons that came out alive. Messengers were sent over to the Stanton mine to see whether or not the others had escaped that way, but they had not, and the smoke was so dense in that direction that it would be impossible for any one to live in it but a very short time.

The efforts to extinguish the fire were continued until about half-past seven o'clock, when it became too dangerous by reason of the presence of a large accumulation of fire-damp in close proximity to the fire, where it might explode and kill them all and their efforts were abandoned, and all left the mine expecting an explosion to occur at any moment.

The writer learned of the accident at 7 o'clock p.m., and arrived at the mine at a few moments after 8. On being informed of the situation, and after a careful consideration of the circumstances, it was suggested that an effort be made to enter the mine beyond the fire from the Stanton mine, hoping that thereby the bodies of the missing could be found. The writer realized that this undertaking would be a perilous one, attended with many difficulties, but he knew the district superintendent, the mine foreman and fire bosses of the Stanton mine as men of experience, who could be relied on to make no mistakes, and he, with the approval and co-operation of the managers, resolved to make the attempt.

In order to accomplish what was desired it was necessary to change and reverse the direction of the air current leading to the Stanton, so that the smoke would be driven back towards the South Wilkes-Barre fan, therefore the South Wilkes-Barre fan was run up to a speed of 200 revolutions per minute. The district superintendent, the mine foreman, and his assistants had descended the mine and were at the bottom of the rock plane ready to make required changes in the airway. Men were stationed at the telephone, and men were employed watching and lubricating the South Wilkes-Barre fan, who were all instructed to be on the alert, ready to give alarm promptly in case the fan failed to keep up the high

speed. The Stanton fan was stopped until the party in the mine had pulled down a stopping and put up another, when instantly the air current reversed its course and carried the smoke away towards South Wilkes-Barre. Immediately after receiving word that the changes were completed, the Stanton fan was set to running again at 25 revolutions, half its usual speed, so as to keep the Stanton workings clear of gas. In the meantime the inside party hurried out of the mine for fear that the reversed air-current should cause the fire to ignite the large body of fire-damp known to have accumulated on the South Wilkes-Barre side and produce an explosion.

A party of men was organized and descended the shaft and went to the foot of the Rock plane. This plane is nine hundred feet long on a rise of twelve degrees, all driven through rock. Upon receiving assurance from the Superintendent, who was still at the telephone on the top of the Stanton air-shaft that all was right, a man was left at the telephone in the mine and one within hailing distance on the way from there on and up the plane. All had locked safety lamps. At the head of the plane, the intense heat of the air-currents had caused the roof to fall so as to close the passage. It took about an hour to open a small passage sufficient to enable one to crawl through. At this time the writer suggested that it would be well to make preparations for flooding the mine as quickly as possible, so as to prevent the fire from passing over to the Stanton mine. Shortly after, a passage was made through the fall and the officials named passed through and down the South Wilkes-Barre gangway several hundred feet. Its parallel airway was also examined to the same point, but none of the missing men were found. It was too hot to attempt further examination all retreated to the Stanton gangway, and after a brief consultation decided to rest a few hours, to give the heated passages time to cool, and that all should return with additional force at 9 o'clock. It was now 5:30 a.m. At the time agreed, the party returned. This time the workings of South Wilkes-Barre were thoroughly examined from the face back to where the fire had traveled and was seen burning fiercely.

This satisfied us that the missing men had fallen suffocated by the smoke at some point between this and the tunnel, and that the fire had traveled inwards to a point 1,200 feet inside of where it started.

The superintendent did excellent work in procuring water, and had the mine flooded by March 12, so that water was running over to the Stanton, but it was boiling hot for several days.

On Monday, March 24, they began to hoist the water out again, and by April 1, it was low enough to enable the district superintendent and the mine foreman to descend the No. 3 shaft for examination. They found the gangway completely closed to within 150 feet of the shaft. On the 4th of April again a party of officials examined all that could be examined, and came to the conclusion that the fire was extinguished. They went down the No. 5 shaft and in as far as the tunnel on top of the falls, and found everything cool, but the roof had fallen to a height of about 24 feet and from there it was full of gas.

A gang of men was set to work that night to reopen the gangway from the No. 3 shaft, using locked safety lamps, but at 2 o'clock a.m. an explosion occurred somewhere inside, and blew them about quite roughly, but they came out safe, and without injury of any consequence.

On Monday morning April 7, when the officials were on their way into the Stanton mine for the purpose of making another examination, another powerful explosion occurred which determined that fire still existed and South Wilkes-Barre was filled with water

the second time. This time it was allowed to remain filled with water until May 28, and after it was taken out, no attempt was made to ventilate farther than the point where the men were at work. The rock plane leading into the Stanton was hermetically sealed so that no air could pass.

They worked incessantly night and day without finding any trace of the missing men until the last night of the year, December 31, when the bones of two were found. The next day, January 1, 1891, the bones of the other six were found. All were near together. They had evidently attempted to go to the return airway and were suffocated by the smoke when between the two doors. The roof had fallen to a depth of twenty-two feet over them. The flesh had disappeared leaving nothing but the bones.

**June 16, 1890; Hill Farm Mine, Dunbar, Pa.;**  
**31 Killed**

*(From a letter to Mr. George S. Rice, Bureau of Mines, from Fred C. Keighley, former State Mine Inspector, Feb. 12, 1913)*

There were 31 men lost in this accident. Two of the bodies were taken out during the afternoon of the first day, the other 29 bodies were not recovered for something like two years afterwards.

As to the cause of the accident and what immediately followed, would say that although it is more than twenty years since the accident occurred I think I can give you a pretty good idea of it:—When I reached the Hill Farm Mine I found that it was on fire and large volumes of smoke were being given off. Of course in the line of my duty as Mine Inspector I inquired into the cause of the accident; what I was told is substantially as follows:

A drill hole had been put down from the surface into the dip section of the mine in order to form a discharge outlet for the mine water. This bore hole was over 500 feet deep and said to be nearly full of water when it reached the coal. I was told that it reached the coal on Saturday night, and the management should have opened that bore hole on Sunday when there were no men in the mine; however, for some reason unknown to me the work of opening the bore hole was not started until Monday morning following, and the miners were all at work. It seems that a miner was engaged in cutting over from the slope to the bore hole when his pick suddenly broke into the hole; the result was that a torrent of water poured out therefrom and the pressure must have been terrific with a head of over 500 feet, as you will understand. The sudden releasing of this water at the bottom of the hole caused a vacuum to be formed in the bore hole itself which was immediately filled with gas from the strata traversed by the bore hole. A trapper boy heard the rushing of the water and at once concluded that water had burst into the mine; he knew that five or six men were working in the dip and would be drowned if there was any great volume of water. He wished to warn them of their danger and in doing this he passed the place where the bore hole had been punctured and the naked light on his cap ignited the gas that was issuing from the bore hole. This developed into a long tongue of flame that reached across the slope and set the brattice cloth on fire; the brattice cloth soon reached some greasy timber, and, it is said, a barrel of pit car oil, and this took fire and set a trip of cars on fire that was standing directly on the slope. Of course the men below these burning cars could not get out as the slope from that point

down was single and ventilated by brattice cloth instead of being paralleled as was the intention later on.

I should hardly class that accident as an explosion, it was really a very large mine fire, but it did have its origin in the gas that issued from the bore hole. The chances are that if the boy had run down five minutes sooner, or five minutes later there would have been no fire; as it was he happened to pass the point with his naked light at the very instant the gas was issuing from the hole. I have always understood that there was no large amount of gas in the bore hole, and if a person would stop to think there could not have been a very large amount for the reason that the hole had been in the process of drilling for some time, two or three months perhaps, and the gas naturally would escape up the hole. The sudden liberation of the water would explain why the gas rushed down the bore hole, the vacuum produced would be enough to draw out any gas that was in that immediate vicinity.

This accident was the cause of that particular provision now appearing in mining law which states that no bore hole shall be tapped during working hours, or while men are engaged at work,—I do not remember the exact words but this is the substance of it. The real cause of the disaster seems to have been the lack of good judgment; there was no reason in the world why the hole could not have been opened up on Saturday night or some time during Sunday.

**April 1, 1893; Neilson Shaft; Shamokin, Pa.;**  
**10 Killed**

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1893, pp. 223-224)*

The accident, which was attended by the greatest fatality of the year, and in fact the greatest fatality which has occurred in the history of mining in this district, and in which ten lives were lost, occurred in Neilson shaft on the morning of April 1st. The shaft bottom being wet, kerosene is used for the torches. Whilst filling a torch, or in pouring oil on the wick to make a better blaze, a can of oil in the hands of the bottom-man in the No. 10 seam level, exploded, setting fire to the oil-shanty and timbers on the turnout. As the mine is very dry, with the exception of a few feet surrounding the shaft, the flames spread rapidly, and in a few moments the smoke had traveled up the No. 10 air-way, to a tunnel connected with No. 11 seam, cutting off and smothering ten men, who were working in this seam. Everything possible was done to rescue them, but when the bodies were reached, after two hours of hard and heroic work, life in each case was extinct.

The following is a copy of the verdict rendered by the coroners jury, which, as will be seen, exonerated the company from all blame.

"We, the jury empannelled to hold an inquest over the dead bodies of miners and workmen who lost their lives in the No. 11 or Red Ash vein on the North dip, West gangway at the Neilson colliery, Saturday morning, April 1st, 1893, between the hours of 7 and 8 o'clock on said day and morning, find from all the evidence and information gained from twenty odd witnesses, that the aforesaid men lost their lives from inhaling smoke caused by a fire in a shanty in the No. 10 vein at the bottom of the shaft, said fire having been caused by the filling of a lamp with torch oil in the hands of (a bottom man) from a can said to have contained from a half to a gallon of said oil, which by the dangerous custom of pouring or squirting

oil from the can on the wick of the said lamp in his hands when lit, ignited fire in said shanty, and from all evidence and the then existing circumstances, believe it was impossible to save their lives."

As soon as the bodies were recovered, in order to extinguish the flames, which were spreading rapidly, all the colliery openings were sealed, as it was thought that by such method the fire could best be extinguished. After remaining sealed for a month, and when all the indications seemed to prove that no fire remained, the main shaft was opened, but it was soon discovered, from some explosions which took place, that the fire was still burning. Preparations were at once made to flood the mine by turning a creek which is close by in to it and on May 6 this was done. The water was allowed to fill to a point 20 feet above the No. 11 seam, as it was supposed the fire had not reached above this point. After allowing the water to remain for about four weeks, it was lowered so as to permit an examination of this seam. On doing so, it was found that a "Feeder" of gas was burning in the roof of the No. 11 tunnel. The creek was again turned in and water allowed to remain until the eleventh day of July, when the work of removing water was again begun. When this was accomplished, it was found that the damage done by the fire and water was considerable. Operations were resumed at the colliery on November 6, 1893.

**August 24, 1894; Franklin Mine; Franklin, Wash.  
37 Killed**

*(From State of Washington, Department of Labor and Industries report)*

One of the most deplorable accidents that has ever occurred in the history of mining, by which 37 persons lost their lives through suffocation by smoke from a mine fire in the above mine, occurred on August 24. The fire originated in breast 62 of the north sixth level; how it did occur will remain a mystery. Two theories were advanced—incendiarism and spontaneous combustion. I believe in the latter. The gobs or refuse which is kept in the breasts are known to have been heated before and after the fire. Each of the old worked-out levels have had fires from that source. The coroner's jury returned a verdict ascribing the cause to incendiarism without any evidence of that nature. The testimony of those that escaped proved that the men could have all gotten out safely, but it seems that they stopped for the purpose of extinguishing the fire; some of them had come from the south side with buckets so as to throw water on it. They would have been perfectly safe in doing so, had the fan remained in operation; but someone stopped it, thus compelling the men to retreat towards the bottom of the slope, and when they reached the rock tunnel leading to the fanway they encountered the smoke which came into the gangway when the fan stopped, thus their only means of escape was cut off, and they were suffocated in trying to go through it. Had this mine been worked by double entry system, or had two levels been connected at stated distances, this loss of life would not have occurred. This would have afforded another means of escape. This is a matter that should be provided for by statute.

This disaster emphasizes the need of having competent men in charge of the ventilating apparatus, when so many lives are dependent upon them. Fourteen wives were left husbandless and 38 children fatherless by the mistake or ignorance of the person who stopped the fan.

**October 8, 1894; Luke Fidler Colliery; Shamokin, Pa.; 5 Killed**

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1894, p. 262)*

A most disastrous fire occurred at this colliery on the evening of October 8, between the hours of 7 and 8 o'clock. A shaft repair crew of three men was repairing the air brattices in the No. 1 shaft, which extends from the No. 10 to the No. 9 seams. The shaft is operated by bore holes from the surface; the construction of it is such that the steam pipes are very close to the air compartment, thus making the brattice and timber in one end of the shaft very dry. For this reason lanterns, only, were used in making repairs, and for fear of fire even smoking was prohibited. Notwithstanding these rules, a carpenter, in direct violation of orders, used a naked light and foolishly placed it against the brattice to look for a leak, thinking to discover it by having the flame draw up through the opening. In doing this he set the brattice on fire, and as everything was as dry as tinder there was no possible chance of extinguishing it. Discovering this, he went up the shaft, shouldered his tool chest, and started out the tunnel to make his escape, but so rapidly did the flames spread that the fumes overtook him and he paid the penalty of his violation of orders with his life. At the time the fire broke out there were 60 men at work in various parts of the mine. Another workman, who was in the shaft, not thinking of self, went down, and together with others who went down the new shaft, notified all the men they could reach to go to the new shaft, which was the most accessible place where they could reach the surface with safety. The colliery, fortunately, is furnished with many avenues of escape, otherwise a greater number of men would have perished. In spite of all efforts, however, four lives were lost. Two of these victims were notified to go to the new shaft, but made a mistake and tried to escape by the traveling-way from the foot of the old shaft to the water-level, but were overtaken by the fumes from the fire and were lost. Two others in the No. 3 slope could not be reached, despite every effort. So intense was the fire, and so rapidly did it spread, that by no efforts could the bodies of the men be reached, although every human exertion was made.

Owing to the location of the fire, it being at both the top and the bottom of the shaft, thus destroying the return air-way, and the mine generating large quantities of explosive gases, any effort to fight the fire would have been extremely hazardous, if not suicidal. The only recourse left was to seal all the openings and fill the mine with water. This was done by turning in Coal Run creek, and also by pumping all available water into the mine. It required over one billion gallons of water to fill it to water level. As the fire had gotten above water level, dams had to be constructed in the new shaft, also in the main tunnel in order to raise the water above the fire. This was done successfully, and at this writing the water has been run off from above water level and the fire found to be extinguished. It was found to have gotten above water level about 100 feet, and did more damage than was expected.

The work of taking out the water below water level has been commenced, but it will take some time before the bodies can be recovered or the mine operated again.

### September 20, 1897; Belle Ellen mines; Belle Ellen, Ala.; 5 Killed

(From "The Age-Herald," Birmingham, Ala., Sept. 21, 1897)

Slope No. 2 of the (Belle Ellen) mines here is on fire and considerable damage has already been done. Five men are behind these flames and are believed dead. They are miners who were cut off by the flames before they could be rescued. The men are undoubtedly dead, as the fire has been raging some time. One of the State mine inspectors is here, and at his advice the entrance was closed to prevent the ingress of air to feed the flames. It is the intention of the fire fighters to pump water into the slope as soon as hose can be procured. The fire is supposed to have originated from the steam pipes—slope No. 2 has been operated only a short time.

(From "The Age-Herald," Birmingham, Ala., Sept. 28, 1897)

Four bodies have been taken out of the Slope No. 2 at the Belle Ellen mines.

A telegram to The Age-Herald last night said the searching party expected to recover the other two bodies during the night or today. The telegram also stated that the fire was under control.

It is believed the fire originated from the dead miners' lamps.

### September 28, 1897; Jermyn No. 1 Colliery; Rendham, Pa.; 5 Killed

(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1897, p. 53)

The fire boss while making his morning examination of working places found an ignited gas blower in a chamber which had been left burning from the previous day, and this in a short time communicated fire to the gob. While changing the direction of the air current so that the fire could be attacked more directly, five workmen were killed from breathing poisonous gases.

(From "The Republican," Scranton, Pa., edition of Sept. 29, 1897, courtesy of the Lackawanna County Historical Society, Scranton, Pa.)

Through the mistake of a careful and trusted fire boss the men were led to their doom. Were fleeing from gas when it overtook them in an immense volume and their lives were quickly snuffed out. Six hours passed before the bodies were recovered.

One of the most horrible mine accidents that has ever occurred in these regions took place in Jermyn Mine No. 1 near Austin Heights, West of Rendham, yesterday afternoon, when five men lost their lives by being suffocated by black damp.

About a week ago the mine was set on fire by a spontaneous combustion of gas in that part of the mine known as "Digwells Counter" in the middle vein. The burning gas set fire to the coal and it gained considerable headway. There was no danger apprehended from it for some time and the men continued at work until yesterday. Different gangs of men alternated in the meantime at fighting the fire, all the men except the fire fighters were ordered to

keep out of the mine yesterday. The order was to remain in effect until the fire could be extinguished.

About 2 o'clock in the afternoon a gang of men went into the mine and changed the air course. This was done in such a way that the fresh air currents went in by way of the old currents came out and came by the way the old one went in.

This was done in order to keep all the impure gases back in the old workings and keep the fresh air where the men were required to work. It was about 3 o'clock when this work was finished, shortly afterward, it is said, some of the drivers went back in the mine were enjoined before they started by the driver boss not to fail to leave all doors as they found them; those open to leave open, those closed to leave closed. These men all came out safely but there has been some doubt expressed as to whether they obeyed their instructions.

About 3:30 o'clock, or shortly after these men came out, the new shift including the five dead men, who were led by a fire boss, went in to take their turns at fighting the fire. At what time they met their death is not known, but two hours later the discovery was made that they were dead. A mistake had been made by the men who went in before or by these men themselves, but by whom will probably never be known.

(The fire boss) knew that the air course had been changed, but if everything was all right the only reasonable hypotheses remaining is that the men went in before the new current had time to carry out the impure air.

About 5:30 o'clock the awful tragedy was discovered when (some) men were going in with a truckload of rails. The men were horrified when nearly a half a mile from the foot of the shaft they discovered a dead body. The oppressive atmosphere told the tale, the men, however, bravely pressed on in the hope of saving the others, but they were rewarded only by finding the dead bodies of all but (the fire boss). These they carried to the foot of the shaft and shortly afterward had them conveyed to their bereaved homes.

In a short time the inside foreman, outside foreman, superintendent and a few others were on hand and organized themselves into a party and went down the mine to recover the body.

The task of reaching it was both difficult and dangerous and the men encountered numerous obstacles. They searched for hours and finally found the body at 10:30 o'clock. (The fire boss) had gone into an out-of-the-way place to avoid the gas, but was suffocated there.

The true circumstances connected with the finding of the body could not be learned as the men in authority refused to say anything and those who were not were pledged to secrecy. At any rate he was found at a considerable distance farther back in the mine than the other men were indicating that he had been in advance of them.

### October 30, 1897; Von Storch Colliery; Scranton, Pa.; 6 Killed

(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1897, p. 53)

A fire was discovered in the Von Storch Slope about midnight, October 29. This slope crosses the measures and intersects the Diamond, Rock and Fourteen "Foot" veins. At the Diamond vein the empty cars are run off on what is known as the light bridge.

Some distance below this on the slope there are two pump rooms. One is known as the Diamond pump and the other the Fourteen Foot vein pump. On the night in question an attendant was engaged in looking after these pumps. At 12:40 he smelled smoke. After ascertaining the pump rooms to be safe, he started up the slope to locate the fire. He found the light bridge enveloped in smoke; he could also hear the roof rock falling. He made an attempt to reach the section of the mine known as the New Diamond workings by way of the rock vein heading, but was prevented from doing so by smoke. He knew the water boilers were in that part of the mine. He then went out of the mine through the second opening shaft, to give the alarm and to notify the company's officials. The fire companies were soon on the ground, but were unable to do effective work for some time, as the dense smoke prevented them from reaching the location of the fire. The mine officials made brave attempts to reach the men by all available avenues from the second shaft, but were cut off by smoke. Finding it was impossible to reach the men they manipulated doors so as to carry the bulk of the smoke away from the imprisoned men, and after doing so directed their attention to the slope which, on account of the heat from the fire, together with the contraction of the air passage owing to falls, was upcasting and thus keeping the fire companies from working. At about 7 o'clock on the morning of October 30, the smoke abated and in a few hours the fire was well under control. At 9 p.m. a rescuing party reached the New Diamond workings and there found one man alive. He informed them that all the other men were dead. He, together with notes left by other members of the party testify that they were all alive at 11:30 a.m., October 30. They had become discouraged and determined to make one final attempt to reach the Four "Foot" vein along a rock plane connecting the two veins. At about 11:30 they all started through the thick smoke up the plane. He was leading the way up the plane, heard his companions saying "good-bye," decided to beat a hasty retreat. In the course of some time he reached the dip chambers, and there, with two mules, he remained until rescued. The bodies of the six others were found by the rescuers at or near the foot of the plane. Had the men, or even one of the number been acquainted with the current in that section of the mine, or had they known the use of the several doors, they could have done more to save themselves by the manipulation of the same than it was possible for the mine officials and others to do in that direction at the time and under the circumstances. Had any one of them possessed that knowledge he failed to turn it to good account at the critical time. It is further demonstrated had they remained in the dip chambers they would have survived. At the inquest which was held in the Lackawanna county court house, Scranton, November 5th and 6th, voluminous evidence was submitted by men and boys who had passed up the slope at various times on the night of October 29 up to 12:30, all stating under oath that no smoke was noticeable at the location of the light bridge when they passed that spot. Evidence was also submitted to show that no stove was in use at that point, neither did any steam pipes come in contact or in close proximity to the bridge. The following verdict was rendered: We, the undersigned, find that \* \* \* and others came to their death by suffocation due to a fire in the Von Storch Slope, the origin of which is to us unknown, but after listening to testimony introduced we believe it to be of incendiary origin. We further believe that the Company did everything in its power to save the men and subdue the flames after they were discovered.

October 1, 1898; Maffett Slope; Wilkes-Barre  
(Midvale), Pa.; 5 Killed

(Transcript taken from microfilm record of "Sunday Morning Leader," Oct. 2, 1898, courtesy of the Wyoming Historical & Geological Society, Wilkes-Barre, Pa.)

Four men were smothered to death in the Kidney vein of the New Maffett slope, adjoining the Prospect shaft yesterday, by smoke emanating from fire in a set of timbers in the gangway leading to their chambers. The men were smothered to death by smoke from the burning timbers, and when found lay face downward in the ditch along the gangway where they had fallen exhausted. Origin of fire unknown.

About 9 o'clock a Slavish woman appeared in the crowd at the top of the slope and stated that she believed her husband had lost his life in the mine as he had not returned from work. She was not certain as to his place of employment, but believed he worked in Maffett. The searching party succeeded in passing the fire and scrutinized every nook and corner in the vicinity, examined the old workings carefully but could find no other body. The search was continued during the night. The fire was extinguished before night.

(The following excerpt was taken from the annual publication, "Pennsylvania Department of Internal Affairs, Part V, Report of Bureau of Mines, 1898," page 76)

The other two accidents, one at the Midvale slope on October 1, whereby five men lost their lives by suffocation caused by the timber in the intake airway taking fire.

Note: This is the only record that could be found of the death of the fifth person.

August 21, 1900; Issaquia No. 4 mine; Issaquia,  
Wash.; 5 Killed

(From microfilm records of "Seattle Post-Intelligencer," Aug. 22, 1900)

Excerpts:

Five miners were smothered to death at the Issaquia mine No. 4 at Issaquia this forenoon. A brush fire spread to the mouth of an air shaft, ignited the timbers, and was sucked down by the ventilation fan into the workings where 80 men were employed.

All miners near the exit escaped but 5 men were in remote chamber and were overcome by smoke and black damp.

Deaths probably caused by momentary stoppage of current of air in shaft—possibly timbers fell and choked the shaft up and stopped the air until they burned away. This gave the damp a chance to settle down.

February 25, 1901; Diamondville No. 1 mine;  
Diamondville, Wyo.; 26 Killed

(From "Mines and Minerals," April 1901, page 388)

On the night of Feb. 25, 1901, a disastrous fire broke out in Mine No. 1 at Diamondville, Wyoming, causing the death of 26 miners and doing much damage to the mine itself.



The management of the coal mines at Diamondville is very good and accidents of any kind have been few, but the nature of the coal is such that it ignites readily, and on the least contact with fire it is prone to break forth into conflagration. The origin of the fire is supposed to have been in the contact of the flame in a lamp with either the woodwork or canvas brattice along the passageways which spread to the coal and thus created the widespread disaster that followed.

The rapid spread of the flames prevented help reaching the unfortunate men from other quarters of the workings. Those who were near the outer workings of the seventh level and who managed to make their escape, seemed to have been so overcome by the excitement of the moment as to be unable to give direct and positive evidence as to what took place or as to the cause of the accident.

In the mine there are employed, during the three shifts, about 200 men. The 7th level is about 2 miles in length.

Unfortunately, the men who were beyond the point where the fire broke out seemed to have lost all presence of mind and were unable, evidently, to reach an avenue of escape.

Upon the first cry of fire the mine management on the ground at once set to doing all that lay in their power to allay excitement, and at the same time took steps to stay the progress of the fire. The men were quickly drawn from workings adjacent and contiguous to the locality of the fire, and had it not been that men were within the burning area that part of the works would have been shut off at once, thereby cutting off possibility of the fire spreading, but while there was any hope of saving life every effort was made to help the men. Water was turned into the burning area, but the fire continued to rage and no voice or cry came from the doomed men below, and as the most threatening aspect rested on the scene, it was decided best, at 9 p.m., to plug the mouth of the working.

It was learned that the fire began at 4:15 in the afternoon and that it began between rooms 40 and 46 in the sixth south entry. This entry is situated about 5,000 feet from the main incline. Almost 3,000 feet from the main incline or slope there is a side track, and at this point drivers gather their loaded cars, and trips are made up to be taken to the slope by the outside drivers who haul the trip with a spike team. Here the drivers make use of a piece of brattice, or heavy duck, which serves as a screen to break the strong air current, and it is believed that this brattice cloth took fire from a driver's lamp. As there was near the brattice a quantity of dry boards and timber it was but a moment until a fierce fire was burning, which set fire to the coal faces adjoining, the flames, gas, and smoke being carried downward to where the miners in that part of the mine were employed, shutting them off from all possibility of escape after the fire had gotten under way. Moreover, these men could not speak English, and when called upon to escape they did not seem to understand the orders given them. One man ran forward amongst these men, upon first realizing that there was a fire raging, in the mine, and warned them to flee for their lives. He escaped by a back entry, and had the unfortunate men followed him, all would have been well, but they seemed dazed, and as the dense clouds of smoke rolled in upon them they doubtless soon became bewildered and suffocation followed. Every possible effort was made to reach them, but with the only result that many of the rescuing party came near losing their own lives in the attempt. When at length it was seen that all attempts were in vain, and that further attempts were only endangering life and property, the

entries were plugged and the fire confined within a given area.

The manager of these mines had months ago prepared the entries for emergencies of this kind and when the work of shutting off the burning district began it was only a short space of time until all other parts of the mine were safe from spread of the fire. After 24 hours had passed, efforts were renewed to reach the suffocated miners and the search continued night and day until March 3rd, when the first few were reached where they had fallen. It was then found that the fire had not reached that part of the mine, and that death resulted from suffocation. These first victims having been thus reached, work of rescuing the bodies continued, and at a little after midnight on the morning of March 4th the remaining 18 bodies were reached in the areas where they had been overtaken by the gas and smoke.

### November 14-22, 1901; Pocahontas Mines; Pocahontas, Va.; 17 Killed

(*Excerpt from "Mines and Minerals," January 1902, V. 21-22*)

The Baby Mine and the West Mine are at Pocahontas, Va. These two mines are part of a group of five mines known as the East Mines No. 1 and No. 2; Silver Ridge Mine, Baby Mine, and West Mine. The workings of this group of mines embrace an area of about 2,000 acres, while the total acreage of the company's property is about 8,500 acres. The East Mines and Silver Ridge Mines are entirely separate, but the Baby Mine and the West Mine in which the disasters occurred on November 14 and 22 are connected through workings.

On November 14, at about 4 o'clock in the morning, a fire was discovered in the Baby Mine exhaust fan. The fan was stopped and after the fire was extinguished, it was discovered that the air from the fan entry, which was still coming out in the direction of the fan, carried with it considerable smoke and heat, and upon examination it was found that there were fires at four different points just off the main entry and the fan entry of the Baby Mine, all fairly well under way, separate and distinct from each other.

The first of these fires, which was discovered, was located about 700 feet from the Baby Mine pit mouth on No. 1 entry on the straight mine track, over which cars had been hauled only a few hours before. Although these four fires were all burning and equally well under way, there had not been, up to this time, any explosion or disturbance of the electric equipment, which is used in this mine for haulage. While a small party at 5 a.m. was making an examination of the fire, in the No. 1 entry at a point aside from the direct intake, and cut off from any draft, a fall of roof coal occurred which caused a disturbance of the gases which had been accumulating in the rear of the fire, resulting in a slight explosion. This did not seriously injure any of the party, who were all within 50 feet of where the fire was burning, and where the fall occurred. It, however, blew out some of the brattices, which permitted the smoke and gases to pass on up through the workings in the old section of the Baby Mine and into the West Mine, where a number of miners had gone to work early in the morning before the regular day shift had entered, and before warning could be sent to these miners, they were overtaken by the smoke and suffocated. In this manner there were nine men suffocated in the West Mine at a distance of a mile from the location of the fire.

In the meantime preparations were being made to fight the fire in the Baby Mine, and while streams of

water were being put on the fire, between 9 and 10 o'clock in the morning a second explosion took place at the same point. This occurred in the following manner:

After it was discovered that some miners had gone into the West Mine before orders had been given not to enter this mine, and that the smoke from the Baby Mine was drifting up into the West Mine, directions were given to start the Baby Mine fan for the purpose of drawing the smoke back from the West Mine out over the fire in the Baby Mine, so as to give the men who were in the West Mine fresh air. The result of starting the Baby Mine fan was that the gases which had been previously generated by the fire and drifted with the smoke, were carried back mixed with air over the fire, resulting in a second explosion. This explosion was, however, slight and although a number of men were near the fire there were none of them seriously injured. In fact no fatalities have occurred in the Baby Mine or within 3,000 feet of the point where the fires and explosion occurred.

The bodies of the men who were suffocated on the 14th inst., were all recovered a day or two afterwards, but it was found that the condition of the West Mine was such that it would not allow of it being worked while the Baby Mine fire was in progress, and after putting up some brattices partly cutting off the Baby Mine from the West Mine, a party of eight, went into the mine entry of the West Mine at 12 o'clock on Friday, November 22, for the purpose of making an investigation and ascertaining the condition of the mine. After having put up the temporary brattices the evening before, which were built of wood separating the Baby Mine from the West Mine, the West Mine fan was started at 4:15 a.m., on the morning of the 22d, and at the time the investigating party entered, had been running at 30 revolutions per minute for 8 hours. The party which entered at 12 o'clock left directions as to what intake doors were to be left open. This gave them good air to a certain point about 1,500 feet in, but they went beyond this point and it developed that the brattices which had been put in between the Baby Mine and the West Mine, did not completely cut off the gas, and the West Mine, being at a higher elevation, the gases from the Baby Mine drifted up into the higher workings of the West Mine, and the party passing beyond the shorter circuit of ventilation entered these higher workings and were suffocated. This gas was composed of white damp or CO, and had a distinct odor which accompanies coal distillation.

The searching parties that went in that same evening, upon the failure of the party of eight to return, discovered the foul condition of the West Mine, and the bodies could not be recovered until after more brattices had been put in. The bodies of this party of eight were recovered on Sunday, November 24, all of the party having died from suffocation at a distance of about two miles in the West Mine, away from the location of the fires and explosions in the Baby Mine.

The fires and explosions in the Baby Mine have done very little damage to the section of the mine which has been recently worked, and has extended only into the old abandoned section of the Baby Mine.

The system of fighting these fires has been to supply them with as much water as possible through pipes which have been extended into the workings, and after these pipes were extended, curved brick dams were put in at the foot of the old entries and in the fan entry, cutting off entirely this section from the section of the Baby Mine in which coal has been mined during recent years. The water pipes extending through these dams have been used for flooding the district in which the fire is located. In this

manner the fire is being gradually extinguished and the ventilation and tracks in the new section of the Baby Mine have been changed so that now the Baby Mine is being worked and the usual quantity of coal is being taken out. The West Mine, through which gas and smoke naturally drift on account of the higher elevation, is also being cut off from the old section of the Baby Mine by brick brattices and dams in place of the temporary wooden brattices. This work is almost completed, and as soon as completed will permit the operation of the West Mine, which will first be thoroughly ventilated. Hereafter, these two mines will be permanently separated by these brick walls. It is expected that coal will be shipped from the West Mine, which produces about 2,000 tons per day, by the 20th of December.

The mines of this company are the largest, and oldest, and most extensively worked in the entire Pocahontas Flat Top field, having been opened in 1882. The coal is of a semi-bituminous character, somewhat softer than Connellsville coal, and somewhat easier to mine, and possibly the easiest seam in the country to work and is, under ordinary conditions, entirely free from dangerous gases. The seam at Pocahontas is about 10 feet thick and in some rooms 18 to 19 feet in thickness.

The Baby Mine is equipped with electric haulage, coal-cutting machines, and electric pumps. The haulage of the West Mine, the East Mines, and the Silver Ridge Mine is done by steam locomotives and mules. The condition of the West Mine as to haulage, drainage, and ventilation is very good. Exhaust fans are used in all of these mines. The company has just erected a new stone power house with a capacity of 1,500 horsepower, so as to admit of a more extensive use of electricity throughout the plant. The coke laries and tipples are operated by electricity, and the towns of Pocahontas, Va., Coopers, and Bramwell, W. Va., are lighted from this plant. The company operated 600 coke ovens.

### January 13, 1902; No. 2 Mine; Dow (Indian Territory) Okla.; 10 Killed

*(From a report of William Cameron, U.S. Inspector for the Indian Territory)*

Ten men were fatally suffocated in mine No. 2, at Dow, Ind. T. On January 13, 1902, a shot, which had been fired just before noon, having set fire to the coal, the smoke caught these men and suffocated them.

Mine No. 2 consists of a shaft 360 feet deep, which is connected by an entry 400 feet long to a slope, which is about 2,000 feet in length with a pitch of 10°. This slope has 5 lifts or pairs of entries, the main entry from the shaft forming the sixth lift. The foot of the slope connects with the above-named entry on a curve. Prior to the time that the connection of the slope was made with the entry—that is, before the coal was cut through to form the connection—the slope was ventilated by furnace, but when this connection was made (on December 20, 1901) it was found that the natural ventilation was more than sufficient, the mouth of the slope being of a greater altitude than the mouth of the shaft. The current of air from this natural ventilation proved to be so strong that it blew out the miner's lights, and it was impracticable to work in so strong a current. To remedy this, a curtain of 3-ply canvass (sic) was placed across the entry leading from the shaft. This proved entirely satisfactory and reduced the air current to a reasonable amount, but still abundant in quantity.

When the curve from the main entry from shaft met the slope, it was found that the entry had been

driven about 4 feet too far to the east, leaving a jog or set off of 4 feet on the west rib of the slope. This was in process of being "slabbed" off on the date of the accident.

Proceeding down from the fifth entries toward the point of junction of the slope with the entry leading from shaft the entire distance was quite dry and dusty. Coal dust and soot were strongly in evidence until I reached a point about 80 feet above the place where the blast had been fired which set fire to the coal. At this point, a canvas curtain had been hung across the slope for purposes of ventilation. At this point the curtain had been burned away and slight evidences of fire were observable on the sides of slope and also on the ties, this being the first sign of flame that had been found. From this curtain down to where the shot had been fired, the evidences of fire increased, the coal on the "rib" or sides of the slope being coked to a depth of from 2 to 2½ inches into the solid coal, showing that the fire had burned fiercely at that point. Passing the shot and proceeding around the curve leading to entry leading east from shaft the evidences of fire were very strong for about 70 feet below the shot and to a point where the three-ply curtain had been hung as above referred to, which curtain had caught fire and been burned away. No force or flame had proceeded out beyond this point toward the shaft. An examination of the shot which caused the fire shows that it was what is technically known as a "slabbing" shot. The hole had been drilled parallel with the rib and about 3 feet on the solid. Hole was drilled in about 6 feet with about 3 feet of powder in a 1½-inch cartridge. Examination of the men who prepared the shot and of others who saw it before it was fired shows that it was a good square shot with a strong heel, one that, if the quantity of powder had been properly proportioned to the amount of force required to move the body of coal in front of it, no accident would have resulted therefrom.

However, as the evidence of several practical miners showed, this shot had been seriously overpowdered, the men who prepared it having admitted to me its length and size as above. This, in the opinion of miners competent to judge, was twice the amount of powder necessary and proper, and in this opinion I entirely concur. Examination shows that this shot threw the coal violently out, pulverizing it, making a large amount of coal dust, and throwing considerable flame, which said flame burned the curtains above referred to and set fire to the adjacent coal, probably assisted by the gas which naturally issued from newly opened works in the McAlester vein, and the abundant ventilation augmented by the burning of the lower curtain, further aiding in the ignition and combustion of this coal, which is well known to be easily ignited and burns freely with great rapidity and fierceness, giving off dense volumes of black smoke. The conclusion, therefore, is unquestionable that the coal was ignited by a blown-out shot which was overcharged with powder; that the slope being the upcast might be compared to a smoke stack or chimney filled with dense black smoke from the fire below and in which nothing could live; that the unfortunate men, all of whom were working in places off the slope, failed to take warning at the first signs of smoke, believing that it would soon clear away, until they were overtaken by it and suffocated before they could reach the exit or mouth of slope.

When the alarm was given at the top by the escaping men and the smoke which issued from the slope, the superintendent, who was at home at dinner at the time, organized a force and went down the shaft to fight the fire at the lower end, which was gotten under control by 8 o'clock p.m., and the work

of getting out the dead men began. The last man was taken out by 5 o'clock the following morning, and the work of extinguishing the fire completely carried on until the following evening, when it was entirely extinguished.

During this examination, I recommended that to reduce the danger from a similar cause in the future, the slope and all the entries below the third lift should be sprinkled so as to keep them moist; that all shots fired in the mine below the third lift should be fired by shot firers, and such shots should only be fired when all other men than the shot firers were out of the mine.

### May 5, 1904; Locust Gap Colliery, Locust Gap, Pa.; 5 Killed

*(From reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1904, p. 466)*

On the morning of May 5th, I was summoned to Locust Gap colliery the scene of a mine fire, and upon my arrival at the colliery, about 6:20 a.m., I found both slopes and fan-way on fire, the fan having been burned down. Five men were entombed inside. I proceeded to the west end slope, which connects with the inside workings of the Locust Gap colliery, and descended 1,700 feet, then back east to the bottom of Locust Gap slope on the second lift. I found a fire there of immense magnitude. The third level of Locust Gap is not connected with the main or hoisting slope, the coal being hoisted from this lift on a tender slope to the 2d left and transferred to the main or hoisting slope.

After finding it impossible to cross east of the slope, we made an effort to go down to the 3d lift through the upcast airway west of the slope, but when we reached the top of the gangway, we found that the water had raised to that point. Our intention was to go along the gangway east until we reached the other upcast airway on the east side of the slope and go up this airway to 2d lift to reach the men through this channel, brattices were put up at once to prevent the fire from getting any air. I then went up to the first level and to the bottom of the slope and found conditions the same as below as far as the fire was concerned. They immediately made preparations to brattice here also. The next move was to slush the slopes and fan way. Also holes were sunk from the surface and silted to prevent the fire from spreading east and west. The work was done with great rapidity.

A futile effort was also made to get down to the second level through an old traveling way on the east side. They got down about 100 feet below the first lift, when they found that the passage was blocked with immense pieces of top rock. These were old workings that had been robbed years ago, and to blast these rocks, meant the losing of more lives.

The five men that were entombed lived in Locust Gap.

On May 8, I again went to Locust Gap in company with the Chief of the Department of Mines, where we met the president and the organizer of the Ninth district of the United Mine Workers. We proceeded to a room in the McClure Hotel and I pointed out on the colliery map to those present what had been done to rescue the imprisoned men. Every one present approved of the methods adopted.

On the 13th of May I again visited the mine, and in company with the inside foreman at Pott's Colliery, went down the old traveling way on the east side. As we got near the first lift I noticed that the air had been reversed, and fearing the smoke or damp might

issue through the hole we decided to return. There were men timbering this manway at the time, and I suggested to the officials that they stop and take the men away, which was done.

The fire originated in the pumpway, while a party of men were timbering it. They were given lanterns to work with, so I am told, but instead of using them they used their naked lights, which resulted in setting fire to the timbers.

The company, regardless of the expense, did all in their power to recover the bodies of the men, before slushing the mines.

**December 4, 1904; Horton Mine, Horton, W. Va.;**  
**7 Killed**

*(From Archives and History, State Capitol,  
Charleston, W. Va.)*

This mine was ventilated by a furnace. The furnace stack was constructed of wood and for some unknown reason the stack burned, catching the coal on fire. Seven men were suffocated by smoke and gas from the fire.

**January 16, 1905; No. 1 Mine; Decatur, Ill.;**  
**6 Killed**

*(From the State Coal Report 1954, Illinois  
Department of Mines and Minerals)*

January 16, 1905, shortly after noon, a fire broke out in No. 1 mine, Decatur, Macon County, which resulted in the death of six men. The fire was discovered in the mule stable and undoubtedly was caused by sparks from a pipe or a partially consumed cigarette. At the time the fire was discovered, about 60 men were in the mine, but by the prompt action of the mine manager in sending runners to give warning, all escaped but the six unfortunates referred to above. The alarm was immediately sent to the city fire department, which responded promptly, but, owing to the location of the fire so far underground, considerable time was consumed in preparing to reach it. By hard work, the fire was brought under control, several men were rescued and all the bodies recovered.

**October 13, 1905; Clyde Mine; Fredericktown,  
Pa.; 6 Killed**

*(From a State report)*

October 13, about 1:15 p.m. a fire was discovered by an electrician, in the pump house situated in a breakthrough between No. 1 and No. 2 right main, about 1,800 feet from the entrance of the mine. All the employees (with the exception of six men who were missing) had safely made their exit from the mine when warned of the danger. About 4 p.m., while making an official visit in No. 5 mine of Vesta Coal Company, I received a message that the Clyde mine was on fire. I at once proceeded to the mine, arriving there at 10:50 p.m. The mine foreman, with a rescuing party, returned from the mine at 10:50 p.m., and reported that they had made two attempts to reach the place where the fire was first discovered and had been driven back by dense volumes of smoke. They said it was impossible to proceed further in that direction.

I learned that since the fire had been discovered the engineer in charge of fan, and a miner, had entered the fan house during the afternoon, to examine the fan, and that an explosion had taken place at that point, seriously burning both men.

I held a consultation with the mine official and after examining the map of the mine produced and carefully considering the pump house location, in which the fire was supposed to have originated, and the report of the mine foreman and rescuing party, I decided to confine myself to the information received, together with report of the explosion in the fan house. The latter impressed me with the belief that if an explosive mixture was being carried on the return to the fan house in such quantities as had been so recently demonstrated, there was a possibility, at any moment, of a repetition of the explosion by the mixture coming in contact with the fire that was raging in Nos. 1, 2, and 3 mines.

I was fully aware that wooden stoppings had been the prevailing method of conducting the air along the main entries prior to this date, and that being the case it would give the fire additional power (sic) to spread from one main to another.

With the above in view and the evidence given by the rescuing party—that there was not a possibility of a living person inside of the mine—we decided to postpone another inside exploration until morning. I gave strict orders that no open lights should be allowed at or near the fan house or main entrance to the mine, that the fan should be kept running at the same speed, and a strict watch kept over its behavior, and should any disturbance be noticed to notify me at once. Early in the morning I found that nothing unusual had taken place, I then decided to make another examination of the mine and ascertain what course to pursue, with a view of recovering the bodies, and to prevent the fire from spreading into other parts of the mine. With a rescuing party I proceeded to the point that had been reached by previous rescuing parties, and then decided that, owing to the dense volume of smoke at the point, it was impossible to proceed any farther in that direction of the main.

We examined the mine map, inspected the fan, air ways, and entrance and then ordered more stoppings to be built with slide door attachment. After the stoppings had been completed we entered the mine by opening the slide door, closing it when through. We then opened the next one on the inside, and upon examination we found large quantities of smoke and gas, sufficient, if ignited, to cause serious results. We suggested that every precaution should be exercised and outlined a method for fighting the fire by forcing water into the mine, thus leaving it in the hands of the mine officials. I continued to make frequent visits to the mine, keeping everything under close observation. November 29, we again entered the mine, proceeded along the main, and upon the examination of No. 11 butt we discovered the six miners, lying side by side, apparently asleep. I would say, that owing to the position of the bodies and the peaceful countenances of the men they had lain down to rest, and the products of combustion had done their deadly work while the victims peacefully awaiting relief from the rescuing party that had made three attempts to reach them.

**June 7, 1906; Red Lodge Mine, Red Lodge, Mont.;**  
**8 Killed**

*(From the report of the State coal-mine inspector)*

The greatest disaster occurring in the coal mining history of the state was that of June 7th, 1906, at the Red Lodge mines, when eight men lost their lives as a result of attempting to approach a mine fire for the purpose of extinguishing or controlling it, and a subsequent effort at rescue.

At the time of the disaster, two fires originating from spontaneous combustion had been burning for

some time. One of the fires was in Room 22, Fourth east entry. Vein No. 4; but the fire that cost the lives of the eight men was that of Room 6, Third west entry, Vein No. 5, the two fires being completely unrelated, and each being on a separate current of air.

During the night of the 6th there was a crew of men fighting the fire in Room 22, and another crew performing the same service in Room No. 6. Toward morning on the 7th the fire in the latter room was gaining headway and part of the crew was called from Room 22 to assist those at Room 6 who were attacking the fire from the Third level Vein No. 5. At about 5:00, the morning of the 7th, those attacking the fire at this point determined to attack it from the opposite side, and with this intention went to the surface and entered No. 4½ water level, went through the rock tunnel and along No. 6 water level to the electric fan located at the intersection of this level and the No. 6 incline. The night crew that had gone down to the electric fan, which had not been running, the incline having been acting as an upcast, intending to reverse the direction of the intake air current, so as to enable them to go down the incline and into the Third west level of No. 6, to the opposite side of the fire in room No. 6, started the fan as a force. The starting of No. 6 (electric) fan had the effect of forcing the air down the incline, No. 4½ water level and the air shaft in No. 6 water level acting as intakes.

The men found the air in the incline so pregnant with gas that they decided to retreat. On counting their number it was found that one had started out toward No. 4½ water level, and Mr. H----- started after him. The balance of the crew started out the level in the opposite direction and finally reached the surface through the air shaft. Mr. H----- found the man overcome and at the same time was himself prostrated. As the fan was running and the water level was acting as an intake, the air was becoming purer and both men revived and in a short time effected their escape and went to the company office. After the arrival at the office of the two men who had barely escaped with their lives through No. 4½ water level, the day crew consisting of thirteen men, was allowed to enter the level in an endeavor to reach the point at which it had been determined to attack the fire. On reaching No. 6 incline, the men strung out along the incline, some being a considerable distance ahead of those behind. Before reaching the Third west level that branches from the incline, the men became aware of the dangerous condition of the atmosphere and attempted to retreat. Those of the crew that started to make their escape through the air shaft of No. 6 water level selected the two most physically able and had them hasten ahead and notify the office of the dangerous condition of the mine air and of the fact that two men, if they had not escaped, would be found along the other end of the level, and that if the rest of them did not get out through the air shaft, to send them assistance. The word reached the office, but not until after the day crew had gone into the mine through No. 4½ water level, and down into the incline. On receiving this information, a crew immediately secured lamps and went down No. 4½ water level to the electric fan where they found one man, and he was sent down the incline to reconnoiter. He returned in a few moments, in an exhausted condition and reported seeing three lights on the incline. A few moments later, 3 men of the day shift came up the incline and through the fan. They were all much exhausted, verging on a state of complete collapse. They said that it would be impossible for a man to live on the incline.

An attempt was then unsuccessfully made to approach from the 2 slope (opposite side). In the meantime the electric fan was stopped, and when the

rescue party returned to the No. 4½ water level entry, some difficulty was experienced in restarting the fan.

When the fan was started, it was allowed to run for about three-fourths of an hour before the organized rescue party attempted to go down the incline. On going down the incline, one man was found lying at a distance of about three hundred and fifty feet from the fan, and two members of the first rescue party and eight men of the day shift were found lying on the floor at different points further down the incline. These men were all removed to the surface as quickly as possible and two of the day shift were finally resuscitated. The others were dead when removed from the mine. The changing of the current of air, i.e. exhausting air past the fire and out and up the incline, filling the passages and old workings with the fumes from the burning coal and wood, during the night of June 6 and to between five and six o'clock of the morning of the 7th, and then starting the No. 6 fan as a force, withdrew the stored gases and forced them down the incline and back into the Third west level of No. 6 vein, and the attempt to enter the incline so soon after the reversal of the current, was, in my judgment, a grave error. The miners should not have been allowed to enter the mine, no one should have been allowed to enter the mine, except to perform such duties as might have been necessary to remedy the condition, and then there should have been proper protective preparation and a full knowledge of the dangers to be encountered. When the condition of the air was discovered by the fire boss—at the time the night shift was at the fan for the purpose of starting it, and when they found they could not proceed down the incline with safety, noting the presence of white-damp—he should have posted on the door of the fan, "Danger, Keep Out!" Neither should No. 6 fan have been ordered stopped when it was, as the purpose of reversing No. 2 fan and opening the slide door in room 17 was to enable No. 2 and No. 6 fans to assist each other, in supplying pure air to that portion of the mine. There had been numerous fires at the Red Lodge mines, but up to this time there had not been any serious results coming from them, and the danger arising from the deadly gases being constantly generated, was not appreciated by those encountering them. Neither the management or any of the employees anticipated serious results. Considering the fact the CO is always present after powder explosions and invariably impregnates the air with large percentages during and after a mine fire, the percentage of insidious men and miners who know anything of this insidious gas and its deadly effect, is surprisingly small.

**May 19, 1907; Engleville Mine, Engleville, Colo.;  
5 Killed**

*(From State Records)*

Fire first started in May, 1906. Stoppings built . . . fire fought almost continuously . . . fire rekindled and reversing of current which had previously escaped through old workings of adjacent Starkville Mine, forced fumes upon the 5 men.

**August 26, 1908; Hailey-Okla. No. 1 Mine;  
Haileyville, Okla.; 29 Killed**

*(From abstract of report of Wm. Cameron,  
by W. J. Fene, Bureau of Mines)*

The fire started at about 8:30 a.m. after the men had been lowered into the mine. The daily supply of lubricating oil had been sent down in open tubs. A

driver passing by with an open light in his hand ignited the oil. Attempts were made to extinguish the flames with water. About this time the mine foreman came to where they were and at once took hold of the tub of oil and dumped it on the floor of the entry. The flames at once spread and ignited the timbers supporting the roof. The mine foreman, cager and driver escaped to the surface uninjured. Twenty-nine men, who were behind the fire, lost their lives in a vain attempt to penetrate the smoke and reach the shaft.

The work of recovering the bodies was begun at once, and the bodies of all the men, except one, were recovered by 5:00 a.m. the following morning.

The damage done to the mine was very slight, with the exception of one fall of roof on the main East entry, near the bottom of the shaft where the fire originated. This fall choked the burning timbers and prevented the fire from spreading inby.

**November 16, 1908; Pratt No. 3 mine; Ensley, Ala.; 8 Killed**

*(From "The Age-Herald," Birmingham, Ala., Nov. 18, 1908)*

Eight dead and one missing is the awful record of the desperate attempt on the part of 50 negro convict miners to escape late Monday night from the Pratt No. 3 mine. The deaths were caused by fire in the manway, which apparently was started by the convicts.

No. 3 mine has a slope through which the coal is hauled to the surface, while the manway is for the entrance of the miners into the mine. The slope and manway meet about a quarter mile underground. Both convict and free labor are worked in the mine.

Monday afternoon when the day shift of convicts were brought from the mine to be taken to the stockade, about 50 were found to be missing. The force of guards at the manway, slope and other points were immediately doubled and preparations made for any attempt to escape on the part of the negroes.

Shortly after 10 o'clock Monday night one of the guards at the manway noticed a small puff of smoke among some timbers at the mouth, then the timbers burst into a huge blaze, and from the manner in which they burned it is believed that oil had been poured upon the timber.

In a moment the manway was a seething furnace, the timber supporting the wall burning with rapidity. The alarm was quickly spread and a systematic fight started against the fire. A heavy force of guards was placed at the slope and the raising of the heavy iron gate disclosed 40 of the convicts belonging to the day shift. It had undoubtedly been their hope that all the guards would be attracted to the fire at the manway and they would have a chance to break through the iron gate and make their exit to freedom.

The thing that helped to save the 60 free laborers and convicts of the night shift who were working deep in the mines was the caving of the walls of the manway between the slope and the surface entrance. The smoke poured through the different passageways and but for the falling in of the walls the miners would have been suffocated.

The eight men who met their death were caught in the manway, their egress through the surface opening of the manway being cut off by the roaring flames above, while the falling roof cut them off from the slope and they were gradually roasted and suffocated.

Dynamite was also found in the passageway and it is believed that it was the intention of the convicts

to dynamite the iron gate in the slope. They were cowed, however, by the sudden raising of the gate and heavy force of guards, and offered no resistance to being marshaled into the stockade.

It was early yesterday morning when the night shift of free laborers and convicts were removed from the mine and as soon as they were rescued a search was made for any of the day convicts who might be hid in the mine. Two were found shortly before noon in one of the furthestmost pockets and it is believed by the prison officials that the missing man is hiding somewhere in the mine.

Four bodies were found during the forenoon lying close to each other, near the spot where the roof caved in while the others were found at intervals of about every two hours, the last one being discovered about 3:30 o'clock.

The actual damage to the mine will be very small and it is expected to be in full operation today.

**November 20, 1908; Red Lodge Mine, Red Lodge, Mont.; 9 Killed**

*(From "Mining Science," Dec. 3, 1908)*

Saturday, November 20, 1908, fire broke out in the Eastside coal mine, and before it was under control 9 lives were lost. The resulting damage is necessarily large. It is said the fire had been walled up for 19 years and unexpectedly broke its bounds.

The State Inspector of Coal Mines reports in a tabulation, Accidents in Coal Mines from October 31, 1908 to October 31, 1909, lists the persons killed and injured but states merely that a "Crib on No. 2 slope caught fire."

**November 9, 1909; Auchincloss Colliery; Nanticoke, Pa.; 9 Killed**

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1909, p. 336)*

On November 9, 1909, at 2:50 in the afternoon, an explosion of gas occurred in No. 2 shaft, Auchincloss Colliery, at Nanticoke, fatally burning one man and setting fire to the timber and coal at the face of chamber known as No. 40, which produced smoke and gas that suffocated eight other workmen, and slightly burning another.

The section of the mine in which the explosion occurred is known as No. 1 counter off No. 1 slope, Ross seam, and is ventilated by a separate and distinct split of air independent from all other parts of the mine and in which about 50 men are employed, but as is the custom a number of them emerged from the mine earlier in the day, among them being miner No. 40, in whose place the explosion is supposed to have occurred and for whom the injured was laboring. Miner No. 40 testified at the inquest, held for the purpose of inquiring into the cause of the accident, that on entering his chamber on the morning of the explosion and on leaving it at 12:20 p.m., he made an examination of his place and found it free from gas and in good condition. He also testified that he worked in this particular place, chamber No. 40, for one year and during that time he recalls only one occasion on which he found an accumulation of explosive gas. Therefore, the cause of the accumulation of gas between 12:20, the time miner No. 40 left his chamber, and 2:50, the time of the explosion, can only be conjectured.

Chamber No. 40 is driven at about a five per cent dip off No. 1 counter and is about 400 feet long, and at the face is a very abrupt upthrow or anticlinal, in consequence of which the coal was in a laminated condition and fell away from the working face, allowing the occluded gases to disintegrate (sic).

Three theories were advanced as to the cause of the explosion, all of which were plausible.

The theory accepted by the coroner's jury as having caused the explosion, was that the seam of coal at the face of chamber No. 40, having suddenly changed from a light dip to a pitch that is almost perpendicular and being of a laminated nature, a pocket of gas was liberated and filled the workings with fire damp at the point where the men were at work, which was ignited in some unknown manner, possibly by coming in contact with one of the workmen's lamps, or by one of the men striking a light.

The most unfortunate incident in connection with this disaster was the failure to escape of the six men who were suffocated. They were working fully a 1,000 feet from where the fire occurred and were warned to leave the mine as there was something wrong. This was evident by the filling of the workings with smoke and afterdamp, but after they had examined the air current in the workings and expressed the opinion that the trouble that existed in the portion of the mine from where the smoke was coming was but slight and would not endanger their lives, they decided to remain. They had sufficient time to reach a place of safety, had they heeded the wise warning of one of their number. They remained, however, and the workings filled with smoke and afterdamp to such an extent that escape was then impossible; the rescuing party being unable to reach them before the deadly vapors overpowered them.

### November 13, 1909; Cherry Mine; Cherry, Ill.; 259 Killed

*(From a report by George S. Rice, mining engineer,  
U.S. Geological Survey)*

The Cherry disaster occurred on Saturday afternoon, November 13, 1909. Of all the mine disasters in this country, it was second only to that of Monongah in the size of its death roll. About 300 lives were lost. The exact number had not been determined.

The Cherry mine is located in Bureau County, Illinois, near the northern edge of the Illinois coal basin, where the coal measures are deeply overlain with glacial drift. Three seams are penetrated by the two shafts, called locally the First Vein, the Second or Middle Vein, and the Third or Lower Vein, numbering from the top downward.

At the point where the two shafts are sunk the glacial drift is about 80 feet in thickness, although in the vicinity it is often from 200 to over 300 feet thick. The First Vein is at a depth of about 320 feet. It is a thin, irregular seam in Bureau County, and not mineable in the vicinity of Cherry.

The Second Vein is about 40 feet below the First Vein and is from four to six feet thick. The mine in this seam was developed some four or five years ago, and the workings are quite extensive, covering an irregular area of about 240 acres. The farthest workings are about three-fourths of a mile from the shaft. The plan of development was by the room and pillar system. About 300 men were employed on the day shift in this seam.

The Third Vein is about 160 feet below the Second Vein, or about 480 feet from the surface. Mining had been started in it only about a year previous.

Entries had been driven around a large block surrounding the shafts and longwall workings had been started. There were about 90 working places, but as the work was being pushed, nearly 200 men all told, were employed in this vein on the day shift.

The mine had two entrances, a large hoisting shaft, and a combined air and escape shaft. Both these shafts went to the Second and the Third Vein.

Coal was brought up from the Third Vein to the Second Vein on a single cage in one compartment of the air shaft.

The loaded cars were hauled around to the hoisting shaft. The coal was caged with the Second Vein coal and hoisted on large cages, on which the two-ton cars were placed tandem.

A stairway runs from the Third Vein up through the Second Vein to the surface, in one compartment of the air shaft. In addition to this method of escape from the Third to the Second Vein, there was a single cage in the southeast compartment of the hoisting shaft, that could be fastened to the floor of the main cage by a rope, which ordinarily hung from the cage seat at the Second Vein.

The mine was ventilated by a strongly built steel fan with steel plate casing. It was reversible, but as ordinarily used, forced air down the air shaft. The air returned, or upcast, through the hoisting shaft. At the Second Vein the intake air split, the larger part of it going through the workings in this seam, the other part continuing down the air shaft to the Third Vein workings.

All haulage underground was by mules. There were stables underground in each vein. The Second Vein stable was located about 60 feet away from and parallel with the main bottom.

The main bottoms, the stable and the landing at the air shaft had been lighted with incandescent electric lights up to about a month prior to the fire. Then a breakdown in the lead covered cable caused the use of torches until a new cable was installed. These torches were of a kind often used around naked light mines and consisted of a piece of two inch pipe, about 16 inches long, plugged at one end and reduced down at the other to hold a cotton wick. Kerosene oil is used in them. Such torches are usually hung to the timbering. When the supply of oil gets low, the torches are tipped down more or less and are apt to drip oil.

In the case of the torches at the air shaft, the evidence shows that there were two hung by wires from timbers, one placed on the north side, the other on the south side of the shaft, immediately adjacent to the manway along the west side of the hoisting compartment.

At 1:15 p.m., a car, containing six bales of hay standing on end, was sent down from the surface, destined for the Third Vein. When it reached the bottom, it was taken off on the east side and was hauled through the east run-around by a three-mule team. The driver left the car of hay with some empty cars on the siding immediately south of the air shaft and went back to the hoisting shaft, taking six loads of coal and returned again to the air shaft with six empty cars. He testified that when the team stopped, he walked past it and saw that the car of hay, which he had left on the previous trip, was burning.

The coupler boy testified that after the driver had brought the car of hay and empties to the siding south of the air shaft, that the cager and he pushed the car of hay through the manway up to a point where the torch on the north side of the shaft was hanging. He didn't notice whether the hay struck the torch, or not. The hay was standing high in the car, and from the evidence, it is probable that the top was higher than

the torch. At all events, they had paid no attention to it and had turned and pushed a loaded car, which had just come up on the cage, off same to the south and coupled it to the cars already standing there. When they turned around after coupling up the loaded car, they saw that the car of hay was on fire.

As a result of a careful study of the evidence, the author presents the following probable sequence of evidence.

At 1:15 p.m., the car of hay went down the hoisting shaft and was hauled to the air shaft.

At 1:20 p.m., the car of hay was shoved into a torch on the north side of the air shaft by the cager and the coupler, who, however, did not observe the result. It would appear from the evidence that the torch was low hanging, and while it would clear the empty cars, the bales of hay would project higher. It seems quite probable that the hay struck it and tipped it backward so that the burning oil would tend to run out, and this might explain the suddenness with which the hay blazed up.

It seems probable that the cager, seeing the hay against the torch, pushed the car away from it, to the south side of the shaft, throwing off one burning bale; then finding others ablaze, undertook to push the car to the sump. It also seems probable that the torch which had set the car on fire was removed before the car was pushed past the point where it had hung. When he got the car to the switch, the narrowness in the road increased the draft. Seeing the blaze was going to set the overhead timbers on fire, he decided to send it down to the third vein, where he knew they had a hose and water tap.

About 1:43 p.m., the car of burning hay was dumped down the hoisting shaft.

About 2:05 p.m., the fan stopped and then reversed, making the hoisting shaft the downcast. Conditions at the bottom of the hoisting shaft temporarily very much improved, so that men straggling into the bottom had no difficulty in getting to the cages.

About 3:00 p.m., the fan doors burned out; following which, the fan was stopped.

About 3:00 p.m., the foreman went below to try to reach the Third Vein with the emergency cage. Owing to the fan having stopped, the smoke probably backed up, and the fire getting closer to the shaft through the stable and pump room, he and party were obliged to abandon further attempts, after having brought the emergency cage up once to the Second Vein, so they lowered and disconnected it and then got on the main cage to ascend.

About 3:15 p.m., a loader belled. It seems probable that the cage carrying the others was then ascending. The signals caused it to be stopped and then lowered just after he was driven back by the smoke and heat.

About 3:30 p.m., cage containing the dead bodies reached the top.

About 4:00 p.m., hoisting shaft sealed.

When the wooden doors of the fan conduit burned out, water was played on the superstructures and down the shaft, but the water supply was limited as the mine was more or less dependent on the mine water and mine pumps which were now stopped.

The flames coming up the air shaft heated the steel plate fan and casing red hot, damaging the plates and melting the babbitt from the boxings. The fan engine was fully protected by a concrete house; the fan conduit, also of concrete, was not materially damaged.

The head frame carrying the sheaves for the Third Vein hoist, while not directly exposed to the blast, was burned so badly that it was removed.

Water was played around the top of the air shaft and down same that evening and night (November 13th) until the active flames were put out.

A pulley was rigged over the air shaft and a rope attached to the air shaft hoisting engine, and a hole broken in the reinforced concrete roof of the fan conduit so that a descent could be made in a small bucket. The Third Vein cage had dropped to the bottom through the burning of the hoisting rope.

At 1:20 p.m., two men, using helmet oxygen rescue apparatus and electric lamps, made the first descent into the air shaft. Signals were given with an automobile horn. They went down only 60 feet; the sheave proved not to be centered so they were hoisted up again. On this being remedied, a second trip was made about 2:00 p.m. This time they got down about 250 feet where it was thought that the shaft lining had broken, as the bucket landed on an obstruction.

A third trip was undertaken about 5:00 p.m., and this time their bucket did not strike the offset and they went to the Second Vein. They found smoke coming out along the roof with considerable velocity. Below the heavy smoke cloud they could see in about ten feet either way, and at the north side could see a fall extending nearly to the shaft. The bucket was so small, and owing to the weight of the apparatus, which is about 40 pounds, in addition to an electric lamp weighing 15 pounds, it was necessary to tie the men to prevent their overbalancing. This prevented any examination of the Second Vein, more particularly too, because there was no landing; that is, the bucket swung in a large shaft which went down 160 feet deeper. The automobile horn signals brought no response from within the mine.

About 11:00 p.m., the air shaft was sealed. Next morning, November 15th, the cover was taken off the hoisting shaft. Using helmets and electric lights, two men went down on a cage in the hoisting shaft about 9:00 a.m. They reached the Second Vein. It was so smoky they could not see, but they got about 25 feet from the shaft, in the Second Vein, on the west bottom before coming up. The timbering in the east bottom was then standing. It was too smoky to see into the pump room.

The air shaft at this time was covered. It was decided to have the cover removed. The fan was then repaired and slowly started upcasting.

That evening, November 16th, a company of firemen from Chicago arrived, bringing a fire engine with them. It was decided to throw a stream of water with this engine, down the shaft through a hole in the covering. This fire engine discharged about 600 gallons per minute.

The following day, November 17th, after a prolonged conference of State Inspectors and others, it was decided to investigate the air shaft, as the thermometer showed that the air in it was of practically normal temperature, although the gases it contained put out the light of a safety lamp. These attempts failed.

That evening, November 18th, the fan was started upcasting, the cover over the hoisting shaft removed, and a stream of water played down from the top by the Chicago firemen. Subsequently, as the shaft became cool from the water and from the incoming cold air, the hose was gradually carried down on the cage to the bottom, where an entrance was effected on the west side. Heavy falls of roof had occurred close to the shaft on the east side and in the pump room, entirely closing the openings in these directions, and also temporarily blanketing the fires under them. Active flames around the immediate bottom were quickly put out by the powerful stream from the hose most skillfully handled and directed by the Chicago firemen, who rendered splendid service at this critical time. In fact, it is a question if, without their skill and the use of their powerful fire-pump, whether a



footing would have been secured at the bottom of the hoisting shaft at this time.

The day following the entrance forced down the hoisting shaft, viz;—Friday November 19th, a considerable number of bodies were recovered from the shaft bottom and vicinity. The mine inside was found to be cool but full of blackdamp, which had to be slowly forced out by the air current. The plan adopted was to clear out one pair of entries at a time. Movements were hampered by the dead bodies of mules and loaded cars. The latter in turn blocked by the dead mules and by falls of roof could not be hauled out without cleaning up the roads, and the situation would not allow this delay.

Owing to the bad air encountered in the mine and the length of time that had elapsed, it was not considered possible that any one who had been trapped in the mine could be alive. Nevertheless, early in the afternoon of the following day, November 20th, —, who had been appointed to take charge of the underground work, happening to enter the second west entry on the south side, heard a noise, and going inward with a shaded light, he was greeted by one of a party of eight men who had been entombed since the start of the fire, and had saved themselves by erecting barricades near the heads of the first and second west entries. They had just made a hole through the barricade in the first west and had come out through the blackdamp to the point where discovered. This was a distance of over half a mile that they had to walk past cars and dead mules in the darkness, and in an atmosphere which would not support a light, except near the entrance.

These eight were in comparatively good condition and were promptly taken up and given medical attention and nursing in the hospital car. They reported that there were twelve men behind the barricade not strong enough to come out by themselves.

The first men in helmets to reach the barricade in the second west could not get through the small hole, and after working a little to enlarge it, returned to the base. It was very hot, and this added to the difficulties of the inexperienced helmet wearers, only two of whom had taken a half hour training. It was necessary for the writer to remain at the base to put on, adjust, and take helmets off the volunteers, being the only one with knowledge of the apparatus. In a number of cases, the men were overcome through mishandling the helmets so that they had to be revived with the resuscitation apparatus. The hole in the barricade was enlarged by the men in helmets so that they could go through it, and one after another, eleven miners were brought out. Some were supported between two helmet men, and a few were able to come alone on being led.

### December 14, 1910; Leyden Mine, Leyden, Colo.; 10 Killed

*(From a Bureau of Mines report by J. C. Roberts,  
mining engineer)*

A fire occurred in the Leyden Mine at 8:30 p.m. on December 14, 1910, which resulted in the death of ten men, all of whom were probably suffocated by the smoke from the fire, as no single man was found 500 feet from his working place.

The Bureau of Mines car arrived at Leyden at 7:30 p.m., December 15, and two hours were spent in training some of the local men who were familiar with the mine in the use of helmets.

The conditions of the mine on arrival were about as follows:

The mine is opened by two shafts 700 feet deep, the fan being located at No. 1 shaft, which is the uptake for the air, shaft No. 2 being the downtake. The air split at the bottom of shaft No. 2, one-half going to the north and the rest to the south side of the mine. The haulage is by mules to the main entries, and by tail rope to the bottom of shaft No. 2. (Shaft No. 1 was used only for hoisting rock.) The power to run the ropes was furnished by electric motors, located the one south and the other on the north side, each 50 feet from the shaft, and worked independently. The fire occurred in the south motor room, and immediately upon the smoke issuing from the fan the pit boss and three other men went down the main shaft (No. 2), got out the five men who were working on the north side, and tried to put out the fire with hose, but some one on the surface reversed the fan and drove out the firefighters who barely escaped with their lives, when the flames shot up the shaft.

The man who reversed the fan hoped to save the 10 men who were working on the south side, forgetting the men at the bottom of the shaft.

In a very short time all the surface plant, including the wooden head frame, engine and boiler room were on fire, the shaft timbers all burned out, and the shaft caved tight, so that when the car arrived there was no air coming through this shaft, which now became the upcast, and the whole mine was filled with "black damp." The State mine inspector very properly would not allow anyone to go down the shaft until the car arrived with the helmets.

At 9:30 p.m. four helmet men went down the shaft, and when within 10 feet of the bottom their safety lamps went out; so they came back, and it was decided to patch up the partition between the two compartments of the shaft, brattice off the north side, and split the main south entry in order to establish a circulation. This was started immediately by the helmet men, and as soon as it was safe for the men without helmets to go down to the bottom, brattice crews were organized and the work proceeded without interruption, the helmet men going ahead, putting up props and nailing on boards, and the brattice men coming behind with the brattice cloth.

A station was then established at the bottom of the shaft, and four helmet men were instructed to go to the parting at the junction of the fifth southwest and "A" entries, where it was hoped that all the men working in that part of the mine had congregated.

The reason for this hope was that this parting was protected by steel doors at each end, and it was thought that if they could get between those doors they might be protected from the smoke and might possibly be still alive. This run was made on the night of the 15th, and four men were found on the inby side of the parting near the door. It seems evident that these four men reached the parting, but the smoke or gas drove them out. Why they went out the inby door instead of the outby is a mystery. As these men were found dead, it was assumed that the other men could hardly be alive, and as the distances to the working places of the others were too great to be traveled with the helmets, all energies were bent to bratticing the main south in order to establish the air and drive out the CO<sub>2</sub>.

By the night of the 18th the air was carried up the first southwest to "B" entry and a station was established 100 feet inby the intersection of the first southwest and "B," and the helmet men explored A, B, C, D, E, F, and G on the southside, and found three men in between the fourth and fifth southwest, and one man in the second southwest near the intersection of first southwest and G.

By the night of the 24th the whole south side of the mine was explored, and still the other two bodies had not been found, and this necessitated exploring the north side of the mine, though it seemed impossible for these two men to have gotten to the north side, when no other men had succeeded in getting over 500 feet from his working place.

An effort was made to explore the shaft bottom where the fire was by coming down the first north-west, and we succeeded in getting to within 100 feet of the main north, but the steam and smoke were so dense and hot that the effort was abandoned.

The air was then cut off from the south side and all carried to the north, which was fully explored in the same way as the south side had been explored, but no trace of the missing men could be found.

We then felt confident that the missing men were on the south side near their working place and had been overlooked, which proved to be the case, as they were found in room 3 off the L entry from the second southwest near the face of the room behind some timbers, at 4:30 on the morning of the 29th.

The cause of the fire will probably never be known, but from all the evidence that can be gotten it seems to be another case of the careless and reckless use of open lights, together with all the dangers they entail.

#### April 7, 1911; Pancoast Colliery, Throop, Pa.; 73 Killed

*(From an abstract by W. J. Fene of a Bureau of Mines report by Chas. Enzian)*

The main and supply shafts are sunk through the measures on the west dip of the Lackawanna basin and cut the Olyphant #4, Diamond Seam, Top and Bottom split of Big seam, New County seam, Clark seam and three splits of the Dunmore or Red Ash seam, to a total depth of about 600 feet.

The East slope and Tunnel main haulage roads are operated by a tail-rope engine located about 400 feet east of the foot of the main hoisting shaft. The north slope engine room which was destroyed by fire and was the cause of the disaster is located in a heading about 800 feet east of the foot of the Main hoisting shaft.

The Dunmore #4 or China is ventilated by two main currents and divided into six splits.

According to the statements of two pipe line men, about 8:15 a.m., while at a point about 500 feet east of the North Slope engine room, noticed smoke coming from the direction of the shaft and upon investigation discovered the North Slope engine room on fire. They immediately gave the alarm and telephoned to the inside workings to get the men out, and also to the superintendent who was on the surface.

In about ten minutes after the fire was discovered, hose had been connected at the head of the North Slope and water was being applied to the fire from the North Slope side. When the Supt. arrived on the scene another line was attached and applied to the fire. When the fire in the Engine Room was under control, they discovered that the timbers and a large number of mine cars on the passing branch were also burning. The Supt. then returned to the surface to procure additional hose, which he attached to the Colliery Fire Service and ran a line down the supply shaft and by means of a twin coupling and valves they applied two additional streams of water on the branch fire.

Bureau of Mines Rescue Car No. 1 and the Rescue Car of the Delaware, Lackawanna & Western Railroad Co. were notified, and both cars arrived during the afternoon. A rescue crew was at once organized

and entered the mine and proceeded to the regulator located at the mouth of Perry's Heading. They found that the regulator had been closed and thought that it was probable that some men had barricaded themselves in the faces of the entry.

It was then decided that four men, wearing breathing apparatus, should enter the air-way and explore to the face, pass through the inside cutoff and along the gangway and return to the base of operations near the shaft. In a short while one of the men returned and stated that one man of the Bureau of Mines had collapsed at a point about 600 feet inside the regulator. Rescue men held in reserve were equipped and sent in to bring him out. As soon as he was brought to the base, which was at 4:55 p.m., every possible means to resuscitate him were resorted to and continued until 10:30 that evening, but without success.

After several hours a second exploration party was formed. They travelled through the affected area, discovering a large number of dead bodies. They returned to the surface and reported the conditions to the officials. Preparations were immediately made for the removal of the bodies and a large force of competent men were selected to do this work. The work of bringing the dead to the surface was continued without interruption until 2:00 p.m., April 8th, when the last of the 72 bodies was removed to the surface.

The engine room contained besides engine and steam line, timber frame for engine foundation, plank floor, wooden oil and supply cupboard, 12 sets (collar and leg) 8' x 10' yellow pine timbers and several planks for board walk from engine room floor through cross-cut to passing branch. A kerosene "Night Hawk" lamp was used for lighting.

From statements by the hoisting engineer, he left the engine room after hoisting one trip, leaving the "night hawk" turned down, at about 7:45 that morning, to go to the New North Slope Engine.

His first intimation of a fire was by smelling smoke while running the engine on the New North Slope and thinking that a door had been set afire he came out to investigate. He stated that frequently during his absence the driver boys working on the branch came into the engine room and helped themselves to oil.

It is highly probable that the fire was caused from any of the following sources:—

The engineer may have been careless in lighting the kerosene night hawk. He may have changed the cotton in his mining lamp and left the burning stub on or near the floor. He may have dropped the match, or clip of burned wick from the Night Hawk; or most probably he filled his own mining lamp, wiping it with cotton waste, sparks clinging to same and dropped it on the floor or near the timber frame, or into the opening at the base of the brake and reverse lever stand.

Possibly one of the driver boys, after having helped himself to oil, wiped his lamp with cotton waste and dropped it into the opening in the floor at the base of brake and reverse levers stand, at which point, from all indications, the fire originated.

The fire extended from the engine room through the cross cut to the passing branch and along the same, burning cars and timbers for a distance of 300 feet, feathering out at the junction of the shaft level and tunnel roads, and extending into both roads for a distance of 75 feet.

The smoke and gases evolved by the fire were carried into the tunnel workings by the main current and caused suffocation to workmen in area of mine workings of approximately 25 acres within about one-half hour after the fire started.

### May 10, 1911; Boston Colliery; Larksville, Pa.; 5 Killed

(Transcript from the "Wilkes-Barre Record," editions of Thursday, May 11, 1911, and Friday, May 12, 1911, courtesy of the Wyoming Historical and Geological Society, Wilkes-Barre, Pa.)

May 11, 1911.—Five men are believed to have lost their lives in a mine fire that broke out at the Boston Colliery at Larksville last night. When the Record went to press two dead bodies were being removed from the mine. The other three men were not found, but they are believed to be dead. At 3 o'clock this morning the fire was raging fiercely and the officials are using every effort to extinguish it. A slight explosion of gas is said to have started the blaze.

When the fire broke out there were about fifteen men at work on the inside of the mines. Within a short time after an alarm was sounded most of the men succeeded in reaching the surface by way of the shaft.

The two bodies were found lying along the road leading to the bottom of the shaft. They had fallen in their attempt to escape from the suffocating smoke and both the bodies were within a few feet of each other. Just how the explosion occurred will probably never be known, but it is believed that one of the deceased missing men ran into a body of gas with a naked light.

The fire was discovered about 9 o'clock by the rockmen at work driving a tunnel. There was a slight explosion followed by smoke that filled the tunnel.

The fire broke out in the Ross vein, or at the top of the mountain, better known as Nesbitt Hill. It is situated about a mile from the foot of the shaft. Examinations by the officials found that most of the blaze was located directly under two large cave holes on the Deare Farm. The caves are filled with water and it is proposed to drive holes into the bottom of them and permit the water to enter the affected workings.

The flames can be seen from the outside, where there is an outcrop of coal and at this point a large corps of men are fighting the flames with water and dirt. The affected section being heavily timbered it assisted materially in making the flames appear like a roaring furnace and it was long before the coal was ignited.

That many men were not in the mines was probably due to the fact that a strike was inaugurated at the colliery on Tuesday, throwing about seventy men out of work and most of them were employed in the section that is on fire.

May 12, 1911.—Several employees of Boston Colliery had to make strenuous fight to save their lives. Company officials say it was impossible for explosion of gas to cause accident.

A report at 3 o'clock this morning from the Boston Colliery, where five men met death by suffocation on Wednesday night, stated that the mine fire is practically extinguished, and that operations will probably be resumed within a few days.

Following the removal of the dead the officials gave their strict attention to the flames. The location of the blaze in the air course on the mountain side made it almost impossible to run a hose line to that point and effective work was accomplished by a bucket brigade. The fire-fighters remained on duty all day yesterday and last night, and the report early this morning was to the effect that the flames had been extinguished and water is being kept poured on the smoldering timbers.

A rockman said that he detected an odor of burning timber and decided to investigate. He was met by a large volume of smoke. Quickly returning to his fellow workmen he explained the affair and all started on a run for the shaft. They then thought of the others. A solid wall of dense smoke, however, drove them back. About half way of the tunnel in which they had been at work is wooden brattice for the purpose of guiding the air. Using their combined strength they succeeded in tearing down the brattice and made their way down a pitching plane. Behind them came the smoke and flame. A misstep meant death. They were fortunate in coming across a coal chute and in this way they slid to the bottom. From here they made their way up No. 4 plane where there was plenty of fresh air and within a few minutes they found themselves at the bottom of the shaft and were soon hoisted to the surface.

Reaching the outside they were told that the other men had not been heard from. Hurrying to Dunn's Colliery they secured several sticks of dynamite which were used in caving the rock and soil back of the opening on the mountain side. The cave resulted in cutting off the mine from the burning section and prevented smoke from entering the unaffected workings.

Oxygen helmets proved invaluable in the search for the missing men. When the first two bodies were found they were lying face downward within a few feet of each other. The remains were found a considerable distance from where they had been working. The remains of the other three men were located at the face of the gangway.

Officials of the company when questioned last night stated that they were not prepared to make a complete statement in connection with the affair, and this will probably not be made until an inquest is conducted by the coroner.

The exact cause of the blaze remains to be determined. The men at work in the tunnel on Wednesday night thought they heard a slight explosion before the smoke and flames were discovered. Officials claim, however, that it would have practically been impossible for gas to gather in the air course and that the fire was evidently started by a lamp being placed behind a piece of timber before the light was entirely extinguished.

### February 22, 1912; (Western) No. 5 Mine; Lehigh, Okla.; 9 Killed

(From a Bureau of Mines report by W. T. Burgess and R. Y. Williams)

At 11:05 a.m., February 22, 1912, a fire occurred in Mine No. 5 at Lehigh, Oklahoma. This fire was caused by a miner's (oilier's) open light accidentally igniting a body of car oil which was being warmed in a steam operated oil heater at the foot of the down-cast hoisting shaft. Of the 200 men in the mine at the time of the disaster, 190 reached the surface through two escapeways, 9 were suffocated by the smoke and afterdamps from the fire, and one man was rescued by the exploration party.

The coal bed is known as the Lehigh seam, which corresponds with the McAlester seam to the north-east; it lies on a 6° dip running N 75° E; it averages 4' 6" in thickness, and it has a cover varying from 59 to 900 feet.

At present all the coal is hoisted to the surface through three shafts—one shaft at mine No. 5 which is 201 feet deep, one at mine No. 6 which is 239 feet deep, and one at mine No. 8 which is 608 feet deep.

The only lighting system in use was the open lights of the miners. A large number of the miners used carbide lamps; many of them burned lard oil; and the trip-riders, bottom cagers, etc., burned either a mixture of lard oil and kerosene or straight kerosene.

The ventilation was maintained by two exhaust fans. One, located near the head of slope No. 5½, exhausted 25,000 cu. ft. of air per minute. The other exhausted 35,000 cu. ft. of air per minute.

On February 22, coal hoisting began at 8:00 a.m. The day was clear, and the fans were both exhausting. Approximately 42,000 cu. ft. of air were travelling down the hoisting shaft at mine No. 5. The balance of air entering the mine was travelling down the emergency shaft noted as being 59 feet deep.

The mine cars were oiled in the east run around at the foot of the No. 5 shaft. Inasmuch as this shaft was the downcast, the temperature in winter weather was so low that the car-oil unless heated would not run. The oil was stored in a 300-gallon tank on the surface, and each day 35 to 40 gallons of oil were drawn from this tank into a barrel which was placed in a mine car and lowered to the foot of the shaft. The barrel was then taken out of the car and placed beside the oil-heater.

The oil-heater consisted of an iron cylinder, 10' in diameter and 2½' in height, and an inch and a quarter steam pipe which fitted or coiled inside the iron cylinder. This coil was attached to the pipe line feeding steam to the mine pump, and whenever heat was desired in the oil-heater, a valve was opened and the steam ran through the coil.

The oil was dipped from the barrel to the heater and was drawn off as needed through a spigot at the bottom of the cylinder. Any drippings were caught in a drip-tub, which had been made by cutting a barrel in half and placing the half under the spigot.

The oiler was drawing oil from the heater, and he was burning in his lamp a mixture of lard oil and kerosene with a loose wick. The oil from his lamp, as he leaned over to fill his can, ran out the spout of his lamp, and burning drops fell into the drip-barrel which contained about 15 gallons of car oil. This oil caught fire.

An endeavor was made to put this fire out by smothering it with a coat and with a grain sack; but both these articles caught fire and burned. Then dirt was thrown into the burning barrel, but the fire was not checked. Finally, the timber caught fire, and things got so hot that men could not remain near the scene.

Of the 200 men in the mine, 190 succeeded in reaching the surface by way of the stairway in the No. 5½ airshaft. This stairway presented a climb of 160 ft.

At 4 p.m., when the Bureau equipment arrived, fan "A" had been reversed and was forcing air down shaft No. 5½. Fan "B" had been stopped. Smoke and gases were coming up the hoisting shaft No. 5. A party of six men entered the mine via the stairway in shaft No. 5½ and following the fresh air explored slope No. 5½ and the branch entries running therefrom.

Eight bodies were recovered from this section known as slope No. 5½. These men had all been killed through suffocation by the gases from the fire. It was 8:20 p.m. before the last of these 8 bodies was brought to the surface.

At 6 o'clock that same evening, one man was found alive in the 4th north entry. This man was not rational and could not be taken up the shaft until 9 o'clock. It is interesting to note that this man, who had remained alive in the mine for 7 hours, had entered the 4th north entry through a door and had thus located himself in a body of stagnant air. Diffu-

sion had not had sufficient time to cause the gases to back into the place where this man was sitting and cause his death. It had, however, made the man irrational.

February 23, a 2" pipe line was run down shaft No. 5½, conducted through the main north plane and by 9 p.m., was throwing water on the fire at the foot of the No. 5 shaft. The water ran only an hour and a half as the pipe line became clogged. Repairs were therefore necessary which took until 11:00 a.m., February 24.

At 11:30 a.m., February 24, fan No. 5½ was stopped, and natural ventilation was depended upon to carry the smoke and gases from the fire up the No. 5 shaft. A party of 7 men then entered the No. 5 mine by way of the emergency shaft which was 59 feet deep and in which there was a stairway. At 12:12 noon, they found near the No. 5 shaft the 9th and last body. From this time on, work was concentrated on keeping the falls cooled with water and loading out the falls as fast as possible.

### June 30, 1914; No. 1 Mine; Cinderella, W. Va.; 5 Killed

*(From a Bureau of Mines report by J. W. Paul,  
H. D. Mason, and W. J. German)*

A fire occurred Tuesday, June 30, 1914, about midnight, in the wooden fan house (on surface) at Mine No. 1 (Coalburg or upper seam) at Cinderella, West Virginia. This fire was rapidly communicated to the wooden air chute, leading from the fan house to the pit mouth of the airway, thence to the timbers and coal in the mine. The gases resulting from this fire suffocated the five night men, who were the only persons in the mine at the time, and their bodies were not recovered until 14 hours later.

Mine No. 1 is one of three mines at Cinderella, W. Va. These mines are located near the summit of a mountain, (elevation 1360 feet), being reached by a steep incline plane 1000 feet in length, with a grade varying from 23 to 33 percent, while the power plant, tipple, washery, and town are located in the narrow gulch at the base of the mountain. (Elevation in valley 850 feet.) The daily output averages 600 tons, and 200 men are employed.

Two coal seams, the Coalburg (upper), and the Winifred (lower), 58 feet apart, outcrop near the summit of the mountain.

Mine No. 1 is in the Coalburg, or upper seam, and the main entry is driven by a drift opening directly through the mountain, a distance of 600 feet. Two pairs of right butt entries are driven at about right angles off these main entries; also two pairs of left butt entries, which are driven in for a distance of 700 and 600 feet, respectively, off the main haulage way. The first left entries are driven within 20 feet of the outcrop, which circumstance was taken advantage of in recovering the bodies of the five victims of the fire.

A fan, 44 inches in diameter, was installed inside a frame building near the aircourse opening of the lower mine, with a frame air chute 6'x6'x115' long and extending up the hillside to the aircourse opening of No. 1 mine, at a vertical distance of 58 feet above. This fan was being used as a blowing fan at the time of the fire. The volume of air being forced into Mine No. 1 at the time of the fire was probably 15,000 cubic feet per minute. This fan was also used to ventilate the lower mine, where a sliding door regulated the amount of air as required. However, as no men were working in the lower mine at the time of the accident, and none had been working there for

some months previous to the accident, only a few thousand cubic feet of air was being furnished the lower mine, or simply enough to permit the pumpman to make his rounds each day.

Mine No. 1 was ventilated by a continuous air current, there being no splits. With the main aircourse as the intake, and the main haulage way as the return, wooden brattices in the crosscuts between the parallel entries, and wooden doors between the butt entries, served to direct the air current in its proper course.

The fire started shortly after 11:30 p.m. The night boss and a demonstrator for the Sullivan Machinery Company, had come out of the mine at 11:30 p.m., to secure some oil and were sitting in the mine foreman's office, 300 feet distant from the fan house, eating lunch. The last places visited by them before they came out of the mine were rooms 5 and 6 off the first left entry—where the five night men were working. Neither are certain as to the exact time they discovered the fire, but probably about 11:50 p.m. They glanced out of the window of the mine foreman's office and saw flames issuing from the fan house.

They endeavored to enter and stop the fan, but the fire had already gained too much headway,—they could not enter the building. They then endeavored to break the connection of the wire (to the fan) at the point it joined the trolley wire, but they failed also in this. The fan continued to operate and the wooden air chute extending up to Mine No. 1 was already burning fiercely, the fan forcing all the smoke and heat directly into Mine No. 1; so that their next thought was for the safety of the five men inside the mine. Two times they endeavored to enter the haulage way and reach the mouth of the first left entries, 100 feet distant, but the smoke was so hot and noxious that they could not proceed into it more than 40 feet. Meanwhile the flames had enveloped almost the entire air-chute, 115 feet in length, and even after the fan stopped running the powerful up-draft from the flames continued to force the smoke and flame into the main air course of Mine No. 1.

The District State Mine Inspector, testified that upon his arrival at the mine, 2:50 a.m., July 1st, the fan house and air chute had burned completely to the ground; so that he was not certain as to the cause of the fire. In his opinion the fire might have started from a hot bearing, an arc from the starting box, or a "partial" (sic) circuit on the wiring, as the fan continued to run for a considerable period after the fire had started, which would not have been the case if there had been a short circuit in the wiring. In his opinion all fan houses and air chutes should be constructed of non-combustible material.

It was decided to drive a manway into the mountain side from the outcrop of the Coalburg seam into the face of the first left air course, and the work of excavating this manway was commenced at 4 a.m., July 1st, and completed at 1:00 p.m., nine hours afterward. Many miners volunteered and the work was pushed as rapidly as possible in one hour shifts. The horizontal length of the manway, when complete, was 27 feet, width 4 feet, and height 5 feet, and many obstacles were encountered on account of the rough character of the ground.

Upon the completion of this opening, it became an intake, as the newly installed fan was exhausting and all other openings were closed.

After waiting for 30 minutes to permit the fresh air current to force out the heavy smoke and gases from the first left entry, a party of six men went into the first left entry. It was still somewhat warm and smoky as they advanced for a distance of 300 feet to the mouth of room 6. A hasty advance was then

made into the face of room 6, and two dead bodies were found beside the cutting machine. Neither body was burned at all, and it appeared that both men had fallen in their working positions, having apparently made no attempt whatever to escape.

Room 5 was next explored by going through the crosscut from room 6, and there were found the other three bodies close together along the right rib 15 feet from the face of the room. None of the bodies were burned at all, and from the positions in which they were found it would seem that none of the men had made any move to escape from the room, the gases having apparently suffocated them all at the places at which they were working. By 2:30 p.m. all five bodies had been recovered.

### May 20, 1918; Villa Mine; Villa, W. Va.; 13 Killed

(From Bureau of Mines report by D. J. Parker)

The No. 5 block seam of coal which is mined has been identified by the West Virginia Geological Survey as the Lower and Middle Kittanning. It ranges from 3'6" to 4'7" in thickness.

Ventilation was afforded by a disk-type fan 5 feet in diameter, belt driven by a gasoline engine and operating as a blower. The fan and engine were located in the main aircourse of the mine about 200 yards underground. From the testimony given at the Coroner's Inquest, it appears that the fan housing or frame was constructed of wood with the engine resting upon a concrete foundation about ten feet away.

The fire occurred about 2 p.m., on Monday, May 20, 1918, and originated in the main aircourse of the mine at the point where the fan and engine were located. A boy sixteen years of age who attended the fan and engine, testified at the Coroner's Inquest that the engine was running when he went outside for gasoline. Upon his return about five minutes later the engine was idle and, the flame was not visible, the smoke encountered was so dense that he was unable to reach the fan.

The mine foreman testified that he was outside of the mine at the time supervising improvements to the track that were under way. Upon being notified that there was something wrong with the fan he tried to reach it but was prevented from doing so by the smoke. After endeavoring to locate the four men on the left side of the mine and the nine on the right he notified the State Department of Mines at Charleston that a fire had broken out around the fan and asked for assistance. Having built a brattice outby the fire, he made a second trip to the airshaft on the right in an endeavor to communicate with some of the men in that section.

From the testimony of the boy, it appears that the fan engine had not been in good condition for some time but whether the fire was due to the ignition of gasoline by a spark from the engine or caused by overheating of the machinery was not determined. Once started the fire readily ignited any combustible material around the fan and also the ribs of the aircourse nearby, since the coal was highly inflammable. Granting that the fan was idle as the boy testified, nevertheless the mine was rapidly filled with smoke, the exit of 13 of the 15 men underground being cut off. Two of the men traveled through old workings and, with some assistance from the outside, escaped up the shallow air-shaft.

Later a temporary fan furnished by the Department of Mines was installed at the mouth of the aircourse and put into operation exhausting, which per-

mitted the exploration of a large part of the mine without the use of breathing apparatus. Additional stoppings were built and numerous falls cleaned up and on Tuesday, May 21st, four bodies grouped together were found on the main entry on the left side of the mine 600 to 800 feet from the fire. The direction of the air current was then reversed and an effort made to locate the nine men on the right side of the mine.

A party of five wearing apparatus and a crew of six men without apparatus, entered the mine at 6:45 a.m. on Wednesday, May 22, explored that portion of the mine in which it was thought that the nine men would be found, one hour and fifteen minutes being consumed by their trip. While the apparatus crew was resting at the fresh-air base men without apparatus explored another section of the mine and discovered the nine bodies lying together at the face of the room. The men had attempted to build a barricade but were overcome before it was completed. Even if they had succeeded in shutting themselves off, life would have prolonged only for a short time owing to the limited space enclosed.

From the evidence disclosed at the inquest, it appears that the ventilating equipment had been in operation at the point underground for several years prior to the fire and the Mine Foreman seemed to regard both the location and method of installation as satisfactory since no objection to either condition had been raised by the inspectors of the Department of Mines. However, the boy testified that the engine had been heating and sparking for a week or two, which was extremely hazardous when gasoline was being used for power, since both the combustible fan-housing and unprotected ribs of the air-course were nearby.

State inspectors testified that the shallow air-shaft at the outcrop did not comply with the requirements of the State Mining Law in regard to a second opening or outlet for the mine, great difficulty being experienced in reaching same owing to the numerous falls and obstructions encountered. It also appears that after the two survivors had gained the bottom of the air-shaft it was necessary for them to have assistance from the outside before they were able to get to the surface. Relative to the condition of this second opening, the mine foreman testified that complaint had never been made concerning the outlet maintained.

### October 29, 1919; No. 2 Mine; Amsterdcm, Ohio; 20 Killed

(From the "Pittsburgh Post," Oct. 30, 1919)

With flames spreading back toward the 21 miners trapped in the north passage of the No. 2 mine, mine officials tonight felt no hope for the men. Rescue parties formed from other workmen were able to remain in the mine only a few minutes because of the intense heat and smoke.

Four American-born workmen were reported to be among the miners entombed when an electric generator operating a fan exploded and set fire to the wood braces, according to company officials. The flames started 200 feet from the elevator shaft, it was said.

Partly suffocated and his clothing and hands burned, a trip driver emerged from the burning mine early tonight. He related how he lay on the floor of a mine car and his mule pulled him to the shaft. He said that the other miners had started farther back.

A water tank was emptied into the shaft by a company of the Steubenville fire department, which arrived here tonight to help fight the fire. Rescue parties worked in relays in an effort to reach the entombed men.

James Gray, aged 67, and Stanley Hinoski, aged 41, gave up their lives for 18 fellow miners, whose bodies were found today in No. 2 mine, where last Wednesday fire entombed 20 miners. Their deaths were caused by asphyxiation. The bodies of Gray and Hinoski were found this morning outside of room No. 2 off entry No. 15, and the others, huddled together, and in a sitting posture, were found inside the room.

In their fight with death the men had tried to brattice the room by improvised means. A wall of coat had been built by the men, and this had been braced with planks, mine ties and other timber, available. With their clothing, of which many of the men were stripped almost to the skin, they had stuffed crevices of the unfinished wall—a wall, which to them had they been able to complete it, would have been a wall of life—to prevent the inflow of poisonous gas.

Further details of the disaster were learned today from 20 loaders and three drivers who escaped from the burning mine, which had been set ablaze by an overheated armature in a fan, by cutting their way through an abandoned entry and coming out at a side entrance three miles away, six hours after the fire started. The loaders and drivers were in Entry No. 14, with Gray and Hinoski.

When the fire alarm was sounded, the men in Entry 14 which was in front of the fire, started toward Entry 15, which was behind the blaze, to warn 18 miners working there. Seeing that it meant sure death, after they had been driven back several times by gas and the fire which was quickly eating its way toward them, the loaders and drivers sought safety. But Gray and Hinoski refused to leave the other 18 to their fate. By almost superhuman effort the two succeeded in reaching Entry No. 15.

The presence of mind, with which Gray and Hinoski gave encouragement to the 18 others, was apparent from the size of the "life wall."

That Gray must have been the guiding figure on whom all pinned their hopes was also evident, for while the others worked with the hope that they could build the wall and stay death until the rescuers got to the room, the following note, in Gray's writing, was found on a board nailed outside the wall: "Help! There are 20 men in this room."

There were only a few more feet of the opening to close when one by one the men were overcome by the gas.

The work of the rescuers was halted by an explosion, which choked several entries.

This afternoon a conference was held between the Ohio State Mine Rescue crew and the Illinois and Pennsylvania crews and a scheme was devised whereby they reached the entry in spite of the fire and gas.

Among the bodies recovered was that of James Gray, Jr., aged 17, son of the aged miner, who fought so valiantly to save his companions.

### November 16, 1920; Arnold Mine; Earlrlington, Ky.; 6 Killed

(From a Bureau of Mines report by C. A. Herbert)

The Arnold Mine located about one mile south of Earlrlington is operating in the No. 2 bed of the Western Kentucky series, is a drift mine and is operated on the room and pillar system, three entries being driven practically thruout the Mine both for main entries and for the room entries.

About 1:30 p.m., a driver coming out along the 16th West entry ran into dense smoke, he abandoned his mules and car at room No. 32 and ran thru the cross-cut opposite No. 32 room and out No. 15 entry

and gave the alarm; he stated that the fire was burning thru the stopping into the 15th entry as he ran out of the entry.

By the time word was gotten to the officials and assistance gotten to the scene of the fire, it was too late to attempt to put out the fire because of the headway it had gained. An attempt was then made to get beyond the fire to the men on the inside in the hope that they might have sealed themselves in, and with this thought in view the compressors formerly used with the punching machine were started up.

Temporary stoppings were put across the 16th entry just in by No. 14 room and the air conducted up No. 13 room and through the room cross-cuts and back down onto the entry by placing stoppings across the rooms; a stopping was then placed in the No. 16 entry just out by No. 21 room.

By the placing of these temporary stoppings the air was largely cut off from the fire and the smoke and gases given off returned out directly along the 15th and 14th entries without going up the entries to where the entombed men had been working.

The rescue party then proceeded up the 16th entry with the air and found that the board stoppings in the cross-cuts opposite rooms No. 46 and 47 had been torn out and that a stopping had been built across the entry just outby room No. 48. This stopping was immediately torn down and three men unconscious but living and four dead were found just inside the stopping, a little distance farther in five men, living but unconscious, were found, in room No. 49 two men were found still living; one man who was standing up in the entry some distance back from the stopping, with his carbide lamp burning when the rescue party first broke through the barricade, ran back along the entry when he saw the rescue party and was found conscious at room No. 52, one body was found in room No. 52 off the 14th entry.

One trapper boy who started out through the smoke with the driver turned back on account of the smoke, but as it was impossible to explore the 14th and 15th entries on account of the dense smoke his body was not found at the time the others were recovered, but was subsequently found in room 25 off the 14th entry.

The fire area was then sealed off by permanent brick seals, these were completed by the evening of the next day.

From the position in which the dead men just inside the stopping were found it would seem to indicate that they were overcome just as they completed the stopping, this was later substantiated by the survivors. From what could be gathered from these survivors they had first tried to erect a barricade nearer to the fire but were driven back by the smoke to the point where the barrier was finally built.

It is doubtless due to the efforts of these five men that the barrier was built and in doing so they, without question, breathed considerably more carbon monoxide than the others who hung back in the relatively clear air.

The cause of the fire is not definitely known. The electrician in charge of the motor generator set furnishing electrical current to the machines and motors stated that about the time the fire was said to have occurred, the circuit breaker flew out, he pushed it back in and as soon as he took his hand off it flew out again, he then pushed it in and held it a moment and glanced at the ammeter and saw that it registered 1000 Amperes which was a very heavy load, and it might be reasonable to conclude that the fire may have had its origin from a shorting of the machine wires in the 16th west entry.

While the origin of the fire is uncertain it may have been caused by the shorting of the machine wires along the 16th entry. As this portion of the entry

had been worked out and only used as an air course, it is possible that this section of the wiring had not been inspected for some time.

## February 23, 1921; Kathleen Mine; Dowell, Ill.; 7 Killed

(From Bureau of Mines report by C. A. Herbert)

Fire of unknown origin was discovered on the Main West Entries just outby the 3rd and 4th North Entries of the Kathleen Mine, Dowell, Illinois, at about noon Wednesday, February 23, 1921. The seat of the fire was approximately 2000 feet from the air shaft and 2600 feet from the main shaft bottom. About 300 men were in the mine when the fire was discovered and all but seven of these men escaped.

Under the leadership of the mine Foreman (sic) efforts were made to fight the fire without calling for outside assistance but the flame spread rapidly and the fire was soon beyond control. Calls for assistance were then sent to the State Mine Rescue Station, at DuQuoin, Illinois, and efforts were made to call U.S. Bureau of Mines Car #6 but in the meantime the Mine Foreman had been overcome by fumes from the fire, considerable confusion appears to have prevailed, and the call for assistance from the U.S. Bureau of Mines was sent to the University of Illinois rather than to the Bureau of Mines.

The Mining Engineers of the U.S. Bureau of Mines had been called to Champaign, Illinois, on February 23rd for a conference. Shortly after their arrival in Champaign they were advised that a mine explosion had occurred some hours previously in the #5 mine, Centralia, Illinois, killing three men and that a fire in the Kathleen Mine, at Dowell, Illinois, had trapped seven men. The Urbana Station had received indirect calls for assistance but could give no further information regarding the accidents. It was endeavored to confirm the calls by long distance telephones but the information gained was very indefinite. The engineers left Champaign enroute to Dowell on the Illinois Central at 11:20 p.m. Car #6, which was at Rosiclare, Illinois, at the time was not called immediately because there was no telegraph or telephone service during the night at Rosiclare. At Effingham, Illinois, a message was delivered on the train advising them to go to the No. 5 Mine at Centralia. Acting on this advice the Bureau of Mines Representatives did not go to Dowell until the bodies had been recovered from the mine at Centralia. After their arrival at Centralia they learned that the Kathleen Mine at Dowell had been put under seal at about midnight.

Before the mine was sealed rescue teams from the State Mine Rescue Station at DuQuoin and Benton, Illinois, were on the scene. The sealing of the mine was sanctioned by the Superintendents of the station and by the State District Mine Inspector, the County Mine Inspector and a member of the State Mine Examining Board. These men had been in the mine and they reported that the fire was at the mouth of the third and fourth North Entries in which Entries the seven miners were trapped. They reported that explosive mixtures of gas were present near the fire and they recommended that further efforts to rescue the men in the 3rd and 4th North Entries would be useless and might result in further loss of life.

On March 17th the seal over the air shaft was open and men equipped with oxygen breathing apparatus entered the mine. By the construction of seals and a series of air locks the advance was made into the 3rd and 4th North Entries.

During the recovery work it was found that the fire area did not extend across the mouth of the 3rd and 4th North Entries. Heavy falls were found in

the Main West Entries. These falls extended from points about 175 ft. in by the 2nd North Entry to points about 100 ft. out by the 3rd North Entry and concealed the actual fire area. Seals were erected in the 3 entries at both ends of these falls and normal ventilation was established in all other sections of the mine.

The seven bodies were recovered from the mine shortly after noon Tuesday, April 5th. The bodies were found in a parting which was being driven off the 3rd North entry. This parting was the place into which it was believed the men would retreat. The men had erected a barricade at a point about 40 ft. from the face of the parting. Brattice boards were used for constructing the barricade. They had started to erect a 2nd barricade in by the 1st one but did not have enough lumber to complete the 2nd one and had used parts of their clothing to complete it. It appeared that a gas explosion had occurred within the barricaded area; part of the barricade was blown down and the men probably were suffocated by the fumes which rushed in upon them following the explosion. Open flame lamps of the carbide type are used in the Kathleen and, doubtless, gas which accumulated in the sealed area was ignited by the flame of the lamp worn by one of the unfortunate men.

#### December 13, 1921; Satanic Mine; Morrison, Colo.; 6 Killed

(From "Coal Age," V. 21, No. 13; Mar. 30, 1922, page 532)

The Satanic is a small coal mine which has been opened by a vertical shaft about 200 feet deep. The coal seam stands almost upright, dipping to the east at an angle of 85 deg. The shaft was sunk in the country rock and drifts were driven to the coal seam on the 100- and 200-foot levels. There are several openings to the surface where the coal seam has been worked out. A small fire started in this mine from spontaneous combustion; it originated in one of the worked-out portions of the mine. On Dec. 13, 1921, the superintendent, with several men, went underground to erect stoppings in order to seal the fire area and to isolate it from the rest of the mine. These men worked underground in the morning without discomfort.

In the afternoon the wind changed and there was at the same time an abnormal rise in temperature outdoors which changed the ventilation in the mine, driving the fumes from the fire area to the place where the men were at work. The fumes contained carbon monoxide and all five men were overcome almost simultaneously. Two men from the surface went down to rescue these men. In the meantime the direction of the wind had changed and the men who went underground passed the body of one man who had been overcome. One of the men was looking for his son, who was one of the five that had succumbed. While they were underground the direction of the air current changed again. The father was overcome and lost his life and the second man barely managed to make his escape.

The superintendent, four of his miners, and the father of one of them, lost their lives in this disaster. If this mine had been provided with fans and if the ventilation had been under control, this disaster would not have occurred. Many of the small mines throughout the country are hazardous on account of lack of controlled ventilation. Many of these mines

have been working for years without inconvenience. Does the disaster at the Satanic teach us a lesson that all mines, whether large, or small, coal or metal, should have positive ventilation, or is this just an exceptional case?

#### December 22, 1925; Webb Mine; Bellaire, Ohio; 9 Killed

(From a Bureau of Mines report by J. N. Geyer)

The fire was first noticed between 6 and 7 p.m., Tuesday, December 22, 1925. About 70 men, comprising the night shift, who cut the coal and distribute the supplies for the following day were underground. The fan was operating at normal speed.

When discovered the fire had destroyed the 6th North door between the intake and return air on the main entries and was also well started in the coal at each side of the door. The outside was immediately notified and the fan was reversed thus placing the escape shaft on return air and the hoist shaft on intake. The night foreman, on learning of the fire, gathered the men from one of the nearby sections and conducted them to the bottom there instructing them to remain until he returned with more. Nine men from this group decided to climb the stairway in the 220 foot escape shaft, then on return air. All of these men lost their lives on the stairway at various points, while all the remaining men in the mine were conducted to the surface by means of the intake shaft without injury. The physician, on examining the bodies, attributed death to the carbon monoxide fumes; however, two men, who had not attempted to climb the stairway, remained in the same gases at the foot of the shaft until the foreman returned and suffered no ill effects. To control the fire 1000 feet of fire hose was obtained from Bellaire to which was attached a pump having a capacity of 150 gallons per minute. With this the fire fighters were able, using gas masks, to surround the fire and load it out by Saturday, January 2, 1926.

The exact cause of the fire is not known; however, two possible theories are prevalent. The first is that the trolley wire became overheated igniting the door and coal on the main entries at that point.

The other theory is that the fire originated from a piece of smoldering brattice cloth which had been thrown near the bottom of the door. As the mantrip was passing through the 6th North door a section boss noticed that the brattice cloth hung along the top of the door was smoldering, apparently ignited by a miner's carbide light or arc from a trolley wheel. The section boss pulled the piece of cloth down and rubbed it vigorously between the palms of his hands to extinguish the fire. He then threw the cloth on the floor where it was probably caught and held by the door in closing. In such a position any sparks that might have remained could easily have been revived by the leakage of air at the bottom of the door thereby rekindling the cloth and ignited the door which was constructed of wood and very dry.

This latter theory is much favored by the State Mining Department and to an extent by the mine officials although they would make no statement.

On January 4, 1926, the mine was entered to search for three horses and one mule, which had been in the mine since the night of the fire. It is interesting to note that all four were found alive and in no immediate danger. They had been loose in the mine for exactly 13 days without any food or water whatever.



**March 12, 1934; No. 10 Mine; Wheatcroft, Ky.;  
5 Killed**

*(From a Bureau of Mines report by Joseph F. Davies)*

The coal is reached by means of a slope which is used as the haulway and by a shaft which is the intake airway and escapeway.

The slope is about one mile long and was driven on about a 10 percent grade, through rock until the coal was reached.

This mine is ventilated by a centrifugal fan at the top of the airshaft and operated blowing. The air splits about 200 feet in by the fan shaft, the air to the right side of the mine passing through the overcast over the main haulage slope, the air to the left side traversing the air courses paralleling main haulage slope.

On the morning of Monday, March 12, 1934, one of the fire bosses evidently completed his usual pre-shift examination of the 10th, 11th, 12th, and 13th right sections. The only unusual thing reported in his written report was that there was a fire at the face of Room 64 off the 10th Right entry. In this written report there is no recommendation. There is nothing to indicate any serious consideration being attached to the finding and reporting of this fire.

Evidently the usual routine of beginning the day's shift was followed and evidently the men were not informed of the presence of the fire, as men entered their workings places on the return side of the fire and in the same air current.

Another incident which tends to indicate that no significance was attached to the report of the fire was: A man trip in which there were 10 or 12 men was pushed through the curtain between rooms 62 and 63 on 10th Right and all were plunged into a dense smoke, their carbide lights were extinguished, and all became excited. As soon as the motorman understood what had occurred he reversed the locomotive and pulled the cars out, bringing all of the men except one who was later found, dead, at the mouth of Room 64. This incident indicates that the seriousness of the mine fire was not apparent to these men or that they were unaware of its presence until they were pushed into the smoke. This also indicates that the supervising officials were either unaware of the fire or that they attached little or no significance to its presence.

It is said that one loaded trip was brought out of the 11th Right entry and that some of the men had to be called out of their working places, although four men were later found dead on this entry.

Evidently considerable confusion reigned, but one story told is significant in its details: "After it was learned that there was serious danger of men being overcome, an empty trip was sent into the 11th Right entry to bring those men out. On the way in the four men who were later found dead on this entry were met making their way out. All of the men that were in the 11th Right section were called and they got into the empty trip and started out. On the way out the four men who were later found dead were passed, but because of the very weakened condition of the men in the trip the motorman was afraid to stop. As the locomotive was moving around the curve from the 11th Right onto the haulageway this motorman fell out of the deck of the locomotive and fortunately fell clear and the trip moved on to the 10th Right where it was stopped and the story told of the motorman and some others lying at the 11th Right intersection. The general superintendent, who had been called from Sturgis, was at this point and immediately took a locomotive and three cars and, with a motorman op-

erating the locomotive, went down to the 11th Right intersection and loaded three men and the motorman, all of whom were unconscious, into the cars. As the superintendent was placing the last man in the car he became so weakened as to fall, fortunately into the car and the motorman, seeing this immediately started the locomotive out and reached the fresh air at the intersection of the 10th Right, where all were revived."

This left five men in irrespirable gases who were later found dead.

A Senior Safety Instructor, U.S. Bureau of Mines Car No. 10, was advised of the fire by telephone, and he immediately secured the gas masks, flame safety lamp, and ten portable electric cap lamps and hurried to the mine. He arrived at the mine about 12 o'clock and found considerable confusion about the surface, and all of the officials underground.

Shortly after arriving underground he assisted in the recovery of the body which was found on the entry at the mouth of Room 64 off the 10th Right.

After this body was recovered, six fire seals were built; one across each of the four crosscuts between rooms 61 and 62, one across the 10th Right entry between rooms 61 and 62, and one across the air course at about the same point.

As soon as the seals were completed, the fresh air moved down through the 11th Right entry and cleared it so the four bodies known to be there were recovered.

It is the belief that this fire was caused from the shooting of coal at the face of room 64 off 10 right, which shot, in all probability, was charged with pellet powder. However, the actual cause of the fire was not determined, owing to the smoke and heat and to the sealing of the fire area before an investigation could be made. When the fire was unsealed it was found that the fire was in room 65.

**May 11, 1935; No. 41 Mine; Barrackville, W. Va.;  
6 Killed**

*(From Bureau of Mines report by J. J. Forbes and  
M. J. Ankeny)*

At about 11:30 p.m., May 11, 1935, a fire occurred in the main hoisting shaft of the No. 41 mine, Barrackville, W. Va., severely burning 11 men, 5 of whom died in the hospital a few hours afterward, and the sixth victim died four days later. Two other men who were in the mine at the time escaped without injury. Of the 11 men who were burned, 10 escaped to the surface without assistance. One of the men who escaped uninjured assisted in the rescue of the other injured man without the aid of protective breathing apparatus.

The 13 men involved, together with the cager at the bottom of the manway shaft, were the only men in the mine at the time of the disaster. The men were burned by a burst of hot gases which suddenly issued from the bottom of the main hoisting shaft when they were preparing to prevent the spread of the fire by means of hose and water from the shaft to the coal bed.

The mine is opened by three vertical shafts approximately 300 feet deep. The man-shaft has three compartments, one of which is used for hoisting materials or men, the second a manway equipped with stairs, and the third for ventilation. The air shaft is a single-compartment shaft with an exhaust fan mounted at the top. The hoisting shaft is provided with two hoisting compartments which are fitted with self-dumping cages, and an air compartment which contains a large lead-covered armored cable, carrying

2,300 volts alternating current, suspended from the top and extending approximately centrally down the shaft, a 275-volt direct-current feeder line in a pipe conduit, attached to the shaft timbers, and a steam line. The man-shaft and hoisting shaft are on the intake and the air shaft is an upcast. These three shafts are in direct line with each other at intervals of about 250 feet. The shafts are lined with wood timber sets which were installed in 1925.

The fire was discovered at 11:40 p.m. by a pumper, who went on shift at 10:30 p.m., relieving the other pumper. When he entered the mine at 10:45 he thought he smelled smoke in the intaking air, but went about his business of visiting a pump. After visiting the pump, he decided to investigate the source of the smoke and discovered the fire in the main hoisting shaft at 11:40 p.m. He immediately notified the switchboard operator on the surface, by telephone, who spread the general alarm.

After giving the alarm, the pumper remained underground and shortly after midnight he was met by the company safety inspector, and the master mechanic. These men were unable to reach the bottom of the hoisting shaft due to the smoke backing up into the entries from the fire. Upon retreating they were joined by the mine foreman, who decided to go back outside to get some help to lay hose lines to the hoisting shaft underground.

Upon arrival at the surface, the fire was issuing from the shaft to a distance of 20 feet above the top of the head frame, completely enveloping it. A crew of men proceeded to run a hose line down the man-shaft, after which the foreman and thirteen others entered the mine and started to lay two hose lines from the bottom of the man-shaft toward the main hoist shaft.

The mine superintendent, arrived on the scene at approximately 5 minutes after 12 and, upon looking into the shaft, could see that the shaft was afire about two-thirds of the distance from the collar, but with very little smoke coming out of the shaft. He immediately arranged to connect up four hose lines to the water hydrants and proceeded to turn water into the shaft. The fire suddenly started to burn violently, thus enveloping the head frame of the shaft about five minutes after water was introduced into the shaft.

The mine superintendent stopped the fan to prevent the fire from being drawn into the mine and igniting the coal. The hoisting shaft became a strong upcast.

The sudden blast of flame which issued from the shaft for a period of over 20 minutes was due partly to the stoppage of the fan and to the disturbances and ignition of the coal dust which had been deposited on the mine timbers during the normal operation of the mine. The disturbances of this dust was caused by the application of water from the fire hoses at high velocity, and later by falling timber and debris in the shaft.

Because of repairs being made to the bull-wheels on the head frame, one of the cages was resting on blocks at the bottom of the shaft, while the other was resting on two 15-foot, 8-inch I beams spanning across the mouth of the shaft, and the cages were disconnected from the hoisting rope (sic). At some time during the 20-minute interval while the flame was issuing from the shaft, the I beams supporting the cage buckled due to extreme heat, permitting the cage to fall to the bottom of the shaft.

When the party entered the mine to lay the hose lines from the foot of the man-shaft to the hoisting shaft, it was found that the atmosphere had cleared up and that they were able to reach the foot of the hoisting shaft without any difficulty from the smoke. Thirteen men were in this party that entered the mine and their objective was to prevent the fire from

spreading into the coal bed and mine workings by means of water. Ten of them approached to within 40 feet of the foot of the hoisting shaft and from that position they could see that the timbers in the shaft were afire at a distance of about 30 feet from the bottom. They did not approach nearer because the danger from falling material was anticipated. The water was then turned on and was being played on the coal surfaces about the bottom of the shaft. Burning embers were coming down the shaft at this time. Another man (the one farthest away from the shaft who was burned) was about 100 feet from the shaft, and two others had retreated a distance of about 300 feet and had just completed pulling up some slack in the hose when they heard a dull rumble. Immediately a dust cloud was forced past them through the entries. A heavy fall had occurred in the shaft, forcing hot gases through the openings connecting the shaft bottom. One of the men came back from the shaft bottom and he was assisted to the surface by the two men who were not affected. While a crew was making preparations to re-enter the mine to determine the fate of the others, nine of them reached the bottom of the man-shaft and returned to the surface by way of the cage, leaving one man, who was lying on the "tight" side along a trip of cars. They succeeded in bringing him to the surface alive.

Five of these men died within five hours and another died four days later. The others completely recovered.

The flames subsided as suddenly as they started and it is believed that the sudden quenching of the flame was due to a fall of debris which closed off the bottom of the shaft, obstructing ventilation, and that this was coincidental to the blast of hot gases which burned the men on the bottom.

About two railroad carloads of rock dust was used, a portion of it being thrown into the shaft, after which the shaft was sealed off at the surface. Arrangements were made to provide for the spraying of water into the top of the shaft after it was sealed. Rock dust was applied in large quantities on the hot material at the bottom of the shaft, and openings leading to the bottom of the shaft were sealed off. The sealing operations were completed on Tuesday afternoon, May 14.

As no significant change took place in the atmosphere behind the seals during the next few days, it was decided to reventilate the area and start to load out the debris in the openings leading to the hoisting shaft bottom. This was done without trouble and subsequently the shaft was cleared of debris and completely retimbered.

While it is likely that the exact cause of this fire which has cost the lives of six men will never be known, this occurrence should forcefully bring to the attention of the industry the fact that too little attention has been given to safety in shafts, particularly from the standpoint of fire and explosions.

It is the general practice in well rock-dusted and watered mines to combat the coal-dust explosion hazard starting at the bottom of the shaft and ending at the working faces. Little or no attention has been given to the dust hazard within the shaft, particularly within hoisting shafts that are intake air. The same, or even greater, precautions as are taken in the mine should be taken in such shafts.

The use of rock dust in fighting this fire was exceedingly helpful in preventing further progress of the fire in the shaft and in at least one of the openings leading to the shaft bottom. In the light of experience gained from fighting this fire in its initial stages, it would seem that the best procedure would be to use rock dust instead of water, especially where large quantities of coal dust are likely to be dislodged or

where there is a likelihood of the water stream coming into contact with live electric conductors.

**August 1, 1936; Kathleen Mine; Dowell, Ill.;  
9 Killed**

*(From Bureau of Mines report by C. A. Herbert)*

About 5:15 p.m., August 1, 1936, a fire was discovered on the 7th north entries near the 31st and 32nd east entries, which resulted in the death of nine men. A set of three transformers, one of 25 KVA and two of 30 KVA, capacity, together with a primary oil switch, had been installed in a crosscut on the 7th north near the 31st and 32nd east entries earlier in the day and it was believed that one of these transformers might have blown up and caused the fire. A subsequent examination of the fire area and the transformers following the opening of the fire seals, disproved this surmise and it is now believed that the fire had its origin on the 8th north, also referred to as the 7th north, aircourse, and to have been due to a "shorting" of the trolley circuit due probably to a fall of roof. Apparently the fall had also knocked down the secondary 220 volt alternating current power wires which crossed over the trolley wire, as a section of trolley wire was found fused to the power wires at the point where the fire was believed to have started.

The mine had been idle the day of the fire.

During the time the State Mine Rescue team from DuQuoin, Illinois was erecting seals on the 7th and 8th north entries outby the fire, several motor trips of material were sent into the 7th north haulage road which is on the return for this section. With these trips, either riding or walking, there were between fifteen and twenty men who had been sent in to assist with the sealing. All of these men were more or less affected with carbon monoxide; nine of them lost their lives. Those who escaped death managed to get through from the 7th north haulage road into the parallel 8th north aircourse entry.

The fire was first discovered shortly after 5 p.m. by a face boss who had a crew working in the 25th west off the 7th north. Upon smelling smoke he made his way up to the fire and saw that it was of such magnitude that additional help would be needed and at once telephoned to the surface. This was shortly before 6 p.m. The recording wattmeter on the surface recorded a sudden flow of current at 5:15 p.m., indicating that the short circuit which evidently caused the fire occurred at that time.

The DuQuoin State rescue team was called about 6 p.m. and arrived at the mine about 7 p.m. with their Gibbs apparatus. By that time the mine foreman who had been to the fire to see what would be needed had four empty locomotive trips waiting on the bottom to haul the men and supplies to the fire area, a distance of about 2½ miles from the shaft bottom.

The rescue team accompanied by the mine foreman and other employees left in the first trip. Smoke was encountered at the 25th east off the 7th north so the trip was stopped and the rescue team and the other men got out and went through into the 8th north, which is the intake aircourse, and up the aircourse to the 25th east.

In the meantime the trip containing the rescue apparatus and materials was taken to the 25th east. It was stated that the motorman wore a gas mask while taking the trip from the 23rd east to the 25th east. The rescue apparatus was assembled and the materials unloaded on the 25th east, which is on the intake, and carried up the 8th north to the fire.

Work was begun on the seals outby the fire and was progressing rapidly when word was received that the men who had gone in with the succeeding trip had been overcome along the 7th north haulage road. They immediately ceased work on the seals and went back to assist in the rescue work. Six of the bodies were recovered by apparatus crews and three by men without apparatus.

It is believed that there were between fifteen and twenty men with the three succeeding trips. All of these men were affected by carbon monoxide; all but nine however, managed to make their way into the parallel aircourse or were rescued by fellow workmen. Nine of these men lost their lives.

The 7th north haulage entry is practically a neutral entry so far as ventilation is concerned, except for leakage around trapdoors or when the trapdoors are opened. There is a trapdoor on the 7th north haulage road between each pair of west panel entries to force the air into these panels. For this reason the left hand 7th north carried practically the full return from the fire and no doubt when the mine foreman traveled in to the fire area along the 7th north haulage just prior to the first locomotive trip going in, this entry was relatively free of smoke or fumes, and the same condition no doubt prevailed when the first trip with the mine rescue crew went in, as it is reported that smoke was first encountered by the crew at the 23rd east entries. However, it is probable that when the first trip with the rescue crew went in the trapdoors along the 7th north haulage road were propped open, making a more direct return of this entry. It is also stated that when the rescue crew first started to work a trapdoor outby where they were building the seals was opened, thus "shorting" the air from the intake to the 7th north haulage road, and that later this door was closed thus throwing the air up to the fire, and then later it was again opened. If this is the case no doubt during the time the trapdoor was open and the air largely cut off from the fire there was a considerable accumulation of monoxide which was later released along the 7th north haulage entry when the door was closed and may account for the conditions being so much worse when the subsequent trips went up the 7th north haulage than they were when the first trip with the rescue crew went in.

Following the recovery of the bodies it was found to be impossible to finish the seals that were started because the fire had gained so much headway.

They next attempted to place seals just outby the 27th and 28th entries but were again obliged to drop back to a point outby the 25th and 26th entries. Here they succeeded in building three wood seals which were plastered with wood fibre plaster. After allowing these to stand twenty-four hours, permanent concrete block seals were erected just outby the wood and plaster seals. These concrete seals were completed Monday, August 3.

The fire area remained under seal during the period August 3 to September 30, inclusive, 1936.

**January 8, 1943; No. 15 Mine; Pursglove, W. Va.;  
13 Killed**

*(From Bureau of Mines report by F. E. Griffith,  
W. D. Walker, Jr., A. K. Bloom, and E. E. Quenon)*

A mine fire occurred in the mine, in which 13 men died. The fire started at approximately 2:55 a.m., January 8, 1943, when a main-line locomotive hauling a train of 23 loaded cars toward the entrance of the mine stopped between No. 2 and 3 north headings on 1 west haulage road. The brakeman, who was riding the rear of the trip, walked outby along the mine cars

and saw electric arcing and flashing and a fire burning in the vicinity of the locomotive.

There were 78 men underground at the time the fire started; 65, some of whom were affected by carbon monoxide, escaped from the mine; twelve men died from smoke and carbon monoxide gas; and one man died, probably from burns, smoke, and carbon monoxide gas.

So far as is known, the men did not attempt to protect themselves with barricades.

Unsuccessful attempts were made to fight the fire direct with rock dust and water, then it was decided to seal the fire area underground. Some work had been done on preparations for sealing the fire when it was discovered that the fire had traveled about 3,000 feet from its origin. About midnight January 11, a decision was made to seal the fire by sealing all the surface openings. The last seal was completed at 10:15 a.m. on January 14.

The mine is opened by four shafts, three drifts, and two slopes. Seven of these openings were used for intake air and two shaft openings were used as return airways. One slope opening has a coal conveying belt and the other slope was used as a manway and for repair material. Two drift openings were used for the haulage of refuse, supplies, and man-trips; the third drift opening was abandoned.

The mine ventilation was accomplished by two fans operated exhausting; one of the fans is an electrically driven 8-foot multiblade propeller type that was stated to be circulating about 137,000 cubic feet of air per minute. The second fan is a centrifugal type and was stated to be circulating 100,000 cubic feet of air per minute.

A mine locomotive, en route to the slope bottom with a train of 23 loaded coal cars, stopped on 1 west haulage entry near the intersection of 3 north. The brakeman, who was riding on the rear of the trip, walked outby along the mine cars and saw electric arcing and flashing and a fire burning in the vicinity of the locomotive. Being unable to proceed farther because of the lack of clearance between the cars and rib, he retreated inby over 3 north entry to a telephone at 8 west intersection and called the dispatcher at the slope bottom. He informed the dispatcher that the locomotive was on fire, and instructed him to pull the trolley-wire switch at the junction of 1 west and 2 north. The brakeman then started back toward the locomotive and cars and encountered dense smoke at about the intersection of 3 west. He then retreated inby over 3 north haulage road and reported the fire to the night foreman, who was in the 16 west working section.

The foreman, accompanied by three men, obtained a fire extinguisher and proceeded, on a trolley locomotive, toward the fire. A short distance inby 12 west the locomotive ran through an insulated trolley-wire block that separated the 250 volts and 550 volts direct current. The 550-volt circuit had been opened at 2:55 a.m. by an automatic circuit breaker on the surface. The four men proceeded on foot and when they encountered dense smoke the foreman sent one man back with instructions to get help and notify the men in the three working sections and to proceed through the 17 right entry to fresh air and escape through the No. 1 mine to the surface.

All the employees in 16 west and 17 right sections were notified and escaped. The employees in 15 west section were not notified because the man who had been instructed to notify these men stated that because of previous exposure to the smoke he felt that he was not physically fit to make this long trip. Further, that he had written a note with chalk on a door

across the haulage road located in 15 west, a short distance inby the 3 north haulage road, to the effect that the employees in this section should escape to the surface through 17 right and the No. 1 mine. (The company designation of No. 15 mine is a combination of two mines formerly designated as No. 1 and 5 mines).

The foreman accompanied by the other two men proceeded by foot to the 8 right intersection on 3 north. They could not advance farther on the 3 north haulage road because of dense smoke and proceeded to the fire area through 8 right and 2 north entries to the 1 west haulage way. At the junction of 2 north and 1 west, they were joined by three other workmen. After obtaining fire extinguishers and charged Cardox blasting devices, they proceeded toward the fire in 1 west using self-rescuers. The smoke became so dense that travel was difficult and they returned to the 2 north haulage road.

The foreman proceeded alone from the 1 west intersection to find out whether or not the men in the working sections had escaped. This trip was made partly by locomotive through the No. 1 mine and on foot to the 17 right section. On arrival at 17 right, about 5 a.m., he was informed that the men in the 15 west section had not been notified. Accompanied by two employees, the foreman started toward the 15 west section on a locomotive to find the missing men. The locomotive was derailed outby 3 north entries on 17 right, and the remainder of the journey was made on foot. The foreman instructed the two men to go into the 15 west section and locate the men, stating that he would go to 14 west off 3 north and open doors in that entry, thus short-circuit the ventilation.

The 15 west section was explored but the workmen had already left. The two men who had been sent into 15 west to notify the employees on that section returned to 3 north entry on a locomotive that was in the 15 west section. Arriving at the intersection, they encountered dense smoke and proceeded by foot several hundred feet inby on the 3 north entry to where they found the foreman in a state of collapse. The two men assisted the foreman until he could not longer help himself. The foreman instructed the men to abandon him, go to fresh air, and secure help. Later, three men from 17 right attempted to rescue the foreman but were unable to do so because of smoke. The body of the foreman was rescued later and taken to fresh air, where unsuccessful resuscitation was administered for 4½ hours.

The last of the employees who escaped from the affected area of the mine arrived on the surface about 7 a.m., January 8.

The general mine foreman accompanied by four other employees descended the intake airshaft at about 6 a.m. This party proceeded to 1 west and 2 north junction through a section of the mine on the outby side of the fire. The party met the State mine inspector and others at the junction of 1 west and 2 north. They were informed that the men in 15 west section were missing.

A rescue party was organized, consisting of State mine inspectors, company officials, two rescue teams, and several other workmen, to explore the affected area.

The rescue party entered the inby end of the 3 north working section through the No. 1 side of the mine, and conducted fresh air to 3 north entries. A Bureau of Mines representative arrived in the 3 north section and met the rescue party, at 15 west, who were on their way to the surface. The State mine inspector reported that all the working sections had been ex-

plored to the 14 west entry, and that none of the missing men had been located.

A second rescue party arrived at 14 west about 5 p.m. and rescue operations were resumed. The ventilation was established to 13 west entries, on 3 north.

While exploring in the vicinity of 14 west, three bodies were located on the No. 4 parallel return air course at the third breakthrough outby 14 west on 3 north. The three victims were within 100 feet of fresh air, and it was evident that attempts had been made by these men to reach an overcast nearby which was a part of the return from a section of the No. 1 side of the mine. The three bodies were brought to the surface about 3 p.m., Saturday, January 9, and operations in the vicinity of 14 west and 3 north were temporarily suspended.

A third rescue party continued the recovery operations from a point about 250 feet outby the 13 west entries on 3 north. The ventilation was finally established to the 12 west entries off 3 north. The rescue party explored the 3 north headings to the intersection of 9 west. These men were protected by breathing apparatus and gas masks during the exploration. Three additional bodies were located on the haulage road of 3 north headings near 9 west. This same party recovered one of the bodies, loading one on the stretcher, and left the third victim. This rescue party returned to the surface with one body sometime in the afternoon, Saturday, January 9.

It was later decided to explore the 3 north entries through 8 right. The rescue party left 12 west on 3 north shortly after midnight and proceeded to the intersection of 8 right and 3 north by 2 north. Five additional bodies were located at the junction of the 8 right side-track on the 3 north haulage entry. These bodies were recovered and brought to the surface along with the two bodies that had been located by the previous rescue party. All persons were out of the mine at 6 a.m., January 10, except the body of the motorman in 1 west entry.

While recovery operations were being conducted on 3 north entries, attempts were being made by company officials and laborers to reach the fire area in 1 west and recover the body of the missing motorman.

An inspection was made of the outby end of the fire and it was observed that the roof coal had fallen on the haulage locomotive and had completely covered it, with the exception of the outby bumper. A recent cave of roof coal covered the locomotive to within 14 inches of the roof on the inby end, and all of the material beneath this layer was a mass of red coals.

Two rescue teams arrived at 1 west about 1:20 a.m. Further attempts to fight the fire directly with hand methods of applying rock dust were futile; the heat was so intense that the main roof was caving.

At about 5:30 a.m., January 9, after applying water to the fire for a short time, the men were driven out of the section by steam and carbon monoxide that had worked its way back through the parallel entries along the left side of 1 west haulage road. Several persons who were near the fire area were in a state of collapse before they could reach fresh air. Carbon monoxide was detected about 300 feet outby the fire.

A later decision by company officials was made to seal the fire area inside the mine. Preparations for the sealing of the area were under way at the time an exploration trip was made through the Buston Run intake airshaft to find suitable locations for seals and ascertain the extent of the fire on the 3 north entries. It was found that the fire had traveled about 1,500 feet from its origin, which made it decidedly dangerous to seal the fire underground. All the men were withdrawn from the mine at 10 p.m., January 11. The

decision to seal the mine at the surface was made about midnight, January 11.

After the mine had been sealed for 7 days and the oxygen had not been consistently reduced in value, the management decided to flood the mine. Water was let into the mine by gravity flow from the surface, through four 8-inch drillhole casings. It had been decided that these flooding operations should continue until the water level in the Buston Run airshaft reached a height of 16 feet, at which time dewatering operations will begin.

From statements made by employees and other evidence, it appears obvious that much delayed action, confusion, and disorganization followed the outbreak of fire. This is borne out by statements made by the brakeman riding the rear of the trip of cars to the effect that because of inadequate clearance around or over the trip of cars, he was unable to reach the fire in its incipient stage. The general mine foreman corroborated the statement that the night foreman did not take immediate steps to notify and endeavor to get the men in the affected area to a place of safety. Further, that from the location and position of the bodies of the men from 15 west section, it is evident that they were badly disorganized. (Had these men turned north on 3 north entry (inby) to 17 right, they could have traveled to the surface in fresh air by the same route taken by the others who escaped.)

The seals were broken and the mine was officially opened April 12, 1943. Exploration trips were made into the mine by numerous Federal, State, and company officials on April 15, 16, 17, 19, and 20, for the purpose of determining the condition of the mine and to ascertain that the fire area had been effectively sealed by the water. Poor ventilation and high water prevented exploration crews from examining the immediate fire area; however, the information gathered at this time was favorable as there were no indications of an active fire.

The slow progress made in the unwatering of the mine resulted in several month's delay in the search for the 13th victim, the missing motorman, and placing the mine back in operation. Some of the delays encountered in unwatering the mine may be charged to the difficulty experienced by the company in obtaining materials.

At about 1 p.m., on May 20, 1944, the body of the motorman was found by the clean-up crew approximately 6 feet outby the front of the locomotive on the clearance side in a ditch. The crew notified company officials that they had found the body before any attempts were made to remove it from its location. Company officials notified the State mine inspector, and the body was brought to the surface about 5 p.m. that evening.

After the locomotive was brought to the surface, the controller was found to be in the off position and the reversing lever was in the direction of the outgoing trip. The melting of parts of the controller and holes burned through the controller shield indicated that an electrical failure occurred inside the controller case.

To state definitely the exact way in which the motorman met his death would be conjecture; however, in the opinion of most of those investigating the cause of the fire, an electrical failure occurred in the controller of the locomotive and the motorman was mortally wounded when he attempted to leave the cab of the locomotive. His body remained in the cab of the locomotive until it came to a stop, and then the body fell out of the cab as the cars and locomotive drifted backward down the grade.

## June 7, 1944; Emerald Mine; Clarksville, Pa.; 6 Killed

(From Bureau of Mines report by G. W. Grove and E. E. Quenon)

A mine fire occurred in the Emerald mine at about 7:10 p.m., June 7, 1944. There were 157 men in the mine when the fire started. Six men, four of whom were working about 1,500 feet in by the fire area and two machinemen who were en route to the surface, lost their lives, presumably from suffocation. Eleven men, working at the River slope and near the Chartiers shaft bottom, escaped unassisted, and 140 men escaped by an emergency stairway in the Lippincott shaft, approximately 3.5 miles in by the fire area. The escape of these 140 men was made possible by the prompt instructions given by the mine superintendent, shortly after his arrival at the mine following the fire, to the night foreman. The night foreman was instructed by telephone to assemble the men in by the fire area and travel to the surface by way of the Lippincott air shaft. Oxygen breathing apparatus, gas masks, or self-rescuers were not used in the escape of these 151 men, nor were any of them barricaded.

The mine is opened by three shafts, two slopes, and a borehole 36 inches in diameter. The openings near Clarksville, Pennsylvania, are commonly referred to as the Chartiers fan shaft, Chartiers slope, and the Chartiers hoisting shaft; these openings are about 1 mile south of Clarksville. The openings near the Monongahela River are called the River slope and air vent. The River slope and air vent are a distance of about 3 miles east of Clarksville. The Lippincott shaft opening is on the Adamston farm about 4 miles west of Clarksville. The Chartiers fan shaft is used exclusively as an upcast shaft or return airway.

The Chartiers hoisting shaft is used for hoisting men, coal, and material.

The Chartiers slope is used as a man and material opening, also as an intake airway. A rope haulage is installed in this slope, and all the slate and refuse are transported to the surface through this opening. A well-constructed stairway is installed along the slope haulageway, equipped with a substantial handrail.

The Lippincott air shaft is 467 feet deep. A 5-inch brick curtain wall separates the intake air from the return air. The shaft is lined with brick and concrete. A stairway is provided in this shaft as an emergency escapeway.

The Lippincott shaft was completed in May 1941, and, without any doubt, had it not been for some means of escape provided near the face workings, the 140 employees who escaped through the Lippincott shaft would have perished following the fire.

The River slope is used as an intake airway and escapeway and is provided with a conveyor belt to transport the coal from the bottom of the slope to the river tippie.

On the afternoon of June 7, 1944, four mine cars of horse feed, three of baled hay and one of grain, were sent underground through the Chartiers hoisting shaft. These cars were dropped a short distance below the shaft bottom on No. 2 butt main entry, just out by the end of the trolley wire. The trolley wire was dead-ended by an insulated turnbuckle, at a point 72 feet from the shaft.

The cars used for transporting horse feed to the underground stable were of a box-type design, constructed of yellow pine lumber, with doors installed in one end. They were reinforced with three steel straps extending around the sides, top, and bottom. The straps were bolted to the box by countersinking the heads of the bolts on the inside, leaving them ex-

posed to the inside of the car. The box was bolted to the bed of an old mine car, which was constructed of wood with steel axles and wheels.

At 7:10 p.m., on June 7, 1944, the circuit breaker at the Chartiers substation was tripped several times and finally remained out. The power was not cut off the mine because circuit breakers at three other substations were not tripped. The four substations furnishing power to the Emerald mine are connected in parallel.

Shortly before the Chartiers circuit breaker tripped, a haulage crew had coupled a trip of five empty mine cars to the four cars of horse feed. The trip was moved less than 100 feet in by the shaft bottom when the motorman observed electrical arcs flashing near the end of the trip. While the trip was in transit, a small roof fall forced the trolley wire down, contacting one of the feed cars. The brakeman made an attempt to break the circuit by pushing the trolley wire away from the cars, and failing to do so, he had the operator of the locomotive jerk the cars from under the fall and trolley wire and pull the trip about 200 feet. The motorman observing the burning car of feed near the end of the trip, uncoupled the locomotive from the trip and traveled a distance of about 2,000 feet around the burning cars by way of the haulage road or No. 1 butt main entry to the machine shop where he notified two mechanics. The end of the trip was left burning about 400 feet from the bottom of the hoisting shaft, beneath a high and extensively lagged place along No. 2 butt main entry.

The motorman made no attempt to extinguish the flame before going for assistance. A 2-quart carbon tetrachloride fire extinguisher and a bucket of dry sand were found on the locomotive after the mine was unsealed. The fire extinguisher was fully charged and in perfect working order.

After the motorman told the mechanics about the fire, they called to the surface and ordered all the available fire extinguishers on the surface sent underground. By the time the fire extinguishers arrived underground, the fire had reached a stage where the fire extinguishers were of little consequence.

The mine superintendent was notified of the fire at about 7:20 p.m. and arrived at the mine within 5 minutes after he was notified. He immediately gave orders to have the night foreman remove the men from the mine, ordering them to escape by way of the Lippincott air shaft; he also had one of his assistants call for the Fredricktown Fire Department. He then ordered the Chartiers fan stopped at about 7:45 p.m. and instructed the attendant to keep the fan stopped until after the men reported to the surface through the Lippincott shaft. A water line was laid with 2½ inch fire hose from Ten-Mile Creek, down the shaft, and to the scene of the fire, a distance of about 1,000 feet in less than 30 minutes. Water was being played on the fire at 8:15 p.m. A second fire hose was installed about 10 p.m., and another stream of water was put on the fire shortly thereafter.

The men were all reported on the surface at the Lippincott air shaft at about 8:30 p.m. with the exception of four track men and timbermen and two machinemen who were en route to the surface, presumably by way of the Chartiers openings.

Smoke and falling roof hampered fire-fighting crews, and the fire continued to spread. Distillates of coal and clouds of dense smoke began issuing from the Chartiers fan shaft, indicating that the fire had burned through into the return. Fire-fighting operations continued until about noon on June 8, when a decision was reached to seal the mine. The seals were erected as near the surface as possible and were completed about 2:30 a.m. on June 9.

Water was pumped into the Chartiers hoisting shaft through a 4-inch pipe for a 24-hour period. About 12 tons of liquid carbon dioxide or 216,000 cubic feet of carbon dioxide gas was introduced into the mine through the hoisting shaft and through the No. 1 borehole. The water and carbon dioxide gas flowed down grade toward the fire area and helped to reduce the temperature in the vicinity of the No. 1 borehole several degrees.

An air lock was constructed outby the permanent seal in Chartiers slope and a disk fan was installed near the portal of the slope and operated exhausting.

On the morning of August 13, 1944, work was begun on construction of a line curtain from the permanent seal near the portal of the slope to the bottom. Work continued until 6:30 p.m., at which time the line curtain had been extended to the bottom of the 630-foot slope and a temporary seal, constructed of wood and plastered with wood fiber, had been completed at the bottom. Crews continued working at the bottom of the slope until midnight and completed a permanent seal constructed of tile and cement.

During the week, work was done on the slope constructing an air lock at the bottom and a concrete cap over an entry that the slope intersected about 50 feet from the bottom.

Exploration trips were made from the fresh-air base at the bottom of the slope to points within 800 ft. As far as could be determined by apparatus crews, there were no indications of an active fire.

Because of the favorable conditions indicated by explorations in the vicinity of the fire area by crews wearing oxygen breathing apparatus and the analyses of air samples, it was agreed that an effort should be made to ventilate and reopen the mine.

On the night of August 19, 1944, work began on ventilating the mine. The air-lock doors at the bottom of the Chartiers slope were opened at about 1:15 a.m., and the seal from the Chartiers fan shaft was removed at 1:35 a.m. At about 2:15 a.m. a disturbance occurred in the mine; the forces caused by the disturbance blew dust up the Chartiers fan shaft and into the outlet of the fan where several workmen were removing the tar from the blades of the propeller-type fan. The forces also blew the explosion doors open on the housing of the stand-by centrifugal fan. The official in charge of the recovery operations believed the disturbance was caused by something falling down the shaft or by a large roof fall underground, and the Chartiers fan was started at about 3:28 a.m., operated exhausting. A small 2- by 2-foot door in the River slope was opened at 3:30 a.m., and the Lippincott fan shaft was also opened and preparations made to start the fan. Smoke began issuing from the Chartiers fan shaft shortly before a second explosion occurred at about 4:33 a.m., blowing smoke, dust, and soot out of the Chartiers fan shaft and slope. The fan was stopped shortly after the second explosion occurred.

From August 20 until November 22, 1944, 14 additional 6-inch boreholes were drilled in the vicinity of the suspected fire area. The holes ranged in depth from 103 to 310 feet. Smoke issued from these holes and from observations and odors of the smoke, it is believed that the fire was active as late as October 1944.

Several million gallons of water was pumped into the mine through some of the boreholes. A maximum temperature of 168° F. was recorded in No. 5 borehole, as late as September 1944. The water pumped into the mine flowed toward the face workings; however, it is believed the water did aid considerably in cooling the fire area.

After the resealing of the mine on August 19 the oxygen content of the sealed area was still further reduced, numerous samples from the various boreholes at times showed less than 1.0 percent oxygen before December 14, and most of the openings from which samples were collected at one time or another contained less than 0.005 percent carbon monoxide. Therefore, in view of the oxygen content of air samples collected and analyzed daily at the mine by the company, and the oxygen and carbon monoxide content of the samples analyzed periodically in the Bureau of Mines laboratory, it was believed the fire was definitely out.

The doors were opened on the fan housing of the old centrifugal fan at noon on December 23, 1944. Mine rescue teams wearing oxygen breathing apparatus constructed two seals on the inside of the fan housing to replace the two steel doors which were so badly deteriorated that they could not be closed.

The old centrifugal fan was started at 2:45 p.m., operated blowing. The caps over the boreholes were removed and air analyses and temperature, carbon monoxide, velocity, and methane readings were taken frequently at the various boreholes to determine the conditions in and surrounding the fire area and in the mine.

After the fan continued in operation a few hours, temperatures were reduced; the oxygen content was on the upward trend, while the methane content was reduced in proportion. Only slight traces of carbon monoxide were recorded from the return of one borehole in the fire area.

The analyses of samples collected from the boreholes indicated that the atmosphere around the fire area on the afternoon of December 24, 1944, was about normal.

The upcast shaft, or return airway of the Lippincott shaft, was unsealed at about 4:15 p.m. on December 24. The Chartiers slope seal was broken at 1 p.m. on December 25, and the door of the River slope seal was opened at 2 p.m. on December 25. The return air at the Chartiers and River slopes was so regulated that only enough air returned through these openings to keep them clear.

The seal on the évasé of the Chartiers Aerodyne fan was broken and the fan was started (operating blowing) at 1:18 p.m. on December 26. The old centrifugal fan was stopped shortly afterwards, and the doors on the fan housing were closed.

An exploration party on the second shift made a trip underground and found two bodies in a pool of water beneath the overcast on No. 2 main dip entry. The two bodies were badly decomposed and recovered in parts. They were brought to the surface on the morning of December 29, 1944. An exploration was then made of 13 west butt along the haulage road in search of the four remaining bodies. However, the bodies could not be located, and it was assumed that they were under falls somewhere in the fire area.

The third and fourth bodies were recovered from underneath the edge of a large slate fall, on No. 2 main dip haulage road, near the outby end of the overcast a few feet from where the first two bodies were found. These bodies were brought to the surface on the morning of January 25, 1945. The fifth body was recovered 115 feet inby the overcast along the No. 2 main dip haulage road and brought to the surface on January 26. The sixth body was recovered 190 feet inby the overcast along No. 2 main dip haulage road and brought to the surface on January 27, 1945.

### July 5, 1944; Powhatan Mine; Powhatan Point, Ohio; 66 Killed

(From Bureau of Mines report by G. W. Grove, M. C. McCall, and O. V. Simpson)

A mine fire occurred sometime between noon and 1 p.m., July 5, 1944, on No. 3 entry, C north face entries, near the slant to No. 3 right butt entries in the Powhatan mine.

One hundred and ninety men were in the mine when the fire occurred. Sixty-six of these men were trapped in by the fire and were killed; 124 men escaped unassisted. Sixty of the sixty-six men killed barricaded themselves in 7 right butt entries off C north face entries with stoppings constructed of boards, posts, screw-type roof jacks, coal, and clothing. One man began erection of a barricade in a crosscut in the chain pillar in 7 left butt entry off C north face entries. The remaining five men apparently attempted to get around the fire and were in part of the area which was sealed. The seals were opened on June 9, 1945, and a great part of the area was explored. Three bodies were found and removed, but rekindling of material under a large fall made it advisable to reseal the area on June 15 and 16, 1945.

The fire occurred when a timberman who was "scaling" roof caused a fall of roof coal and rock which pulled the trolley wire out of a trolley frog and allowed the wire to contact the track rail which ignited the coal. The timberman pushed the trolley wire off the rail and against the rib, and then traveled to a circuit breaker near the junction of main west entries and C north face entries, a distance of about 2,000 feet. The fire was confined to the C north face entries between 3 right butt entries and 5 right butt entries.

This mine is opened by four shafts and six slopes: namely, two air shafts about 110 feet deep at Cats Run, Powhatan Point hoisting shaft about 147 feet deep, Big Run shaft about 110 feet deep, a slope at 24 right entry off west main entry, Cats Run slope, a slope at the face of B north entry, a slope at the face of C north entry, a slope at Powhatan Point, and a slope at 16 north off west main entries.

Ventilation is induced by a 10-foot propeller-type fan operated blowing at about 5-inch water-gage pressure.

About 200,000 cubic feet of air a minute was circulated in the mine through nine splits. When the mine was inspected in November 1943, it was liberating 535,968 cubic feet of methane in 24 hours.

Attempts to extinguish the fire by the use of rock dust and water and by loading the burning caved material with a loading machine were unsuccessful, and the fire gained headway. The C north face entries were ventilated with about 28,000 cubic feet of air a minute. This quantity of air was confined to the Nos. 2 and 3 C north face entries and was permitted to sweep over the fire in order to carry smoke away from the men engaged in fighting it until about 3 p.m. when a hole, approximately 4 feet in diameter, was made out by the fire in a stopping between Nos. 3 and 4 C north entries to short-circuit some of the air from the fire and into the return air course in No. 4 entry. This hole was later partly covered with brattice cloth because the quantity of air was not sufficient to keep the smoke away from the men who were fighting the fire. A member of a rescue team entered No. 4 entry C north to determine the quality of the air returning from the fire by the use of a methane detector, a carbon monoxide detector, and a flame safety lamp. The atmosphere, according to the detectors used, contained 4.5 percent explosive gas, 1 per-

cent carbon monoxide, and less than 16.5 percent oxygen.

A stopping between Nos. 1 and 2 entries C north, and out by the fire, was broken in an effort to force intake air through No. 1 entry toward the faces of C north face entries.

Fire was evident in the No. 1 C north face entry when the stopping between the Nos. 1 and 2 entries was removed. This fire extended along both ribs for a distance of about 100 feet from the slant into No. 3 right entry toward the main west entries. It was extinguished with rock dust and water used by crews wearing oxygen breathing apparatus.

The amount of air that could be forced into the No. 1 entry between two regulators was limited. One of these regulators was near the main west entries and the other was in by No. 3 right entry off C north face entries.

About midnight, one man advanced to and removed the regulator in No. 1 entry in by No. 3 right entry C north face entries, thus permitting the air to move unrestricted toward the face of the entry. While plans were being made and a party was being organized to attempt to reach the face of No. 1 C north entry, the fire again broke through from the No. 2 to the No. 1 entry at about 4 right entries and spread rapidly toward No. 3 right entry. Because of the risk of having fire break through into the No. 1 entry behind any advance crew, and because of the danger of the fire burning into No. 4 right entry which with Nos. 1, 2, and 3 right entries C north face entries were worked out, abandoned, sealed with incombustible stoppings, and known to contain methane, it was decided about 3:30 a.m., July 6, that all rescue men should be withdrawn from the mine. A meeting of the above men augmented by representatives of the United Mine Workers of America was held on the surface, and a decision to seal the mine was made about 5 a.m. The fan was stopped and the construction of 10 seals was begun about 7 a.m. and completed about 10 p.m., July 6.

Arrangements were made to have a 3-1/8-inch diamond drill rig and a 9-inch churn drill sink holes in 7 left off C north face entries, and in C north face entries, so that communication with the entombed men could be established provided the men were still alive. A road was constructed for a distance of approximately 1 mile through fields and a wooded area so that the drill rigs could be moved to the drilling locations.

The 9-inch churn drill began operation at 9 p.m., July 7, and completed a hole, 395 feet deep into No. 2 entry C north face entries in the slant at 9 right entry, at 5 a.m. on July 9, with a drilling time of 32 hours.

The 3-1/8-inch diamond drill began operation at 1 a.m. on July 8 and completed a hole 551 feet deep into No. 2 entry 7 left off C north face entries at a point opposite room No. 8. This hole was completed at 7 p.m. on July 10, with an actual drilling time of 66 hours.

Tests of the air at the bottoms of both of these drill holes showed that the air was irrespirable. A telephone and a signaling device were lowered to the bottoms of the drill holes, but no response was received from the entombed men.

A decision was made to drive a pair of entries from the surface to the faces of the C north face entries, to facilitate recovery of the bodies of the trapped men. These entries were driven from a district on Captina Creek known as Fishbasket, about 1,400 feet from the faces of C north face entries.

A bulldozer began breaking ground in Fishbasket on July 9 in preparation for the driving of two slopes about 30 feet long from the surface to the coal bed.



The slopes were difficult to sink because they were in loose ground and did not intersect the coal bed until July 18. In addition to sinking the two slopes, a transmission line about 8,000 feet long, a tippie, a substation, a morgue, two office buildings, a mine rescue station, and a supply yard were constructed. A fan duct was also built and two fans were installed in parallel.

The two entries driven from the bottoms of the slopes in Fishbasket were driven three shifts a day for a distance of about 1,385 feet to intersect the faces of Nos. 1 and 3 north entries. These entries advanced an average of 49+ feet a day in each entry. The entries advanced slowly until the first slant was completed July 26, and room was provided for switching cars. The remaining distance of about 1,260 feet was driven at an average of almost 63 feet a day in each entry with a maximum of 219 feet in one day. This 219 feet included 39 feet in crosscuts, 96 feet in the left entry, and 84 feet in the right entry. Connection with the C north entries was made August 14, 1944. The last cut was removed by hand by rescue teams under oxygen and inside of air locks which were also built on August 14.

Three mine rescue teams established ventilation in the Cats Run slope on July 30, by opening the seal at the portal of the slope and advancing 400 feet of vent tubing from blower fans on the surface to an air lock inby the bottom of the slope. Portable telephone communication was established from the slope portal to the slope bottom.

On July 31, seals were removed from the Cats Run fan housing, the main hoisting shaft at Powhatan Point, and the Big Run air shaft, and the haulage road was ventilated outby from the temporary seals in main west entries.

On August 14, rescue teams wearing oxygen breathing apparatus and working inby an air lock "picked" through from the left entry driven from Fishbasket into the face of No. 1 entry C north face entries.

Exploration trips in the C north face entries to locate places for erecting stoppings and an air lock were started at 1:22 p.m., August 14. The work of erecting stoppings and air-locking operations was continued with nine State-maintained mine rescue teams working three shifts a day.

In the interval between August 15 and August 31, rescue teams built 28 seals and 6 air locks, while advancing from the faces of C north face entries to a point near 6 right entry. These stoppings and air locks were built in five moves and covered a distance of about 1,950 feet.

Barricades erected by trapped miners were found outby No. 1 room in Nos. 1, 2, and 3 entries 7 right C north face entries on August 24, but an increase in atmospheric pressure and a resulting change in the quality of the air in the sealed area caused the recovery men to be removed from the mine until August 28.

August 29, a fresh-air crew found a brattice-cloth stopping in No. 4 C north face entry between Nos. 2 and 3 entries 7 left. A board was also found in this location, which had an arrow on it pointing toward 7 left entry, and a second board found there had the check number 643 written on it.

On August 31, a rescue team under oxygen found and recovered the body of a man from a crosscut between Nos. 2 and 3 entries at No. 8 room 7 left C north, face entries. This man had check No. 643. He had begun erection of a barricade but had been unable to complete it.

Many persons participating in the recovery work were of the opinion that atmospheric pressures would cause increasing hazards as the fire area was approached, and that the sealed area was now as small

as it should be. Men and rescue equipment were withdrawn from the Fishbasket opening for the foregoing reasons and were transferred August 31 to Cats Run to begin air-locking in the main west entries to C north face entries.

Work was begun air-locking in the main west entries at 2 a.m., September 1, and was completed September 27, at 10:20 p.m.

Mine rescue crews, wearing oxygen breathing apparatus, opened the seals in 7 right C north face entries at 6:30 p.m., September 12, and ventilation in these entries was advanced by fresh-air crews. Exploration of 7 right C north face entries was greatly hampered by extensive falls and very dangerous roof conditions. It was also necessary to move the methane in these entries slowly because it discharged in Fishbasket near the fan which was operated blowing and was driven by an electric motor.

The barricades erected by the trapped men were examined while the methane was being removed from 7 right entries C north face. They had been constructed inby the first slant crosscut, of posts, ties, screw-type jacks, clothing, and coal.

Bodies of the trapped men were found in Nos. 2 and 3 rooms on the right side of the 7 right entries C north face entries about 11 p.m., September 12, but it was not practical to recover any of them until some falls were leveled, dangerous roof "scaled" and timbered, and the rooms ventilated.

Fifty-eight bodies were recovered from rooms Nos. 2, 3, and 4, 7 right C north face entries from September 13 to 22, and two were recovered in the 7 right entries, during the constant search from September 22 to October 5. Fresh-air crews moved and loaded numerous falls of rock both by hand and with loading machines in order to find and recover the bodies in 7 right. The work was carried on three shifts a day, except for interruptions caused by changes in the atmosphere in the sealed fire area.

Letters and notes written by the men barricaded in 7 right C north face entries indicated that the men working in 5 right C north face entries were probably in 5 right, and since further advance in C north face entries was deemed inadvisable, it was decided that a pair of entries would be driven to 5 right. These entries were started September 25, at a point about midway between 7 right and 6 right C north face entries, and were driven on an angle of 45 degrees to intersect 6 right at Nos. 4 and 5 crosscuts. They crossed 6 right and were driven parallel to C north face entries until they intersected 5 right, a total distance of about 1,125 feet. These entries cut into 6 right October 6, and into 5 right October 18. Rescue teams, wearing oxygen breathing apparatus, erected seals in 5 right and 6 right entries near C north face entries to isolate them from the fire area.

Exploration of 5 right C north face entries disclosed that the men working there had made an attempt to escape. They left their dinner buckets (5) and two jackets in the second crosscut from the faces of the entries and traveled into the C north face entries. An exploration trip in the C north face entries at 5 right furnished no clue as to where these five men had gone. Rescue crews reported roof conditions very bad and traveling difficult in C north face entries. State, Bureau, company, and union officials conferred and decided to abandon further exploration because of the dangerous roof conditions and difficult traveling in C north face entries until the fire was definitely known to be out and the area could be ventilated so recovery would be in fresh air.

Equipment in 5 right C north face entries was removed from the mine at Fishbasket, and the two entries driven from C north to 5 right were sealed near C north face entries October 20.

Notes written by some of the entombed men are conflicting, yet they do show what conditions were in the barricaded area and give an idea as to how long the men were alive.

A note was found August 17 on a dinner bucket in the mechanic's shanty between 7 right and 6 right C north face entries. This note stated, "I have gone to B north by way of 7 right."

Another note found was written at 4:40 p.m., 5:30 p.m., 6:30 p.m., and 9 p.m., July 5. It stated that the dirt stoppings (barricades) were completed by 4:40 p.m. and that men had failed in an attempt to reach B north face entry through 7 right, C north face entries.

A note written by an engineer, listed 48 men within the barricaded area. This note was in error regarding the number of men, because it did not list several men known to be there. It was significant, however, because it did not contain the name of any man that worked in 5 right C north face entries.

A long letter written by another indicates that he probably did not survive after midnight, July 5. The latter part of his letter written at 11:07 p.m., July 5, was illegible and the lines of writing wavered.

All of the notes found indicate that the trapped men were active and alive until 10 p.m., July 5, and that some of them were alive until after 11 p.m.

None of the notes indicated that the trapped men made any effort to bypass the fire, in C north face entries, and travel to the main west entries.

A meeting was held May 8, 1945, and a decision was made to begin recovery of the sealed fire area at midnight June 9, 1945. This decision was made because since March 18 the oxygen in the samples from the sealed area had varied between 0.8 and 1.8 percent, and because the carbon monoxide in the samples (with 2 exceptions) had not been above 0.005 percent.

Representatives of the Ohio Division of Mines, the company, and the Bureau of Mines entered the Cats Run slope of the Powhatan Mine at 11:00 p.m., June 9, 1945. They were accompanied by two complete mine rescue teams and three members of a third team. The entire party arrived at the seals erected in C north entries near the intersection with main west entries at 11:40 p.m.

The second shift entered Cats Run slope at 7:00 a.m., June 10, and arrived at the mouths of C north face entries at 7:40 a.m. Two rescue teams removed the inner permanent seals and the temporary seals in Nos. 1, 2, and 4 C north face entries. They worked in oxygen breathing apparatus inby the air locks in the respective entries. The work was started at 8:32 a.m. and was completed at 11:15 a.m.

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The day shift entered the mine at Cats Run at 10:45 a.m., June 11. A party, members of which were representatives of the Ohio Division of Mines, the company, and the Bureau of Mines, explored all of the accessible sealed area. Some falls, over which it was impossible to travel, were encountered, but explorations extended to both ends of these falls. An oxygen-deficient atmosphere in 6 right entries prevented exploration, but these entries had been explored before the area had been sealed.

The bodies of three men were found by the above-mentioned party in the first crosscut between Nos. 2 and 3 entries of 5 right off C north entries. The men had made a very ineffective attempt at erecting a barricade.

The bodies of the two men not yet found are the motorman and the brakeman of the locomotive which was in 5 right C north face entries.

The afternoon shift on June 11 removed the three bodies and continued searching for the other two.

Smoke was found coming from the inby end of a large, tight fall in No. 2 C north face entries at 8:34 p.m. This fall was part of that covering the origin of the initial fire. Notice of the fire was received outside the mine at 9:05 p.m.

A decision to seal the fire area, at the original seal locations, was made at 2:15 a.m., June 12. All men were out of the mine at 9:45 a.m., and the fan was stopped.

An attempt to fight the fire was not made because: 1. The fall over the fire was too "tight" to travel over or even ventilate. 2. It was estimated that about 35 cars of rock could be loaded each shift and the fall contained several hundred cars of rock; therefore, it was believed inadvisable to ventilate the area for a period which would permit all of the rock to be loaded. 3. The seals in the mouths of 3 right entries C north face entries could not be inspected, and these entries contained a large body of methane and were near the fire.

June 20 another meeting was held relative to the resumption of mining in the Powhatan mine. It was agreed by all parties, previously named, that the mine be operated, and plans were made to continue patrol of the seals and collection of air samples. It was necessary for a representative of the Ohio Division of Mines and one of the Bureau of Mines to prepare and post a notice that the mine was safe to be operated before the men would go to work.

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A meeting of representatives of the Ohio Division of Mines, the United Mine Workers of America, the company, and the Bureau of Mines was held March 20, 1946, and a decision was made to begin recovery of the sealed area at 12:15 a.m., March 31, 1946. This decision was made because carbon monoxide had not been found in any of the air samples collected from the fire area since November 13, 1945.

Searches for the two bodies still in the mine were conducted from the time the fire area was ventilated until the bodies were found about 8:50 a.m., April 10. These bodies were found in No. 2 C north entry at the inby corner of the first crosscut between Nos. 2 and 3 C north entries outby the 5 right supply-track chute. They were brought to the surface at the river portal of the mine at 10:50 a.m. the same day. These men, the motorman and brakeman in 5 right off C north, had apparently tried to get out of the mine by either No. 2 or 3 entry, and were retreating toward the faces of the C north entries when they were overcome.

On April 2, the loading machine in No. 3 C north entry pulled the trolley wire, the feeder cable, and a piece of ¾-inch steel-wire rope from under a fall at the long slant into 3 right. The end of the trolley wire had been melted, the steel-wire rope had been burned through, and copper from the trolley wire had melted on the rope and cooled there. This definitely confirmed the belief that the fire originated in No. 3 C north entry at the long slant into 3 right.

#### November 4, 1948; Milt No. 1 Mine; Kitzmiller, Md.; 5 Killed

(From a Bureau of Mines report by W. D. Walker, Jr., T. J. McDonald, and W. D. Baldwin)

A fire occurred in a wooden fan house at 10:45 a.m., November 4, 1948, at the Milt No. 1 mine, Kitzmiller, Garrett County, Maryland. The fan housing was on the surface, but the smoke and fumes from the fire in the fan house resulted in the death of five men who were underground. One man (the mine foreman) escaped uninjured and unassisted. The exact cause

of the fire cannot definitely be stated; however, all evidence indicated that the fire originated at a gasoline engine, which was housed in a wooden structure adjacent to the wooden fan house. The gasoline engine was used to drive the mine fan. The fire consumed the wooden fan house, the wooden air duct, and the wooden shed which housed the gasoline engine. Creosote-treated timbers in the drift portal were charred.

The mine provided employment for eight men, including the mine foreman, who was the owner. One of the employees worked on the surface, and the other seven worked underground.

Air circulation in the mine was induced by a 3-foot propeller-type fan, which was on the surface, in line with the drift opening, in a wooden structure provided with a wooden air duct. The fan was driven by a gasoline engine, operated blowing, and could not be reversed without reinstalling the fan-drive motor. According to the records, the fan induced the circulation of about 9,000 cubic feet of air a minute, which was blown through the Milt No. 1 mine and exhausted through abandoned workings in the Pee Wee mine. The mine was rated nongassy by the Maryland Bureau of Mines and had never had a Federal inspection.

The fire was discovered at 10:45 a.m., November 4, 1948, by the man who worked on the surface. According to statements of this man (tipple-man), the gasoline tank, which was mounted directly over the fan-drive engine, was filled with gasoline at 7 a.m., the engine and fan was started at that time, and both operated normally until the fire occurred.

The tippelman stated that the usual procedure at the mine was to fill the gasoline tank at 7 a.m., start the engine and fan, and let them run until the gasoline in the tank was consumed, and this generally resulted in the stoppage of the engine shortly before noon. The practice was then to refill the tank, restart the fan engine, and let it continue in operation until the end of the shift. He also stated that he had been away from the immediate vicinity of the fan house for about 10 minutes prior to the discovery of the fire. During this period he could hear the fan operating; however, because of the terrain, the fan house was not visible. He stated that he heard the fan stop operating at 10:45 a.m. and assumed that the drive engine had run out of gasoline; however, upon investigation he discovered fire burning in the vicinity of the engine. He obtained the fire extinguisher from the nearby supply shed and applied the contents to the fire. This was a small capacity (1 pint) throw-type carbon tetrachloride fire extinguisher which had little or no effect on checking the progress of the fire.

It was stated that the two drivers came out of the mine with trips of coal about the time the fire was discovered. One driver assisted the tippelman in his efforts to extinguish the fire by throwing dirt on it. The other driver proceeded underground with a pony and an empty mine car to bring the men out of the mine. This driver contacted the mine foreman about 500 feet inby the drift portal, which was about midway between the outside and the working places. The driver continued toward the working places, and the mine foreman proceeded toward the outside. The mine foreman stated that he encountered smoke about 125 feet from the haulage drift portal, and that he had difficulty in reaching the outside because the smoke obstructed his vision.

Upon reaching the outside the mine foreman traveled by motor car to Kitzmiller, Maryland, which was about 2 miles from the mine. There he obtained the services of a local fire department and trained mine rescue men. In the meantime, the tippelman and the driver continued their efforts to extinguish the fire.

Upon reaching the mine, the fire department immediately began using chemical fire extinguishers and water on the fire. At about 11:30 a.m. the fire was under control enough to permit three men wearing universal gas masks to make an exploration trip underground. These men located the five bodies 250 feet inby the drift portal. They immediately returned to the surface and pushed a mine car to the point where the bodies were found, and after placing the bodies in the car, pushed it to the outside. The fire was extinguished and the bodies recovered at 11:45 a.m., which was 1 hour after the fire was discovered. Artificial respiration was started at once and continued until 2:30 p.m. Two medical doctors and a nurse arrived at the mine after the bodies were recovered and remained there until 2:30 p.m.

It is believed that the men who died started from the working places in the mine car which the driver had taken into the mine, that the pony which was pulling the car was overcome by the fumes from the fire, and that the men then proceeded on foot to the point where their bodies were found. The mine car, containing some of the deceased men's equipment, was found 367 feet inby the haulage drift portal, and the pony was found 29 feet outby the car. This would indicate that a man unhooked the pony from the mine car to permit it to return to the outside if it were able.

### March 8, 1960; No. 22 Mine; Pine Creek, W. Va.; 18 Killed

*(From a Bureau of Mines report by W. R. Park,  
J. T. Whalen, and W. M. Cordray)*

A mine fire was discovered at 8:30 a.m., Tuesday, March 8, 1960, immediately inby the 3 left overcast on the west-main haulageway in the No. 22 mine. As a direct result of the fire, 18 men died from asphyxiation and/or carbon monoxide poisoning. Two men escaped from the No. 4 unit section (4 left barrier) 1,600 feet inby the fire area, and 30 other men were in scattered sections of the mine outby the fire area. All men were withdrawn from the sections outby the fire; these men assisted with the recovery and fire-fighting operations. Sixteen men died while traveling inby from the fire area and their working sections in the direction of the Elk Creek slope. These men had erected a partial brattice-cloth barricade 950 feet inby the junction of 4 left and west main entries and approximately 3,500 feet inby the fire area. Two other men died near the entrance to the No. 7 unit section, 1,700 feet inby the fire area.

Access into the mine was through a slope and 3 shafts. The slope (Elk Creek) 525 feet in length on a 16-degree pitch, had been used as an escapeway and intake airway. The 3 shafts were namely, a coal-hoisting shaft, a man-and-material hoisting shaft, and a return air shaft. The return air shaft was 210 feet in depth; the other 2 shafts were approximately 483 feet in depth. Mining was being done in the high-volatile bituminous Cedar Grove coal bed, which averaged 60 inches in thickness in the areas being mined.

Ventilation was induced by one electrically driven axial-flow fan, operated exhausting, and circulating through the mine approximately 190,000 cubic feet of air a minute. An additional fan, formerly in use, was provided at the Elk Creek slope.

The day-shift crew, consisting of 52 employees, left the surface about 7:30 a.m., Tuesday, March 8, 1960. About 7:35 a.m., two production crews, consisting of 15 men, including officials, left the shaft bottom in special self-propelled man cars for No. 4 left barrier and No. 7 right barrier sections. These man-trips were

followed about 4 or 5 minutes later by the two section haulage men, each operating a "light" locomotive; a track crew, consisting of 3 men, shortly thereafter followed the "light" locomotives with a locomotive and 3 tool cars enroute to No. 7 section. Twelve of the remaining 32 underground employees were engaged in the production of coal in 2 right section outby the fire area; 20 employees engaged in haulage and maintenance left the man-shaft bottom for their respective work areas shortly after the man-trips.

The Nos. 4 and 7 section locomotives followed the Nos. 4 and 7 man-trips to No. 4 sidetrack, located just outby 3 left entries to take 10 empty mine cars from the No. 4 sidetrack to No. 7 section. They had reached their working sections when the fire was discovered at 8:30 a.m. The track crew pushed the 3 cars from the shaft to the No. 7 section, and therefore, they did not travel as rapidly as the "light" locomotives. The Nos. 4 and 7 section man-trips reached their respective working sections without incident, and these crews were producing coal when they learned of the fire.

Three mine electricians worked in the No. 7 barrier section during the 12:00 midnight to 8:00 a.m., shift, March 8. These men worked their shift repairing the face electrical equipment and greasing. They were a few minutes later than usual leaving the section on the morning of March 8, and they called the haulage dispatcher and asked for travel instructions about 7:40 a.m. The dispatcher instructed the electricians to travel to 3 left entries and wait in 3 left until the Nos. 4 and 7 section man-trips passed. When the man-trips passed the entrance to 3 left, one of the electricians called the dispatcher and asked for clearance to the shaft bottom after advising that the two man-trips had cleared 3 left. The dispatcher instructed the electricians to wait until the two "light" locomotives and the track crew were clear of 3 left and then proceed to 2 right and clear the main haulage road. The 2 section locomotive operators switched 10 empty mine cars from the No. 4 sidetrack and proceeded towards No. 7 section. The electrician was on the main haulageway at the 3-left switch observing the locomotives and cars as the two motormen traveled inby. As the lead locomotive hauling the mine cars reached the 3-left overcast, a large electric arc or flash occurred that filled the entry from rib to rib. The electric arc and flash appeared to begin on the trolley-wire side of the entry. The motorman did not stop his trip and the other motorman following two or three car lengths behind the trip failed to stop and continued inby the overcast. Although the electricians did not know what caused the large flash of flame and arc, they did not investigate because the two locomotives continued traveling inby without interruption. Examination of the two section locomotives in July 1960 showed that the trolley pole immediately adjacent to the trolley harp on the No. 25 locomotive had been burned and charred. Also, an electrical blister was present on the harp casing. The trolley pole and harp on No. 27 locomotive did not show evidence of burning or charring. After the two section locomotive and the track crew cleared the 3-left switch, the electricians traveled to 2 right entries where they waited about 10 minutes until the main-line locomotive passed. The dispatcher's record for March 8 shows that the main-line motorman left the shaft bottom at 8:05 a.m., with 85 mine cars enroute No. 4 sidetrack, which is about 2 miles inby the shaft bottom. He arrived at No. 4 sidetrack without mishap, but then had to wait for a locomotive to return to the sidetrack to help clear the main line. While waiting he saw a locomotive traveling on the main haulageway inby 3 left entries and he then heard a noise which he thought made by loading or unloading of tools into or out of a mine car. The locomotive after about a 4- or 5-minute stop proceeded inby. About 5 minutes after the locomotive left

the overcast area, he observed a light or flame in the area; and advised the dispatcher that a fire was burning just inby the 3-left overcast. The fire appeared to have started on the trolley-wire side of the haulageway about 5 feet inby the 3-left overcast. The fire had spread along 4 or 5 wooden crossbars, the supporting legs, and the accumulations of dust on the ribs. The dispatcher instructed him to move the trip of empty cars and get the chemical fire truck to the fire.

The locomotive and mine cars observed at the 3-left overcast were being used by a 3-man track crew. It will never be known why the track crew stopped at the 3-left overcast, and no one will ever know what activities or duties were performed by the track crew at the location. It is possible that the trip or part thereof was derailed at the overcast location, and the noise heard by the main-line motorman was caused by the rerailling of the cars; it is also possible that the crossbars and legs were ignited by arcs or sparks from the trolley wire during the derailment and the noise was made by the crew attempting to extinguish the fire. Examination of the locomotive used by the track crew showed that the trolley pole adjacent to the harp was burned and charred, and the pole cable was in two parts. The locomotive and cable were energized by wrapping several strands of feeder wire cable around the harp casing and then fastening these wires to the pole cable. The cable blow-up, repairs to the cable, and igniting of the roof supports could have caused the trip stop at the overcast. Another possible explanation for the track-crew stop at the overcast is that they observed flame or smoldering fire resulting from the arcs and sparks made by the locomotive crew that preceded them. If the observance of fire was the reason for the track-crew stop, the crew failed to extinguish the fire completely, as it was relatively large when discovered about 5 minutes after the track crew left the location. The mine foreman, who was on the surface, was informed of the fire; he immediately instructed the dispatcher to have the doors in 3 left opened and the power disconnected. Immediately after being advised of the fire, the dispatcher was in conversation by trolley phone with a section motorman, who was inby the fire. The dispatcher instructed him over the trolley phone to travel outby the fire and help procure the fire truck and fight the fire. He replied that he would help immediately but shortly thereafter, he informed the dispatcher that the fire was too large for him to travel through it. He was then advised by the dispatcher to proceed to and take the men from No. 7 section to No. 4 section and get in touch with the safety engineer and go to fresh air. About this time, the electric power was "cut off" and there was no further communication with anyone inby the fire.

The superintendent and mine foreman arrived on the scene and took charge of the fire-fighting operations. An 80-gallon chemical truck and a water-car were moved to the scene of the fire where water and chemicals were applied until the supplies were exhausted. A high-pressure rock-dusting machine was moved up and rock dust applied; however, very little headway was made in controlling the fire along the heavily timbered entry. The roof material fell as the burning crossbars collapsed. They arrived at 3 left about 20 to 30 minutes after the fire was discovered and estimated that the fire had spread along the haulageway for a distance of about 80 feet when they arrived. The air line was disconnected at 2 right and water was obtained by tapping the 5-inch line and starting a 600-gallon-a-minute pump located at a "sump" in 2 right. Fittings and materials were assembled and a 3-inch diameter water hose was laid to the fire area by 11:00 a.m., the same day. Water was directed on the burning material, which had fallen to a height of about 4 feet and for a distance

of about 200 feet. A temporary stopping was erected across the haulageway outby the fire area to exclude as much as possible air from passing over the fire. Later, an additional 3-inch water line was laid to the fire area.

About 12:25 p.m., on the day of the fire, a continuous-miner operator and a ventilation man, each of whom had been working in the No. 4 left barrier section inby the fire, arrived at the junction of the main haulageway and 3 left entries where they met men fighting the mine fire. They learned of the fire while loading coal at the face of a working place in No. 4 section; they traveled to the mouth of the section where they found the men with the safety engineer and the section foreman. There was much discussion about the possibility of escaping through the Elk Creek slope. The ventilation man maintained that it would not be possible to travel to the slope, as the west main entries between the slope and their location was closed. The safety engineer listened carefully concerning escape routes and then instructed the section foreman to take his crew and travel towards the Elk Creek slope. The two men then left the other men and traveled to 4 left entries. Heavy smoke was encountered when the door at the 4-left overcast was opened and considerable smoke was encountered in Nos. 1 and 2 entries of west main entries inby the airshaft headings, a distance of about 1,200 feet. After passing the air shaft headings, they found the air of good quality; however, extensive falls of roof in Nos. 1 and 2 entries made travel slow, difficult, and hazardous. After traveling a distance of about 3,000 feet in several hours they arrived at the entrance to 3 left entries about 12:25 p.m., without injury. None of the other employees, 18 men, entrapped by the fire escaped.

About 1:15 p.m., March 8, a party of State and Federal inspectors and company officials entered the mine through the Elk Creek slope, which had been closed with a stopping fitted with a mandoor several months prior to the fire. The door was opened to permit about 47,000 cubic feet of air a minute to enter the mine and enable the crew to explore the area and determine conditions therein. This party traveled about 900 feet along the west main entries, when they were forced to withdraw because of hooved bottom, standing water, and concentrations of carbon monoxide. Before leaving for the surface, changes were made to divert the intake air from west mains to the main fan through 5 left entries. A second trip was made through the Elk Creek slope about 5:00 p.m., of the same day to explore further, but the crew returned to the surface and no further attempts were made to enter the Elk Creek slope opening. During the evening of March 8, tapping sounds were made on the borehole casing from the surface to the underground workings about 2,000 feet from the fire area, but there was no response. The Nos. 1 and 2 entries of the west main entries were originally used as return airways; however, these entries were changed to intake airways previous to the fire and they were to be used as escapeways and travelways. The No. 2 entry was separated from Nos. 3, 4, 5, and 6 entries by cinder-block stoppings. The Nos. 7 and 8 entries of west main entries were used as return airways and were separated from No. 6 entry by masonry stoppings. Work was started on the evening March 8 to advance in Nos. 1 and 2 entries of west main entries as far as possible inby the fire located on No. 4 entry; this work was done to permit travel inby the fire and permit the installation of temporary stoppings in Nos. 3, 4, 5, and 6 entries at locations inby the fire. Crews were also engaged in timbering No. 2 entry and in repairing and reinforcing the permanent stoppings in crosscuts between Nos. 2 and 3 entries adjacent to the fire area. A 3-inch plastic water line was connected to the 5-inch

water line in No. 4 entry and then extended along the No. 2 entry. Two-inch branch water lines fitted with valves were tapped into the 3-inch water line and placed through the stoppings into the fire area. Test pipes equipped with valves were placed in the stoppings to determine the quality of air in the fire area. A rescue crew equipped with gas masks traveled in Nos. 1 and 2 entries for a distance of about 1,200 feet inby 3 left entries where they encountered difficult traveling because of roof falls, dense smoke, and concentrations of carbon monoxide. A rescue crew also attempted to travel through crosscuts from No. 2 entry to No. 4 entry inby the fire area; dense smoke and fumes prevented the crew from reaching No. 4 entry. A crew of men equipped with gas masks made a trip into the air-shaft headings and explored the area. During this trip and about 510 feet inby the fire, smoke and heat were encountered when an opening was made in a stopping between Nos. 2 and 3 entries.

Because of the difficulty of traveling from 3 left entries through Nos. 1 and 2 entries of west main to the area inby the fire, providing supplies for the erection of checks, temporary stoppings, line curtains, and installing roof supports was slow, difficult, tedious, and hazardous. The absence of open travelable openings at the inby end of the fire made the containing of the fire at the inby end almost impossible. To facilitate the erection of temporary stoppings across the Nos. 3, 4, 5, and 6 entries of west main entries inby the fire, an attempt was made to reverse the direction of air flow through the fire area by directing the intake air to the inby end of the fire through Nos. 1 and 2 entries and returning such air over the fire through Nos. 3, 4, 5, and 6 entries and through a metal tubular overcast into 3 left entries. Unfortunately, although this change was beneficial, it failed to permit a complete air reversal through the fire area. While this ventilation change was being made, water was being applied to the fire area at all critical points and temporary stoppings were installed across Nos. 2 and 3 entries inby the fire area to divert the intake air to No. 4 entry. Temporary stoppings were erected in crosscuts between Nos. 4 and 5 entries for a distance of approximately 600 lineal feet in No. 4 entry inby the fire area. This work was accomplished by crews wearing gas masks. A fresh-air base (No. 5 station) was established on the haulageway (No. 4 entry) 500 feet inby the line of temporary stoppings.

Exploratory crews traveled Nos. 7 and 8 entries of 2 west main entries in intake air over heavy falls of roof for a distance of about 1,500 feet; at this location, they found both entries closed by wooden stoppings. Later, a crew opened these stoppings, which permitted intake air to ventilate the active working places in No. 7 section. This crew, in their search of the area for the trapped men, found two full lunch buckets. The crew returned through Nos. 7 and 8 entries to the fresh-air base at 3 left entries. A gas mask crew reached the No. 7 section from No. 5 station on the haulageway at almost the identical time that the men traveling in intake air through Nos. 7 and 8 entries reached No. 7 section. During the same shift, a gas mask crew traveled the haulageway to the 4-left overcast, where 2 locomotives and a man-trip car were found. The working places in 4 left barrier section were explored before the crew returned to the fresh-air base. Shortly after these exploratory trips were made with gas masks, a fresh-air base (No. 6 station) was established on the haulageway (No. 4 entry) inby the entrance to No. 7 section. Additional exploration trips in the 4 left section, the 4 left storage tracks, and No. 7 section confirmed the belief that the entrapped men had moved from and were not in these areas. Crews wearing gas masks or oxygen breathing appa-

ratus continued making exploratory trips into open areas inby No. 6 station, and about 3:20 p.m., March 15, 1960, the bodies of 14 of the trapped men were located approximately 950 feet inby the junction of 4 left and west main entries, a distance of about 3,550 feet inby the fire area.

About 8:35 p.m., on March 16, 2 additional bodies were located in Nos. 6 and 7 entries approximately 120 feet inby the 14 bodies. During the afternoon of March 17, a rescue team probing in the vicinity of No. 7 section located the last two bodies of the trapped men in Nos. 5 and 6 entries of west main entries. The body of the last victim was brought to the surface about 4:45 p.m., March 17, 1960.

Immediately after the bodies of the victims were brought to the surface, all work consisted of enclosing the fire area with masonry stoppings or seals. Such seals were completed in Nos. 3, 4, 5, and 6 entries inby the fire on March 25, 1960. On March 27, crews on a 3-shift a day, 7 days a week basis began loading out the burning fire materials at the 3-left overcast on No. 4 entry (haulageway).

Hot materials, fire, smoke, and carbon monoxide were present in the loading areas from March 27 until June 9, when loading of the burning materials was discontinued. The fire material was removed from No. 4 entry for a distance of 400 feet. At this time,

it was decided that loading of the fire material should be discontinued, as the fire appeared to be traveling inby in Nos. 3, 4, 5 and 6 entries of west mains entries faster than the fire materials were being loaded, and the fire area should be completely sealed as rapidly as possible. As either masonry seals or incombustible stoppings were erected in all entries, except No. 4 entry, outby the fire, between Nos. 2 and 3 entries and between Nos. 6 and 7 entries from 3 left entries to inby the fire, seals were needed only in Nos. 3, 4, 5, and 6 entries inby and in No. 4 entry outby the fire to completely close the fire area. As the only travelways from 3 left entries to inby the fire were restricted to difficult walking and/or crawling, it was decided that seals inby the fire could be installed most rapidly if a tracked haulageway was provided from 3 left entries to the west mains entries inby the fire. Accordingly, conventional loading machine crews began driving three entries through the left barrier pillar adjacent to west main entries from 3 left entries to a point inby the fire. The driving of the entries was begun June 13 and completed July 10. Seals were completed in Nos. 1, 2, 3, 4, 5, 6, 7, and 8 entries of west main entries outby the fire while the barrier entries were being driven. Seals in Nos. 1, 2, 3, 4, 5, 6, 7, and 8 entries inby the fire were completed July 10, 1960.

TABLE 2.—Major disasters by haulage

Date	Name of mine	Location of mine	Killed
1870:			
August 10.....	Heins & Glassmire <sup>1</sup> .....	Middleport, Pa.....	9
August 29.....	Preston No. 3 <sup>1</sup> .....	Girardville, Pa.....	7
1889:			
May 9.....	Kaska William <sup>1</sup> .....	Middleport, Pa.....	10
1897:			
January 13.....	Wadesville <sup>1</sup> .....	Wadesville, Pa.....	5
1898:			
November 5.....	Exeter <sup>1</sup> .....	West Pittston, Pa.....	9
1901:			
December 28.....	No. 1.....	Hartshorne, Okla.....	6
1904:			
November 2.....	Auchincloss <sup>1</sup> .....	Nanticoke, Pa.....	10
1905:			
February 18.....	Lytle <sup>1</sup> .....	Minersville, Pa.....	5
March 9.....	Clear Spring <sup>1</sup> .....	West Pittston, Pa.....	7
April 26.....	Conyngham <sup>1</sup> .....	Wilkes-Barre, Pa.....	10
1906:			
November 3.....	San Toy No. 1.....	San Toy, Ohio.....	5
December 22.....	Breese-Trenton.....	Breese, Ill.....	6
1907:			
August 17.....	Sonman.....	Sonman, Pa.....	5
1908:			
August 28.....	Warrior Run <sup>1</sup> .....	Wilkes-Barre, Pa.....	6
1909:			
January 25.....	Washington No. 5.....	Franklin, Md.....	5
1910:			
December 31.....	Lick Fork.....	Thacker, W. Va.....	10
1911:			
March 22.....	Hazel.....	Canonsburg, Pa.....	9
1914:			
January 14.....	No. 7.....	Mulberry, Kans.....	6
April 30.....	No. 2.....	Cumberland, Wyo.....	5
May 29.....	Maryd <sup>1</sup> .....	Maryd, Pa.....	6
December 9.....	Tripp <sup>1</sup> .....	Scranton, Pa.....	13
1915:			
July 30.....	Patterson No. 2.....	Elizabeth, Pa.....	9
1917:			
September 17.....	Orient.....	Orient, Ill.....	5
1922:			
September 23.....	Raleigh-Wyoming No. 2.....	Glen Rogers, W. Va.....	5
1935:			
May 7.....	South Wilkes-Barre <sup>1</sup> .....	Wilkes-Barre, Pa.....	7
1942:			
December 15.....	Laing No. 1.....	Laing, W. Va.....	5

<sup>1</sup> Indicates anthracite mine.

## DESCRIPTION OF MAJOR DISASTERS BY HAULAGE

August 10, 1870; Heins & Glassmire Colliery,  
Middleport, Pa.; 9 Killed

(From Reports of the Inspectors of Coal Mines of the  
Anthracite Coal Regions of Pennsylvania, 1870,  
p. 127)

A driving-wheel on a hoisting engine broke while 12 men were being transported on a cage in the 300-foot-deep shaft. The drum having no brake, yielded to the combined weight of the rope, cage, and men, and the force of the descent was so great that the building was shattered and the machinery removed. The cage, which broke through the sump cover, carrying with it the 12 men, was instantly covered with water and held down by the coils of the hoisting rope. Nine of the men on the cage were killed and three were injured.

August 29, 1870; Preston No. 3 Colliery, Girardville, Pa.; 7 Killed

(From Reports of the Inspectors of Coal Mines of the  
Anthracite Coal Regions of Pennsylvania, 1870,  
p. 15)

Seven men were killed when a wagon (mine car) was improperly placed on the cage and caught the shaft timbers near the surface. The car and men were dropped down a distance of 300 feet.

May 9, 1889; Kaska William Colliery; Middleport, Pa.; 10 Killed

(From Reports of the Inspectors of Coal Mines of the  
Anthracite Coal Regions of Pennsylvania, 1889,  
pp. 239-242.)

This is the most deplorable calamity that has taken place in this district since the year 1870, there being the greatest number of lives lost by a single accident during the last 18 years. It is true beyond a doubt that many of the victims that lose their lives in and about the mines, contribute more or less to their own misfortunes, but in this case it was the reverse. These ten unfortunate men had finished their day's work and were ascending the shaft, expecting to reach their homes and families in safety. Those hopes however, they never had an opportunity of realizing, for when the cage arrived about midway of the shaft, an empty mine-car was pushed into the shaft, and in the same compartment the ten men were ascending. The car came in contact with the cage, snapping the rope, dropping it with the ten persons, about two hundred and fifty feet down to the bottom of the shaft, where they were either crushed to death or drowned in the sump.

It was in the evening about six o'clock when the accident occurred and the hoisting of coal had ceased for the day. The three top-men whose duty it was to take the loaded cars off the cages and put the empties on, had started for their homes. However, before

two of them had gotten far from the top of the shaft the outside foreman met them, requesting them to return and send three empty cars down the shaft in order that the night shift should have sufficient cars to make their shift's work.

The two top-men that were present returned, viz: the man having charge of the head of the shaft, and one of his helpers. Both men stated in their evidence before the coroner's jury, that after returning to the shaft the first thing they did was to run an empty car into the foot of a plane. The cars are hoisted up the plane by an automatic chain hoist, the plane being fifteen feet long, having a vertical rise of about four feet in fifteen. They also stated that they ran the car onto the transfer truck, and transferred the truck and car from track "A" and track "F": ready to run it on the cage as soon as it arrived at the landing. The headman testified that he secured the car on the truck by a stop block, also that he placed the stop or safety block in position, blocking the track between transfer truck and the shaft. The helper in his testimony corroborated this statement in every respect. The headman also stated that as soon as he had secured the car he moved from the car to the tally board to mark the number of cars hoisted that day, and while in the act of marking the number of cars he heard the car in motion, and as he looked around he saw the car running to the shaft and the helper behind it. There is no doubt whatever as to the helper having removed the stop blocks and pushing the car off the transfer toward the shaft, from the fact that he himself testified that he removed the safety blocks and pushed the car off the transfer. When questioned as to his motive for doing so, he answered that he thought the headman said all right, the usual signal given when the cage arrived at the landing point and was ready to receive the empty car. We do not think for a moment that he intended to run the car into the shaft, but we are of the opinion he being anxious to get home and not altogether satisfied in consequence of having to return to perform additional labor after working hours, he, in order to reduce the time they would have to stay, opened the safety blocks and pushed the car off the transfer, not intending that it should run into the shaft, but that it should be in close proximity to the cage when it arrived at its landing place, and that by doing so he would save time.

In looking at the other side of the question the helper had been working on the head of the shaft several months and was fully aware that after the car was pushed off the transfer it would run to the cage by gravitation, the intervening track between transfer and cage having sufficient grade to carry the cars to the cage, there being only about six feet between the front end of the car and mouth of the shaft.

The tracks and system by which the cars are handled at the upper landing stand sixty feet above the surface. The structure is built of iron. Previous to the building of the iron shaft frame, also the new breaker built in connection therewith, the coal and employes were all landed at the same point, viz., the level of the surface. During that time the mouth of

the shaft was protected by flat gates raised and lowered with the cages. After the new structure was completed the system was changed, the coal being landed at the upper landing whilst the employes were all landed at the original landing on the surface. In place of the flat gates the mouth of the shaft was secured by a fence, whilst at the upper landing the north and south sides of the mouth of the shaft were fenced. The east and west sides of the shaft were opened for the free passage of the loaded and empty cars to and from the cages, and safety blocks were placed in position between transfer and cage to keep the empty cars from accidentally running into the shaft which, up to the date of the accident, was deemed sufficient protection, and that the law was complied with which reads as follows: "Safety blocks or some other device, for the purpose of preventing cars from falling into a shaft or running away on a slope or plane, shall be placed at or near the head of every shaft, slope or plane, and said safety blocks or other device must be maintained in good working order."

There was considerable comment through the press in reference to the terrible disaster, and, as usual, the company was condemned because it had not complied with the law, and the inspector did not fail to receive an equal amount of condemnation because he had not compelled the company to comply with the law. However, these comments were generally made by those who knew nothing whatever about the circumstances or conditions that existed, and much less about what the law required. It was and still is the opinion of the public in general that the cars could and were run into the shaft from the breaker or some other distant point, and that there was no obstruction to stop the cars from running or being pushed into the shaft. That, however, is erroneous for the fact is the cars had to pass through three different movements, before a car could be brought into a position to be run on the cage or into the shaft. The tracks running from shaft to breaker and returning from breaker to shaft, are gravity roads and are on two different levels, hence the cars had to be raised up the incline plane before they could reach cage landing. From the head of the plane for a distance of fifteen feet the cars pass along the south side of the shaft where it is intercepted by the transport truck, on which it is carried from track to track. The track on which the car stands intersects with the two tracks leading to the cages when they are landed. When the car is in a position to run on the cage the front end of the car stands within six feet of the cage or shaft, and in that position the headman left the cars standing, he having placed a stop block in front of the car on the transfer and the safety block across the track, between the shaft and transfer, hence, before the car could be moved from the transfer these obstructions had to be shifted from the position he had placed them in. And, in the second place, it required the power of a man to push the car off the transport. Yet, notwithstanding this, it is too true that through the ignorance or carelessness of this one man ten unfortunate men lost their lives. Since the accident occurred, automatic gates have been placed in position and safety blocks operated by the keeps on which the cages rest. It is more than probable had these arrangements been in use previous to the accident the chronicling of the sad loss of life would not be necessary. But this was the last place about the colliery where any person ever expected an accident of that character to occur. The Middle Creek shaft had been in operation for seventeen years under precisely the same conditions. However, after the accident automatic gates were placed at the head of this shaft also.

January 13, 1897; New Wadesville Shaft,  
Wadesville, Pa.; 5 Killed

(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1897, p. 210)

A sad accident occurred at the New Wadesville shaft about 7 o'clock on the morning of January 13, while the men engaged in sinking the shaft were changing shifts. Four of the day shift men had gone down, and four of the night shift had been hoisted to the surface. After they had gotten off the bucket, the chageman of the day shift, with three laborers, got on to go down, taking with them the pump boy. The weather was very cold and during the time the bucket had been standing at the landing, the cross head had been frozen to the guides above the surface landing, and, unnoticed by the top man or those in the bucket, did not follow the bucket down. The bucket was stopped at the pump station, 200 feet below the surface, and the pump boy got off and relieved the night pump boy, who got on the bucket to go to the bottom to be hoisted with the next load of men. The bucket was again lowered, and when about 100 feet below the pump station, the cross head became loose by the jarring of the rope through it, and went down, striking the bucket with fearful force, breaking the cross head and one of the three chains, by which the bucket was suspended, knocked the four men off, causing them to fall to the bottom of the shaft, a distance of three hundred feet, killing them instantly. The pump boy was inside of the bucket, but had been struck by part of the broken cross head, and was fatally injured, but had been left in the bucket, which was hanging sideways, being held by only two chains. The engineer, when he felt the jar, stopped the engine, and, not knowing anything of the condition of the bucket or cross head, was afraid to move either way, when one of the men employed at the shaft, who had just arrived on the scene, quickly took in the situation and the need of prompt action, sprung on to the rope and slid down, at great risk to himself, as he did not know whether the bucket had been left on the rope or whether the rope had been broken between the surface and the bucket. He, however, succeeded in getting down safely and found the pump boy as above described, and, after disengaging the bucket from the wreck of the cross head, guided him to the top, when he was sent to the Pottsville Hospital, but the poor boy died shortly after reaching there. The writer was at the shaft shortly after the accident, and made an examination as to the cause, and found the guides in the shaft in very good condition, and free from ice or anything that would prevent the cross head from following the bucket down. The steam pipe in the shaft kept the temperature much above the freezing point. There was a thin coating of ice on one of the guides, about ten feet above the surface landing, at the place where the cross head was when the bucket was at the landing, and I think that as the bucket had stood longer than usual on this trip, that the cross head froze and stuck there unnoticed by the top man or those on the bucket.

November 5, 1898; Exeter Shaft, West Pittston,  
Pa.; 9 Killed

(Transcript taken from microfilm record of "Wilkes-Barre Times," Saturday evening edition, Nov. 5, 1898, courtesy of the Wyoming Historical & Geological Society, Wilkes-Barre, Pa.)

"About 6:30 o'clock while the shaft carriage was lowering a load of men to their work in the mine, three loaded coal cars crashed through the head-gates



and thundered down the hoisting compartment onto the descending cage.

"The three loaded coal cars which were precipitated down the shaft were brought from the red ash shaft about a quarter-mile west, all the coal from which is drawn by a locomotive and run through the Exeter breaker. A short distance from the mouth of the Exeter shaft is a switch which is always supposed to be turned so that the cars will run onto the breaker track and not onto the track leading to the shaft compartment, but the switch was turned wrong this morning and after the engineer had made a "fly" by running his locomotive on a branch, the cars instead of going round on the track to the breaker kept the straight track to the shaft, plunged into the opening with great velocity and went down onto their terrible mission of destruction. Seven of the ten men were killed and three injured and it is believed that not more than one can recover.

### December 28, 1901; No. 1 Mine; Hartshorne, Indian Territory (Okla.); 6 Killed

(From the report of William Cameron, United States Inspector for the Indian Territory)

Six men were killed in mine No. 1, at Hartshorne, Ind. T., by being dumped from the cage while ascending the shaft on the 28th day of December, 1901, falling a distance of about 115 feet.

On Saturday, December 28, at about 1 o'clock p.m., I was notified by telephone of the above accident. I went to Hartshorne on the next train and commenced investigation.

Hartshorne shaft No. 1 was sunk in 1889. It is the third oldest shaft in the Indian Territory, and has been the largest coal producer in the Territory. The hoisting shaft consists of two compartments with a third compartment for ventilating and pumping purposes. Each hoisting shaft is 6 feet by 8 feet. The framing consists of "sets" of timbers 9 by 9 inches, which are planked vertically on the back side, allowing the timbers to project into the shaft. Between the two hoisting compartments are buntons of 6 by 6 inch timbers, the "sets" and "buntons" being about 4 feet apart. To the framing timbers and buntons are affixed guides. The guides are 5 by 8 inches. The cages used are known as self-dumpers, and the type of cage in use in this mine has been in use from the time of the commencement of the production of coal to the present time. While ascending or descending the shaft the dumping portion of the cages are kept in a vertical position by a one-sided shoe which engages the south side of the guides, the guides being cut away at the top of the tippie so that the cages may dump the coal out of the pit cars on the cages down the chutes into the railroad cars beneath. The hoisting engines are "McMullen" double, horizontal, direct-acting engines, with 18 by 30 inch cylinders. The engineer at the time of the accident was an experienced and competent engineer.

On Tuesday, December 24, 1901, prior to the accident, the cage in the west hoisting compartment was repaired, inspected, and thoroughly overhauled. On December 28 at noon the mine had shut down at the half day. Most of the miners had been hoisted out of the mine, and at about 12:15 p.m. the engineer received the usual signal for hoisting men, and his statement is that he gave his engine steam for about one-third of the distance and then shut off the steam, the engine running by impetus and gravity. Just as his indicator showed that the cage was a little more than half way up the shaft the machinery was brought to a sudden standstill. The engineer states that he

was hoisting the men at the usual rate of speed, which was about one-half the speed with which coal was hoisted. It seems that there were nine men got on the cage to be hoisted, and some of the men who were rescued state that there were three men on the south side of the cage and six men on the north side, thus throwing the preponderance of weight on the north side of the cage, and this would cause the half-shoe to press against the south side of the guides. When the cage had reached a little above half way up the shaft it suddenly dumped and precipitated six of the men down the shaft, the three men on the south side clinging to the cage in some manner and were afterward rescued.

When I arrived at Hartshorne, at about 3 o'clock in the afternoon after the accident, I descended the shaft in company with my predecessor and the president of the coal company.

I carefully examined the guides and the timbers of the framework. I found that the half-shoe which engaged the south side of the guides on the west side of the west compartment had been torn partially loose from its fastenings. It was bent and twisted, and had been crushed past the guide, splintering and shivering the guide. At some 4 or 5 feet below the place where we found the cage lodged the guide had been crushed and splintered away. I also found some apparently recent marks on the lower side of the framing timber. These marks commenced about five "sets" of timbers below where the cage was then lodged, the first marks being slight, but increasing in depth on the timbers above until the timber was reached under which the top of the dumping portion of the cage was firmly stuck. I am unable to say whether the preponderance of weight on the north side of the cage pressed the half-shoe so firmly against the guides as to force the shoe from its fastenings and past the guides or whether some obstruction had intervened between the edge of the bottom of the cage and one of the framing timbers. One of the men may have been caught in this manner, and his body may have formed the obstruction.

Such an obstruction would have caused the half-shoe to bind against the south side of the guides and have torn the shoe loose and crushed it past the guides.

### November 2, 1904; Auchincloss Colliery, Nanticoke, Pa.; 10 Killed

(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1904, p. 226.)

At 6:40 a.m. November 2, ten men were instantly killed in No. 1 shaft at this mine while being lowered to their work in the Baltimore seam, 1,065 feet below the surface. The headman had given the signal to the engineer to lower the cage and did not discover anything wrong until the ascending cage reached the surface landing at a frightful velocity, going through the tower and taking with it bridge trees and sheave wheel. It did not stop until the crosshead and uprights of the cage had become fastened under the drum in the drum pit, which resulted in stopping the engines. The descending cage struck the landing fans of the Baltimore seam with terrific force, causing both carriage sills to break, dropping with its load of human freight to a depth of 400 feet into the water, the shaft being filled with water to a depth of 210 feet. Rescuers were immediately sent down No. 2 shaft to the Ross vein crossing through to No. 1. They succeeded in climbing down to the surface of the water to ascertain if any of the men might be living, but no signs of life were found. A hasty ex-

amination of the two engines was made by the District Machinist, who reported that the engines were all right in every respect and responded to the operation of the throttle valve and levers.

Preparations were immediately made for the recovery of the bodies of the unfortunate victims. The broken cage of the Baltimore landing was hoisted to the surface and taken out and substituted by billy block and bucket. At 4:30 p.m. three men were sent down to the surface of the water. Platforms were placed upon the buntons, grappling hooks and ropes were secured and the work of grappling for the bodies was begun an hour later.

The remains of the last miner were not discovered until 1:20 p.m. November 12, when they were found caught in the debris between the bottom of the broken cage and the broken pieces of an old mine car.

The cause of the accident is practically unknown. The hoisting engineer, claims that he had perfect control of his engines until within 50 or 60 feet of the landing. A minute examination made by the master mechanic, district machinist, and Supt. of the Vulcan Iron Works shows that the condition of the engines was in every respect first class. It is therefore very evident that the responsibility for this accident lies with the hoisting engineer. It was caused in my opinion by the double throw of the reverse bar during this trip. In other words, after he had started his load with steam, he threw his reverse bar over, permitting the loaded cage to descend by its own weight to within the distance that he claims he had control of his engines. It appears to me that he must have thrown his bar over again, not realizing that his engine was already running against itself and must have given her steam with the intention of slackening speed to reach the fans, when instead of slackening the speed it was increasing to a tremendous velocity, with the result noted above.

#### February 18, 1905; Lytle Colliery, Minersville, Pa.; 5 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1905, p. 413)*

Five men were descending slope in gunboat on west side at point opposite No. 2 level, when they were killed by a fall of rock.

The throttle valve of the tender slope hoisting engine being out of order, the officials concluded to lower the men in the gunboat of No. 2 slope. They placed a false bottom in west gunboat which made it convenient for men to get in and out. The east was running empty, timber being lowered in it during the day to No. 3 level.

The east boat was lowered rapidly, there being no person aboard. There were three boat loads of men lowered before the accident occurred.

The east or empty boat jumped the track disturbing the timber on the slope at No. 2 level, which in turn set the top moving, and it fell about the time west side boat with men in arrived at this place.

#### March 9, 1905; Clear Spring Colliery, West Pittston, Pa.; 7 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1905, p. 194)*

These seven men were going home after their day's work. They came to the foot of the shaft and got on the cage and gave the signal to the engineer to hoist. When the cage had ascended about 250 feet, the rope

broke and the cage with the seven men aboard dropped to the bottom of the shaft killing them instantly. Cause of the rope failure was not determined.

#### April 26, 1905; Conyngham Colliery, Wilkes-Barre, Pa.; 10 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1905, p. 241)*

Shortly after 6 o'clock a.m. April 26, 1905, ten men were killed at the Conyngham colliery by the breaking of the rope in the shaft in which the men are lowered to and hoisted from their work. Several cage loads of workmen had already descended to their work. These ten men in their turn stepped upon the cage. The cage had just about reached the Hillman landing where most of them intended to get off. The engineer had slackened the speed and was about to stop when the rope parted. The safety catches failed to work and the cage dropped to the bottom of the shaft, a distance of about 400 feet.

The engineer in charge of the engine at the time was a man of many year's experience as an engineer. He said that all went well until he was about to stop the engine, when he felt a jerk on the engine, and the rope, which is usually drawn taut by the weight of the cage, hung slack. He knew instantly that something was wrong. A few moments later word came up through the speaking tube from the footman that the cage with its load of human freight had struck the bottom with a terrific crash. A rescuing party of officials and workmen labored for several hours before they finally succeeded in extricating all of the bodies from the tangled mass of wreckage.

The question arises, why did the safety catches on the cage fail to work? I must say that I was greatly deceived in them. At the Delaware shaft, where I was foreman for a number of years, the same kind of safety catches was used upon the cage. I had often seen them tested and they never failed to work satisfactorily.

These safety catches were what are called the quadrants. They are made of brass, with a row of teeth around the outer rim. They are adjusted by means of rubber springs through which the drawbolt on the cage passes. If the rope breaks or becomes detached from the cage, they are supposed to wedge and grip tight upon the guides in an instant. There are four of these quadrants on each cage, or two to each guide, opposite each other.

Why they did not grip the guides and hold the cage on the morning in question is in my opinion due to one of two causes:

1st. That the safety catches on that cage were out of order at the time of the accident; or,

2nd. If they were not out of order, they were not safety catches such as the law requires that will be effective under any condition that may arise in hoisting shafts.

As to the first condition, we have the sworn testimony of the men whose duty it was to examine and keep in good order these safety catches, that they had examined them and that they were in good working condition.

As to the second condition, it was shown by the testimony of a man who was looking at the cage as it was coming to the Hillman landing, that when the rope broke, the cage disappeared in an instant, showing conclusively that the safety catches failed absolutely to act. The guides at the point where the cage was when the rope broke were in good condition, but they showed no signs of the safety catches having taken hold of them. This was a surprise to us all.

After the accident a great many opinions were expressed by different persons as to why the catches failed to work. The opinion most expressed was that the piece of rope hanging to the cage had held the catches taut and therefore they could not grip the guides as their inventor intended they should. If this theory be true then it must be acknowledged that the safety catches are not equal to all emergencies that may arise in our shafts.

I had intended, after being notified by the Chief of the Department of Mines, to test all the cages in the shafts in my district, and to test some of them under about the same conditions as prevailed at the Conyngham shaft at the time of this accident, namely, to drop a cage when several hundred feet of rope were (sic) attached to it. But when I spoke to some of the superintendents about doing this they were loath to do it. They felt that it would not be right for me as a Mine Inspector to cause them any more trouble or expense than operators were subjected to in other inspections districts. I had to acknowledge that their point was well taken, and as I had no authority to compel them to furnish pieces of rope of different lengths, I was compelled to abandon my idea of making such tests. The problem whether a piece of rope attached to the cage and falling with the cage will hold the safety catches taut and prevent them from taking hold is so far as I know at the present time unsolved.

Since this disaster, I doubt whether superintendents, foremen and intelligent mining men generally believe that if a cage loaded with men were descending a shaft and the rope were to break, or the cage become detached, the cage would stop in its descent.

In my experience in testing safety catches, I have found that if the cage does not stop the very instant it is cut loose it generally goes to the bottom. There seems always to be a reason for this. Sometimes something about the catches breaks, or the catches having small teeth get filled up with wood from the guides, or pieces break off of the guides, and when this happens the cage gets a start and generally lands upon the bottom.

After the above explanation of my experience in testing the safety catches, it will be seen how unlikely it would be for a heavy cage loaded with men going down some of our shafts as fast as they do sometimes, to be caught by the safety catches. In my opinion, it seems nearly impossible for the reason that the heavy weight and the momentum of the cage going down would cause something to break or give way.

Even if the catches did hold fast and the cage stop suddenly, the result to the men would be the same as if the cage had struck the bottom hard. The chances are that they would all be injured or possibly killed by being thrown off the cage into the shaft. It is evident that all the dangers to which we are subjected in going up and down our hoisting shafts are not eliminated by the safety catches.

I have no wish to create any unnecessary alarm among mining people. Some of the safety devices now in use are the best that the market affords, but the question arises: Are they given proper attention? Every person whose duty it is to look after them should do so without fear or favor, and according to law. If he does this he should have nothing to fear, but on the contrary he should have the thanks of his employers and of the men who must ride upon the cages.

The two best safety devices are:

1st. To always keep good ropes in shafts where men are hoisted or lowered. 2nd. To employ good and careful engineers, and not allow them to be overworked; men, who when hoisting or lowering men will

run their engines as the law requires. If these two safety devices were adopted, there would scarcely be an accident of this kind.

The officials in charge of the mine always sincerely deplore any serious accident. The mine Inspectors also regret them exceedingly and sympathize with the victims and their friends. But regret and sympathy amount to nothing to the victims, or to widows and orphans. What is needed is more strict oversight (sic). If the provisions of the mine law were carefully followed, as the law intended they should be, there would be fewer accidents.

Take for instance the accident at the Conyngham. It shows plainly that the law had not been fully complied with, for what reason I am unable to explain. There were four men, three engineers and one carpenter, delegated by the foreman to look after the ropes and cages in this shaft. At the inquest, three of these men swore that they had examined this particular rope on the day before the accident, and that they could not see any broken strands in it. Yet when the rope broke the next day, there were numerous broken strands to be plainly seen on both ends back along from where the rope parted. I do not think that all of these broken strands had been broken between the time of their examination and the accident. It seems to me that these broken strands must have been visible to any one examining the rope for several days before the accident, and if they were, then all of those men whose duty it was to examine the rope and report its condition to the foreman, failed to do their duty, both to themselves and the company employing them, and also to the unfortunate victims and others who were compelled to ride upon this cage.

The only explanation that I can give as to why these men did not see those broken strands was, that they did not examine it as carefully as they should, and the reason they reported it in good condition, was that they took it for granted that as it was used only to lower and hoist men there would be no danger of it breaking. Of course this is only my supposition, and I may be wrong.

#### November 3, 1906; San Toy No. 1 Mine; San Toy, Ohio; 5 Killed

(From the "Zanesville Signal," Tuesday, Nov. 6, 1906)

The chief inspector of mines, after a personal investigation of the death of five men in the San Toy mine, Perry County, on Saturday night at quitting time has given out the following statement regarding the accident.

"The circumstances surrounding the accident were not as first reported. The hoisting cage did not turn over or dump in the shaft as first reported. The hoisting cages at San Toy, like many others in the state, are large, heavy iron structures, and are dumped automatically at the top of the shaft running the coal out of the mine car without taking the car off the cage, commonly called self dumping cages. The sides are not guarded by wooden or iron bars similar to the old-fashioned wooden cages, this would interfere with the automatic dumping, but a light wooden structure called a crib or cage in which ponies, horses, and employees go down and up is placed on the hoisting cage and is much smaller than the floor of the hoisting cage and there is about a foot of clear space on both sides and ends. It has two drop endgates so as to permit the employees or ponies to pass through. These endgates swing on an iron bar at the bottom and are fastened at the top with two long iron pins.

"The testimony of the miners show that in coming up, those next to the endgate would sometimes take the

pins out and hold the gate with their hands ready to drop as soon as the cage reached the surface landing especially if they were in a hurry to get home. Whether this was done or not will always remain a mystery, but by some means the gate was dropped in the shaft and caught the shaft timbers tilting the wooden cage and breaking one end of it, throwing the men against the side of the shaft and with the instinct of a drowning man they are supposed to have clutched and grabbed each other and in consequence six men were precipitated to the bottom, four instantly killed and one dying shortly after, and one other sustaining a broken limb and a fracture of the other limb."

Three men, who clung to the cage were saved.

**December 22, 1906; Breese-Trenton mine; Breese, Ill.; 6 Killed**

*(From the State Coal Report, 1954, Illinois Department of Mines and Minerals)*

December 22, 1906, a very deplorable accident occurred at the Breese-Trenton mine, Breese, Clinton County. Six men got on the cage to go to their working places to begin the day's work when, from some cause not given, the cage fell down the shaft 300 feet, killing all the men almost instantly, breaking legs, arms, and crushing their bodies in a horrible manner.

**August 17, 1907; Sonman Shaft Mine; Sonman, Pa.; 5 Killed**

*(From State inspector's report)*

The engineer, instead of lowering the cage, hoisted it to the automatic dump in the head frame with such force as to displace the angle guides, upsetting the cage straight down the shaft. Five men fell to the bottom, a distance of 350 feet; the other three escaping by clinging to the cage and shaft timbers. At the inquest, the engineer stated that he had left the engine after hoisting a man up the shaft to see if there was water in the boilers. Upon receiving a signal to let the men down, he unintentionally sent the cage the wrong way, hoisting it to the automatic dump instead of lowering it into the shaft. The evidence shows that he hoisted the cage slowly at first, but when an alarm was given by the men around the top of the shaft, he became excited and shot the cage up. The following is a copy of the verdict:

"We the jurors, find from the evidence presented that the death of—and four others at the Sonman mine, August 17, 1907, was due to an unintentional mistake of—, operating the engine that raised the cage instead of lowering it, causing the fatalities."

**August 28, 1908; Warrior Run Colliery, Wilkes-Barre, Pa.; 6 Killed**

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1908, p. 213)*

August 28, 1908, at 4:30 p.m., in Red Ash Slope, Warrior Run Colliery, an accident occurred by which 6 men were killed and 5 injured.

The empty cars were run by gravity from the breaker plane to head block near the head of the slope over the light track. It was the duty of the car runners to run the empty cars with sprags from the head of the breaker plane to head of the slope, also the loaded cars from head of the slope to head of the breaker plane. Orders had been given to these

car runners to take a car of manure to the hole down which the manure was to be put for use in building a dam inside the mine. The method of doing this should have been to run the car, properly spragged, to the head block along the light track which had an average grade of 1.93 per cent. It should have been stopped and attached to the hoisting rope used for hoisting up the main slope. The car should then have been pulled past the spring switch stopped before reaching the slope track and then dropped back along the loaded track, and, after having been detached from the rope, allowed to run by gravity to the hole attended by the car runner. This procedure was, however, not carried out, and the evidence shows that instead of the car loaded with manure being attended by the regular car runners, this duty was being looked after by a headman whose business it was to attend a switch lever at the head of the slope. This change of work was evidently an arrangement between the headman and the car runners, so that the runners might go home earlier without waiting to shift the car. Although the head block was known to have been in place some days prior to the accident it is probable that it was not in place on the day of the accident.

The superintendent of the colliery testified at the inquest that when he last examined the head of the slope the block was in place and that he was given no orders for it to be removed, and that anyone giving such orders did so without authority. It was claimed that the headman stated to a witness immediately after the accident that he had ordered the head block removed, but this statement was denied by the headman at the inquest.

The car in running down the light track evidently gained greater headway than the man who was running it expected and he was unable to sprag it so that it would slow up before reaching the slope switch. The evidence showed that instead of stopping the car and then transferring it from the light to the loaded track by attaching the car to the hoisting rope, an attempt was made to switch the car from the light to the loaded track without attaching the hoisting rope to the car. This point does not seem to be disputed by either side, and the headman claims that it was a common practice to thus switch the cars, while the company officials claim that it was contrary to direct orders to do it. However this may be, an effort was being made to make such a switch at the time of the accident, but the car had gained such headway that it was impossible to stop it between the switches. Consequently the car ran up the plane at the head of the slope to the point opposite the foreman's office. To do this it was necessary for two wheels of the car to pass over the hoisting rope, which ordinarily stands taut about 5 inches above the track when the rope is down the slope and loaded as it was at the time of the accident. It was also necessary for the car wheels to turn the switch, and ordinarily this would have left the switch in a position for the car to run back upon the loaded track. At this point the day after the accident, a trial hoist, under the condition at the time of the runaway, showed that the car was derailed each time that it was hoisted past the switch trusting to the switch being thrown by the car wheels instead of by hand as was customary. Hence the conditions were such that the car should have been derailed before reaching the main slope even though the head block was not in place.

The evidence brought out at the inquest showed that when a car had previously run away under similar conditions and had passed the head block, it had gone up the slope and returned upon the loaded track as was to be expected. At the time of the accident, however, the car passed over the rope, the switch was

thrown, and after reaching a point the car returned down the slope for a distance of 900 feet, where it came in contact with man-cars, attached to the hoisting rope, containing twenty men ready to be hoisted to the surface. The impact broke the rope cone and allowed the cars and men to fall 200 feet farther down the slope, killing 6 men and injuring 5 others.

The verdict of the Coroner's jury was as follows:

"We find that—came to their deaths from injuries received August 28, 1908, at Warrior Run Colliery, in a collision on a slope between a man-car coming up and a loaded car going down.

"The evidence shows that a car loaded with manure was being run down a plane with a pitch of one and one-eighth degrees towards the mouth of the slope with the intention of switching it off on another track before it reached the mouth of the slope, but the head-man who was running the car at the time lost control of it and it ran down past the mouth of the slope up on the apex and then back switched and ran down the slope, meeting the man-car coming up.

"The evidence shows also that the customary head-block near the head of the slope was not in place, it having been previously removed. It is quite evident to us that had this head-block been in place the accident would have been avoided.

"We, therefore, find that the outside foreman, whose duty it was to look after this safety device, was negligent in his duties in not maintaining in good condition a head-block near the head of this slope as the Anthracite Mine Laws directs. We find too that the head-man and two runners were guilty of contributory negligence in running cars over the tracks at this point with the head-block missing."

The head-man and the outside foreman were prosecuted in court. The Judge found the head-man not guilty and the foreman guilty.

#### January 25, 1909; Washington No. 5 Mine; Franklin, Md.; 5 Killed

(From the "Annual Report" of the Mine Inspector for Allegany and Garrett Counties, Md., May 1, 1908 to May 1, 1909)

The most distressing mine accident of the year, or I may say, in the history of mining in the George's Creek Valley, occurred at the Washington Mine No. 5, near Franklin. Here on Monday morning, January 25, five men were killed; two outright, two dying within ten hours after the accident, and another on the day following the accident. Nine others were more or less seriously injured. A laborer, aged 18 years, single, and a blacksmith, aged 46, married, were killed outright. A carpenter aged 22 years, single, and a mine laborer, aged 26 years, single, sustained injuries from which they died shortly after the accident. A weigh-master, 22 years old, married, died from injuries received two days later.

The accident occurred on the plane, early in the morning. It was the first trip run. The men were riding up the plane to their work, as had been the custom for them to do. The incline-plane is very steep and about 2,200 feet long, which no doubt caused many to ignore the danger and ride up.

In the middle of the incline-plane there is a double track, where the loaded car descending passes the empty car going up. At this point an automatic switch is used, so constructed that the loaded car, going down, passes through and leaves the latches in proper position for the empty car, ascending on the following trip, to pass on the opposite side. The accident happened on the first trip on Monday morning, which accounts for so many men being on the car. No cars had been run on the plane since Saturday evening.

For some reason not clear, the first trip on Monday, with fifteen men, some on the inside of the car, and others standing on the front and rear bumpers, ran in on the wrong track and collided with the loaded car descending, killing five and injuring nine, as stated before. Of the fifteen on the car only one escaped being injured, and strange to say, this man was riding on the front of the car going up the incline.

On being notified I went to the scene of the accident and made a thorough investigation. I examined the switch carefully and found it in good working condition, in fact, not the least impaired. The only logical conclusion as to the cause of this frightful accident is that the latches were changed some time between the time of the last run on Saturday and the ill-fated one on Monday morning, which dealt death and injury to so many.

#### December 31, 1910; Lick Fork Mine; Thacker, W. Va.; 10 Killed

(From "Archives and History," State Capitol, Charleston, W. Va.)

These men were all in an empty car ascending the slope from the bottom and were drawn to the surface counter balanced by four cars going down. The operator lost control of the trip. On reaching the surface, one man realized what was happening, leaped from the car and escaped with minor injury. The other 10 men stayed in the car and the men and the car was dashed against the drum and headhouse, instantly killing the men.

#### March 22, 1911; Hazel Mine; Canonsburg, Pa.; 9 Killed

(From Bureau of Mines report by L. M. Jones)

The accident of March 22 occurred at the beginning or at the outby end of No. 8 double parting on No. 2 main about a mile from the foot of the slope. A trip consisting of five cars filled with miners was going into the mine. When they reached this parting the first car jumped the track and was dragged about 40 feet when it crashed into the left rib knocking off chunks of coal. A little beyond this point it struck the left post of the second set of a stretch of timbered entry. The forward corner of the car was splintered and the end of the brake rod bent in, which caused the middle of it near the brake to bend outward. The resistance of the post to the cars advance caused the second car to be shunted off to the opposite side of the track. This car struck the center post of the same set, knocking it forward and allowing the two 40 pound rails, which acted as the collar of the set, to fall across the car. The withdrawal of the support of the roof precipitated a large fall of rock, which also fell on the car. One huge piece became caught between the outby end of the car and the roof near the next set, and this brought the whole trip to an abrupt stop. There were ten men in the second car and nine of them were dead when the men from the other cars were able to get them out from under the rock. The tenth man was sitting very low in the car and a huge piece of rock arched from the man next to him to the corner of the car and so saved him from being injured. There are three causes contributing to the accident. The primary one was the high speed at which the trip was moving.

The timbering of the entry at this point consisted of sets independent of each other made up of two posts, one at either rib and a central post with a collar of two 40 pounds rails extending from rib to rib. The rib

posts were partly set into the rib but not wholly so. The tee iron was not fastened to the posts in any way but simply wedged against the top. When the car hit the outside post it knocked it forward but may not have caused the rails to fall. However, the withdrawal of the center post by the second car let down the rails, which fell across the end of the second car and the death of some of the miners was in all probability due to the rails.

In regard to precautions to be taken to prevent similar accidents, the first one is without doubt to run the trips at less speed.

Again, had the sets been tied together by some means, the likelihood of the failure of one set would have been greatly decreased. A guard rail along the posts set in the rib would prevent a wild car from knocking out the posts.

### January 14, 1914; No. 7 Mine; Mulberry, Kans.; 6 Killed

*(From Bureau of Mines report by H. D. Mason, Jr.)*

The accident occurred at 7:10, Wednesday morning, January 14, 1914. Six men were being lowered on the West cage when the cable parted allowing the cage to fall to the bottom of the shaft (130 feet deep). All six men were fatally injured two of them dying before they had been brought to the top; two others died within two hours, one after twenty-four hours, and one after three days.

The cage which fell was somewhat crushed, being driven down 11 inches into the sump beyond its normal position. The bottom platform was split and assumed a slightly convex shape. The wooden bonnet was only slightly damaged, and the guides and buntions in the shaft were not damaged at all.

According to the testimony given at the inquest no previous trouble had ever been experienced with the cable or the safety catches. The testimony, however, did show conclusively that it had not been the definite duty of any of the mine officials to examine the cables and safety catches, and to lubricate the cables at regular intervals. The state mining law of Kansas does not define those duties.

The accident occurred at 7:10 a.m. as the men were being lowered in the West cage to their work. Ten mules had been lowered to the bottom on the East cage (which cage was always used for lowering the mules) and three cage loads of six men each had been lowered in the West cage. Six men entered the fourth cage and were being lowered to the bottom, when the cable broke at a point 14 feet 6 inches above the top of the cage, and the cage fell to the bottom of the shaft fatally injuring all six men. The engineer was unable to hold the East cage (empty) and it also fell to the bottom, but without any great violence.

The bottom cager and other men at the bottom at once lifted the injured men off the cage (none of them were thrown off the cage when it struck) and gave them what assistance was possible. The East cage was then tested and adjusted for hoisting (the Westside cable being removed from the drum) and the injured men were then hoisted, two at a time, to the surface, where doctors had arrived to care for them.

The cable which broke is one inch in diameter, six strands, 18 wires to the strand, hemp core. The cable broke at a point 14 feet six inches from the point of connection on top of the cage, this attachment being made with 4 rope clamps. The break was rather clean and sharp, more definitely a break than

a tear. Some of the wires at the broken end were rather rusty and brittle. The cable beyond the break was not in very good condition, being badly worn, and many broken wire ends protruded in places. From the testimony given (under oath) this cable had been put in service in July 1912, or about 18 months previous to the accident (hence the tonnage hoisted must have been considerably over 100,000).

It seems probable that the break occurred about the middle of the shaft, that is at a point 60 or 70 feet from the bottom (the shaft being 130 feet deep) at which point the cage would have been descending rapidly.

It is customary with hoisting engineers, when lowering man-cages to reverse when the cage is about half way down, to prepare for the stop at the bottom, —and this jar may have caused the rope to part.

The safety catches were of the gravity type and failed to hold the falling cage. These catches had been made by the Company (sic) blacksmith, an experienced man. From the evidence submitted it seems doubtful whether or not the safety catches on the West cage had ever been given a thorough test.

The safety catch on the East side of the cage made no abrasion whatever upon the East guides, until the cage struck the bottom, where we found the point of the safety catch embedded 1 inch in the guide.

The safety catch on the West side of the cage did catch the guides to a slight extent. The first impression made was at a point 47 feet above the shaft bottom, from which point the face of the wooden guide shows an abrasion for a distance of 26 feet, then an 8 foot space is missed, after which the face of the guide again shows abrasion to the point where the cage struck the bottom.

### April 30, 1914; No. 2 mine; Cumberland, Wyo.; 5 Killed

*(From "The Rock Springs Miner,"  
Rock Springs, Wyo.)*

Two men were killed, a third fatally injured, seven seriously injured and a score are slightly injured as the result of the breaking of a coupling in No. 2 mine, Cumberland, on Wednesday, April 30.

A train of ten mine cars was coming up the slope of the mine with about 62 men aboard when the coupling between the third and fourth cars broke and seven cars started down the slope, gaining terrific momentum within a few seconds.

Many of the miners, realizing that death would result if they were carried to the bottom of the slope, threw themselves from the cars and escaped.

Before the cars had proceeded 200 feet their velocity was so great that they jumped the rails and crashed into the walls of the slope. Two men were horribly crushed and instantly killed.

Eight others were crushed or maimed and several of them will be permanently crippled. The less seriously hurt of the injured were in cars the momentum of which was checked by the cars which jumped the rails.

The car was equipped with a "safety rope" but this broke when the breaking of the coupling brought a great strain upon it.

The aforementioned report indicated three killed rather than five. Since Bureau of Mines Bulletin 509 records 5 men killed, undoubtedly 2 of the injured died later.

**May 29, 1914; Maryd Colliery; Maryd, Pa.;**  
**6 Killed**

*(From Bureau of Mines report by Charles Enzian)*

On May 29, 1914 about 3:15 p.m. an overhoist accident occurred in the tower of the south hoistway, main shaft of the Maryd\* Colliery, Maryd, Pa., when the self dumping cage containing 8 men was hoisted above the dumping chute in the shaft tower. Six men were instantly killed; 5 falling down the shaft, a depth of about 600 feet, and one falling to the ground at the surface landing about 20 feet below the dumping chute. The seventh man was thrown into the dump chute, sustaining a compound fractured leg and lacerations about the head; he still is confined to the hospital where he is slowly improving. The eighth man clung to the cross-head of the cage and when rescued from that position was found to be suffering from shock and a few scratches. He returned to work when the colliery resumed operations a few days later.

Steam driven shaft engines raise and lower mine cars, men and supplies between the surface and the two levels. The engines are directly connected to drum shaft which is provided with clutch to adjust the hoists for the different levels. This engine is also equipped with an engine stop.

The engineer had been at work only 45 minutes of the afternoon shift. He is a middle aged man with 16 years experience as a shaft hoisting engineer, almost continuously employed under the supervision of the present superintendent. In February 1914 he had a similar accident while hoisting coal, but no one was injured.

The drum clutch had just been set, changing the hoists from the No. 2 level to the No. 1 level. While engaged in hoisting a cage containing 8 miners from the No. 1 level the engineer apparently forgot that he had set the clutch for this higher level and continued the operation of his engine as though he were hoisting from the No. 2 level. When the cage passed the surface landing and approached the dump-chute position in the tower, at which the guides are recessed on an angle of about 45 degrees to allow the tipping wheels and balance shoes to engage the goose-neck channels which tip the platform of the cage forward on an inclination of about 30 degrees, the speed of the cage was too great to allow the entire entrance of the tipping wheels into the guide recesses and caught on the points of the recesses. The impact shattered the guide on the south side of the hoistway, and as the cage was being pulled upward, a distance of about 3 feet when the "stop" locked the engines, allowed one side to swing free off the guide back against a tower girt; this momentarily tilted the platform of the cage into such a position that sufficient clearance was made for 5 men to fall into the opening over the shaft between the end of the cage and the end of the dump-chute. These 5 men fell to the bottom of the shaft, a distance of 600 feet and were undoubtedly killed instantly. One man was thrown backward and landed on the surface 20 feet below; he also was killed. The seventh man was thrown forward into the dump-chute at the time of the first impact; his life was saved by the action of the dump-chute tender, by stopping the breaker scraper line as soon as he realized an overhoist was being made. The eighth man on the cage also displayed great presence of mind by jumping up and clinging to the cross bar of the safety catches, immediately underneath the cross head of the cage, from which position he was rescued.

\*Pronounced "Mary Dee."

The engineer cannot give a satisfactory account for mistaking the hoisting levels. He apparently disregarded the drum indicator, disk and pointer displayed in front of the engine drum.

As soon as the accident occurred the workmen and colliery officials exerted every effort to care for the living men rescued, and to recover the bodies of the men who fell down the shaft. An extra cage ready to be attached to a rope is always kept on hand, and as soon as this could be placed in the shaft the north cage was lowered and the bodies recovered in less than three hours after the accident. A force of men was put on to repair the guides at the head of the shaft tower. The damage was very slight and repairs were completed in three days when the colliery again resumed operations.

**December 9, 1914; Tripp Shaft, Scranton, Pa.;**  
**13 Killed**

*(From Bureau of Mines report by Daniel Harrington)*

At about 6:20 a.m., December 9, 1914, when lowering the third cage load of men into the Tripp shaft of the Diamond Colliery, 13 men were precipitated from the cage at a point about 285 feet below the surface to the sump, a distance of about 300 feet, and fearfully mangled; one man was found clinging to the side of the cage when it reached the Clark vein, 300 feet below the surface. He was taken off very slightly bruised, but badly frightened. The bodies of the victims were taken up on the cage on the opposite side of the shaft, and it was found that 13 men had been killed, which together with the man saved, brought the total occupants of the cage to 14, though the State Law of Pennsylvania restricts the number on a cage at any one time to 10.

The Coal Company (sic) officials state that the accident was caused by an explosion of powder, which shattered the cage supports and broke the bottom loose. It was established that at least one of the men on the cage purchased that morning 25 pounds of dynamite, and had it with him on the cage, and some of the shaft attendants claim to have heard a sound resembling the explosion of powder at or about the time of the accident in the shaft.

Against the powder explosion theory is that advanced by most of the miners, that the cage bottom became detached from its upper supports on one side, allowing the floor of the cage to take a position of about an angle of 45° along its length, supported on one side sufficiently to prevent the cage floor from going to the bottom of the shaft, but with an opening sufficiently large to precipitate all the men except one, who clung to the side of the cage, downward and against the side of the shaft. An inspection of the cage shows no evidence of a powder explosion; there are no signs of blood on the sides or floor, and if even one stick of dynamite had exploded, blood would certainly be deposited on either the side of the cage, or the floor or both; the cage floor has four planks running lengthwise along the rails, and outside the rails, and these planks are in place, and give absolutely no evidence of a shattering accident which accompanies a powder explosion. The planks between the rails are missing, leaving only the nails which fastened them to the transverse joints or beams below, and these beams (5 in number) are exposed and show no shattering. The rails on the cage floor are absolutely straight and not in the slightest degree displaced from their accustomed position. The upright wooden posts which constitute supports for guides, and which brace the center of the cage show no signs of powder violence

at the floor line or at any point above that line, nor do the hood nor any part of the wood or iron work on the cage show signs of powder violence.

The fact that the shaft lining is unscarred in any manner, and that cages were running thru it within a few hours of the accident also tends to discount the idea of a powder explosion. It is stated that the feet and legs of the victims show no evidence of burning or of the terrific violence which would attend an explosion of powder in such large quantities and in such close quarters. Moreover, a powder explosion on the cage would undoubtedly have so badly stunned the one surviving that he could not have maintained his hold on the side of the cage, and there would have been no question in his mind as to whether such an explosion actually occurred.

An inspection of the cage shows clearly the immediate cause of the accident; the cage has a powerfully constructed timber box frame floor attached by four diagonals  $1\frac{1}{2}$  inch diameter rods, to the cross piece above to which the hoisting rope is attached. These four  $1\frac{1}{2}$  inch diameter rods are welded both at the top near the rope support beam, and at the bottom near the cage floor, to flat iron straps. The only bond other than those four  $1\frac{1}{2}$  inch rods between the bottom or floor of the cage and the beams above to which the hoisting rope was attached, are two vertical timbers mortised and bolted above to the beam which holds the rope attachment and mortised and bolted below to the lengthwise timber of the box frame floor. At this point where the vertical timber supports are mortised to the floor beam, there are 5 bolt holes which very materially weaken the original 4 x 10 vertical posts. Hence the floor of the cage depends totally for a bond to the hoisting rope on four rods  $1\frac{1}{2}$  inch diameter, which have been welded in 8 places and to two pieces of 4 x 10 oak weakened by a mortice of  $\frac{1}{2}$  inch, and by 5 bolt holes in an area of 8 x 10 inches.

One of these welds in the  $1\frac{1}{2}$  inch rods became loosened by continued vibration, and this threw a double load on the companion rod on the same side of the cage. This other rod also had a flaw, as the broken section showed but about one half of the total area cohering, the flaw being not in the weld but in the solid part of the rod; when the second rod failed on the same side, the only remaining support of the cage bottom on that side was the 4 x 10 oak vertical post. This oak post was greatly weakened by the bolt holes at the point where it was bolted to the floor, and gave way at that point leaving the cage bottom supported on one side only, and throwing the occupants into the shaft sump, some 300 feet below.

It is admitted quite generally that frequent inspections are made of the rope, the cage and the shaft, but a very minute inspection would be required to detect either the disconnected weld, or the flaw in the solid rod.

A serious lack of discipline is apparent. It is admitted by the company officials that 14 men were on the cage, whereas the state law prohibits the handling of more than ten. The company officials state that their rules call for not over 10 men at one time on a cage and throw the burden on the top cage tender, who at first insisted that not more than 10 men were on the cage. It is reported by the Scranton, Pa., newspapers that on December 10, 1914, the morning following the accident the various companies around Scranton, consumed practically double the time lowering the men that they had previously done, implying that not only this mine but many others were openly violating this provision of the state law.

### July 30, 1915; Patterson No. 2 mine; Elizabeth, Pa.; 9 Killed

(From a Bureau of Mines report by H. D. Mason, Jr.)

An outside haulage accident occurred at the Patterson No. 2 mine, near Elizabeth, Pa., at 2:30 p.m., July 30, 1915, resulting in the death of 9 men and injuries to seventeen. A loaded trip of eighteen cars broke away after coming out of the drift mouth and ran down the 1000 foot incline finally plunging off the tippie, (over 40 feet high) and into a section gang of 27 railway laborers. Two coal company employees were killed on the tippie, and seven of the section men underneath. The incline and tippie had just been partially completed and had only been in operation three days at the time the accident occurred.

On the outside a new single track incline has recently been completed down the hillside into Lovedale hollow where the new tippie has been erected. This incline from the slope-mouth to the tippie approach is about one thousand feet in length and the average grade 16 to 17 per cent.

The tippie structure, which is 40 feet above the tracks, is built at an angle to the right from the tippie approach. It was this curve in the track which caused the runaway trip to leap from the tippie instead of crashing directly through the partially constructed tippiehouse.

About 2:30 p.m. a loaded trip of 18 cars had just come out of the slope mouth, when suddenly the attachment broke between the last car and the haulage rope, and the entire trip started down the incline rapidly gaining momentum as it went. The safety switch located above the tippie approach apparently failed to derail any portion of the flying trip, which swept the full length of the tippie approach and then plunged off the tippie slightly beyond the point of curvature in the track.

Four men were working on the tippie, two of whom managed to escape with slight injuries, but the Superintendent and a workman were both caught and crushed to death near the dump, where the run away trip sideswiped the structural steel frame work causing these two men to be caught in the wreckage. Twenty-seven section men were working on the ballasting of the tracks at a point in line with the approaching trip, but at least 100 feet distant (horizontally) from the place where the trip leaped from the tippie.

The rushing trip, weighing at least 48 tons, leaped this entire distance, and caught many of the section men as it fell. Seven men were killed, some of them completely buried under the falling cars and coal. The debris from this wrecked trip, on the evening of the accident, covered a space about 50 feet long by 20 feet wide, the trip having apparently remained almost intact until it struck the ground. Some of the tippie men, on the railway cars above the tippie, shouted a warning to the section men, but the plunging trip struck among them just as they started to run away.

A break in the clevis to which the trip was coupled had apparently permitted the loaded trip to get away. A piece about 4 inches long had been broken from the eye of the clevis, thus permitting the coupling to slip out and freeing the trip. The clevis had been made from  $1\frac{1}{2}$  inch iron and was strongly socketed to the  $1\frac{1}{2}$  inch cable. At the point where the fracture occurred there was apparently an inner defect in the welding, the outside rim, however, appearing smooth and substantial; so that, it would have been difficult to have detected this defect by inspection.



**September 17, 1917; Orient Mine; Orient, Ill.;  
5 Killed**

*(From the "State Coal Report," 1954,  
Illinois Department of Mines and Minerals)*

September 17, 1917, five men were killed in the Orient mine. An incompletely caged loaded car at the main shaft had caused a wreck, and men were being hoisted on the escapement shaft cage. This was a single cage with counterbalance in guides that operated like a separate cage. This counterbalance came out of its guides and collided with the cage at the half-way location in the shaft, causing the cage to fall to the shaft bottom, a distance of about 250 feet.

**September 23, 1922; Raleigh-Wyoming Mine  
No. 2; Glen Rogers, W. Va.; 5 Killed**

*(From "Archives and History," State Capitol,  
Charleston, W. Va.)*

Five men were working in a sump at the bottom of a seven hundred foot shaft cleaning debris that had accumulated during construction work on the shaft. They were loading the debris on a skip and for some unknown reason, the skip plunged down the shaft pinning the men underneath, killing them instantly. At the time of this accident, this was supposed to be the best and safest installation in the State.

**May 7, 1935; South Wilkes-Barre Colliery;  
Wilkes-Barre, Pa.; 7 Killed**

*(From Bureau of Mines report by R. D. Currie)*

South Wilkes-Barre Colliery is an anthracite mine with two main shaft openings. No. 3 shaft, which is the main hoisting shaft, is 1005 feet deep to the Baltimore level. This shaft has 3 compartments, two of which are used for hoisting with balanced cages.

The 7 men who were killed are commonly called "Cagers" or foot men, whose duty it is to travel from one level to the other and place loaded cars on the cages and remove empty cars from the cages in the usual operation of hoisting coal from the mines. At the time of the accident, these 7 men were traveling on the cage from the Baltimore to the Hillman Vein, and had reached a point approximately 100 feet below the Hillman Vein when a piece of rock falling from somewhere above, struck the cage. The piece of rock destroyed the cage bonnet and apparently knocked 3 of the men off the cage to the sump below. Of the 4 men remaining on the cage, one of them apparently was not killed outright but died several hours later.

The piece of rock which fell and struck the cage dropped approximately 630 feet before striking the cage. This piece of rock is about 9x15x30 inches, and was apparently sand rock, thus weighing about 175 pounds.

The outstanding feature of this shaft is the fact that  $\frac{7}{8}$  inch boards were used to line the east and west ends of the shaft, and these boards, provided no support and in no way added to the safety of the shaft. On the other hand, they made it impossible for shaft men to properly inspect the condition of the side walls of the shaft. A crew of shaft men inspect this shaft every night and take care of any repairs necessary to timber, guides, or side walls. This crew, consisting of a foreman and three regular men, who make a detailed report of the condition of the shaft in a special book provided for this purpose before going off

shift, reported on the night prior to the accident that the shaft was in safe working condition.

The board lining is being removed from this shaft, and 2-inch lagging is being placed in the shaft at any points where spalling off is noted. This will make it much safer and more easily inspected. The lagging will undoubtedly add to the support of the loose shale and rock, whereas the board lining was only a blind to prevent the inspection of these hazardous conditions.

There is a change of formation at approximately the point where the piece of rock fell from the shaft, and a weathered shale underlies the sand rock bed from which the piece fell out. Undoubtedly if the board lining had not obscured the view of these conditions, it would have been observed by the shaft crew and could have been remedied.

**December 15, 1942; Laing No. 1 Mine; Laing,  
W. Va.; 5 Killed**

*(From Bureau of Mines report by William T. Rachunis  
and Warren V. Lamb)*

A disaster occurred, about 11:30 p.m., December 15, 1942, on a man car operating on a surface incline of the Laing No. 1 Dorothy mine, resulting in the death of 5 men and slightly injuring 6 others. The accident was caused by the sudden acceleration in the speed of the man car while 14 men were being lowered to the bottom of the incline; eleven of the 14 men jumped from the speeding car.

The surface incline, provided for transporting men and supplies to and from the mine level, extends from approximately the level of Cabin Creek to near the level of the mine openings into the mountainside. This incline is approximately 1,600 feet long, and the grade varies from 15 to 60 per cent.

The man-and-supply car is provided with a removable rack, equipped with seats, which is used when men are being either hoisted or lowered. The man car can accommodate a maximum of 15 men at a time. The  $\frac{3}{4}$  inch diameter hoist rope is attached to the man car by means of a clevis-type socketed coupling. There are two bridle or safety chains attached to the man car and to a clamp on the rope about 14 inches above the socketed coupling. An automatic stop or derailing device is not provided to stop the man car in the event the rope breaks above the safety- or bridle-chain clamp.

The hoist, installed on the top of the incline is operated by a gear-connected, 50-horsepower, 220-volt alternating-current open-type induction motor. A locomotive-type controller, which is fully enclosed and capable of being reversed, is provided. The hoist is equipped with a friction-type drive, and a hand-operated brake. There is no indicating dial on the hoist to show the position of the man car on the incline, and the hoist operator is not in position to see the man car except when it is near the top of the incline. The hoist is not equipped with automatic overwind, speed-control, or stop devices.

Telephones are installed at the bottom of the incline and in the hoist house, and are used to communicate with the hoist operator when men are being hoisted. There are no means of signaling the hoist operator from the man car or from intermediate points along the incline. When men are being lowered, an attendant is stationed at the top of the incline to see that the workmen get aboard the man car in an orderly manner. Each workman is given a brass check, which he presents to the attendant who is responsible for seeing that the men get aboard the man car according to their proper turn, and that too many do not ride

at any one time. When the man car is loaded, the attendant signals the hoist operator by either waving his arm or calling "All right".

The accident followed the sudden acceleration in the speed of an incline man car on which the 14 men were being lowered.

The 14 men had completed their work in the mine and had been checked on the man car at the top of the incline, after which the attendant at the top had given the signal for the hoist operator to lower them to the bottom. As the man car continued to gain speed for a distance of approximately 300 feet after leaving the top landing, the men evidently assumed that the man car was out of control and they began jumping off. An instant after the eleventh man had jumped off, the man car stopped momentarily, and 2 more stepped off. The man car then continued to move down the incline for a distance of about 100 feet to where it was derailed by running over one of the injured men who was on the track. At this point, which is approxi-

mately 400 feet from the top of the incline, the fourteenth or last man stepped off the man car after it had stopped.

The night shift hoist operator, who has had nine years experience operating hoists, had been hoisted up the incline, and had relieved the operator on duty a short time before the accident occurred.

Upon questioning, the hoist operator seemed to be somewhat confused as to just what had happened. However, it is evident that the friction or clutch drive of the hoist was disengaged. After receiving the signal to lower, the hoist operator released the brake and opened the controller without knowing the friction or clutch drive was disengaged. The hoist operator realized something was wrong when the speed of the hoist drum increased. He then applied the brake and stopped the drum momentarily after which the brake was released. The hoist operator stated that he did not think anything serious had occurred until he noticed there was slack in the hoist rope.

TABLE 3.—Major disasters by roof falls and bumps

Date	Name of mine	Location of mine	Killed
1846:			
January 12	No. 1 <sup>1</sup>	Carbondale, Pa.	14
1885:			
April 6	Cuyler <sup>1</sup>	Raven Run, Pa.	10
1886:			
September 13	Marvine <sup>1</sup>	Scranton, Pa.	8
1894:			
February 13	Gaylord <sup>1</sup>	Plymouth, Pa.	13
1896:			
June 28	Twin Shaft <sup>1</sup>	Pittston, Pa.	58
1908:			
May 13	Prospect <sup>1</sup>	Wilkes-Barre, Pa.	5
1914:			
September 4	No. 1	Adamson, Okla.	13
1920:			
May 22	Mallory No. 3	Mallory, W. Va.	5
1923:			
December 8	Mount Jessup No. 1 <sup>1</sup>	Jessup, Pa.	5
1929:			
June 5	Halcon	Wise, Va.	5
1930:			
August 8	Gilberton <sup>1</sup>	Gilberton, Pa.	8
1938:			
July 1	Praco No. 7	Praco, Ala.	6
1945:			
March 12	Crucible	Crucible, Pa.	5
1948:			
May 20	No. 2	Dante, Va.	6
August 6	No. 11	Capels, W. Va.	6
1957:			
December 9	Glen Rogers No. 2	Glen Rogers, W. Va.	5
1958:			
February 12	Lundale	Lundale, W. Va.	6

<sup>1</sup> Indicates anthracite mine.

## DESCRIPTION OF MAJOR DISASTERS BY ROOF FALLS AND BUMPS

January 12, 1846; No. 1 Mine, Carbondale, Pa.;  
14 Killed

(From book "The Story of Anthracite" prepared and published by The Hudson Coal Company, 1932, pp. 172-174)

About eight o'clock in the forenoon, a roof fall, involving an area of almost fifty acres, imprisoned many men. Although most of the men were rescued, fourteen lives were lost; eight of the bodies were never recovered.

(From "The Mining Herald and Colliery Engineer," June 6, 1885, p. 246)

The fall of the roof of the coal mine at Raven Run and imprisonment of the ten miners underground, recall to a survivor of the first great mine disaster in this country the most marvelous escape of some of the miners who were imprisoned behind a wall of fallen coal a mile thick at the time of the disaster. The mine was one at Carbondale. For several days in the Winter of 1844<sup>1</sup> it had been giving warning to the miners by what is known among them as "working"—ominous cracklings of the roof here and there through the mine—that they were laboring in constant danger, but with the proverbial recklessness of their class they continued to work. Suddenly, while nearly one hundred miners were below, and most of them working in the distant galleries, and immense area of the mine roof fell.

The superintendent of the mine was a Scotchman named Alexander Bryden, and he had a son among the laborers below. Bryden was at the top when the fall occurred, and he rushed at once into the mine to see if it were possible to rescue any of the workmen. Before he reached the fallen mass of coal he met several miners who had in some way escaped being crushed by the roof. They told Bryden that it was not possible that any of the other miners could be alive. He insisted on making an effort to work a passage through the wall in the hope some of the men might be alive behind it and could be rescued, and the miners he had met on their way out of the pit, where top coal was still falling on every side, refusing to aid him, the superintendent went on alone. His lamp threw but a dim light on the scene, but he found a small opening made by the tops of two large slabs of coal having stuck together, with their bases on the bottom of the mine three feet apart. Into this crevice Bryden crawled, and found the opening continued in a devious course into the depths. It grew so narrow and low that he was compelled to lie flat and drag himself along. In that way he worked himself at the end of the choked chamber, where he emerged from the passage into a small open space. He was greeted by

a shout that told him some of the imprisoned miners were still alive. The fall had extinguished every light, and they had failed to find an opening in the wall that lay between them and the mouth of the mine. Among the miners was Bryden's son. The superintendent quickly told the men what they must do in order to escape. One of their number had been crushed by the fall, and lay moaning with both arms and legs broken. Bryden took this man on his back, and, creeping with him through the opening, told the others to follow. Twelve of the men were able to keep strength enough to reach the opening on the other side of the mine without aid, but eight of them was necessary for the others to drag along the jagged floor and sharp edges of the passage. The ominous crackling could be heard at short intervals coming from different parts of the mine, and every one of the miners toiling through the narrow and crooked crevice in the wall expected every moment to be crushed by the settling of the mass of coal. They were all saved, however, and the writer's informant, now an aged resident of the county, is the last survivor of the party, the brave Bryden having only recently died. The old miner referred to had two sons in another part of the mines (sic) who were among the victims of the disaster.

Among those who were in the mine at the time of the fall of the roof was Assistant Superintendent Hosie. Two days and nights after he crawled from the mouth of the pit. He was haggard and bleeding and his fingers were worn to the bone. He dropped unconscious at the mouth, and it was hours before he could give any account of his experiences in the mine. He had been surrounded by falling coal, and when the mass had settled he found himself without light or implement of any kind. After groping about in the space in which he was imprisoned, he found a small aperture in the wall and he crawled into it. From that time he dragged himself through places which were barely large enough to admit his body, sometimes being forced to dig away obstructions with his hands, never once thinking of sleeping, choked by thirst, and not even cheered by a knowledge of the direction he was going, until, after 48 hours of constant and disheartening toil, he emerged from the prison well and knew that he was in the tunnel leading out of the mine.

In removing the fallen mass of coal the discovery was made that but few of the miners who were victims of the disaster had been killed outright. Groups of workmen were found surrounded by unmistakable evidence that they had worked desperately with their picks in the hope that they might cut a way to liberty, but, without water or light, and with foul air following the tumbling roof, had at last succumbed to their fate. One poor fellow was found alone, held fast to his waist in a mass of coal. He had worked with his pick-axe until he died with the tool clutched in his hands. Mine rats had eaten the flesh almost entirely from his body. Years afterward skeletons of other victims were occasionally found beneath the coal.

<sup>1</sup>The year 1844 does not agree with other records, but this is obviously due to the lapse of time after the disaster.

April 6, 1885; Cuyler Colliery; Raven Run, Pa.;  
10 Killed

(From the "Mining Herald and Colliery Engineer,"  
Apr. 11, 1885, p. 178)

About one o'clock on Monday afternoon last, the mining village of Raven Run was thrown into a state of the wildest excitement by the announcement that an extensive cave-in had occurred at Cuyler colliery and that ten men then in the mine were probably killed. The concussion caused by the fall was so great that it sent a cloud of dust up from the breaker, and this told the persons outside what had occurred. A few minutes later the whole village seemed to be at the scene of the accident, and the cries of the wives and children of the ten men who were known to be in the fatal mine, could be heard throughout the entire village. There was hope at first that the men in the mine might have escaped the fall, but the concussion was so great that most persons believed them dead even if they had not been killed by the fall. The lapse of a few hours time confirmed the worst fears of those outside, who watched and waited in vain for the return of the ten men in the mine. They not only failed to come out, but exploring parties returned without any tidings of them.

Cuyler colliery has been in operation about twenty years. The workings are in the Buck mountain seam and consist of a drift or water level, and two slopes, which are sunk to a depth of about 700 feet below the water level. The slopes are sunk at a distance of perhaps a mile apart, but are connected both by the water level gangway, through which the coal is still taken to the breaker, and other gangways below. The seam at this point is about twelve feet thick, and an excellent quality of coal. The workings are divided into four lifts below the water level, the bottom one of which is in the basin, and the total distance from the lower gangway to the surface, as the seam runs, at an average pitch of about 18 degrees, is about 1,000 feet.

The fact that the seam had an excellent roof enabled the operators to take a great deal of coal out of it at little comparative cost. Very little timber was used or required, and the pillars are said to have been very weak. At a point about four or five hundred feet west of the east slope, a crush began several months ago. The pillars were weak and cracked continually under the weight of the great mountain of rock above them, the squeeze extending from the lower lift gangway to the drift level. Three or four days before the accident occurred the squeeze on the pillars and on what little timber there was in the mine became so heavy that the men were afraid to work under it, and on Monday morning work was suspended at the mine owing to the dangerous condition of the workings. The inside boss then selected seven men to go into the lower lift to retimber the gangway at the point at which it was being crushed. At the same time a worker and his son, aged 18, who were working a breast in the second lift, also went in to work, and a driver went in to take the coal away from them. These were the only persons in the mine on the day of the accident and being directly under the fall, were killed instantly. An examination of the mine shows that the fall extends eight hundred feet along the gangway and all the way to the surface. The fall can be approached from either side, and this enables those acquainted with the working to determine accurately the width of the break, but it also dispels the hope that the miners might be taken out alive.

September 13, 1886; Marvine Colliery, Scranton,  
Pa.; 8 Killed

(From Reports of the Inspectors of Coal Mines of the  
Anthracite Coal Regions of Pennsylvania, 1886,  
pp. 20-22)

Marvine mine, which had previously been in successful operation, employing about 250 men and boys, on September 13, 1886, was the scene of a serious disaster, caused by an extensive fall.

The fall was caused by the settling of eight (8) acres in a basin of the mine north-west of the shaft, in which locality the coal of that part of the mine, the vein being about sixteen (16) feet thick, had been mined out. Pillars of the usual dimensions, which had been left for supporting the roof, were crushed by the superincumbent pressure. There were about 100 men and boys working in the portion of the mine that caved in. All except eight escaped. These could have gotten out safely if they had persevered as the others did. They were within ninety (90) feet of the foot of the slope. At this point, it seems they had a consultation and turned back into the mine. They were met going back by William -----, son of John -----, who implored his son with tears in his eyes to return with them, but he went right toward the shaft; he got to a point where he was caught by a fall of roof and held fast until relieved by a propman, who was coming out after him. Both of them came to the foot of the shaft in safety. They were also met going back by the fire boss, who tried to persuade them to return and go out with them, but without avail. One of the party that lost his life, was out at the foot of the slope, when he heard his uncle imploring for assistance. He returned to his relief, but never came out alive. The heroic action of John Howells deserves special mention. As he was coming out, creeping over the fall with the roof falling around him, he heard the cry for help of a boy who was held fast by a slab of rock. He returned, turned the rock off his foot, but the boy lost some of his toes and could not walk. Howells hoisted him on his back and carried him to the foot of the shaft, a distance of about 2,000 feet.

The first indication of a creep or squeeze was on Monday morning, September 6th. A slight squeeze was noticed in Thomas ----- chamber. He was compelled to quit and would not be allowed to work any longer. Next morning the squeeze extended to the chamber inside. He had to quit work also. Next morning the squeeze extended two chambers further in. When it got this far, all the men were removed from this section of the workings to another portion of the mine. The squeeze seemed to stop at this point, and did not extend any further at that time.

On September 13th, the men went in as usual in the morning to their work, and, from the testimony of the witnesses who appeared before the coroner's jury, everything was quiet and no sign of a squeeze. About eight o'clock, the coal began to chip off the pillars from the pressure of the overlying strata, and at about fifteen minutes after eight o'clock the mine foreman thought he had better stop the work in that part of the mine. He then sent messengers through and notified everybody to come out. They all came out except the eight men who have been mentioned as going back and being lost. Every effort was made to rescue them, but the roof kept falling and it was dangerous to risk going over the fall. On the afternoon of the 13th, every place was blocked tight with falls from the roof. Air bridges and doors were all destroyed, which caused the stoppage of the circulation of air. About noon, on the 14th, gangs of men were

started to cut through to rescue the men at two places. The distance to be driven was 154 feet. It took nearly six days to go through to the lower heading. Six bodies were found at the face of the heading on September 21st, and two bodies were found on the 23rd.

**February 13, 1894; Gaylord Colliery; Plymouth, Pa.; 13 Killed**

*(From reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1894, pp. 153-156)*

At about 2:15 a.m., Tuesday, February 13, 1894, an extensive area of the workings of the Gaylord colliery at Plymouth, Pa., collapsed, closing the workings in each seam from the Red Ash to the surface, and thirteen workmen were buried nearly under the center of the mass. No one escaped, and no one can explain how these thirteen experienced men were so suddenly entrapped.

On Monday morning, February 12th, the general foreman discovered a squeeze in the workings of the Ross seam. On examination he suspected that the base and origin of the squeeze was beneath, in the Red Ash seam, and sent his son and another person to make an examination in the old workings of said seam. They went down and found the breasts on the third lift west of Plane cracking and showing a decided indication of a troublesome squeeze. This part of the Red Ash seam workings had been finished and abandoned for seven years and only about eighty car loads of coal remained to be mined in the seam altogether at this time, and that from a place above the head of the plane.

After a consultation, the superintendent and general foreman decided to have a row of props set to support the pillar on the west side of the plane just above the third lift, and a party of sixteen men were selected and sent for to execute the work. The mine was idle and the men had to be summoned from their homes. Four laborers were there already or came earlier than the others. The mine foreman was in charge. He showed these four men the place and told them to clean along the rib to make room for the props. After working there awhile and hearing ominous cracking in the pillars and coal falling in the breasts west of them, they became afraid and decided to leave and go home.

On reaching the foot of the shaft, they met the other party of men coming in with props and tools. The foreman asked, where they were going, and they answered that they were afraid, and would go home. All right, answered the foreman, if you are afraid, you better go. This was shortly after six o'clock p.m. Three men had been left outside to cut props and ten went to work setting the props up.

At 10:30 they were using the timber up, six more of the party went outside to help in getting more props. It was a cold, stormy, night, but by fifteen minutes of twelve they had cut the necessary supply and sent them down the shaft. Then they went into the engine house to warm themselves. The night engineer asked them if there was much danger there and they replied that there was no danger at all; that the four laborers who went home were unnecessarily alarmed. At about 12:10 they all descended the shaft.

At 2:15 a.m., the engineer felt a concussion of air and the speaking tube whistle blew a long, loud whistle. He immediately gave alarm by blowing the steam whistle. The general foreman and a number of miners responded in a short time and went down

the shaft and attempted to go up the plane, and succeeded in going up a distance of about 400 feet, where the place was crushing and threatening to close in upon them. They shouted, but heard no reply. Lest the missing men had gone up the plane and were groping in the darkness of the open workings above the plane, parties were sent to enter above from the manway at the outcrop. They, after a search for several hours, came out satisfied that the men were not there. Every open space above and below and around the caved workings was searched without avail. Shouting and tapping brought no response. By noon all hopes of saving the men had vanished and work was promptly commenced to reopen the plane. It was over 1,600 feet in length, and the thirteen missing men had been working about the middle of it.

The stable boss was in the mine with the men till near 1:15 a.m., and he says that all appeared safe when he left. He was at the top of the plane at midnight, and saw no sign of a fall. When coming out he noticed the roof cracking about 100 feet below the men, and he called to the foreman, and told him. He replied, "It is all right; hurry and send us cap-pieces." He went outside and asked the engineer what time it was and the engineer said it was 1:30 a.m. The planks were taken down and placed on the car and hoisted up to the middle of the plane, and the cave took place at 2:15 a.m. Evidently the plane was clear of all obstruction when it was operated, and this shows that the final crush was sudden and without the usual warning.

All the bodies were found in a short distance. The farthest had not gone more than 240 feet in his flight for life. All were covered by the coal crushed in from the pillars. About 600 feet of the plane had to be reopened to find all the bodies, and the workings of this seam were abandoned. Work was continued incessantly day and night until all the bodies were found.

**June 28, 1896; Twin Shaft; Pittston, Pa.; 58 Killed**

*(From reports of Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1896, pp. 79-85)*

About three o'clock on the morning of June 28, 1896, a disaster occurred in the workings of the Twin Shaft. A general caving-in of the overlying strata took place, which caused the death of 58 persons who were at work in the mine. A large gang of men were engaged all during the night to stop a "squeeze," and while doing so they were entombed. The bodies were never recovered.

In 1887 the Twin Shaft was sunk from the Marcy seam to the Red Ash, the latter being a total distance from the surface of four hundred and thirty four feet. When the hoisting shaft was approaching the Red Ash seam, an anticlinal was encountered, one side of the shaft passing through the same. The headings were opened eastward and driven to the boundary line between them and the Phoenix mine workings. At about one hundred and fifty feet from the shaft the head of No. 1 slope was located, the total length of the slope being two hundred feet. At the head of this slope was placed a pair of small engines that hauled the coal from the foot of No. 1 slope to the shaft level. The distance from the foot of No. 1 slope to the head of No. 3 slope is 300 feet. The No. 3 slope was driven a distance of one thousand feet to the basin. The continuation of the slope was driven up the opposite pitch a distance of twelve hundred feet. The fifth

vein or top split of the Red Ash vein was opened, the thickness of rock between the two veins being eleven feet, and the thickness of coal in the upper split being about four and one-half feet. About ten acres of this vein or split had been worked. The vein being low, it was necessary for the miners to take up a part of the rock on the bottom to make room for the height of the cars. It was frequently found, in doing this, that the blasts would weaken the rock so much that it would break down into the chamber beneath. The rock overhanging the fifth seam was of such a hard character that the miners could not drill it with their tools. Hence it was that the bottom was taken up instead.

In February, 1896, a fissure was struck in the roof, which gave off considerable water and soft coal, which opening was six inches wide. On account of striking this fissure, mining in that locality was stopped and a bore hole was put down from the surface to test the thickness of the rock. The bore hole showed one hundred and forty six feet of sand and two hundred and fifty-seven feet of rock, making the total depth from the surface of the sixth seam four hundred and three feet. The bore hole showing ample covering, the work of mining in the vicinity of the fissure was resumed. At my visit on March 26th, I went around the faces of the workings with the Mine Boss and the Fire Boss. I examined the fissure and saw some water coming down from it, but not sufficient to create any anxiety or apprehension of danger. I visited it again on April 15, and went through the workings of the fifth and sixth seams. I did not see or hear any unusual disturbance of the overlying strata or the pillars. Everything was quiet.

On Sunday morning, June 28, 1896, at about four o'clock, I was notified that an explosion had occurred in the Twin Shaft. I immediately proceeded to the shaft and went down. I was surprised to find that a large cave-in had occurred, instead of an explosion, and that a large gang of men had been at work all night timbering to stop a squeeze, and that while doing so they had been entombed. We started down No. 2 slope in the direction of the men, but were driven back by reason of the caving in of the roof. We then tried to go down No. 3 slope, but failed to get any farther than where the cars were standing on the slope, on account of falling roof. We next tried the barrier pillar inside of No. 3 slope, but came in contact with a large body of explosive gas and were driven back. Returning to the foot of the shaft, I realized that the return air bridge to the fan would have to be attended to, or it would be broken down and we should be driven from the shaft.

Getting the men organized with competent leaders, the work of standing props and building "cog" pillars was started, the men advancing as rapidly as possible, only to be driven back again and again. By perseverance and the use of all the precaution possible the roof was in a measure secured about the foot of the shaft. And let me say here, that a more courageous set of men than those who volunteered that morning to work for the rescue of their fellow workmen it has not been my lot to meet. It would be impossible for me to give an adequate idea of the danger which attended the work. The pillars were crushing within fifty feet of the bottom of the shaft. In half an hour after "cog" pillars were built, it was impossible to get near them, owing to the crushing in of the roof all around them. However, perseverance and pluck accomplished much even under such dangerous conditions.

On the afternoon of the accident, when all hope of rescuing the entombed men from the Twin Shaft, even if they were alive, was abandoned, it was ordered that a bore hole should be drilled through the barrier pillar between the Clear Spring and Twin workings, to deter-

mine, if possible, the condition of the atmosphere inside of the fall. After two failures, a hole was drilled successfully through the pillar. The drill reaching the twin workings at a distance of ninety feet. The gas was found coming from the Twin workings under such a pressure that it could be detected by the safety lamp at a distance of ten feet from the mouth of the hole.

After a careful consideration of the situation, it was decided that the only feasible way to reach the bodies was to proceed down No. 3 slope, it being by this time apparent to those in charge that all of the men who had been at work in No. 3 slope at the time of the accident had been crushed to death by the cave-in. Accordingly, on July 6th, the work of opening a passage through the fallen rock in the slope was commenced. The undertaking was fraught with the greatest danger, and it was necessary to forbid the use of explosives on account of the surrounding atmosphere being filled with a mixture of explosive gas. The fallen rock was broken by means of hammers and wedges then loaded upon trucks and taken along the road at the head of the slope to be used as packing for the support of the pillars. Work in the slope was pushed vigorously day and night until July 29, the opening having been driven a distance of 553 feet from the head of the slope. The workmen then refused to continue work, as their danger was continually increasing. The timbers in the slope were constantly settling, and there was great danger that the rock above the timbers might give way, crush the timbers and close the opening, thus making it impossible for the rescuers to escape. The officials of the coal company therefore deemed it advisable to ask all of the mine inspectors in the Anthracite Coal region, and all of the superintendents of the neighboring coal companies to meet in Pittston on July 24th, 1896, and confer in regard to the advisability of continuing the work in No. 3 slope.

The conclusion reached at the conference was as follows:

"After a thorough examination of the mines and maps of the property mined from the Twin Shaft, the unanimous expression of opinion by the gentlemen was that they were surprised at the progress which had been made, taking into account the condition of the mines, the continuance of the squeeze, the presence of an enormous quantity of gas, and the fact that no explosives could be used in prosecuting the work. No suggestions were made that any better method of working could have been adopted. Their judgment was that everything possible had been done, and is being done, to reach the bodies of the entombed men. Deep regret was expressed by all present at the apparent impossibility of ever finding the bodies.

"The question of driving from the Clear Spring workings through the pillar of coal between their mines and the Twin Shaft workings was taken up and fully discussed; and it was decided that it was not only impracticable, but useless.

"The indications as shown in the mines and on the surface demonstrated beyond a question that the fall was general over the entire territory between the No. 3 slope and the Clear Spring colliery."

I must say that in all my experience with underground caves, I have never failed before to know of any crush or squeeze that did not give ample warning, which, if heeded, would enable all to escape before the general collapse took place. In this case, however, it appears from the testimony of some of the witnesses—men who came out of the mine a short time before the cave and said that they would not have been afraid to go to sleep at the foot of No. 3 slope then, without fear of the roof coming down—that they did not hear any pillars crushing, any unusual sounds coming from

the roof, or any other indications of a cave while they were at the foot of No. 3 slope. My opinion is that the Superintendent and Mine Boss were deceived in the location of the crush or squeeze, which, I believe, was taking place along the faces of the chambers in proximity to the fissure and about twelve hundred feet from where the men were working at the pump. It is my opinion that if, when the body of gas was discovered at nine o'clock on Saturday evening, an examination had been made around the face of the workings, it would have been found that a general crushing of the pillars was going on and (sic) unmistakable sign that a cave was about to take place.

I have no doubt they thought the squeeze was only local in the vicinity of the pump, which was located in the sixth vein, and that there was no particular danger to them even if a cave should occur from the breaking down of the divided rock between the veins, so that very little attention was given to the squeeze up the pitch from where they were. There, however, the disintegration of the pillars was going on rapidly until a sufficient area was so robbed of its support as to cause a sudden thrust of the over-lying strata down upon the pillars in the basin; these failed to stand the extra weight thus thrown upon them, and from all the indications they gave way, instantly entombing the men.

**May 13, 1908; Prospect Colliery (Midvale Slope)  
Wilkes-Barre, Pa.; 5 Killed**

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1908, p. 217)*

At 12:30 noon, May 13, 1908, a fall of roof occurred in No. 4 road, No. 246 Bowkley vein in Midvale slope by which a timberman, a timberman's helper, a miner, a driver, and a doorboy, were instantly killed and two others slightly injured. It appears from testimony taken at the Coroner's inquest held at Wilkes-Barre, that a runner had run a trip of two loaded cars down a section and had failed to place the proper number of sprags in the wheels, which allowed the trip to get beyond control. When the trip landed on the gangway road it jumped the track discharging (sic) four props that stood on the lower side of the road, and a portion of the roof fell on top of the cars. The runner sent the driver to call the timberman to replace the cars on the track and to secure the roof. When the timberman arrived they replaced one of the cars on the road and pushed it back so that they could replace the other derailed car and the props. While this was being done, a large piece of top rock fell, without warning, catching seven of them. It also appears from the testimony that the timberman had failed to sound or examine the roof before they commenced to work at the derailed cars. He should have seen that the roof was safe to work under, knowing that all the props under this particular piece of rock had been discharged.

**September 4, 1914; No. 1 Mine; Adamson, Okla.;  
13 Killed**

*(From Bureau of Mines report by J. J. Rutledge and others)*

On Friday, September 4, 1914, between 4:10 and 4:20 p.m. a cave-in occurred at the No. 1 mine at Adamson, Okla., in which 13 men lost their lives. These men were either killed by falls of rock or were suffocated by the afterdamps, probably the former. As the rescuers were unable to reach them and the

mine will never be reopened, the truth will probably never be known.

The mine is developed by a main slope with east and west side entries driven on water level. Side entries, or lifts, are driven 150 ft. apart, this distance increasing as the pitch decreases. The lower of a pair of side entries serve as the air-course and haulage road. From the top entry rooms are driven directly up the pitch. These are 125 feet in height (sic) and average 24 feet in width. Room pillars are supposed to be 10 feet thick, but in practice run all the way from 0 to 14 feet. The barrier slope pillars are 15 feet thick, and about the same distance is left between the top of the rooms and the air-course of the next higher lift. In this mine the practice is made of holing through the last room on the entry. Usually 4 or 5 other rooms are also holed through to make the ventilation problem an easier one.

The mine had worked most of the week ending Saturday, Sept. 5. On Friday, Sept. 4, the mine worked as usual and coal was being hoisted from the east and west side of 8th, 9th, and 10th lifts, with approximately 40 miners and 26 day men in the mine. The 10th is the bottom lift. All entries above the 8th had been worked out and abandoned. At 10 o'clock in the morning the four men working in the 8th west entry were taken out and given a trip to the surface, owing to the timbers and roof "working." This entry had been nearly worked out and it was the intention to pull the rails from it. At 2:45 p.m. the men working in the 9th west entry were ordered to take their tools and leave as the roof and timbers in this entry were also "working." This practice of removing the men from an entry during a day, or several days, while the entry shows signs of being under heavy pressure and then allowing them to return when this pressure has been relieved is very common in this field, and so in this case caused no comment. There were no falls or other disturbances on any of the other entries or on the slope. At about five minutes to four they stopped hoisting coal and lowered the first man trip. Eighteen men were taken on this trip, nearly all from the 10th lift. After this trip had been hoisted to the surface the mules were brought out of the mine. This is the custom at this mine to have the mules brought out after the first man trip. Ordinarily this takes about 10 minutes, but there were some delays and there was approximately 15 minutes from the time that the first man trip reached the surface till all mules were out of the mine. A miner and the shot firer together with about five other men were waiting at the 8th lift for the second man trip. They report that there was no disturbance at 4:05 p.m. At this time the shot firer went inside the door in by the 8th west parting and while in there heard the roof working and the timbers breaking in the 8th west entry. He became alarmed and went out to notify the miner, who went in and listened to the disturbance for three or four minutes. At the end of three or four minutes he was convinced that something serious was about to happen and hurried out. He told the men on the 8th west parting that the mine was caving in and called the same news down to the men on the 9th lift, warning all to get out of the mine. All then started to run up the slope haulageway. By this time the pressure had ridden over to the slope and the slope timbers were cracking and the roof working. No coal, however, was spalling off the ribs. By the time the men reached the fifth lift the man trip was coming down for the second load. The men stopped the trip but cooler heads allowed it to go down. At the 7th lift it was either stopped by two men waiting there or by falling rock. These men got in the trip, which started up and picked up several more men at the 4th lift and was then hoisted to the top. Six men

from the 8th lift had walked to the surface by this time. The engineer said that between the 6th and 7th lift the bell rang intermittently as the cage was being lowered. This was probably due to falling pieces of rock short circuiting the signal wires. When the second man trip reached the surface the trip rider notified the engineer that the mine was caving and requested him to send the trip to the 9th lift as fast as possible. The trip was lowered without anyone accompanying it, but when it reached the 6th lift it stopped, due, as they thought on top, to the car jumping the track. However, when they tried to pull it out it was found to be stuck. Two men went down to investigate. They got within 100 feet of the 6th lift and discovered that the trip had been caught by a fall. The coal was squeezing at this point and it was thought dangerous to remain there, so after having made the investigation they returned to the surface. About one hour afterwards two miners, tried to get down the manway, but found it closed tight by a fall just below the third lift. The east air-course just below third lift was also found to be closed, and there was, therefore, no means of ingress to the lower workings of the No. 1 mine.

The 7th east entry of the No. 4 mine was said to lack 30 ft. of holing through into room No. 43 off the 6th west entry of the No. 1 mine. It was decided that driving through this pillar would offer the most favorable chance of reaching the entombed men.

They drove a cross-cut five feet wide and four feet high, drilling and blasting in the same manner as is done in driving entries. When the cross-cut had been driven 29 feet the advance 5-ft. hole broke through into the No. 1 mine. The gas pressure which had developed in the No. 1 mine since the accident was sufficient to blow the drillings out of the hole. The air rushing in from the No. 1 mine contained a large amount of firedamp.

On Sunday, September 6, the cross-cut by that time had been enlarged so that it was 2 feet x 3 feet in section, which left ample room for rescue men to pass through.

Exploration down room No. 43 a distance of 40 feet to the 6th west entry of the No. 1 mine, revealed the entry closed by a fall just outby the room neck. The fall was 12 ft. high and ran to the roof, 18 ft. outby room 43.

At 2:37 p.m. a party went into the No. 1 slope to ascertain if it would be possible to enter the mine through the second lift. They investigated below the second east entries and declared it to be blocked by falls, so the party returned to the surface at 3:16 p.m.

From the surface and underground evidence it would appear that the main disturbance covered an area approximately 1400 ft. by 600 ft. In no place was there a noticeable surface subsidence. From the manner in which the cracks curved on the west side it would indicate that the main cave had been halted by the barrier pillar between the No. 1 and No. 4 mines. There was a heavy weight on this barrier coal at the time the cross-cut was driven, indicated by the ease with which this coal was pick mined.

The cave-in occurred within a very short time, possibly in less than 15 minutes, and nothing of a similar nature has ever happened in this field before, so the cause could only be conjectured. The slope, however, was over 1600 ft. deep and there was a very heavy rock cover over the bottom lifts. In spite of this heavy cover little or no pillars had been left either between the rooms or as barrier pillars for the slope. The room pillars were 10 feet in width and the slope pillars 15 ft., and in case of weight coming on these over any extended area they were not of sufficient size to offer any resistance.

May 22, 1920; Mallory Mine No. 3; Mallory, W. Va.; 5 Killed

(From "Archives and History," State Capitol, Charleston, W. Va.)

While engaged in construction work at Mallory Mine No. 3, the Superintendent and four laborers were instantly killed by a fall of rock and dirt just inside the main entrance.

December 8, 1923; Mount Jessup No. 1 Mine; Jessup, Pa.; 5 Killed

(Taken from the "Scranton Times," edition of Dec. 10, 1923, courtesy of the Scranton Public Library, Scranton, Pa.)

While rescue gangs continued today to proceed cautiously toward that section of the No. 1 mine at Jessup, where five men are imprisoned behind a mammoth fall of roof, company officials and mining men held but little hope that the missing men would be found alive.

Rescue gangs who entered the mine Saturday after waiting several hours for the rumblings of the caving workings to cease began the actual digging through the mass of rock, coal and debris last night at 9 o'clock, it was announced today by the company officials.

Owing to the danger of the roof under which they were toiling the rescuers were directed by State mine inspectors to erect substantial timbers one hundred feet this side of the cave in order to protect the rescue gangs.

At 4 o'clock this afternoon the rescuers had not heard any sounds from the far side of the squeeze and the belief grows that all five men are dead.

The cave occurred about 1:30 Saturday afternoon in what is known as the Grassy vein of No. 1 mine, where there were thirty men robbing pillars. At the first rumblings of a slide Foreman Jones ran through different chambers sounding the alarm and got twenty-five men on their way up the plane to the surface. Jones then discovered that there were still four men in another part of the vein and he turned around.

"I'm going back for them," he said to the other miners. The rumblings of the squeeze were now loud and the other men warned Foreman Jones of the danger. He ignored their advice and heroically made another dash to give the alarm to the others. Jones never was seen after that. Whether he reached the other four and was on his way out with them or whether he was caught before he got that far will not be known until the men are reached. It was thought for a time that Jones and the other four might have started out through the Sterrick Creek, but they failed to appear and it was then certain they had been trapped.

There is a burning culm dump over the mine where the cave occurred and it was expressed by mining men today that the weight of this dump and the drying up of the clay on the roof of the mine caved it in. Company officials, however, would not admit this. With mine inspectors they asserted it would be impossible to tell just what caused the disturbance until more progress is made through the debris.

Because of the dangerous condition the rescue men were unable to start promptly Saturday afternoon. They had to wait several hours until they felt certain the squeeze had stopped "working." Then the company pressed every available man into service and rushed carloads of timber underground to make the



room safe for the rescuers. While more than 100 men are engaged in the task of trying to reach their fellow workers only thirty can do the actual timbering at a time because of the amount of space they have to work in. Six-hour shifts are in effect and when one gang finishes a second gang swings in.

When the news of the tragedy reached the surface Saturday it spread throughout Jessup and several thousand people, many of them relatives of the missing men, gathered. Hundreds of them remained throughout the night. During the heavy rain yesterday the crowd outside the shaft swelled to more than 2,000. This morning another crowd appeared. Everybody was talking about the heroism of Evan Jones, who tried to save the four other men. The name of Jones is on all lips around the shaft and many a prayer went up that he and the others might be found alive. Jones is married and is the father of two children.

The latest word from the scene was that it may be days before the missing men are found.

### June 5, 1929; Halcon Mine; Wise, Va.; 5 Killed

*(From a Bureau of Mines report by W. J. Fene)*

A fall of roof slate occurring at about 8:00 a.m., June 5, 1929, in the mine near Wise, Virginia, resulted in the death of five men, including two machine men, two loaders and one trackman.

The Halcon Mine is a small operation, employing 35 men and producing about 150 tons of coal a day.

The room and pillar system of mining is employed and pillars are recovered on the retreat by the slabbing method.

No systematic timbering method is employed, timbers being placed where they are thought to be needed. However, in rooms usually two lines of props are used.

The accident occurred during the time the pillar between rooms 2 and 3 were (sic) being undercut. Two loaders and a trackman were waiting for the cut to be completed when the fall occurred. The undercut had about been completed when the roof broke along a slip parallel with the rib over the undercut and fell before the men could escape. The coal in this room is about 30 inches thick.

According to the mine foreman's statement, he was in the room about 30 minutes before the fall occurred and at that time the roof seemed to be in good condition and there was no evidence of the roof "taking weight." Two falls occurred; the first, the one that caught the men, was about 20' by 18' by 1½', the second, about 50' by 18' by 1½', occurred after the mine foreman returned to the room after being notified of the accident.

It is the writer's opinion that a safer method of recovering pillars in this mine could be employed and that in the room in which this accident occurred proper precautions and timbering methods were not used.

### August 8, 1930; Gilberton Colliery; Gilberton, Pa.; 8 Killed

*(From Bureau of Mines report by K. S. Marshall)*

An accident occurred on the Furnace Slope of the Gilberton Colliery, Gilberton, Pa., at about 4:45 p.m., August 8, 1930, in which 8 men were killed, 3 men were seriously injured and 2 men were slightly injured.

There were 35 men on the shift engaged in repair work. Six men were en route to the surface above the point of rock-fall and were not endangered. Sixteen

of the men who were below the fall had the good fortune to escape uninjured.

The property has been developed through two slopes driven on the Buck Mountain vein and a vertical shaft located several hundred feet toward the basin from the outcrop of the Buck Mountain vein. The shaft was originally used for hoisting water, but modern electrically-driven pumps are now used to handle the mine water and the shaft is now used for handling all men and material. Both slopes are used to handle coal.

The Furnace Slope is reported to have been in use for about sixty years. It is 2,056 feet in length, measured on the pitch. The slope is straight but makes a slight angle to the east of the true dip of the Buck Mountain vein on which it is driven. The average pitch for its full length is about 45 degrees.

There are seven levels turned from the Furnace Slope. One named the Furnace level is turned 292 feet from the surface after which six levels that are numbered are turned in order down the slope.

It was stated that on April 29, 1930, a wreck on the slope knocked out timbers which brought down top rock and started a slide that cleaned out a lot of timbering and slope tracks. This material went to the bottom and practically filled the slope from the sixth to the fifth lift. Following this wreck and damage to the slope it was decided to completely remodel and repair the slope. An estimate of \$60,000 was made on this work and the job was authorized. The mine was closed down completely insofar as coal production was concerned until this work should be completed. It was reported that the job had cost \$90,000 up to the date of the accident.

The repairing and retracking of this slope was a large undertaking, which, without the most careful planning and coordination, would be distinctly hazardous. Three shifts of 35 men each, all of whom are reported to have been selected for their experience and ability, were employed on the job, and the work had been carried on continuously including Sundays and holidays until August 8.

The slope was sectionalized by batteries (bulkheads) composed of three rows of posts, eight posts, ten inches or over, to each row, and lagging. Each battery was covered with a cushioning mat of broken rock before work on the next lower section of the slope was permitted. It was stated that had it not been possible to attack this work in the various sections simultaneously it would probably have taken eighteen months to have completed the work.

The job was practically completed. It was stated that this shift had about twenty feet of track and forty or more feet of guard rail to place to complete the connection of slope track that had not been possible until the third lift battery was removed. The eleven o'clock shift was to install and test out the operation of the new gun-boats on the repaired slope and the plans were to operate the mine on a production basis on Monday, August 11.

On August 8, the 3 o'clock shift was in full swing laying track just above the third lift and spragging some timber sets. The last batteries had been removed by the day shift and the entire slope had been examined by the shift foremen. In addition, the superintendent, foreman, State mine inspector, and company safety inspector had visited and traveled this part of the slope on this day.

At about 4:45 p.m., the foreman with five other men had ridden up the slope to the surface and it is stated that, within perhaps a minute after these men had passed underneath, a large slab of rock fell from the top at a point about fifty feet below the first lift and slid down the slope at terrific speed. The rock passed a group of four men just above the second lift without catching any of them; it passed a second group of five

men about 100 feet above the third lift and seriously injured one; it tore down through a group of twenty men, scattered from ten to fifty feet above the third lift and crushed six to death instantly and two so badly that they died shortly afterward in the hospital. Two other men were injured quite seriously and two more received minor hurts.

It is said that coming down to the third lift that the rock was riding the guard rails of the west track and that practically every man on that side was wiped out.

Considering the weight of the rock and the fact that it was sliding on rails with relatively small friction surface, the writer feels that the speed attained by this rock sliding down the slope would be but little less than the speed attained in a free fall through a distance equal to the vertical component of the slope distance. It would seem reasonable to assume that the rock was traveling at a rate of seventy-five feet a second when it tore through the group at the third lift, and that probably not more than ten seconds elapsed from the time the rock fell from the top until it struck the men.

In checking the clearances needed for the larger "gun-boats" that were to be installed, it was found that 4 to 6 inches additional height was needed at this point due to a bulge in the top rock over the west half of the slope. This point was examined by officials and experienced slope men in considering the advisability of drilling and shooting 11 plug holes to break off sufficient rock to gain the desired clearance. It is stated that complete agreement was had on the propriety of shooting such plug holes and that the rock would stand such treatment.

The shots were fired on Wednesday, August 6, two days before the accident. The roof was "barred down" clean and tested after the shooting.

The completed work was approved by company officials and it is stated that this point was examined and sounded with an iron bar on all subsequent shifts, including testing at one o'clock Friday, the day of the accident. There seems no doubt that the officials were in accord in their belief that this rock was safe. The dimensions of the rock which fell is given as 16' by 18' by 14'.

An observation of the top at this point on the morning of August 11 when the writer visited the slope showed a condition, which, had it been possible to determine before the rock fell, would have reversed the decision of every official as to the safe condition of the rock.

The surface from which the rock parted was "slick-top." There could have been no bond between the rock which fell and such top except the cohesion obtained due to the tight contact of smooth surfaces usually attributed to a vacuum. Further this roof was now cracking and showing water drippers to an extent that involved the top for some distance both up and down the slope from the point where the rock fell.

### July 1, 1938; Praco No. 7 Mine; Praco, Ala.; 6 Killed

(From Bureau of Mines report by Frank E. Cash)

At 8:10 a.m. Friday, July 1, 1938, a roof fall occurred on 14 south wall in Praco No. 7 Mine, trapping nine men, three of whom were rescued alive, severely shocked, with minor injuries, one rescued alive, died, probably from shock, en route to the surface, and the remaining five bodies were dead when recovered. In addition to the above nine men, two other men on the wall near the entry escaped uninjured.

During the past few years various width places were

driven pointing to long wall work. During 1938, three walls 250 feet deep have been developed.

Fourteen south wall had a face 260 feet wide, and had retreated 153 feet. The timbering was split timbers 8 to 12 square inches area set with wedges 4 feet centers parallel to the face and a cut (approximately 6-foot centers in the direction of retreat.)

Very little or no weight had been noticed except in a small area 50 or more feet back from the face May 20th, until about 12 noon, Thursday, June 30th, while, during the process of cutting, the wall roof began to work and take weight. The machine crew cut the remaining 50 feet of face after movement began and before the first fall occurred.

The first fall began working about noon, the major part fell about 2 p.m., and was quiet at 4 p.m. This fall was rectangular in shape and fell angular to the face, leaving about half the mined out area roof standing with little or no weight evidenced.

The fall reached the face, caught 100 feet of the conveyor, from 60 feet from upper end to 90 feet from lower end of wall. Between 5 and 11 p.m. Thursday the Assistant Superintendent, Night Foreman, and others, went in on the wall, removed the tail pan from upper end of wall to lower end, against fall, set 4 rows of additional timbers back of the conveyor and 6 additional timbers around the tail pan of the conveyor.

They then shot 40 feet of the 90 feet on the lower end of the wall, ran the conveyor to clear the pan, and shot the remaining 50 feet next to the entry, set 6 timbers, which were knocked out by the shot, and ran the conveyor to clear the pan. Being satisfied with the condition of the wall, they went to the surface at about 11 p.m. Thursday, June 30th. The fire boss made the wall at 2 a.m., July 1st, and gave instructions to re-examine the wall before work was begun.

On Friday, July 1st, the wall crew of 12 men reached the wall area about 6:45 a.m., the wall was examined by a certified man and the crew given "OK" to begin work.

The wall was quiet, the crew went to work, the Assistant Superintendent came in on the wall, sent two men off to another wall, one trip of 12 cars had been loaded, and the crew was loading on 2 empty cars which were left at the conveyor boom, when the second, or disastrous fall came at 8:10 a.m. Friday, July 1st.

Rescue and recovery was accomplished by loading the fresh shot of coal and timbering rock and coal between the conveyor and coal, since all 9 men, except one, were between the conveyor and the face when the second fall came, apparently without warning. Rescue operations were completed 5:30 p.m., Saturday.

### March 12, 1945; Crucible Mine; Crucible, Pa.; 5 Killed

(From Bureau of Mines report by F. E. Griffith,  
E. M. Lewis, and G. M. Smith)

Falls of roof material occurred on the day shift about 8:30 and 8:45 a.m., Monday, March 12, 1945, in the Crucible mine. Five men were killed, and three men narrowly escaped injury. The accident occurred when the timbers were tripped out from under roof by falling material in a pocket off a split that was driven through a 90-foot-square block of coal near No. 5 room, 23 butt left, off 3 flat west entries. The bodies were recovered by tunneling through the fallen material. The last of the five bodies was recovered at 3:15 a.m., March 13, 1945.

It is estimated that more than 500 tons of roof material had fallen in the first and second falls that occurred when the timbers collapsed. The material in the first fall, that buried the five men beneath it, con-

sisted of 12 to 14 inches of roof coal, 12 inches or more of draw slate, and several inches of black shale. The material of the second fall consisted of a solid black "slate" boulder, approximately 30 feet long by 30 feet wide with an average thickness of about 4 feet.

A split had been driven through a 90-foot-square block of coal and two 8½-foot cuts of coal had been taken from a pocket to the left of this split. The right rib of the pocket was started 6 to 8 feet out by the point where the split had cut through into No. 4 of a group of five entries known as 23 butts. This procedure followed at this mine. It was stated that it was carried out in this case because of heavy falls in a break-through and falls in the No. 4 entry.

From statements of officials and others who had visited the working place a short time before the accident occurred, the place was timbered in accordance with the adopted standard; three cross bars had been set in the pocket and a fourth was being set at the time of the fall. This could not be verified by observation at the time of the investigation because only a small portion of the fallen material had been loaded out. It was noted, while inspecting other working places in the vicinity, that the timbering standard requiring cross bars at about 4-foot intervals was maintained. It was also noted that cribs were placed near the breakline in most of the other working places. However, no claim was made that cribs were set at any point in the place where the accident occurred. The lack of such a roof support may or may not have a bearing on the initial roof fall, which consisted of coal, draw slate, and shale.

A hidden, almost vertical, slip or cleavage plane was parallel with the face of the pocket and another was almost parallel to the right rib of the split. From the statement of the trackman, who narrowly escaped injury when the initial fall occurred, the roof started falling at the face of the pocket. It is thought that the falling of this roof material tripped out the supporting leg posts of the cross bars without breaking them or giving much advance warning.

### May 20, 1948; No. 2 Mine; Dante, Va.; 6 Killed

*(From Bureau of Mines report by Edward Thomas and W. E. Park)*

A coal outburst causing the death of six men occurred about 9:00 p.m. on May 20, 1948, in the No. 2 mine, Dante, Virginia.

Eight men were in the face regions of the 19 left section, wherein the outburst occurred; and three other employees were also in the section. The flying coal covered the six men killed and partly the other two men in the face region, injuring them slightly. The five alive in the 19 left section escaped without assistance.

The coal outburst or "bump" occurred about 5 minutes after four or five shots of explosives were fired simultaneously in the bottom bench of coal in the No. 2 room. The greater part of the block of coal in by the face of No. 1 room was dislodged and badly shattered.

Work in the affected section (19 left off 12 left) was resumed 4 months ago after a lapse of 22 years. This work was being done to help straighten an old pillar line, and to recover room pillars to the right and left of Nos. 1 and 2 rooms. The Nos. 1 and 2 rooms were being driven through three partly mined pillars of coal, 150 feet wide, that had been left for protection when the inby room and entry pillars were mined in 1926.

Reportedly, no unusual conditions were encountered in driving the Nos. 1 and 2 rooms off 19 left until May 20, when several outbursts occurred. Similar blocks of coal throughout the mine had been mined in essen-

tially the same manner, with only the usual "weighing" problems connected with ordinary pillar recovery. However, the fire boss' report on May 19, 1948, stated that "excessive weight in the 19 left section was breaking the top and ribs and breaking timbers on the left." The same man's report of May 20 stated that "excessive weight was breaking the ribs and heavy mountain shots were coming on the 19 left section." The day-shift foreman reported on May 20 that "some loading delays were caused by bumps in the 19 left section." Reportedly, the ribs in Nos. 1 and 2 rooms had been crushing for several days.

About 2:30 p.m., May 20, 1948, a coal outburst or "bump" occurred in the No. 2 room off 19 left while a center cut was being made with an Arcwall mining machine. The mining machine was thrown 15 to 18 feet out by the face, and the cutter bar of the machine was broken in two places. Twelve or thirteen cars of coal (the exact number is uncertain) was dislodged (about 40 tons) from the face by the outburst, and one of the machinemen had one or two ribs fractured by flying coal.

The roof and coal had been "working" considerably before this "bump" occurred, but afterwards quieted and appeared to be static. The day-shift employees moved the loading machine into the No. 2 room and loaded 5 or 6 cars of the dislodged coal before the shift was ended. The general mine foreman and the assistant superintendent were notified of the coal outburst, and they visited and inspected the Nos. 1 and 2 rooms between 4:15 p.m. and 5:00 p.m. They stated that "the roof and coal were working less at the time of inspection than at any time during the week," and that they saw no reason why the night-shift employees could not load coal in these places.

The second-shift employees began their shift at 6:00 p.m. in the No. 2 room, and loaded eight cars of loose coal in this place. These eight cars and the five or six cars of coal loaded by the day-shift employees were dislodged by the "bump" at 2:30 p.m. and by a second "bump" that occurred while the loose coal was being loaded in No. 2 room by the second-shift crew. The second "bump," which occurred about 8:00 p.m., threw about two cars of coal from the face, some of which struck the loading-machine operator and injured his arm slightly.

After the loading machine was moved to No. 1 room the shot firer and machineman drilled and prepared four to five shot holes in the bottom bench of coal in the No. 2 room. This bench of bottom coal was left intact by the two coal outbursts; the top bench of coal (above the "middle man") was dislodged to a depth of 6 or 10 feet in the face.

The machineman stated that after the charges were prepared for blasting, the shot firer left the face region to visit the explosives-storage boxes, and that he (the machineman) made the final preparations for blasting. The blasting cable extended from the face of No. 2 room through the left crosscut off No. 1 room to near the right rib of No. 1 room. The machineman fired the blast while standing near the right crosscut off No. 1 room. He stated that a third coal outburst occurred within 4 or 5 minutes after the shots were fired and before he had moved from the location where he had fired the blast.

Six employees who (loading-machine operator and helper, two timbermen, a trackman, and a slate picker) were in the right crosscut, were killed. One man (the mining machine operator who actually fired the shots) was along the right rib and near the right crosscut in No. 1 room. The shot firer was coming through the left crosscut off No. 1 room; the motor crew was returning to the face of No. 1 room with a trip of six empty cars (pushing the cars); and the section foreman was near the telephone (800 feet from the face) when the accident occurred.

The machineman, shot firer, and brakeman from the 19 left section stated that the roof and coal were "working" considerably and that some of the different crew members had talked about leaving the places before the "bump" occurred at 9:00 p.m. The shot firer and machineman stated that the coal outburst came suddenly without warning.

Several hundred tons of coal was dislodged; coal was thrown 75 feet outby the face along the No. 1 room tracks; the right crosscut (18 feet wide and 40 feet in depth) was filled with thrown coal; the block of coal inby the original face to probably the seven left air course (80 to 90 feet) was dislodged; the coal to the right of No. 1 room (40 feet wide) was dislodged and shattered; and the block of coal between Nos. 1 and 2 rooms was dislodged and shattered, especially near the face of No. 2 room. The loading machine was shoved about 60 feet outby the face; and the end of the loading boom was forced against an offset in the left rib of No. 1 room. The track near the loading machine was twisted and bent; also numerous timbers in the crosscut to the right of No. 1 room and in the No. 1 room were dislodged.

The shot firer and machineman (the two men at the face who were injured slightly) were partly covered by the flying coal. The shot firer was able to free himself, and he helped free the machineman. They were unable to see because of the excessive dust, but were proceeding from the face when they were met by the motorman and brakeman, who were also partly blinded by the excessive dust. These four men, joined by the section foreman, returned to the face of No. 1 room and discovered that the rest of the crew had been covered completely by the dislodged coal.

To recover the bodies, members of the rescue party hand-shoveled in teams, for short periods because of the excessive dust. The first body was found near the center of the roadway in No. 1 room and about 15 feet outby the right rib of the right crosscut; the second body was uncovered about 8 feet from and directly opposite the right rib of the right crosscut; and four bodies were found together near the mouth and right rib of the right crosscut off No. 1 room. The six bodies were recovered and removed to the surface by 2:00 a.m., May 21, 1948. The six men apparently had been killed instantly by the flying coal.

### August 6, 1948; No. 11 Mine; Capels, W. Va.; 6 Killed

*(From Bureau of Mines report by John Zeleskey  
and L. L. Wylam)*

A fall of roof rock on a man-trip caused the instant death of 5 persons and injuries to 8 others in the No. 11 mine at Capels, McDowell County, West Virginia, about 12:50 a.m., August 6, 1948.

At the time of the accident, 47 men, including the brakeman and locomotive operator, were on the man-trip, which was proceeding at a speed of about 4 miles per hour toward the shaft bottom. Thirty-four of the men on the man-trip escaped uninjured, and two received only slight injuries and were not hospitalized. Of the two more seriously injured, one died after admittance to the hospital.

The investigation of the accident revealed that it was caused by a roof fall on the out-going man-trip in motion on the 4 south main haulage road. The roof at the location where the accident occurred was not timbered.

The rock that fell on the man-trip consisted of one large piece of rock measuring 12 feet wide; 26 feet, 10 inches in length; and 10 inches in thickness. This rock, after falling, had broken into two pieces 10 and 16 feet in length, respectively, and several small pieces.

This large piece of rock fell on the edge of the 6th car and completely covered the 7th and 8th cars on the man-trip. The 6th car back from the locomotive contained 5 men, 3 of whom were injured; the 7th car contained 5 men, 4 of whom were injured and 1 was instantly killed; the 8th car contained 5 men, 4 of whom were instantly killed and one was injured. The men in the remaining cars of the man-trip were not injured and assisted in giving aid to the injured and in the removal of the dead and injured men to the surface.

On Sunday, August 1, 1948, a crew of six men scaled the top along the 4 south heading, and the loose roof outby the location where the accident occurred was taken down; this was substantiated by date marks of the fire boss. The entry at the location of the accident was 13 feet, 9 inches wide and 6 feet high above the rails where the roof fall occurred.

The exposed area which fell was not supported by any kind of timber because the roof was considered good by the mine management. During the investigation, it was stated that on August 6, 1948, at 12:30 a.m., or 20 minutes before the accident occurred, a fire boss examined the roof along 4 south haulage and that he did not observe any unusually dangerous roof condition. The man-trip motorman, who was also the main-line motorman, stated that he made 10 or more trips along this haulageway during the working shift in addition to operating the man-trip and did not observe any unusually dangerous condition of the roof at this point. Some of the men who were riding the front end of the man-trip and who escaped injury stated that they also failed to notice anything to indicate that a fall was about to occur as the trip was going by and that the roof fell suddenly and without warning.

The primary cause of this roof fall accident was the failure to expedite the completion of room timbering along the haulage road in the 2 south section. Work was in progress to timber the roof along all main haulage roads in the mine. Also, a primary cause was the failure to adequately examine the roof by the sound-vibration method. Furthermore, the management failed to realize that from a safety standpoint, no roof should be considered good, but should always be treated as hazardous.

### December 9, 1957; Glen Rogers No. 2 Mine; Glen Rogers, W. Va.; 5 Killed

*(From Bureau of Mines report by J. L. Gilley,  
F. J. Furin, and Thomas Allamon)*

A coal-mine bump occurred at 10:45 p.m., Monday, December 9, 1957, in the main east section of the Glen Rogers No. 2 mine and resulted in the instant death of 5 men and slight injury to 1 employee. The 7 other employees in the section were not injured. The rescue work, led by company officials, was completed at 6:35 a.m., December 10, 1957.

At the time of the coal-mine bump, blasting of coal, cutting or mechanical loading operations were not actually in progress. Reportedly, 20 or 30 minutes had elapsed since cutting or blasting operations were performed.

Conditions within the active workings, from statements of witnesses, appeared normal. Essentially similar statements by witnesses were that small bumps (bumping) incidental to normal pillar extraction in this coal bed had occurred during this and the recent previous shifts.

No. 1 room had advanced about 230 feet, the No. 2 room approximately 250 feet, and the No. 3 room about 190 feet into the barrier block.

On the date the accident occurred, the second shift entered the mine at 4:00 p.m. The main east crew of

13 men, including the foreman, arrived on the section about 4:30 p.m. The loading machine crew was instructed to proceed to No. 1 room and load out the remainder of a cut of coal that was left from the previous shift. After the coal in the No. 1 room was loaded, the loading-machine crew loaded the cut of coal in No. 3 room, and in the meantime, the cutting-machine and preparation crews had cut and prepared the faces of No. 1 room and No. 2 room crosscut. Inasmuch as it was nearing quitting time, the foreman stated that he instructed the loading-machine crew to take the loading machine in No. 2 crosscut, instead of in the No. 1 room. Also at this time, the foreman sent the cutting-machine and the preparation crews into No. 3 room to prepare this place for cutting and blasting. The preparation crew and the machine crew set 3 crossbars, and while the preparation crew was extending the track to the face of the No. 3 room, the cutting-machine operator and his helper drilled 3 holes in the face of the place. After drilling the 3 holes, they walked back and were placing the drill on the cutting machine parked about 30 feet back from the face when the bump occurred. The shot firer standing near the front end of the machine and about 5 feet outby 1 of the members of the preparation crew who was killed, miraculously escaped injury.

The gathering-locomotive brakeman stated that 3 cars of coal had been loaded from the No. 2 room crosscut, and when the locomotive returned from the sidetrack with 5 empty cars the loading-machine crew had signaled the brakeman to stop the trip until they had finished cleaning up the loose coal.

The section foreman stated that he was late in eating his lunch and while he was at the "dinner hole" (approximately 300 feet from the face of No. 1 room) sitting on a box eating a sandwich, the bump occurred. He said the concussion apparently must have knocked him off the box he was sitting on. He further stated that the dust in the suspension was so dense he could not see, but he started immediately toward the faces to account for his men. On his way in, he met the cutting-machine operator who told him that a fall of rock had occurred in No. 3 room and that the preparation crew had been caught underneath it. He said he went into No. 2 room crosscut and then into No. 3 room and called to the men, but when he did not get an answer to his repeated calling, he notified the surface about the bump and the men being caught.

The stress wave released was rather intense, and reportedly the tremor was perceived by persons on the surface within a radius of 2 miles from the scene. The greatest forces were released in No. 2 room and in the No. 2 Room crosscut, but effects of the bump were evident in each of the other 2 rooms; however, the intensity was least pronounced in No. 1 room. Considerable damage was done to the loading machine by the collapse of a large section of roof rock that ranged from 22 to 49 inches in thickness, 16 feet in width, and 35 feet in length. Several roof supports were broken and dislodged and line brattices were dislodged near the faces of the 3 rooms. The section of roof detached in No. 3 room was about 25 feet long and ranged from 2 to 33 inches thick.

February 12, 1958; Lundale Mine; Lundale,  
W. Va.; 6 Killed

(From Bureau of Mines report by James T. Whalen  
and William M. Cordray)

A roof fall occurred at 6:25 p.m., Wednesday, February 12, 1958, in the Lundale mine, Lundale, West Virginia. Seven men were caught by the falling ma-

terial; 5 were killed instantly and an additional man was injured so seriously that he died about 54 hours later in a hospital in Man, West Virginia. The seventh man was caught and covered completely, but he was not injured by the roof fall. Work of recovering the injured man and the five bodies was directed by company officials and inspectors of the West Virginia Department of Mines and the United States Bureau of Mines and was completed at 3:05 a.m., February 13.

The extensive fall of roof in an old haulage entry in No. 17 road section occurred with almost no warning; the area was being reactivated to provide a shuttle-car roadway to three new working places.

During development of No. 17 road section, roof in Nos. 14 and 17 roads (track entries) was supported with roof bolts only; 4 bolts were installed through crossbars. Roof bolts were not used in other entries in the section, and a row of line timbers was installed on each side of the entry to support the roof in Nos. 13, 15, 16, and 18 roads. These roof-support procedures were adequate during development, but immediately prior to the roof fall on February 12, practically every line timber inby the transfer point in No. 17 road section had rotted or been broken by heaving floor material or coal falling from the ribs. Some of these timbers were being replaced along the new shuttle-car roadway on the day of the roof fall.

A barrier pillar, 400 feet in length and 200 feet in width between road No. 13 and the mined-out No. 41 section, was being recovered in conjunction with the chain pillars in No. 17 road section. The barrier pillar was being mined by driving rooms in sets of 3 and then recovering the pillars. The roof-fall area in No. 17 road section was developed about 17 months prior to the accident.

At the beginning of the first shift (7:15 a.m., to 3:15 p.m.), February 12, the day of the accident, work was started to clean and retimber a shuttle-car roadway from the transfer point on No. 14 road to No. 18 road. This roadway was being prepared to open 3 rooms (Nos. 9, 10, and 11) into the barrier pillar adjacent to No. 18 road. While part of the crew cleaned the loose coal from the roadway, material that had sloughed from the ribs during the time the area was idle, other crew members throughout the shift timbered roof inby the transfer point; 18 bolts were also installed on No. 18 road at the entrance to No. 11 room. During the shift, the foreman and crew members observed and examined their roof inby the transfer point and in the general area where the roof fall occurred later. Employees and the section foreman testified during the investigation that audible noise of roof "working" was about normal and as expected in pillar areas; these men also testified that no unusual evidence of "weight" was observed on timbers or ribs anywhere in the area.

The second shift entered the mine February 12 about 3:15 p.m. The crew cleaning the roadway was instructed by the section foreman to continue cleaning No. 17 roadway and to clean the ribs so that the entry could be retimbered. The loading-machine operator tested the roof along the proposed roadway and found it solid except for a break in the roof near the left rib of the 45-degree crosscut left off No. 17 road. Coal was loaded from the floor from rib to rib along No. 17 road (entry) and in the 45-degree crosscut; several shuttle cars of coal, broken posts, and brattice material were loaded from this crosscut. Loading was then directed toward and into the open crosscut right between Nos. 17 and 18 roads and directly opposite No. 9 room in the barrier pillar. When the new roadway had been advanced a short distance into the right crosscut, the conveyor chain on the loading machine broke into 2 pieces. The loading

machine was then trammed from the crosscut to No. 17 road so as to provide sufficient maneuvering room to repair the conveyor chain.

The shuttle car hauling from the loading machine with the broken conveyor chain was used to procure a supply of conveyor flights for the broken chain. The conveyor chain was strung out on the floor in front of the loader in No. 17 road when the shuttle car returned with the flights. In traveling a short distance outby the loader, the shuttle car developed brake trouble. The shuttle-car operator needed assistance to repair the car brakes, and he requested such help from the shot firer; this left 7 men repairing the conveyor chain of the loader. While working on the shuttle-car brakes, the car operator and shot firer heard a "ripping" noise in the roof inby and immediately thereafter an extensive fall of roof occurred.

Immediately after hearing the "ripping" noise, the shot firer ran outby and the car operator, who was working at the inby end of the shuttle car, traveled to the controls and began moving the car outby; however, the inby end of the car was caught by the falling roof material. The shuttle-car operator and the shot firer were outby the falling roof material, but the seven men working inby the shuttle car on the conveyor chain were covered by the roof fall. The loading-machine operator was not injured severely and he was able to crawl from under the fallen roof without assistance. The shot firer and shuttle-car operator were able to hear at least one man under the fallen rock call for help. Examination of the fall area indicated the other five men under the fallen roof were dead.

The roof material fell from rib to rib and extended lengthwise for 87 feet in No. 17 road; it ranged from 12 to 60 inches in thickness and extended into the right crosscut off No. 17 road about 24 feet. The fallen material broke over the loading machine and into several pieces on the outby end.

Roof in No. 17 road, a track entry, was supported during development with roof bolts installed on 4-foot centers. The roof-bolting plan for track entries

stipulated that 5/8-inch-diameter bolts of high carbon steel and at least 36 inches in length be used with wooden crossbars, 2 by 8 inches by 16 feet in length. Other provisions of the roof-support plan required that entries be driven at maximum widths of 18 feet and crosscuts not used for haulage be supported with timbers. Examination of No. 17 road in the fall area and outby the roof fall during the investigation showed that 36-inch length roof bolts had been installed through wooden crossbars on the recommended 4-foot centers lengthwise and crosswise. However, timbers had not been set in unused crosscuts as required by the roof-support plan and the entry averaged 25 feet in width in the roof-fall area; coal sloughing from the ribs contributed materially to the excessive width of the entries. Apparently, the corners of the 45-degree crosscut adjacent to No. 17 road had been loaded during the cleaning operations, as the entrance to this crosscut was 44½ feet in width. The 45-degree crosscut was about 26 feet wide midway between Nos. 16 and 17 roads.

Work was started immediately to raise the fallen rock on the outby and right side of No. 17 road, as the rock was thinner at this location and appeared to be the location from which the 1 man alive should be rescued. It was necessary to remove the bodies of 2 of the victims located near the edge of the rock before attempting to release the live man. Cribbs were erected under the rock and blocking (crossbars and timbers) was advanced as the rock was raised so that every precaution could be taken to prevent the massive rock from shifting or breaking. The bodies of the first 2 victims were removed from under the fallen rock at 10:15 p.m. and 11:25 p.m., respectively. One man was rescued alive and conscious at 11:45 p.m., February 12. He died in a local hospital on February 15, 1958, 54 hours later. The body of the last victim was recovered about 2:35 a.m., February 13, 1958.

The rock that fell intact measured 87 feet in length, averaged 25 feet in width, and varied from 60 inches in thickness at the inby end to 12 inches at the outby end of the fall.

TABLE 4.—Major disasters by inundations

Date	Name of mine	Location of mine	Killed
1883: February 16.....	Diamond.....	Braidwood, Ill.....	69
1885: December 18.....	No. 1 Slope <sup>1</sup> .....	Nanticoke, Pa.....	26
1889: September 9.....	White Ash.....	Golden, Colo.....	10
1891: February 4.....	Spring Mountain <sup>1</sup> .....	Jeanesville, Pa.....	9
1892: April 20.....	Lytle <sup>1</sup> .....	Minersville, Pa.....	10
1898: May 26.....	Kaska Williams <sup>1</sup> .....	Middleport, Pa.....	6
1912: July 24.....	Superba and Lemont.....	Evans Station, Pa.....	18
1917: December 17.....	Wilkeson.....	Wilkeson, Wash.....	6
1927: April 8.....	Carbonado.....	Carbonado, Wash.....	7
1952: March 27.....	Holmes Slope <sup>1</sup> .....	Forrestville, Pa.....	5
1959: January 22.....	River Slope <sup>1</sup> .....	Port Griffith, Pa.....	12

<sup>1</sup> Indicates anthracite mine.

## DESCRIPTION OF MAJOR DISASTERS BY INUNDATIONS

February 16, 1883; Diamond Mine; Braidwood,  
Ill.; 69 Killed

(From *A Compilation of the Coal Reports of Illinois, 1882-1930*, pp. 63-73)

The most conspicuous event which has occurred during the year or which has ever marked or marred the annals of coal mining in this State to this time, was the calamity which befell the Diamond Mine, and the miners in it, at Braidwood, in February last. At this place, by the sudden precipitation of a seal of surface water into the workings of the mine, in the middle of the day, 69 men were engulfed and miserably perished; 39 women were made widows; 93 children were made fatherless, and the mine itself and its owners were involved in common ruin.

The topography of the county in which the Diamond Mine was located, is known to be in general very level and low. The seam of coal is thin, and near the surface, and one of the chief sources of expense in mining it is the handling of the great quantities of water which continually accumulate in the workings. There is said to be ten square miles of this level and marshy tract upon which the Diamond and other mines are located, and it is all so flat that no natural drainage is locally possible, and ordinarily all accumulations of water lie upon the surface until absorbed or evaporated. Even when thrown out of the mines with pumps it has no alternative but to find its way through the soil back again. Another feature of the situation is that all the coal in this field is worked on the long-wall system, and as fast as the mineral is removed the surface comes down with the roof, and consequently makes a loose, irregular break all along the face of the workings, particularly susceptible to the action of water, and leaves in general an uneven and treacherous surface for water to stand upon.

For several days prior to the 16th of February, 1883, there had been a general thaw in the vicinity of Braidwood, accompanied by warm rains, which reduced the winter's snow to water and swelled to a flood, which overspread the entire surrounding country. That this was an unusual condition of things, is not claimed. Water in similar quantities had accumulated and stood upon the surface there before. On several occasions in former years, surface water had found its way into the mine, and two years previously it had broken through in such quantities as to create general alarm. In this case it is stated only that the volume of water was not greater than usual. Its depth is given as from one to three feet, but whether it was more or less, would seem hardly to affect the gravity of the situation. It was spread like a sea over the entire face of the country, and constituted an open menace to every mine in the vicinity. That it was regarded as an element of danger, is shown by the action of the superintendent of an adjacent mine, who prohibited the men from going into his works, and ordered out those who had gone down before his arrival. Yet the men of the Diamond Mine went below that morning as usual, and with only 54 feet of sand and surfaced drift between them and

an untold weight of water, began their day's work—which they never finished.

At about 11 o'clock in the morning the "cager" at the bottom of the main shaft discovered an unusual amount of water flowing to the bottom, and sent word to that effect to the men at the different working places, by the drivers who came to the shaft with their loaded cars. Being still uneasy about it, he came to the top to ascertain if possible the cause of it. Making no discoveries, he descended the shaft again, and reaching the bottom found the volume of water already so great that he had difficulty in rescuing a boy, who had charge of a door near the shaft, with whom he at once ascended again to the top. By this time those who had taken the alarm were clambering out by the escapement shaft, and the mine was now filling so rapidly that those who failed to receive the alarm, or were at too great a distance from the shaft, were speedily and hopelessly shut off from all escape whatsoever. The point at which the breakthrough took place is on the eastern boundary of the workings, while the principal working place was at the western extremity—the main or hoisting shaft being midway between them. In this, as in other mines, the main shaft was located in the dip, or lowest point of the coal, so that all water which accumulated in the mine could flow to the shaft, and then be raised with pumps to the surface. The depth of the old air-shaft, near the break, was 68 feet, that of the main shaft was 84 feet, and that of the escapement 75 feet. The first rush of water was consequently at the bottom of the main shaft, that being the lowest point, and all escape at the point would be shut off some time before the outer galleries of the mine would be filled. It is probable, therefore, that no water would reach the working places on the west boundary until it was really too late to make any escape except by the escapement shaft. The bottom of this shaft being nine feet higher than that of the main shaft, it would afford an opportunity for egress after it was no longer possible to reach the bottom of the main shaft. To this point those who did escape made their way, and at this point the last desperate struggle of those who barely escaped was made, and, groping for this outlet in despair, having almost reached it, twenty-two men awaited and accepted their doom.

Unhappily there was a fatal defect in the construction of the road-way leading to this escapement shaft, which proved full of fatal consequences. At a short distance from the bottom of this shaft there was a dip or declivity in the roadway, followed by a corresponding rise, and creating a hollow about fifteen yards in length. Of course this hollow would be filled with water to the roof, while the road on either side of it was still out of water, and thus the advantage of the higher ground at either end would be neutralized and lost. It will be seen by statements made by those who escaped last by this route, that they had to dive or plunge through this fifteen yards of water in order to reach the bottom of the escapement shaft. Had such an emergency as this been foreseen or anticipated, it would have been a simple matter to have taken down the top and filled up this road to a uniform level, thus affording safe egress, possibly, to the entire

working force, before finally being overtaken by the water. Another complication arises in all such cases as this, from the doors set across the roadways for the purpose of directing and controlling the currents of air. One of these doors being closed with the weight of a body of water against it equal to its own dimensions, would constitute a barrier as impassable as a wall of rock—and so, doubtless, many desperate men found it. Those who did escape had their most dreadful struggle with the doors leading to the escapement gallery, and the location at which the bodies of twenty-two others were found indicates that they may have had a similar struggle in vain.

It will thus be seen that when this sea of surface water began its headlong rush into the cavities of the Diamond Mine, it first closed the exit by the main shaft, then by the escapement shaft, and then hermetically sealed the doors, and took possession of the more remote recesses of the mine at its own deadly leisure.

As soon as the nature and extent of the catastrophe could be realized on the surface, active measures were proposed and taken for the rescue of those who were yet within the mine. These were, however, as brief as they were futile. It was as difficult to get into the mine as it was to get out. The pit boss descended the main shaft, but found only water, and the black damp so heavy as to put out his light. Two men, however, succeeded in making an entry by the escapement shaft, but they never returned. Their bodies were found afterwards among the twenty-two victims near the bottom of the shaft; and their widows and children and friends can only lament their fruitless heroism. This closed the chapter and completed the death roll.

Succeeding the fruitless impulse to save, came the resolution to at least recover the bodies of the dead. Nothing more remained which could be done, and even that proved a most arduous undertaking.

First the exact spot where the crevasse had taken place had to be located and inspected. With the aid of a boat the vortex was reached, and found to be about 50 x 90 feet in area. Nothing could, of course, be done towards removing the water from the mine until the construction of a coffer-dam around this place so as to shut off the further flow of water into the workings. To accomplish this required the building of a dam 5,000 feet in length, in water three feet in depth—an undertaking in itself requiring much time, skill, and labor. Fortunately there was an abundance of assistance at hand.

All the mines in the vicinity at once suspended operations, and both the miners and superintendents directed all their energies and resources to the work of recovery. In the course of a few days the dam was completed, and the company's pumps, augmented by as many others as could be advantageously placed, were at once set in motion for the purpose of hoisting a body of water, the volume of which could only be conjectured.

These powerful pumps were driven to the limit of their capacity night and day until the 26th day of March—38 days after the flooding of the mine.

On the 25th the first descent was made to the mine below, and on the 26th the first bodies were recovered. The mine itself was found to be a total wreck. The water had carried with it, to all parts of the works, vast quantities of mud from the surface, and had loosened and displaced supporting timbers, and had so softened the roof that it fell in large masses as soon as the water was taken out. This not only blockaded the roadways, but also so obstructed the air-courses that it was impossible to re-establish the circulation sufficiently to displace the accumulated black damp. The entrance into the workings was consequently attended with great difficulty and danger—not only from the accumulations of gas and debris, but from the

loosened and impending rocks which were falling and liable to fall at any moment.

After the recovery of the last six bodies (28 in all), and a thorough search of all the accessible recesses of the mine, it became evident that the bodies of the remaining victims must have been buried in the ruins, and could not be reached, except at great risk of life, and further effort at recovery was abandoned. The company offered to continue the pumping and to afford all necessary facilities, if men could be found to go on with the explorations below, but the improbability of any further satisfactory results deterred the men from taking any more risks.

Consequently by general consent, though not without the protest of those deeply afflicted, the long sustained effort was at last suspended. The dead were identified and buried. The fires were drawn from the furnaces, the pumps ceased, the shaft gradually filled again with water, and the late populous mine became simply the silent sepulcher of the unrecovered dead. And such it will ever remain. The property is abandoned, and will be only known in the future as the scene of the great tragedy.

### December 18, 1885; No. 1 Slope, Nanticoke, Pa.; 26 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1885, pp. 75-78)*

At about 10 o'clock in the morning a large body of quicksand and water broke through the roof into the Ross vein workings causing the death of twenty-six persons. The cave broke in near the solid face of a counter gangway on the apex of an anticlinal or saddle. The bodies of the entombed men were never recovered.

The No. 1 slope was sunk on the lowest, or Red Ash seam, and this seam is nearly all worked out, so far as it can be mined from this slope. In 1881, a tunnel was driven from the third lift at a distance of about 120 feet west of the slope to Ross seam, the next one above. This tunnel reached the vein at a distance of 487 feet horizontally. For the first 2,000 feet the average dip of the seam is about 18 degrees. Here the gangway curves sharply around the synclinal of a basin, and back on the strike of another dip, and again around the saddle of a small anticlinal. Most of the persons lost were working in breasts on this saddle, and within a short distance of the point where the sand broke in. There were four persons working in the basin, at the foot of places driven up to the counter-gangway on top of the saddle. One of these escaped and said that he saw the other three struggling in the mud behind him. Those three are among the lost. The two drivers, the runner, and door boy, had gone in with the cars about half an hour before the sand broke in, and it is supposed that they had reached the miners who were working on the anticlinal before the accident happened. In less than one hour from the time it broke in, the gangways were completely filled from floor to roof, all the way out to the slope, and up part of the way into the breasts. All the men who worked the breasts on the right of the straight gangway escaped through the faces of the breasts and out through the air shaft. Upon exploring the workings above the sand level, a mistake was made in the location of the cave, and, while laboring under this mistake, it was generally believed that the men who worked on the saddle described were on higher ground than that which the sand had filled, and, consequently, were probably all alive. A large gang of men were at once set to work to effect a passage through the sand down a breast at a distance of about 2,000 feet from



the air shaft, and by Monday evening, December 21, they had reached the bottom of the basin, right opposite a hole which had been driven on the opposite side or other pitch, to the counter-gangway on top of the saddle. As far as they could see with the light of a Clanny safety-lamp, this hole was clear of sand, and they were greatly elated and encouraged by the prospect, believing that they could rescue the entombed men in a few hours. The said hole was rising about 45 degrees, too steep to climb up without ladders or steps, and orders were promptly sent out for ladders. While waiting for them, an old battery was cut out of the way at the bottom of the hole, and occasionally, while doing that, small quantities of dirt were noticed to fall from above, which caused them to be watchful and ready to retreat in case a rush should come.

Shortly after cutting the battery away a large quantity rushed down and drove them all back. The passage made through the sand was only three and a half feet high and about the same width, and it was made a distance of about two hundred and fifty feet. The debris had to be carried away in buckets, and at this time there were about sixty men employed, one behind the other, handing the buckets back and forth. It was thought difficult for so many to escape in case water and sand rushed in again, therefore seven or eight only returned to see what fell, and while they were at the bottom it rushed down again, and filled the passage all the way up to about twenty feet higher than when they started to make it, and the men escaped only by the greatest exertion. If the whole number had returned, there is no doubt that most of them would have been caught, and added to the number already entombed, but, fortunately, the few that had returned were not so much in one another's way, and they escaped. With this unexpected occurrence, all hopes of rescuing the entombed men alive were dispelled. This also caused the officials to think that probably the sand bar broke at the top of the anticlinal or saddle, and the engineers were set to work to locate the hole. This hole was a deep cone-shaped depression on the culm bank, and was about three hundred feet diameter on top. When the survey was done, it proved that the cave broke in near the solid at the face of the counter-gangway on the apex of the anticlinal, and that all the entombed men were very probably caught and killed soon after the sand broke into the mine. It also showed that the only way to recover them would be by clearing the gangway from the slope in until they were found, and this work was commenced at once and pushed vigorously up to the date of this writing, February 25, 1886. The sand was found to be packed tight from the floor to the roof in the two gangways, and although they have cleared the main gangway to a point within two hundred feet of the curve, not one body has yet been recovered. The officers of the company fear another rush of quick sand when the gangway is cleaned to the curve, and the probabilities at present are that that will take place. If it does, the bodies can never be recovered, and it is doubtful, also, whether the workmen who are clearing the gangway can escape if it should rush in under the great pressure supposed to be behind it. The danger apprehended has been fully explained to them, and it is their will, at present, to work on and see whether the bodies can be recovered or not, but the officers, apprehending danger to those working in other lifts as well as to them, may conclude to abandon the work.

This accident is a remarkable one, nothing like it having occurred before in the anthracite coal regions of this State. Any one visiting the mine prior to the accident would have pronounced it one of the safest mines in the region. The pillars were large and regular, the roof strong and safe throughout, as far as

appearance indicated. There was no crush, nor anything to create alarm, or to give the least sign of danger. No one suspected that it was possible for danger to exist from quick sand. The No. 4 tunnel workings were in the same vein, and higher on the pitch, between this and the outcrop, and had mined nearly one and a half miles further without encountering trouble of this nature. The levelings showed that there were two hundred and sixty-two feet of strata right over the vein at the point where the sand broke in, and it was supposed that about two hundred feet of it was rock. The surface where it broke in was covered by a culm-bank, forty-seven feet high, and this was up on the side of a dry sand-hill, somewhere about sixty or seventy feet above the level of a creek. The rock is seen on the surface above the culm-bank, and also below it at the creek, but between these two points the rock seems to have been washed away to a depth approaching closely to the vein, and again replaced by sand and water. The appearances of the surface are such that no one suspected that such a depth of sand existed there, and, therefore, no one could have foreseen the possibility of such a calamity as that which happened. It was such that no blame can be attached to any one, for every practical precaution was taken to mine the coal so as to insure safety of the mine and the workmen employed.

#### September 9, 1889; White Ash Mine; Golden, Colo.; 10 Killed

*(Submitted by the Colorado Coal Mine Inspection Department)*

About 4:00 p.m., just after men descended shaft for afternoon shift. Water from old Loveland Mine shaft broke into workings of White Ash Mine filling it with debris and water. Shaft filled to mouth with CO<sub>2</sub>, water 140 feet up the 790 foot shaft, and debris covering the cage prevented an attempt to rescue bodies. Both mines were permanently sealed.

#### February 4, 1891; Spring Mountain Colliery; Jeunesville, Pa.; 9 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1891, pp. 150-152)*

On the 4th day of February, 1891, there occurred one of the greatest disasters that ever happened in this district. No. 10 slope in the Wharton vein is opened by a tunnel from No. 1 slope. No. 1 slope is sunk on the Mammoth vein from the surface, while No. 10 is a subterranean slope, from near the top of which another tunnel is driven into the Mammoth vein to a point from whence the gangway passes the second opening of the Mammoth vein near the large barn of the company.

The No. 10 slope is about 600 feet long and has a vertical depth of 158 feet where it reaches the basin, which rises westward very rapidly. On this basin gangway, breasts were driven on both pitches, and in breast No. 11, is where the water from No. 8 slope gangway was tapped by a miner, who had no idea of his danger. No. 8 gangway had been abandoned since the 1st of June, 1886, and the slope was allowed to fill up with water to the level of No. 7 slope gangway, where it ran to the pumps in that slope and was pumped out. Relying on the map, which showed a strong pillar for a vein four to five feet thick, the superintendent and mine foreman laid out No. 11 breast in No. 10 gangway, and let two miners drive it. On the 4th day of February the No. 8 gangway was broken into, and,

while the two miners made their escape, three miners, five laborers, and a bottom man drowned by the flooding waters, and their bodies were recovered between February 18 and 23 inclusive.

As soon as I received notice of this disaster I went to Jeanesville, and went into the mines and on reaching the No. 10 slope, found the water within 18 feet vertical of the top of the slope or 140 feet vertical over the foot of the slope, and more than 80 feet higher than the tops of any of breasts in the southeast gangway, and over 40 feet above the top of No. 5 breast on the northeast gangway where living men were found. Finding that everything possible was being done, and that two pumps had already begun to work on the flood, we came away and examined the maps, and after a careful look over them it was decided to place a pump in No. 7 slope and follow down on that side with the pump until it was ascertained that the water from No. 8 workings was no longer discharging into No. 10 workings, and so faithfully was the work prosecuted that two weeks from the day of the accident, one body was recovered, and on Monday afternoon, February 23, by one o'clock, all the missing persons but four had been accounted for. As on Sunday the 22nd, the bodies of two miners and two laborers were discovered in breast No. 1 of the southeast gangway, and on examination of the breast, it was found that they had been closed in at the top of the breast, and for 18 feet from the high water mark in the breast their footprints were found in the mud, showing how they had followed and noted the receding of the waters. For some reason they had built a fire, and placing it in an iron powder keg, had put coal on it and by this act had consumed the life sustaining oxygen from their compressed air, in which they were hermetically sealed as it were by the water, and then their lives went out with the fire and they were asphyxiated by carbonic oxide gas, as were even the rats which were found with them dead.

Finding that all the bodies that were supposed to be on the lower levels were recovered, and that the last four missing would be likely to be found in the pitch in one of the breasts we were in that afternoon, and finding black damp in the manway of No. 5 breast, a brattice was carried along the gangway from the pillar on the south side of the gangway before it branches into the two gangways, and the brattice was run to the pillar between breasts 5 and 6, and it being after five o'clock it was determined to go out and have supper and let the air work on the damp while we were gone. About seven o'clock an exploring party started up the inside manway of No. 5 breast, and after going to the first heading the foreman rapped on the manway and halloed, and then in silence that followed what was his surprise and that of those with him to hear a weak faint voice halloo back, then indeed there was excitement in that mine, for word was passed out for a doctor, that one man had been found alive and it seemed as if everybody was endowed with new strength, and while the Superintendent went to the top of the breast, some tried to get more air to the upper heading and some were dispatched to the slope for bed quilts and blankets and to hurry the doctor in so as to give the men, who all four by this time were discovered to be alive, some proper nourishment and to advise about their removal from the mine.

A doctor who was visiting in Jeanesville came right into the mines where the men were and advised getting them down as soon as possible and into better air, and this was the hardest part of all the rescue, for here were four men helpless as babes to be taken down a narrow space of less than three feet wide in many places and not more than two feet high in some places, but the human toboggan was formed to

carry this precious freight down this 45° pitch and they landed them all one at a time safely at the foot of the breast, and thence willing hands carried them to the slope where they were placed on a truck and hauled to the top of the slope and placed in improvised beds in the engine room where the doctor thought best to keep them till the next day, and very early in the morning they were removed from the mines to the Sons of Temperance Hall. In a few days three nurses were brought up who stayed and nursed them until they were out of danger.

#### April 20, 1892; Lytle Colliery; Minersville, Pa.; 10 Killed

(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1892, pp. 248-259)

This property in former years had been worked very extensively, both on the east and the west side of the colliery now being opened. However, the old maps showed that there was a boundary pillar standing between the old western and the eastern workings, or what is better locally known as the Wolf Creek and the Forestville workings. As this pillar was about the only available place in the territory to open the property by a slope, the company determined to open up their colliery at this point, and sink their slopes in the boundary pillar on the Primrose slope. On the east side of this new slope opening, the Primrose vein had been worked to a depth of fifteen hundred feet below water level, or about nineteen hundred feet below the mouth or top of the new opening.

On the west side, the condition of things was much more favorable, because the workings of the Primrose vein on this property had not been operated very extensively. A slope was formerly worked on this seam, known as the Old McDonald colliery, but was only worked one lift below water level, or about three hundred feet, and the gangway driven eastward up to the boundary pillar, or, thereabouts.

The new openings consist of two slopes; the one on the eastern side was sunk through the old water level workings for a distance of about four hundred and fifty feet. At this point the old Wolf creek water level was reached. The west side, or the main hoisting slope, was sunk in the boundary pillar, and was continued down about two hundred feet below the water level. In order to guard against accidents by reason of the water on the east side, holes were bored a distance of forty feet, and five feet apart, as the slope was being sunk. At the time of the accident the sinking of the slope had been discontinued for the time being, and two tunnels were being driven, one north and the other south. The latter was extended to reach the old workings on what is known as the old Red Ash, or Diamond vein workings, which would give them a lower level of about ninety feet vertical to deliver the water into from the old workings. During the progress of this work on the lower level, a gangway was being driven westward on the old water level above, with the intention of tapping and drawing off any water that might have lodged in the old McDonald workings above this level.

In driving this gangway, bore-holes had been bored from fifty to one hundred and twenty feet in advance. Finally the bore-hole reached the old workings, tapping the water, bringing considerable relief to all parties connected therewith. However, the relief was only of a short duration, for in two or three days after the tapping of the water, it burst into the mine, filling up the lower lift and drowning the ten persons employed in driving the tunnels, notwithstanding the

care taken to ascertain to what distance the old workings had been extended eastward, both from old maps, and from old miners who had lived and worked in the vicinity of the colliery, and more particularly from those who had worked in the colliery when it was abandoned.

Some of the old miners had a fair recollection of the extent the gangway had been driven, but unfortunately no one appeared to know, or else it had been forgotten that there had been an old water level drift worked on this seam and abandoned some forty-four years before. Nevertheless a water level had been worked, and the gangway extended several hundred feet east beyond the slope gangway, where the water was tapped.

In driving this gangway in which the water was tapped, chutes and headings followed up the gangway in the rear for the purpose of ventilation. And to furnish some coal for steam purposes, two hundred feet back from the face of the gangway a breast was started, the officials of the colliery supposing that they had about four hundred feet of solid coal between the gangway and the surface.

However, in this they were woefully (sic) mistaken, for the opening or breast had not been driven more than twelve feet above the heading, when the coal began to show indications of water by droppers falling from the roof and other places.

The inside foreman, on learning of this, told the miners to stop working at the face, and that they should stand a row of props along the face. Before the men had time to secure the face by timbers, it burst out, liberating the impounded water in the old gangway, with the fearful result as before stated.

After the accident, several of the old miners recollected that a water level drift had been worked, and that the gangway from its mouth for a short distance was driven down a dip, in order to gain a longer lift. In order to drain or carry off the water from this drift, by reason of its dipping at its mouth, the operators had taken advantage of the surface surroundings, and had gone down the valley some distance and dug an open cut. Commencing to carry it level from the point from which they started, by the time they had reached the drift gangway they had gained about ten feet vertical height, or they had reached the lowest point of the gangway.

However, years before this company commenced their new operation, all sight and evidence of the old drift mouth and open cut had been obliterated, by their being filled up with material washed down from the hillsides and valley above the opening, forming a barrier or dam, impounding the water in the old water level.

**May 26, 1898; Kaska Williams Colliery; Middleport, Pa.; 6 Killed**

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1898, pp. 235-239)*

On May 26, 1898, a loader boss, a pump runner and four laborers, met their death at the Kaska-William colliery, by water breaking in from old workings which had been abandoned many years before. A tunnel was being driven from the Seven foot vein on the shaft level, south. The tunnel men were working by night, and the laborers were loading the stuff by day. The tunnel men had cut the bottom of the Orchard vein during the night of the twenty-fifth, with the last round of shots fired, but had not gone into the face of the tunnel after firing, so that they did not know that the vein had been cut. The fire boss, in making his rounds in the morning discovered that the vein had been cut, and so

reported to the inside foreman, who took some men with him and drilled a hole in the vein about six feet long to find its thickness. During this time the laborers were engaged in loading the stuff that had been cut by the shots fired during the night before. The colliery was idle on the twenty-sixth, and no men were at work in the inside slope, which is about 360 feet deep below the shaft level, the tunnel being 400 feet west of the top of the slope. About 11 o'clock in the forenoon, the loader boss, who was working near the top of the slope, was let down the slope by the fire boss, to feed the mules, and the pump runner, who had been up the slope during the forenoon was let down about 12 o'clock noon, to go to the pump. The fire boss remained at the top of the slope, expecting them to return soon, and was waiting to hoist them up. Between 12 o'clock and 1, the water broke in at the Orchard vein, which had been cut at the face of the tunnel. He heard the water coming and retreated toward the bottom of the shaft, and on the way met the inside foreman, who had been at the pump room at the bottom of the shaft, getting his dinner. They attempted to get back to the slope, but the water was rising rapidly at the bottom of the shaft, and they had to retreat up the shaft. The water rose to the roof at the bottom of the shaft, cutting off all communication with the inside slope, and the tunnel where the water had come from. The steam pipes were broken by the rush, and the pumps at the bottom of the shaft were stopped. The water from the shaft was hoisted by tanks until the 28th, when one of the pumps was reached and started, the second pump being started the following day. On May 30 the shaft was clear of water and the work of clearing up the debris began. The top of the inside slope was closed, also the gangway between the top of the slope and the tunnel. The timber and track in the hoisting slope had all been washed down the slope, and the workings below were filled with water to within 166 feet of the top of the slope. The pump slope which is 75 feet west of the hoisting slope, was filled tight with stuff that had been washed out from the tunnel. The hoisting slope was retimbered down to the water and the pumping of water out of it began on July 22. In the meantime, the cleaning up of the gangway from the top of the slope toward the tunnel was being done and the first body was found buried in the debris in the night of July 2, and the second body on July 9. The mouth of the tunnel was reached July 14, and the third body found on July 27 in the gangway west of the tunnel. The face of the tunnel was reached on August 16, when it was found that the old gangway on the Orchard vein, from which the water had come, was about 15 feet on a pitch of 50 degrees above the top of the tunnel. The body of the fourth man who was in the tunnel was not found and had evidently been washed down the slopes, along with a mule and three mine cars that were on the shaft level when the water broke in. The Orchard vein slope, from which this water broke in, had been abandoned many years ago and was caved in at the surface. In the latter part of 1896 the company began to reopen it and on February 10, 1897, got down to the water, which was 185 feet from the top of the slope. The water was being pumped out, but the slope being full of debris, it went down slowly and was finally stopped. On November 13, 1897, the superintendent of the colliery told me they were going to drive a tunnel from the Seven-foot vein on the shaft level to the Holmes and Primrose veins. I immediately got out the Geologic Section, which was the only section in my possession, and which showed that the Orchard vein did not come down to the level of the proposed tunnel, so that it would not be of any use to drive the tunnel any farther than the Primrose vein if the section was correct; and, if it was not correct, it would

be of no use, as the Orchard vein had been already worked. As this plan was perfectly feasible, I could raise no objections, and considered it would not need much watching until the Primrose vein had been cut and the holes were being driven up the pitch, and only then after they had been driven up a couple of hundred feet, as there was ground enough above that to allow for any inaccuracy in the elevations which the Geological Section had marked as only estimated, and which could not be relied upon.

After the water had broken in on May 26th, I found that the tunnel had been driven beyond the Primrose vein and had cut the Orchard vein, which had come down below the level of the tunnel, instead of making a basin above, as the Geological Section had shown. That the Geological Section was not correct was plainly apparent after the Holmes vein had been passed and when the Primrose vein had been reached, and the tunnel continued, it was plain that the Orchard could be cut on this level, and the superintendent had been expecting it to be cut for several days before. Yet, knowing this, he failed to take the ordinary precautions which were necessary for the safety of the lives and property under his charge.

The boss laborer, it seems, had been in the habit of firing any holes left unfired by the tunnel men, during the day shift. That morning there had been a top hole left unfired. The contractor said he had put the blasting battery in the box and locked it before he left that morning, the boss laborer also having a key to the box. After the accident the blasting battery was found washed out near the pump room with the wires attached. The box in which it was kept has not been found yet, so that it is evident that after the officials left the tunnel, the boss laborer had fired this top hole, and no doubt put powder in the hole that had been drilled to test the vein and fired that also, which broke the barrier of coal between the tunnel and the water. This barrier had held the water back for ten or eleven hours, after the tunnel men had fired during the night.

### July 24, 1912; Superba and Lemont Mines; Evans Station, Pa.; 18 Killed

(From "Mines and Minerals," September 1912, pp. 69-71)

On July 24 a tremendous downpour of rain occurred in the vicinity of Uniontown, Pa., that found its way into the Superba mine and trapped 14 men. At about the same time the flood found its way into the Lemont mine about 1 mile away, drowning four men.

Both the operations are in Fayette County, a few miles northeast from Uniontown, Pa. Superba, the smaller mine, is at Evans Station, and is purely a coal-shipping proposition working on one of the upper measures known as the Sewickley coal, a bed about 5 feet in average thickness and separated from the Pittsburg (sic), or Connellsville coking seam by some 90 feet of intervening strata.

The main openings of each plant are more than a mile apart and are on opposite sides of the same main valley. The Lemont openings enter direct on the outcrop and with the inclination of the seam; the Superba inlets, in the opposite hillside, swing around in several consecutive angles until they get the natural bearing and follow the same inclinations as the Lemont workings. The dip on the main slope of the Superba mine is about 7 per cent; the Lemont opening is more on a local "backbone" in the basin, consequently somewhat flatter.

The conformity of the surface area covered by the recent flood is not one that would naturally cause apprehension or anticipation of this unusual disaster,

save in the fact that the coal outcrops along the bottom of the foot-hills defining the valley; but the latter is one of ample width and extent, with several miles of gently rolling or undulating country to the base of the regular mountain chain on the east (Laurel Ridge).

The waters did not enter either mine through the natural or expected sources, the regular mine openings, but in each place broke through the surface in the low places of the main valley and where the old workings had been driven up almost to the crop of the coal, leaving but a few feet of surface to cover these excavations. Flowing into these old excavations, it sought its own course, spread in all directions, and was simply beyond human control for the time being. Eventually the body of water covering the valley did rise sufficiently high to flow into the manways of both plants, and in this rise, sections of low country for miles around were covered and impassable (sic), indicating the suddenness and extent of the storm.

The first sign of serious trouble took place about 1 p.m. in the sudden disappearance of a heavy stream of water that flowed along the western ditch of the railroad; immediate investigation showed the water to have broken through the surface at the Superba mine; and from all reports a similar break occurred at the Lemont mine at about the same hour. Sixty odd men were at work in the Superba mine and a full quota of employees at the adjoining plant.

Messengers acquainted with the workings were at once dispatched to notify the men of their danger and then hurry them out as rapidly as possible; and after strenuous effort on the part of the messengers and many narrow escapes, all but 14 of the total in Superba and 4 in Lemont made their way to safety. That effective and very rapid work was done by the messengers is illustrated in one case where a Superba trackman, working in the extreme dip and farthest point in the mine, was rescued along with many others. Of the other 14 men lost, several were within rescue distance, but the rush of the water carrying with it timber and heavy debris, finally battered and beat them back until there were totally exhausted and lost. Much of this final overpowering was due to the additional stream flowing into the traveling way shortly after the messengers started on their journey to notify the men; this new stream caught even the messengers on their return trip and in their then exhausted condition, their escape was only short of miraculous. Also, in this mine, with only 5 feet of height in which to travel, all the men were handicapped, due to the crouched position necessarily maintained; and as the water continued to rise, their space for air supply became rapidly contracted, and all the way through they suffered many physical disadvantages in the strenuous endeavor to make their way to safety through strong current of water, laden with debris, and with the usual passageways blocked with foreign matter.

While a dip of 7 per cent is rather heavy in the usually flat beds of coal in this section, such pitch does not afford, as has frequently been the case in the heavy pitching anthracite seams, highly elevated places to which men can retreat in case of flooding, and where for a limited time they will likewise find air storage sufficient to maintain life, if quick rescue can be accomplished. But in the present case, as the water flowed in the main openings or even the new breaks, it would rapidly fill up all the excavations, and those who could not keep ahead of this rise, would be trapped and covered. As the men were all probably on their way out from the various parts of the mine, where those who became victims met their end it would be difficult to state; many of them would likely be floated off to other parts from where they met the water until they lodged on some obstruction.

In the Superba mine there are probably 40 acres of exhausted territory now full of water, and the length of time required to pump it out is problematic, depending on the success with which persistent endeavor will be met, and the amount of repair work to be done as the work advances. This work of pumping and eventual recovery of the bodies was put under way as quickly as the conditions would allow.

The inundated portion is one of much commercial activity; several railroads, a street railway, and numerous mines and industries, as well as the homes of the employees, are strung along the valley for some miles. Bridges are numerous both on highway and rail, indicating the tortuous course of the streams; and the stoppage of water through a few of these at a critical time becomes a serious matter. It would appear that it might be good policy for the numerous industries to come to some arrangement for establishing of definite water channels. While the possibilities of a similar flood are equally for and against its occurrence, an investment of the kind here referred to will be of much smaller moment than the many thousand dollars lost in a few hours during this recent downpour; and the guarantee of safety to the men working underground will be a feature far more commendable and of greater moment than any monetary consideration.

### December 17, 1917; Wilkeson Mine; Wilkeson, Wash.; 6 Killed

(From Bureau of Mines report by G. W. Evans)

This accident occurred at midnight Monday, December 17, 1917, and resulted in the death of six men. Four bodies have been recovered to date, but the other two bodies have not yet been reached, although efforts are still being made to reach them. The accident took place in a water level working in what is known as the No. 3 South Gangway.

Two men escaped with their lives from this accident. According to their statement, they were knocked down and rendered temporarily unconscious by the concussion of air at the time of the accident. Their lights were put out at the time, and they do not know how long they remained unconscious, but it was probably not more than five or ten minutes. They were revived no doubt by the air readjusting itself after the first concussion, and, upon regaining consciousness, they started down the chute from the point at which they were working. They were working at the top of chute 22 at the seventh crosscut, and hurried down the pitch to the fifth crosscut, which is the intake airway and manway to the surface. When they reached the fifth crosscut, they encountered water and glacial clay and they had some difficulty in getting over the material into the main part of the airway. They had great trouble in getting out to the surface for the reason that this airway is very long and has varying pitches, goes through several rock tunnels and rock chutes and finally comes to the surface at a point a mile or a mile and a half from the place at which the accident occurred. They then hastened to Wilkeson in the dark, and, upon arrival there, notified the general foreman of the Wilkeson Mine.

He found, on entering the mine, that the glacial clay and water had come out into the fifth crosscut to No. 13 chute and on reaching the gangway found that the material had come out as far as the No. 7½ chute. He immediately organized rescuing parties and began cleaning up the track so as to get cars and the materials in to effect a rescue. The air had to be re-established in several instances and the work of cleaning up the track was very slow and laborious.

Four shifts of men, working six hours each, were placed on this work and every available space was covered that could be, in order to hasten the rescue work. This work was continued until 6 a.m., Dec. 21st, at which time the Deputy Mine Inspector for the State of Washington, reported the working faces, especially up the pitch, unsafe for the rescuers to do any further work in. He found that the glacial clay had been rendered more plastic by reason of the presence of the second inrush of water and that the clay had started to run again and he felt that it was better to delay the work until such time that the clay had settled. About this time a conference was held with the officials of the miners' union, the State Mine Inspection Department, the two men who escaped from the accident, and the rescuers, and it was decided that the men imprisoned could not possibly be alive at this time and to continue the work might result in losing other lives. It was thought best to take due care for the safety of the men who were doing the rescue work.

After the material had settled in the chutes and crosscuts, the work has continued and on January 18th at 6 a.m. one body was found in 21 chute on January 19th at 5 a.m. another body was found at No. 20 chute, and on January 20th at 8 a.m., the third body was found in No. 20 chute also. At 4 a.m., January 23rd, the fourth body was found in chute No. 21½. The rescue work is still in progress, but instead of working along the gangway and the first counter, as has been done formerly, it has been thought best to get into the chutes from the fifth crosscut. It was found on inspection made February 5th that the material was becoming rather plastic and oozing out from among the timber that had been placed to hold it back. Therefore, it was thought safer to approach these places from above rather than from below.

The No. 3 South gangway is a water level drift driven on the No. 3 bed, which dips from 30 to 35°. This bed contains in the neighborhood of 10½ to 12 ft. of coal and other material that is mined. The bed in this part of the mine dips at angles varying from 35 to 42°. The roof is composed of a sandy shale that is extremely short grained and considerable difficulty is found in holding this roof over any great area, and for this reason, the roof caves immediately back of the area from which the pillars have been removed.

Three stages of work are indicated. The gangway and first counter are driven together and at intervals narrow chutes are driven from the gangway connecting the first counter, and above the first counter breasts 15 ft. in width are driven up the pitch with connecting crosscuts at every 40 ft. These breasts are carried up the pitch to the fifth counter or to a point four blocks above the first counter. The fifth counter constitutes the intake airway after the chutes have been driven and remains the permanent intake for this portion of the mine. Shortly after driving these breasts and crosscuts, a squeeze comes on which closes them and for that reason then only two openings remain open into this part of the mine, and are the main gangway and the fifth crosscut or second counter. The second working then consists of opening up these former breasts and cogs are placed along the rib to protect the sheet iron chute, which is carried up between the cogs. Above the fifth crosscut then, chutes 5 ft. in width are driven up into the solid coal, and when a pre-determined point is reached, such as the twelfth crosscut, the pillars are removed. The second working then consists of driving the narrow chutes, connecting crosscuts. The third working consists of removing the pillars by means of skips as indicated.

As noted heretofore, the roof is extremely short grained and brittle, for that reason they have great difficulty in holding up any considerable area of it under which the coal has been removed. For this

reason, then, it is very unlikely that any considerable area of this roof had remained standing unsupported in the district that has been mined out, inside of chute No. 25. It is more than likely that the roof has caved close to breast 25 and the chute which continues up the pitch above the fifth crosscut which might be considered a continuation of breast 25.

We have just stated that everything indicates that no considerable area of roof remains standing. For this reason then the blast of air that occurred probably could not have been originated by an extensive fall of roof. It would clear this point absolutely if it were possible to get into the area in which the accident has occurred, but, judging from the appearance of the working, it is very doubtful if this area will ever again be reached, and, for that reason then we are giving the information we have at hand at this time, and our theory is based upon the information we have so far gathered.

The greater portion of the Puget Sound area, of which this mining district is a part, has been glaciated and in many places thick deposits of glacial material overlie the coal beds and coal areas. Prior to the glacial period, pre-glacial streams had cut channels which drained the coal area topography of that time. In addition to well defined stream channels, pot holes were also developed.

Immediately above the coal occurs a stratum of this fine grained glacial clay, approximately 70 ft. in thickness. Above this glacial clay occurs a very coarse glacial gravel, in which boulders 2 ft. in diameter are common. We observed further that the surface water, which filters into the surface gravel, appears in the air chute in the form of a spring at the contact between the glacial clay and the coarser gravel. We observed further that beneath the glacial clay and next to the coal outcrop there was no sign of water coming from this source, but that the water occurring in the air chute, came from above at the contact as indicated.

What might have happened in this case. A pot hole reaching below the general surface of the ground, might have occurred at some point, such as near the top of chute 24 or 25 and extended down to within a short distance of the coal bed. A narrow channel cutting across the measures at right angles to the line of strike might have had similar effect on this particular part of the mine. At the time of the deposition of the glacial material, this pot hole or narrow channel would naturally be filled with the glacial clay up to the top of the opening and then we would have above this the accumulation of 70 ft. or more of the material or until the area affected had reached the level formed by the deposition of this clay. On top of this clay, then, was deposited the coarse glacial material we now find in the air chutes connecting with the surface.

Any water occurring within this channel or pot hole at the time of deposition of the glacial clay might be trapped beneath the clay, and the further deposition of clay and accumulation of gravel above the clay would cause this water to be under considerable pressure. If this condition did exist, and the cave should have occurred at this point, the inrush of the water under pressure would account for the concussion of air that occurred and which rendered unconscious the two men who escaped. The fact that there was only one inrush of water at the time of this accident and the slight inrush several days later would indicate that no surface stream of any magnitude had been encountered, and that the surface, as far as we can determine, has not been disturbed, and the further fact that no coarse gravel has thus far been found within the mine would indicate that only the glacial clay had come into the mine workings and that the cave had not yet, at least,

brought through the glacial clay allowing the coarser material to come in.

The absence of any quantity of roof material in the mine workings would indicate that no large portion of the roof had come in at the time of the accident.

We have searched very carefully for a distance of one-fourth of a mile above the probable seat of this accident, looking for any sign of a break in the surface, but have been unable to find any indication that the surface has been in any way disturbed.

This condition might have been caused by accumulation of glacial clay and the pre-glacial channel or pot hole and the material running out of the channel or pot hole but not extending up into the 70 ft. of material which might bridge the top of the opening. In this manner then the clay was not weakened sufficiently to allow the weight of gravel above to break through the roof of clay and into the mine. Water trapped at the foot of this channel or pot hole will be under great pressure. The first opening could have been dammed temporarily after the first inrush of material, and water perhaps accumulate back of this temporary dam, and the releasing of this dam could probably account for the second slight inrush which alarmed the mine inspector at the time he called off the rescue work temporarily.

#### April 8, 1927; Carbonado mine; Carbonado, Wash.; 7 Killed

*(From Bureau of Mines report by John G. Schoning)*

About 12:45 p.m. on April 8, 1927, a cave-in occurred in the Carbonado mine in which seven men were killed by the downrush of gravel, mud and water.

These men were working in the North Morgan seam which is from 15 to 20 feet thick, and pitches from 60 to 80 degrees, and is covered with about 200 feet of gravel, clay, and earth, which without warning gave way and rushed into the mine burying the men who were in its path.

Six of the men killed were engaged in pulling pillars. The seventh was a motorman leading a trip of coal out of number 5 chute.

To extract the pillar, an angle chute is started above the cross-cut and driven to about the center of the block, then up through the block to the cross-cut above, then through the block above the cross-cut, after which a round of holes are drilled, and the holes loaded and blasted at one time, thus shooting down all of the coal in the block at one time. This is called booming the pillar. The coal is then run down the chutes and loaded into cars on the gangway. When rocks start to run down the chute the pillar is abandoned and work started in the pillar below.

Two men were engaged in this work in the fourth cross-cut between number 5 and 6 chutes. One was caught by the rush of gravel and mud but was taken out alive within a short time after the cave, none the worse for his experience. He was held directly on top of the other by the debris, and while he was unable to get out without help, he tried to keep the other's head above the water and mud but found this impossible. The dead man was dug out of the mud between 4 and 5 chutes at about 2:30 p.m., Friday, April 8.

Two bodies were taken out of number 7 chute at 3:00 a.m. and 11:00 a.m. on Monday the 11th.

The motorman's body was found in number 5 chute, just below the bulkhead, early Monday morning April 18. A miner was found in number 5 chute at the foot of the angle leading up to number 3 and 4 chutes, on April 20, and another was taken out of the angle chute above the first cross-cut between 4 and 5 chutes. He

was recovered on Saturday morning, April 23. (It appears that one body was not accounted for in the report.)

The gravel came down in three distinct rushes or surges according to the men who were working near the affected area. Presumably it came into the mine faster than it could get down the pitch through the workings, and would be held up for a while then it would taken another surge.

When chutes were driven up the pitch some of them would be driven through to the gravel. This was done for two reasons. To find out where the gravel was, and also that it might be used as filling. The contact between the gravel and coal was not regular, number 4 chute running into gravel about 30 feet above the sixth cross-cut, while it was struck in the sixth cross-cut between number 6 and 7 chutes, but not in number 6 chute.

Up at the fourth cross-cut and above it the pitch was about 70 degrees, and the hanging wall was very hard to break, and it was nearly impossible to cave a place after the coal had been extracted, therefore if the gravel did not run in there would be a large open place left.

Evidently there was a lot of open country up around number 7 chute, and the heavy winter rains loosened up the gravel so that it let go and came into the mine with a rush, carrying everything before it as it came. The cave left a hole about 100 feet long by 50 feet wide by 50 feet deep.

Six holes were fired in number 6 pillar about 11:30 a.m. on the morning of the accident. The resulting jar, and the weight of the water soaked gravel, the large open space where the coal had been extracted in seven and eight pillars, the steep pitch on which the mining was being done, all of these no doubt played a part in causing this cave-in in which seven men lost their lives. The exact cause of this accident will probably never be known.

### March 27, 1952; Holmes Slope Mine; Forrestville, Pa.; 5 Killed

*(From Bureau of Mines report by E. H. McCleary and others)*

A sudden inrush of water occurred in the Holmes Slope mine, about 8:35 p.m., Thursday, March 27, 1952, causing the death of five workmen. Two other men who were near the slope bottom when the inrush of water occurred were able to escape. Only seven men were employed underground on the second shift. The accident occurred when a round of blast holes in No. 6 breast off the west Holmes gangway broke into old workings of an abandoned "bootleg" hole.

In years past numerous "bootleg" holes or mines were operated in this area, but records or maps of these operations were not made. In later years the area was strip mined and the openings of these "bootleg" holes or mines were destroyed or covered; therefore, they were not shown on current mining maps.

The open breast-and-pillar method of mining was used, but current production was obtained from two breasts and development of the gangway. Coal produced from the breasts was loaded by gravity onto a chain conveyor and that from the face of the gangway was hand-loaded onto the same conveyor, which transported it to a "buggy" near the bottom of the slope. The west Holmes gangway was turned at a point approximately 40 feet above the bottom of the slope and was driven on the strike of the vein for a distance of 340 feet. "Monkey" headings driven between the chutes were utilized as an airway. The gangway was

about 10 feet in width and the airway averaged from 6 feet in width. Chutes, 8 to 10 feet in width, were driven from the gangway to the "monkey" heading at which point breasts of approximately 20 feet in width were driven up the pitch.

It was stated during the investigation that preshift, on-shift, and weekly examinations were not made by State-certified officials, nor was a State-certified official employed to supervise the operation of the mine.

At the start of the shift a cut of coal was blasted off the solid face in the west Holmes gangway and this coal was loaded out about 5 p.m. While the workmen were drilling for another cut of coal in the gangway, the shift leader entered No. 7 breast. Arriving at the face of the breast he saw that a round of blast holes fired by the day shift had not completely removed the cut and that there was another hole to be fired. He charged this blast hole and after warning the other workmen of his intentions, he fired it. While this work was being done, the No. 6 breast workmen stood several props and drilled and charged an undetermined number (believed to be 10 to 13) of blast holes. When all was in readiness for blasting in No. 6 breast, these workmen retreated to the gangway and informed the men working therein that they were ready to blast. By this time the gangway workmen had loaded about half the coal from their second cut. All retreated along the gangway to a point between Nos. 4 and 5 chutes. The shift-leader asked the time and was informed that it was almost quitting time. He realized that it was necessary to operate the pumps before leaving the mine and hurried out of the gangway. He was about 5 feet from the head of the conveyor near the foot of the slope when he heard a blast, followed immediately by a second blast and a loud rumbling noise and a terrific gust of wind. Observing the conveyor operator, near the east gangway entrance and believing that an explosion had occurred, he called to him to get up the slope. As the two men hurried up the slope, the "buggy" passed them. They signaled the hoisting engineer to stop and then to hoist the "buggy." Arriving on the surface the hoisting engineer was instructed to go to Minersville for help as it was believed an explosion had occurred. Shortly after the hoisting engineer went for help they heard the signal bell and they believed someone inside the mine was calling for help. The leader immediately manned the hoist and the "buggy" was lowered into the mine. When it was returned to the surface it was wet. It was then decided that one would operate the hoist and the shift foreman would follow the "buggy" as it was again lowered in the slope. He walked about 25 feet back of the "buggy" as it was being lowered. When the "buggy" was about halfway down he heard it splash in water and then he realized that it had not been an explosion but an inrush of water. He then started to return to the surface and had reached a point about 30 feet from the slope portal when he became exhausted and had to be helped from the mine.

After determining the approximate amount of water in the mine, it was decided to obtain three electrically driven pumps from Pittston, Pennsylvania. The three pumps, each of 220-foot head, 250 gallons-a-minute capacity, arrived at the mine about 6 a.m., March 28. Work was immediately started to install one of the pumps and it was in operation at 12:45 p.m., March 28. However, this pump was not operating efficiently, therefore, a second pump was substituted at 4:30 p.m. the same day. A larger pump was also installed at 6:30 p.m. The smaller of the two pumps was later replaced by a large pump which was put into operation at 5:07 p.m., March 29. These two larger pumps operated continuously except when it was

necessary to move them closer to the water as it receded, until the water was below the level of the West Holmes airway, and then the operation of one pump was discontinued. The total amount of water pumped from the mine during unwatering operations was estimated to be 1,200,000 gallons.

As the water receded, investigators and workmen were able to enter the west Holmes airway, and the first body was observed in the gangway through No. 3 chute at 2:15 p.m., March 30. This body was brought to the surface at 4:30 p.m.

After further exploration, the bodies of three other victims were found near the face of the west Holmes gangway at 5:50 p.m. Owing to the large amount of debris and loose material hanging in No. 6 breast, it was necessary to stand numerous props and install lagging in No. 6 chute before these bodies could be recovered; therefore, the last of the three was not removed from the mine until 12:30 a.m., March 31. A stream of water was still running from No. 6 chute at the time. The body of the fifth victim was found at 1 a.m., March 31, near the face of No. 7 breast where it was lashed to a prop by a belt. This body was brought to the surface at 2:03 a.m.

Flooding of the mine caused property damage to two small pump motors and a conveyor motor; however, considerable debris covered the pans of the conveyor line in the west Holmes gangway. The entire mine was abandoned and all of the equipment, except part of the conveyor line and one of the pumps, was removed before the investigation was completed.

Legible water marks on the roof, floor, and sides of No. 7 breast indicated that the water had only risen to within 25 feet of the face of this breast. Although the water rose to a higher elevation in the slope, it is believed that the compression of air in No. 7 breast prevented the water from rising to a higher elevation therein. The No. 6 breast could not be explored owing to large rocks and washed material having closed the breast and chute; however, a stream of water continued to flow from this breast.

The water that flooded the mine and caused the death of five workmen entered from abandoned "bootleg" workings immediately after blasts were fired at the face of No. 6 breast. Testimony of former operators revealed that the York tunnel area, in which the Holmes Slope mine was located, had been extensively mined in former years by "bootleg" operations that were not recorded nor mapped.

Information relative to a possible dangerous body of impounded water in the area was given to one of the operators by a former "bootleg" miner, however, this information apparently was not checked thoroughly to determine its accuracy. It was further learned during the investigation that six "bootleg" holes had been formerly operated in the same vein and in the immediate area as the Holmes Slope mine.

Testimony given during the investigation indicated that stop distances had been determined by the official in charge of underground operations for breasts driven off the west Holmes gangway. This official stated that these stop distances would leave a 100-foot barrier between old workings and the faces of the advancing breasts. Apparently the determination of stop distances was based on the belief that none of the abandoned workings was more than 180 feet in depth. However, from information available, the No. 6 breast had been advanced beyond a point that would have left a 100-foot barrier.

Although the operator was cognizant of the fact that abandoned "bootleg" workings existed in the area, test holes were not drilled in the faces or in the ribs of advancing breasts.

## January 22, 1959; River Slope Mine; Port Griffith, Pa.; 12 Killed

(From Bureau of Mines report by William Rachunis and G. W. Fortney)

The Susquehanna River broke into the River Slope area of the May Shaft section, Schooley colliery, Thursday, January 22, 1959, at 11:42 a.m., entombing 12 men and causing extensive property damage. A total of 82 men was in the mine at the time of the river break-in, of whom 38 escaped unassisted and 32 were rescued. The break-in occurred in the Pittston vein at or near the point where the shaker chute crosscut, which was driven at about a right angle off the slope and over an anticlinal, intersected a chamber that was previously driven from a lower level. The shaker chute place was driven from a point where the rock slope first intersected the Pittston vein. The aforementioned places had been driven 90 feet beyond a safety stop line, and within 70 feet of borehole No. 1146 where core drillings indicated the rock strata to be only 19 inches in thickness between the river bed and the Pittston vein. The break-in was caused by mining in an area beyond the safety stop line beneath the river where the thin rock strata was insufficient to support the weight of the ice-laden river. The ice-laden river had risen from 2.1 feet above the zero mark at elevation +512.07 feet at the Federal-State Flood Forecasting Service Station at Wilkes-Barre, Pennsylvania, at 7 a.m., January 19, 1959, to 15.6 feet at 10:45 a.m., January 22, 1959, the day of the occurrence.

The principal mine openings are the River slope and May shaft. Three other shafts in adjoining areas were available for emergency escape from the underground workings. The River slope, about 245 feet long, was driven in rock on about 25° pitch to where it intersected the Pittston vein. The depths of the shafts were as follows: May shaft 332.37 feet; Hoyt shaft 528.84 feet; Schooley shaft 579.90 feet; and Eagle air shaft 60 feet.

Mining was being done in the Marcy and Pittston veins which lie flat to a maximum inclination of 45°. The average thickness of the Marcy vein is 4½ feet and the Pittston vein 11 feet. The immediate roof overlying the Pittston vein was slatestone ranging from 2 inches to 37 feet in thickness, and the main roof was sandstone ranging from 1 foot 5 inches to 51 feet in thickness.

The mine was operating on the day of the occurrence. The temperature soared from a low of 7 degrees Fahrenheit on January 19, 1959, to a high of 62 degrees Fahrenheit on January 21 and 22, 1959. This accounts for the ice-laden river at the time of the occurrence, as thick ice had formed upstream during November and December 1958 and the early part of January 1959. Precipitation during January 1959 was above normal, according to the U.S. Weather Bureau at Avoca, Pennsylvania; the official reading was 2.99 inches, which is 0.73 inch above the normal of 2.26 inches. The fireboss' book did not indicate any unusual condition underground prior to the inrush of water. It is believed that the extra weight of the swollen ice-laden river was a contributing factor in the river break-in at the River Slope mine.

Six men reported for work at the River Slope section at their usual starting time, 7 a.m., on January 22, 1959. Three of the workmen were assigned to continue the work of developing a slope in the Marcy vein, and two were directed to remove shaker pans in the Pittston vein where mining had been completed. The sixth man was a certified assistant mine foreman



who examined the two workings areas during the pre-shift and on shift. Other workmen at the colliery were assigned their respective tasks and area locations at the May shaft office. The assistant foreman visited both working areas and instructed the men in the Marcy vein to pull down some loose roof and to stand a timber set. Reportedly, there was no evidence of weight and the supports were intact in the Pittston vein area during the examination; the workmen assigned there began removing the shaker pans. About 11:30 a.m., the men heard a prop crack in the place that had been driven over the anticlinal. The miner-in-charge went down to the Marcy vein working place and informed the assistant foreman of the condition, and the assistant foreman informed the Marcy vein workmen that he was going up to ascertain conditions in the Pittston vein and inquired of them if they wanted to go outside for lunch while he was examining the upper area. Reportedly, the men stated that they would finish the car they were loading before eating lunch. The assistant foreman and miner proceeded up the rock slope to the Pittston vein intersection where they met the other workman. As they were starting into the chamber off the slope, the roof gave way and water and debris rushed in with tremendous force; this was at 11:42 a.m. The three men, realizing that the river had broken through and that it was impossible for them to be of assistance to the three workmen in the Marcy vein, which was almost directly below the intruding raging water and debris, hurried up the slope to the surface. The assistant foreman telephoned the colliery superintendent informing him of the situation, and the superintendent then telephoned the various underground working sections issuing orders that all men be notified to get out of the mines immediately. He also notified the operators of adjacent active mines of the serious situation and suggested that they remove workmen. Such prompt and thoughtful action undoubtedly saved many lives. All the affected companies removed underground personnel immediately upon notification.

Twenty-three men working in the vicinity of the May shaft area escaped via the shaft at various intervals, some of whom traveled through ice-laden water and debris. Reportedly, one of the victims was lost in this area when he stopped to change his grease-covered clothing, which was his regular habit before leaving the mine. Eleven men working in the Hoyt shaft area escaped via that shaft, but traveled through water to reach it. Thirty-three men escaped via the abandoned Eagle air shaft, after wandering around for several hours. The first seven of these men found their way to the bottom of the shaft at approximately 2:45 p.m.; one of the men was able to ascend the shaft unassisted and reported the location of his fellow workers to the people standing by on the surface. The remaining six of the seven-man group were assisted up the shaft by insulated wire cable pulled by men on the surface. Rescue men entered the mine at 5:30 p.m., and the remaining 26 men were located at 6:45 p.m. These men were assisted up the shaft in the same manner, except that a 1-inch hemp rope was used instead of the insulated wire cable. As of this writing, the 12 missing men are still entombed in the mine.

Extensive damage was evident in areas that were in the direct path of the intruding ice-and-debris-laden water where examinations were made in areas that were unwatered. Roof supports and heavy equipment in these areas have either been swept away or moved from their original positions. Mine workings, some

active and some inactive, were either inundated or partially flooded as far northeast as No. 4 shaft, and as far southwest as Henry colliery.

Work of blocking the breach was begun soon after it occurred. The eastbound track of the Lehigh Valley Railroad was broken and diverted toward the area of the break-in. Railroad gondolas, small mine cars, bales of excelsior, and other available materials were dumped into the opening. Heavy equipment, such as autotrucks, bulldozers, and cranes were placed in operation on January 23, 1959, the morning following the break-in, and large bounders were dumped and pushed into the opening along with the other materials. This work continued around-the-clock, and on January 25 the opening was blocked sufficiently to stem the fast inflow of water to a much lesser degree. Following this lessening of inflow, the break-in area was surrounded with a semi-circle of large rocks and earth materials having a radius extending into the river about 185 feet and on a level with the railroad bed. This work lessened the inflow of water further, but an estimated 20,000 g.p.m. of water was still inflowing.

Twenty-two deep-well pumps ranging in capacity from 3,000 to 6,000 g.p.m. were installed at the various shaft openings affected by the break-in. The first of these deep-well pumps started operating at 3:26 p.m., February 3, at Schooley shaft and the last one at 11:30 a.m. on March 17 at Hoyt shaft. The affected area was unwatered from a high water elevation of +502.25 feet reached at 8:30 p.m., January 25, to an elevation of approximately +200.00 feet, which is being maintained by the operation of four deep-well pumps at the time of this writing, June 5, 1959. As of June 6, 1959, more than 11 billion gallons of water had been pumped from the involved area.

Work of installing a concrete bulkhead in the underground break-in area began March 11, 1959. Workmen erected two underground bulkheads of heavy planks and timbers across openings adjacent to the plugged area after reinforcing the inside area adjacent to the railroad gondolas with steel rods inserted into the floor, roof, and ribs. Four boreholes 8½ inches in diameter were drilled from the surface into the break-in area, and 1,230 cubic yards of concrete were poured into the void. This work reinforced the involved area sufficiently to stop pressure on pillars and timbers along and over the slope where the Pittston vein was first intersected and where the break-in occurred. Further sealing and reinforcing is being done, continuing from this area and extending to the offcourse and under-river chambers to the lower end of the slope. Work of erecting an earth cofferdam to surround the break-in area began March 25, 1959, by extending two dikes from the eastern shore line of the river (one above and the other below the break-in area) to Wintermoot Island in the river. The third side of the dam was erected on the island. This work was done to divert the river to the western side of the island while a permanent seal was being erected in the break-in area. The cofferdam was completed on May 27, 1959, which decreased the inflow of water into the underground area to an estimated 400 g.p.m.

Workmen began relaying the washed-out track on May 11, 1959, down to where the water was overflowing from the Pittston vein into the Marcy vein. Water was bottled up in this area because a 4-inch borehole, used for drainage in the area, was blocked. This area was unwatered by installing a portable sinking pump of

1,200 g.p.m. capacity. The area down to the third left chamber off the lower Pittston vein intersection has been recovered. These three chambers lead to the two offcourse and three under-river chambers in the Pittston vein in the break-in area. Present plans are to erect bulkheads in these and other recovered chambers and to drill boreholes from the surface into the involved area, to flush a large part of the area mined under the river, and to complete the sealing with concrete.

Searches were made in accessible openings of the affected areas, however, no trace was found of the bodies of the 12 victims.

(None of the bodies were recovered. Eventually, all pumping operations were stopped, which resulted in the flooding and abandonment of mine areas north of Wilkes-Barre below the level of the underground pool.)

TABLE 5.—Major disasters by explosives

Date	Name of mine	Location of mine	Killed
1894: July 17.....	West No. 1 Slope <sup>1</sup> .....	Stockton, Pa.....	8
1900: November 2.....	Berryburg.....	Berryburg, W. Va.....	14
1902: December 9.....	South Wilkes-Barre <sup>1</sup> .....	Wilkes-Barre, Pa.....	5
1904: January 30.....	Maple Hill <sup>1</sup> .....	Mahanoy City, Pa.....	5
May 5.....	Lance <sup>1</sup> .....	Plymouth, Pa.....	5
1906: May 15.....	Shenandoah City <sup>1</sup> .....	Shenandoah, Pa.....	7
December 20.....	No. 1.....	Stone City, Kans.....	7
1907: January 29.....	Johnson City.....	Johnson City, Ill.....	7
1917: April 18.....	Lynden.....	Mason, W. Va.....	5
1919: June 5.....	Baltimore Tunnel <sup>1</sup> .....	Wilkes-Barre, Pa.....	92
1920: July 26.....	No. 6.....	Sublet, Wyo.....	8
1922: November 3.....	Eddy Creek <sup>1</sup> .....	Olyphant, Pa.....	6
1937: June 21.....	Rupert.....	Keystone, Ohio.....	6
1941: February 14.....	Fidelity.....	DuQuoin, Ill.....	7

<sup>1</sup> Indicates anthracite mine.

## DESCRIPTION OF MAJOR DISASTERS BY EXPLOSIVES

July 17, 1894; West No. 1 Slope, Stockton, Pa.;  
8 Killed

*(From reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1894, p. 195)*

At 7 o'clock a.m., Tuesday, July 17, 1894, eight persons were instantly killed by an explosion of powder at the foot of the subterranean shaft from the Mammoth vein to the Wharton vein of the west No. 1 slope at Stockton.

The miners and loaders were employed in the Mammoth vein, to which a tunnel is cut back from the foot of the subterranean shaft, in robbing what would be known as the third lift of the Mammoth vein of the west No. 1 slope, and as usual were on this morning taking to their several schutes (sic) the powder, fuse and caps which would be required through the day to start the batteries; the miners having brought back the night previous what had not been used the day before.

The powder, fuse and caps were all brought from the magazine on the surface by the footman, in order to avoid all danger of explosions on the slope, or in the shaft, by reason of careless handling of the caps and sticks of powder by the men while riding down the slope with it, or in the shaft on the cage. He kept them under lock and key in a box near the foot, when not distributing them to the men.

On this morning, while he was giving out to the men the powder, fuse and caps they each made request for, in some way an explosion was caused and every one present killed.

There are many theories as to what was the cause of the explosion, one being that one of the men had dropped fire from his lamp or pipe into a cap; another that some one had been picking at a cap with a lamp picker or horse shoe nail to remove the fine sawdust with which they are sometimes clogged, and still another that one of the men having his powder lying beside him on a bench near the box cut his fuse into lengths and began placing the caps on these lengths of fuse ready for use when required, and in pushing the fuse into the cap twisted the point into the fulminate of the cap and it, exploding near his powder, set it off, and that in turn set off what was in the box nearby. The only thing we know is, there was an explosion caused in some way by some one of the eight persons present, and those of us that remain should take warning and be careful in the handling of these explosives ourselves, and be watchful of others to see that they are careful.

The Superintendent was informed of the explosion and at once went to the slope and entered the mine and was lowered to the foot of the shaft, where the work of recovering the bodies at once began. This was rendered difficult owing to the timber at the foot of the shaft being blown down by the force of the explosion, but by 11 o'clock the bodies were all placed in coverings and these in boxes provided by an undertaker and by 12 o'clock noon they had all been taken to the surface where the undertakers took charge of them.

An inquest was held and the jury rendered a verdict of accidental death for which no blame could be attached to any living person.

November 2, 1900; Berryburg Mine; Berryburg, W. Va.; 14 Killed

*(From "Mines and Minerals," December, 1901, p. 196)*

The Berryburg Mine, which is a drift, was opened the fore part of 1900.

The extent of the mine workings increased rapidly, and by November the main headings had reached a distance of 600 to 800 feet. From these headings had been turned lateral headings, and from the latter rooms were turned. The plan of the mine consists of one main heading running due south and two headings running due west, each of which pairs had separate drift mouths 260 feet apart. These headings are called respectively the South Mine and the West Mine.

These two mines are connected by a tunnel, called the fan entry, which is used for the return air current on its course to the fan. At the middle point of this fan entry is the fan slope, at the mouth of which is located a ventilating fan which is used to exhaust the air from the two mines.

It was while the night force was on duty on the night of November 2, 1900, at 11:30 o'clock that an explosion occurred which resulted in the death of 14 persons, but which did practically no damage to the mine.

From all the evidence obtained at the investigation of the disaster nothing was produced to show that at any time had gas been found in any part of the mine. Two days after the explosion and after the ventilation of the mine had been stopped for 12 hours, a party of experienced mine men visited the workings and made a close inspection for gas but failed to find a trace.

No deduction could be drawn from the foregoing conditions as to the cause of the explosion. Further testimony revealed the exact condition of the mine immediately after the explosion, and also the location of and the condition of the bodies of the men who lost their lives in the explosion. Within the neck of the No. 2 room, which had been abandoned, on the first east heading were found the dead bodies of two men. They showed signs of having been badly burned. It appears that these two men in their confusion took the wrong course to get out of the mine and became victims of the after gases of the explosion. Four men who at the time of the explosion were working at the face of the second east heading came out uninjured through the first east heading and passed the room where the two men were found.

On the main air course was found one man who had no sign of having been burned. He was killed by the after gases and as his duties did not require him at the point where he was found it is probable he was coming from the face of the main air course.

On the outside about 75 feet to 100 feet from the entrance were found Andrew — with all his hair burned off and face and hands burned, also three unidentified bodies badly mutilated. Two of these bodies were completely severed at the waist and the head of

one body was almost completely gone. On the outside and in line with the course of the main heading are several poles upon which are strung the electric wires. Against one of these poles the head of one man had struck with such force as to completely destroy the head. The poles nearest the mine were canted several inches from a vertical position, showing that the force coming out of the mine was very great.

At the time of the explosion there were, in addition to the above, four other men in the South Mine. These men escaped to the outside, but each was badly burned, so badly that one died the following day, and another on the third day after the explosion.

Near the face of the fourth west heading there had been a large fall of roof slate, and on the night of the explosion this slate was being broken up with dynamite.

Simultaneously with this work the shot firer was shooting down the coal with powder in different sections of the mine.

Several sticks of dynamite were placed to break the slate and at some distance from the slate a box containing 18 sticks of dynamite was left. The fuse was lighted and the men were making their escape when the explosion occurred with the loss of life above mentioned. The box containing dynamite was never found.

The assumption might be that this dynamite shot caused the mine to explode, but, while it may have been the primary cause, it was not the ultimate as the condition in another section of the mine indicates that the explosion in its greatest violence came from the powder box on the main heading.

After the explosion it was found that the coal was on fire near the powder box; the powder box was blown down the main heading; the switch lever at the entrance to the No. 4 west heading was bent; the door at 4 west was blown in by; the stopping between the main south entry and air course was blown west; the door in 3 west was blown toward the face and the force came out of the mouth of the mine with great destruction.

That dust took an active part in this explosion was fully demonstrated as the dust was completely charred along the main heading. Some charred dust was also found at the face of the No. 4 west but not to the extent as found in the vicinity of the powder box.

Evidently an explosion of some element or elements took place within the vicinity of the powder box on the main heading.

A probable theory of this explosion, based upon the conditions within and at the mine at the time of the explosion is ventured.

In the first place the fan had not been running for several hours and as the mine has no natural ventilation the air within the mine was at a standstill.

Heavy powder shots had been discharged throughout the mine and dynamite had been used in the breaking of slate.

Under these conditions the mine would be full of powder and dynamite smoke and it is probable that in the heavy powder shots a part of the powder was not entirely consumed, or so incompletely consumed as to evolve a considerable volume of carbon monoxide gas (carbonic oxide), which is inflammable and will explode.

It is further safe to say that the last dynamite shot fired caused the 18 sticks of dynamite near by (sic) to discharge. This would have the effect of stirring up the dust within the mine. Following immediately upon this the powder at the powder box was discharged by some unknown means and this in turn ignited the carbonic-oxide gas and dust and the mine explosion was the result.

The resulting gases would be composed largely of carbon dioxide and would not support life.

(It is obvious that this explosion was initiated by an unconfined shot of explosives and propagated by coal dust. It is evident that the small amount of explosives in the mine could not have created the extreme violence that resulted. At the time of this explosion many experienced mining men had not been convinced that bituminous coal dust would explode, especially when the atmosphere contained no methane.)

#### December 9, 1902; South Wilkes-Barre Colliery; Wilkes-Barre, Pa.; 5 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1902, p. 212)*

On December 9 an explosion of dynamite occurred at the South Wilkes-Barre colliery that caused the death of five men and the serious personal injury of three others. The company has a rule prohibiting men from taking any high explosive down the shaft with them, as an empty cage is provided for that purpose. On the above date a miner employed in driving a gangway in the Baltimore seam, procured a box of dynamite at the supply house, brought it to the head of the shaft, descended and reported to the fire boss. He and his laborer returned to the foot of the shaft and waited for the dynamite. There were four cases sent down on the cage, three for a contractor, who is driving a tunnel. The miner and his laborer took their box from the cage, the miner carrying it; went around the shaft to the empty track side, walked up on the east side empty car road, when the dynamite exploded, instantly killing three men, injuring one so that he died in the ambulance as he was being taken to the hospital, and another, who died the following morning. Three men were severely injured and several others were more or less severely bruised. In my investigation, and also at the inquest held by the coroner, it was impossible to obtain any information regarding the cause of the accident, as every person in the immediate vicinity of the explosion was instantly killed. The force of the explosion was so great that it displaced the main air bridge that crosses the empty car roadway, and dislodged a number of props that were standing along the road side.

#### January 30, 1904; Maple Hill Colliery; Mahanoy City, Pa.; 5 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1904, p. 264)*

On January 30, five machinists were killed in Maple Hill No. 2 shaft. The top man says that they all came up and fired a blast, making the sump. Then they went down again to fire another round, leaving the laborers on top. One man soon returned to the surface again saying that he wanted four sticks of dynamite and two exploders, which he received from the top man. He took them with him and went down again. He held them in his hand. The exploders were fastened in the dynamite ready to be used before he left the top of the shaft. The top man said that the bucket had just about reached the bottom when there was a signal given to the engineer to hoist men. When the bucket was up about 275 feet from the bottom there was an explosion, and when it landed

there was no one on it. The hose which was in the bucket was partly hanging out of it and was torn. There was also in the bucket one monkey wrench, one manifold, one 18 inch steel point, all of which were broken except the 18 inch point. In making a personal examination I found six rivets blown out of the bucket and the bottom bulged out. I also found pieces of oil cloth clothes on the timber about 275 feet from the bottom. On examining the bottom of the shaft I found that a round of shots had been fired in the sump. There were also five holes in the hitch in the northwest corner which were charged and two holes charged in the northeast corner hitch, and six sticks of dynamite on a loose rock connected by wire ready to be fired with the battery. In my opinion the dynamite and exploders had not been used, but were in the bucket with the men ascending the shaft. The supposition is that one of the tools found in the bucket fell on the exploder, which was fastened to the dynamite in the bottom of the bucket, causing the explosion. Five men were found dead at the bottom of the shaft.

**May 5, 1904; Lance Colliery; Plymouth, Pa.;  
5 Killed**

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1904, p. 263)*

At about 11:40 a.m. an explosion of dynamite occurred which instantly killed two men and fatally injured three other men who were in the gangway at the time. Dynamite and exploders were stored in a box in the vicinity of the working place. A laborer was at the box when a terrific explosion occurred. The cause of the explosion was not determined.

**May 15, 1906; Shenandoah City Colliery, Shenandoah, Pa.; 7 Killed**

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1906, p. 462)*

May 15, 1906, Shenandoah City Colliery, two repairmen, four miners, and a driver went to their work about 6:55 a.m. on the first lift Buck Mountain Slope. Three had just reached a tunnel between the fifth and sixth breasts when a terrific explosion occurred, instantly killing them.

The bodies of those found near the tunnel were horribly mangled indicating that dynamite was the cause of the accident. The driver was found at No. 9 breast, having been thrown from his mule, and smothered by fine dirt and rock that rushed over his face when the timber was blown out. The others were found at the sixteenth and seventeenth breasts, having been crushed by falling timber. The explosion at the mouth of the tunnel was evidently caused by dynamite and black powder. This was indicated by the mangled bodies, the broken and shattered timbers, the pulverized rock and coal, and the heated condition of the debris that burned the hands when placed near it.

**December 20, 1906; No. 1 Mine; Stone City,  
Kans.; 7 Killed**

*(From the State Inspectors Report, 1906)*

On the morning of December 20, the men were just going to work, at about 7:30, or a few minutes later. A number of them were a little way in the tunnel waiting for the "trip" to be made, some of them intending to ride in on it. The boss driver was at the front of the trip (train of pit cars), the motorman sitting on the rear of the motor, several men at the end of

the trip, and the coupler busy coupling up the trip. In the first car was one man with no powder. In the second car there were four men, each with his powder jack. These cans are supposed to be sound and to have metal caps, but the men sometimes use very defective ones and often lose the caps and stuff the tops with paper and the like. One such can was found later that morning unexploded, though of course no one knows what was the condition of the cans in the second car, as the men who were in that car are all dead. Of twelve cans, some on the cars and some on the ground near by, eight were exploded. At the side of the second car a man was sitting on the ledge with a powder jack and a pipe. This man was among those killed. The men wore their lamps. The coupler signaled the motorman to go forward a few feet. As the motor started there came an explosion, followed immediately by another and severer one, and later by a third and lighter one. The motorman stopped the machine at once, it having gone not more than two feet. The greater number of the witnesses agree that the explosion started in the middle of the trip, undoubtedly in the second car, as that is where the worst damage is done. About all we have from any of the men in that car is that one man (now dead) said that he was sitting on his powder jack when it exploded.

One man testified that the motor moved eight or nine feet and that the explosion started from it. He was not on the trip himself and the evidence of the other men all goes to show that about two feet was the greatest distance moved by the motor.

Now, as to the probable cause of the explosion there are several possibilities:

**FIRST.** Sparks are thrown from the wheels and trolley as the motor runs. These go but two or three feet, however, and the nearest point at which there is known to have been powder was ten or twelve feet from either wheels or trolley pole, so I think it highly improbable that the powder was ignited in this way.

**SECOND.** The jar of starting might have caused a spark to fall from the pipe or lamp of one of the men as he crouched in the car. The falling of such sparks is of common enough occurrence.

**THIRD.** The power for the motor is supplied by an overhead trolley, the current returning through the wheels and rails as in the ordinary street-railway car. At times, however, there is bad contact at the rails and the current runs back through the draw-bar and through the cars, so that men riding there often receive shocks from this bar.

In view of these facts, and the fact that the explosion occurred just as the motor started, I am inclined to think it very probable that the powder was ignited by a spark between the powder grains (sic) coming in this way from the draw-bar. In any case, whichever of the above causes may have been responsible for this explosion, it is unsafe for the men to ride in the cars with powder.

**January 29, 1907; Johnston City Mine, Johnston  
City, Ill.; 7 Killed**

*(From the Illinois State Coal Report, 1954)*

On the morning of January 29, 1907, an explosion of thirty kegs of powder in the Johnston City mine, Johnston City, resulted in the death of seven men. The cause of the explosion, in the opinion of the State Inspector, was due to the rough handling of the powder by the men while unloading it from the car and placing it at convenient points where the drivers would pick it up and distribute it to different places in the mine. The majority of those killed were leaving the bottom, on foot, to go to their working places.

**April 18, 1917; Lynden Mine; Mason, W. Va.;  
5 Killed**

*(From "Archives and History," State Capitol,  
Charleston, W. Va.)*

On Wednesday morning, April 18, 1917, about 7:00 a.m., an unusual happening occurred at Mason, in Mason County, when lightning struck a powder magazine at the Lynden Mine, exploding thirty kegs of powder. There were five men working in the powder house and when the magazine was demolished, all five men were killed.

**June 5, 1919; Baltimore Tunnel Colliery; Wilkes-Barre, Pa.; 92 Killed**

*(From Bureau of Mines report by S. P. Howell  
and others)*

About 6:45 o'clock on Thursday morning, June 5, 1919, ninety-two (92) men lost their lives in Baltimore Tunnel Mine, due to an explosion of black blasting powder, forty-four (44) were more or less seriously injured and seven (7) escaped uninjured.

The accident occurred only a short distance inside the mouth of the mine.

The tunnel in which the accident occurred is driven through the rock on a slight up grade and intersects the several seams worked. The tunnel is used for drainage, ventilation, and as a main haulage way.

On the morning of the accident the man trip was made up near the tunnel mouth as usual. The trip consisted of thirteen cars and carried, according to the best information, one hundred forty-three men, twenty-four kegs of black blasting powder, and some drills and possibly other tools.

The last, or thirteenth car, had barely cleared the tunnel mouth when, due to some trouble ahead with the trolley wire, the motor was detached from the trip and ran ahead 250 feet and stopped. On account of the delay occasioned, the men began getting out of the cars, at which time the explosion is said to have occurred.

Within an hour after the explosion, all men had been removed from the mine. Rescue apparatus was not used in the recovery work.

An unglazed powder was used in this mine and was issued to the miners in 25 pound metal containers, 7 inches in diameter and 27 inches in length. The powder itself was wrapped in double thickness heavy paper tube and folded back and forth on itself in links not unlike sausages.

The mine cars, third and fourth from the rear end of the trip which contained the powder that ignited were outside of the mine and were examined carefully for signs of burning by electric arcs or flashes. Five powder cans and seven covers were seen in the tenth car and two cans and two covers were seen in the eleventh car. All of these were very closely examined for marks or burned spots due to electric current and none were found. There were several tobacco pipes and miners' lamps of the open flame oil type in both of the cars. The metal parts of the cars such as bolts, angle iron braces, etc., were also closely examined for evidence of arcs and none were found.

Examination was made of the rails, bonding and trolley wire over the length occupied by the trip of cars at the time of the ignition. The trolley wire did not show any signs of recent arcing. The wire was loose from two of the hangers. The bonding of the rails was in poor condition. In two places there were

open joints in the rails without either bonds or fish plates. In some places the bonds were not joined to both sides of the joint, and at the mouth of the tunnel the cross-bond was fastened only to one rail.

Since the examination by the writers was made on the second day after the disaster, the tunnel had already been cleaned up, and thus may have made more definite and conclusive evidence unavailable.

The possible causes of the ignition may be considered under three heads, namely: (1) electricity, (2) open lights, (3) lighted tobacco pipes.

The writers are strongly of the opinion that open lights were responsible for the ignition in the Baltimore Tunnel Mine and for "safety-first" reasons, because such lights increase mine hazards, with respect to initiation of gas explosions, mine fires, and igniting of explosives, look forward to the time when open lights will no longer be permitted for use in mines.

The rule in the 1918 anthracite laws, (Rule 1, Article II) that "the owner, operator, and superintendent of a mine or colliery shall use every precaution to insure the safety of the workmen in all cases, whether provided for in this act or not, and shall have supervision, direction, and control of the mine foreman and all other mine employees," is only very general. A very definite rule should be made and enforced so that there will be no mistakes in the handling and transportation of explosives.

The Bureau report recommends that: Black blasting powder be transported only in containers of non-conducting and non-combustible materials in separate trains accompanied only by those necessary to operate the trains; explosives removed from storage for transportation in shafts be deposited a safe distance from where men gather and distributed in the mine by a qualified person to each miner where persons do not call collectively; powder containers be inspected before they are distributed to the men; dynamite be placed in closed reinforced canvas bags with shoulder straps by a competent person at the powder house for convenience in carrying; a record be kept of explosives issued to limit the amount distributed to that necessary; and the State appoint a committee of experts to revise the mining laws and regulations, particularly as they apply to such new equipment as has been introduced—electricity as a factor in mining is wholly ignored by such laws as exist.

**July 26, 1920; No. 6 Mine; Sublet, Wyo.; 8 Killed**

*(From Bureau of Mines preliminary report  
by G. W. Grove)*

The verdict brought out at the coroner's inquest and as rendered by the jury: "We, the jury, find that when striking the keg of powder with a mallet it caused the spark which lit the powder." According to all information which can be obtained the powder kegs were opened with a wooden mallet and wooden pins which were found after the explosion, and according to the testimony of some of the men who were burned the explosion occurred as the powder man struck a keg of powder with a mallet in the act of opening the keg.

After talking with the state mine inspector and company officials, all of us more or less had the idea that in breaking the keg the sharp points which naturally would be driven inside of the keg, two or more may have met and in rubbing over one another these points may have caused a spark. I do not know whether any investigations along this line have ever been carried out or not but it seems that there is a possibility of this occurring.

Outside of the above there was nothing brought out at the verdict or through any other way of investigation that would indicate that the powder was not properly handled or that the magazine was not clean, or that the handling was in fault in any way. The magazines which this company have at their other mines are duplicate of the ones which were blown up and are constructed of concrete, a concrete roof, wooden floor and wooden door which is covered with galvanized iron on the outside. The walls of the magazine were about eight to ten inches in thickness. The force of the explosion was strong enough to blow off the roof and blow out the sides, the floor however was uninjured.

The men who were killed were three or four men who were waiting their turn to get powder, the powder man and three or four men who were walking from the manway down the path some distance from the magazine. One of the men was instantly killed, another lived a few minutes and the six others died in the hospital before morning—the accident having occurred about 4:45 p.m.

### November 3, 1922; Eddy Creek Colliery; Olyphant, Pa.; 6 Killed

*(From a transcript taken from the "Scranton Times" edition of Saturday, Nov. 4, 1922, courtesy of the Scranton Public Library, Scranton, Pa.)*

A terrific explosion yesterday afternoon in the Bird's Eye slope of the Olyphant mine at Throop, brought death to five men and serious injuries to three others.

Those injured by the explosion are in the Mid-Valley Hospital, Olyphant, and reports from that institution this afternoon indicated that two were in a critical condition and may not recover. One is believed to have been internally hurt.

The accident happened while the eight men were driving a tunnel in the slope, under the direction of a mine contractor. They had entered the mine yesterday afternoon at 3 o'clock and were to work until 11 last night. Three were working their first day in the mine in many months.

The exact cause of the explosion has not yet been determined, but one of the three injured men in the hospital gave a statement of what the men were doing at the time the blast came. He had just poured powder in the five holes that had been drilled in the solid rock at the face of the tunnel and started away with a box of powder under his arm. The other men were standing directly in front of the face of the tunnel, one of the men now dead stepped up to connect the electrical attachment that is used in setting off the explosives that tear through the solid rock.

He states that this man seemed to have only reached the point where the connection was to have been made when there was a big flash and the explosion. A large piece of flying debris struck him in the leg and he fell and started to crawl along in the mine to give the alarm. He had gone about fifteen yards when he met another employee who ran out and called help. On the surface calls were sent for ambulances and physicians and within a short time there was considerable excitement in the neighborhood.

The explosion was of such great force that it blew the heads from two of the victims and otherwise mangled their forms. A third man had both legs blown off.

Note: Apparently one of the injured men died, since State and Federal records indicate that six men were killed.

### June 21, 1937; Rupert Mine; Keystone, Ohio; 6 Killed

*(From Bureau of Mines report by W. J. Fene)*

Five men have died and one is not expected to live as the result of burns received when a keg of black blasting powder exploded in the Rupert mine at Keystone, Ohio, on June 21, 1937.

The mine was opened about one year ago by two drifts, which had been driven into the hill about 350 feet. Four rooms have been driven off one entry and two off the other. Ventilation is natural, induced by a stack over a shallow air shaft. Carbide lights are used, and coal is shot off the solid with black powder and squibs.

Six men were in the mine on the day of the accident, and had congregated in a cross-cut 100 feet in by the drift mouth to eat their lunch. According to a story related by the man who was still living, one of the men was in the act of preparing a cartridge when the black powder was ignited. The story does not relate just how the powder was ignited, but since all the men were wearing carbide lights and some probably smoking, it seemed safe to assume that either carbide light or smoking was responsible for igniting the powder.

Following the explosion, four of the men were able to walk to the outside and the other two crawled to the outside.

Two truck drivers were the only ones on the surface at the time and they, with the help of nearby neighbors, rendered first aid treatment until doctors and ambulances arrived. All the men were severely burned about head, face, arms, body, and legs. A pony that was standing nearby was also severely burned.

Five of the victims died during the following day, and when the writer visited the hospital at Gallipolis, Ohio, during the morning of June 23, the sixth man was unconscious and was not expected to survive. The dead included three brothers, sons of one of the owners of the mine.

Examination of the keg holding the powder that exploded showed a pick hole in the top and the side of the keg was flattened out. Examination of empty kegs in the mine showed that it was common practice to open kegs by means of a pick.

No violence resulted from the explosion. A woven mat curtain in the cross-cut was not blown out, and empty powder kegs and lunch pails located in the cross-cut were not disturbed. A keg with about two pounds of black powder in it, was also not disturbed.

This accident was primarily the result of carelessness on the part of one of the men. In the first place, carbide lights and black powder, especially in 25-pound kegs, should not have been permitted. It is only a short distance to the outside and cartridges could have been prepared outside rather than underground. The mining law of Ohio permits the use of carbide lights and black powder. In this case, the man who was preparing the cartridge with an open light on his head was careless and is primarily responsible for the accident.

P.S.—Since writing the above, it has been learned that the sixth man has died.

### February 14, 1941; Fidelity Strip Mine; DuQuoin, Ill.; 7 Killed

*(From Bureau of Mines report by C. A. Herbert)*

About 9:00 a.m. February 14, 1941, an explosion occurred in the liquid oxygen explosive plant, located

at the Fidelity Mine about 5 miles west of DeQuoin, Illinois, resulting in the instant death of the seven men who were at the plant at the time.

The liquid oxygen explosive manufactured at this plant was being used in blasting the overburden preparatory to stripping, or uncovering, the coal by means of electrically-operated shovels.

Liquid oxygen explosive, usually referred to as "L.O.X." is a high explosive of about the same strength as 40% nitroglycerine dynamite and consists of a combustible absorbent saturated with liquid oxygen. Usually, some form of carbon in canvas sacks is used as an absorbent to form the explosive cartridge. It is a highly inflammable explosive and is more sensitive to impact than 40% nitroglycerine dynamite.

This disaster was due to the accidental detonation of approximately 650 pounds of explosives contained in a soaking box in which the carbon filled cartridge sacks were being saturated with liquid oxygen.

It was impossible to determine the cause of the detonation of the explosives as all evidence was destroyed by the blast and all of the employees at the plant were killed. A number of possible causes for the detonation may be conjectured; a most likely one being the accidental ignition of the explosives by a match or cigarette, as smoking materials were found on the bodies of several of the victims.

The L.O.X. cartridges used consisted of a canvas sack  $7\frac{1}{2}$ " in diameter and 24" long, containing 8 pounds of carbon, and when saturated with liquid oxygen weighed from 28 to 30 pounds.

The explosive was transported by truck from the explosives plant to the pit, in the soaking boxes in which the cartridges were saturated with liquid oxygen. These soaking boxes held 24 cartridges, or a total of about 650 pounds of explosives, and served as temporary magazines from which the cartridges were carried to the shot holes as needed. The boxes are square with tight-fitting lids and are lined with copper and insulated with balsa wood.

The liquid oxygen explosive (L.O.X.) plant is located in the mine yard at the Fidelity mine, in close proximity to a number of buildings some of which are regularly occupied. The roadway leading to the mine office and to other surface buildings is only about 50 feet distant on one side, and on the other side and about the same distance away is a railway passing track over which there is a considerable amount of switching.

Fifty feet south of the plant is a storehouse used for the storing of electrical supplies. Within 500 feet there is a large garage for the mine trucks, and about the same distance away is a residence occupied by an employee of the mine. The mine office and the preparation plant are about eight or nine hundred feet distant.

The explosives plant is a steel structure covered with corrugated iron, about 125 feet long and 50 feet wide. It is divided into two sections by a 12-inch brick partition. The larger of the two sections houses the compressors and other equipment necessary to the manufacture of liquid oxygen, while the smaller section is where the cartridges are packed in the soaking boxes and where the soaking or saturating of the cartridges is done.

In the soaking room end of the plant the soaking boxes are handled on a four-wheel rubber-tired hand truck. From this hand truck they are loaded on the auto trucks for transportation to the pit, by means of a mono-rail traveling-crane.

After the 24 carbon cartridges have been placed in the soaking box the box is moved onto a platform scale adjacent to the brick partition and opposite the liquid oxygen storage tank in the main part of the

plant. A weighed amount of liquid oxygen equivalent to four pounds of liquid oxygen per pound of carbon is then run into the box through a bronze pipe. During the time the liquid is being run into the box the lid is slid back about two inches to make room for the pipe, thus leaving a crack about 2" wide the length of the box. About forty-five minutes are required for saturating the cartridges.

The carbon (gas black), was purchased in the cartridge sacks ready for soaking and received at the plant in carload lots. The supply of carbon-filled sacks was stored in a loft above the soaking room. When unloading and storing a car of carbon sacks it was necessary to carry them into the soaking room from the railroad car and toss them up through a hole in the loft floor.

There are two regular employees at the plant; the engineer in charge and one who packs the carbon cartridges in the soaking boxes and attends to the soaking or saturating of the cartridges.

At the time of the explosion there was a soaking box on the scales and the soaking time was about completed as the truck driver was on his way to the plant to pick up the box and was only about 600 feet distant when the explosion occurred.

In addition to the box on the scales there was another in the soaking room which had been packed with cartridges ready to be soaked.

On the morning of the explosion a supply of carbon cartridges was being unloaded from a box car, which had been placed on the siding adjacent to the plant, and stored in the overhead loft. This was being done by three laborers who were not ordinarily employed at the plant. In addition, there were two carpenters working at the loading entrance. One of the carpenters was on a ladder and the other was standing on the ground at its foot, holding it.

For some days prior to the explosion a painter had been engaged in painting the plant building and equipment. Shortly before the explosion he had left the plant to get a new paint brush.

Unquestionably, the soaking box of explosives on the platform scales exploded. All that could be found of the box, hand truck, or platform scales was one of the rubber-tired wheels of the truck. A crater marked the location of the scales. All of the steel members of the structure at the soaking room end were blown away. Some bent and twisted beams had been blown some distance.

The bodies of the six victims at the soaking room end were all mutilated; that of the carpenter who had been on the ladder was blown about 500 feet and was mutilated the worst.

The brick partition wall and the 1000-gallon liquid oxygen tank were blown towards the north or opposite end. The body of the plant engineer was also blown towards this end.

Smoking materials were found in the clothing of several of the victims.

Considerable damage was done to the residence south of the plant and the doors of the garage were blown off.

The box car from which the carbon sacks were being unloaded was demolished. Some carbon in sacks and a considerable amount of loose carbon was scattered around on the ground for a radius of about 100 feet.

The soaking box with the unsoaked cartridges had been blown about 50 feet.

Several automobiles belonging to employees at the plant and parked nearby were destroyed, partly by violence but mostly by the intense heat of the explosives and the burning carbon which was thrown into the air and ignited by the explosives.



TABLE 6.—*Major disasters by miscellaneous causes*

Date	Name of mine	Location of mine	Killed
1870: March 22.....	Potts <sup>1</sup> .....	Locustdale, Pa.....	5
1877: July 11.....	Brookfield.....	Brookfield, Ohio.....	7
1885: August 11.....	West End <sup>1</sup> .....	Mocanaqua, Pa.....	10
1887: April 27.....	Tunnel <sup>1</sup> .....	Ashland, Pa.....	5
October 1.....	Bast <sup>1</sup> .....	Ashland, Pa.....	5
1891: October 23.....	Richardson <sup>1</sup> .....	Glen Carbon, Pa.....	7
1894: October 11.....	Henry Clay <sup>1</sup> .....	Shamokin, Pa.....	7
1904: May 25.....	Williamstown <sup>1</sup> .....	Williamstown, Pa.....	10
1911: October 3.....	Drifton <sup>1</sup> .....	Freeland, Pa.....	5
1913: May 6.....	Taylor.....	Beaver Dam, Ky.....	5

<sup>1</sup> Indicates anthracite mine.

## DESCRIPTION OF MAJOR DISASTERS BY MISCELLANEOUS CAUSES

March 22, 1870; Potts Colliery; Locustdale, Pa.;  
5 Killed

*(From a state report on persons killed in the mining district of Schuylkill for year ending Dec. 13, 1870)*

Killed by an explosion of the breaker boilers at 7 o'clock a.m., while preparing for to go to work, destroying the building and machinery, and injuring ten others.

July 11, 1877; Brookfield Mine; Brookfield, Ohio;  
7 Killed

*(From "The Chronical," Warren, Ohio, Wednesday, July 18, 1877)*

The scene of the accident was the Brookfield Mine Tunnel, which was completed last winter. It runs underground a distance of about a mile in three directions, and over ten miles of entry work have been driven. The tunnel is 3,915 feet long. Until recently the coal has been transported on cars drawn by mules. This not proving adequate or satisfactory, a small locomotive was employed in which anthracite coal was used. The tunnel being narrow—8 feet wide at the bottom, six at the top, and six feet high—the smoke and noxious gases generated formed a deadly poison. On the 11th inst., a number of men working in that part of the mine were suffocated by the foul air, seven of whom lost their lives. The men with the engine, after being in the slope but a short time, became affected by the gas, and fell in a senseless condition. The engineer managed to reach the mouth of the tunnel and gave the alarm. A number of persons rushed in to rescue the affected men, but were themselves overcome by the gas. Squads were then organized to go in and bring out the fallen, and in this way 36 were taken out, there being seven fatal cases.

On whom the responsibility immediately rests, if upon any party in person, we have not learned. The popular talk is that the disaster is properly chargeable to defective ventilation, and that the superintendent of the mine, one of the men who perished, had urged the sinking of an additional ventilating shaft, but that his recommendation had not been complied with.

The State Mine Inspector, in his last annual report, says he visited this mine, and found in it "a strong current of air," rarefaction being caused by two 24 foot boilers placed at the bottom of the air shaft to make steam for the water pump.

The air doors of the mine, and all the other ventilating arrangements are well maintained, and the mine is in good condition. This was before the employment of an anthracite coal burning locomotive in the mine, and that may account for the changed condition of the air in the mine.

August 11, 1885; West End Colliery, Mocanaqua, Pa.; 10 Killed

*(From reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1885, p. 73-75)*

The West End colliery, near the village of Mocanaqua, across the river from Shickshinny, was the scene of a shocking disaster on the 11th of August, 1885. Ten men lost their lives from breathing the poisonous gases which arose from the fires under the boilers in the mine. The mouth of the drift through which the coal is brought out of this mine is four thousand five hundred feet east of the breaker, and the mine cars are hauled from a turnout two thousand feet inside of the drift-mouth to the breaker. All the workings between the mouth and the turnout above water level were finished, the coal having been mined out to the outcrop. At the inner end of the turnout there is a slope sunk diagonally down the pitch on a small grade about six degrees, to a distance of one thousand two hundred feet. There were workings on each side of the slope. The coal above water level is mined above a gravity-plane, between that and the outcrop. The foot of the plane is about five hundred feet inside of the head of the slope. Owing to the difficulty of obtaining water on the surface, the boilers which generate steam to run the slope engine and the fan engine were placed in the mine a short distance below the head of the slope on the left side, where the air current returns to the out-cast. The fan was located about three hundred feet away from the boilers, between them and the out-cast, and from the fan to the mouth of the up-cast there was a distance of over one thousand feet, rising on an average grade of about fifteen degrees. Thus the air-current first passed through the workings of the slope, and then up behind the boilers, taking with it the gases arising from the fires through the fan, and directly out through the up-cast. On the night of the 10th of August, at about eleven o'clock, the eccentric strap on the fan engine broke, and the fan stopped running. There were a few men working on the night shift, but as they had never seen or heard of dangerous gases being generated in the mine, the stoppage of the fan caused no alarm and they finished their night's work before leaving without suffering any inconvenience from lack of ventilation. By half-past seven next morning, the eccentric strap was repaired ready to take into the mine, and the engineer, machinist, and mine foreman together took it with them, and rode from the breaker on the locomotive train into the mine. There were from forty to fifty workmen riding in on the same train. All knew that the fan had broken and was not running, but it seems that no one apprehended any danger. Upon reaching the turnout at the head of the slope, the mine-boss and the machinist took the strap toward the

fan, and the workmen went on to their working places. At this time it was believed that the fan could be fixed to run in about half an hour, but after putting the eccentric strap in place, the engine was started, and it would not run. The boss and others went in to the fan several times to pry it off center, and finally they discovered that the fan-shaft was bent so that it could not run. Messages came to the boss, at this time, that the men were getting sick down the slope by inhaling foul air, and could not walk out. The boss himself was affected in the same manner by inhaling the noxious gases in the fan, and he soon became unconscious.

The air was healthy on the west side of the slope, and the men from that side ran to assist those on the other side; but the subtle poison was such as to effect them again in a short time, and it proved a difficult task for even these to escape. Many fell unconscious and had to be carried up the slope and sent out in cars. By mid-day a large number had to be carried out, being unconscious, three of whom were dead and seven more missing, nearly every one who worked in that mine having been helping. The slope-men were, by this time, sick from inhaling the gas. A fresh relay of men came in the afternoon and succeeded in bringing out the bodies of the remaining seven. They were found lying at various points on the gangways of the east side workings.

The cause of the accident was that, during the time the fan was not running, the air-current reversed, and instead of conveying the gases produced from the combustion of coal under the boilers out through the up-cast, the air came in that way, and conveyed the gases down into the workings, and the men who worked in those workings which it entered first were the ones that suffered first from inhaling it. The air current must have changed its course only a short time before the men entered their places. Upon entering, they were taken sick immediately after reaching the faces of their workings places, but were reluctant to leave so soon, believing that the fan would start and refresh the air every minute. However, they finally started out, and the ten fell and failed to reach a point where the air was pure. Others fell in the same manner, but were rescued by workmen from the other parts of the mine.

The night and morning were very warm and close, and when the temperature of the up-cast air became cooler than the temperature of the air outside, the current naturally reversed. The mine foreman did not expect this to take place, and, believing that there was no danger, permitted the men to go to work. It was here he made a serious mistake. Whether he thought it was safe or not, he should not have permitted them to go to work until the fan was set running and the workings places examined and ascertained to be safe; but, having never seen any danger in the mine, these precautions were overlooked.

**April 27, 1887; Tunnel Colliery, Ashland, Pa.;**  
5 Killed

*(From the "Mining Herald and Colliery Engineer,"  
May 7, 1887, p. 143)*

Wednesday afternoon, April 27th, the whistle of Tunnel colliery, at Ashland, Schuylkill county, Pa., sounded an alarm that quickly brought hundreds of people to the hillside southeast of town, where that operation is located. This colliery has been noted for the great accumulation of gas in its gangways and the many frequent and serious accidents which have there occurred. In the west gangway, adjoining breasts, numbers 85 and 86, there were two pillars which had been closely worked, and for two or three

weeks past a fall of coal had been expected. Work, however, was not suspended, the bosses believing that sufficient warning would be given for the men to escape without injury when the fall and consequent rush of gas afterward occurred, but it was assuming a great risk which resulted in the sacrifice of five lives. This gangway runs under the hill on the south side of town for about a mile and in the different breasts there were nearly thirty-five men working on the afternoon of the 27th. Shortly after ten o'clock a strong current of air, the usual warning of the serious consequence which so often result, rushed through the gangway and was a signal for all the men to hurriedly flee in the direction of the bottom of the slope. They nearly all succeeded in reaching a point of safety before the terrific crash was heard, which brought down from the pillars into the gangway hundreds of tons of coal and rock. It was immediately followed by a rush of the deadly gas, which is the horror of all mine workers. It drove the air before it and succeeded in getting within its fatal grasp nine or ten men, who were working so close to where it started that it was impossible for them to escape it. For more than an hour after the rush it was almost impossible to approach nearer than 200 yards of the terrible scene in the dark and gloomy death chamber. Four of the victims were first recovered, and it was feared for a time that their existence on this earth would be very short, but efforts to restore them to consciousness were successful, and it was discovered that they were not seriously injured. However, upon going farther, the rescuing party found five bodies in which life had become extinct, the gas having done its work effectually by smothering them to death.

It was fortunate that the gas was not ignited or a terrific explosion would have resulted with fatal consequences too horrible to imagine.

One of the rescued states that when passing out of the gangway in his effort to escape, he saw the five men who met their deaths, and thought that they too were trying to get out. He supposed they were aware of the coming rush. The point where the victims were smothered is about one and one-fourth miles from the colliery, where the men entered the mines, and is supposed to be midway between Ashland and Locust Dale, underneath the cemetery. The men used safety lamps and fortunately no explosion resulted. This part of the mine had been idle for a week and the employees were anxious to go to work when the order was issued on Monday. The seam of coal at this locality is from 40 to 60 feet thick and these men were engaged in robbing pillars.

**October 1, 1887; Bast Colliery; Ashland, Pa.;**  
5 Killed

*(From The Colliery Engineer, October 1887,  
pages 66-67)*

On Saturday afternoon, the 1st inst., a disastrous and entirely unexpected accident occurred in the Bast Colliery, near Ashland, Pa., that resulted in the death of five persons by suffocation; and about twenty others were more or less injured.

The Bast Colliery is opened by a slope in the south dip of the Mammoth Seam, 810 ft. long on dips varying from 29° to 52°. The present level from which coal is hoisted is the second below water level. From the foot of the slope a tunnel is driven south 810 ft. where it cut the south dip of the Mammoth Seam in the first basin south of that in which the slope lies. This tunnel cuts the Holmes Seam, next south of the slope, on the south dip. The measures on the north dip of the slope basin were worthless.

The gangways in the Mammoth Seam at the south end of this tunnel were driven east and west, and breasts worked from them, till the boundary lines were reached. The West Gangway in which the accident occurred was driven 2100 yds. from the tunnel to the boundary, or line of pillar to be left between Bast Colliery and the old workings of the Potts and Wadleigh Collieries lying just west, in the same seam. There were 100 breasts worked from the gangway, each 10 yds. wide, with 10 yd. pillars between them. The breasts were opened with double shutes, or a shute on the outside and one on the inside of the rib of the breast, which were driven up narrow for 15 yds. to the "stump," or first heading. In the pillar stump a manway was driven up to the same heading, and from each manway spout holes were driven to the air gangway which was driven in the vein, above the main gangway. These breasts were worked by the yard, and left full of cut coal till finished, the miners traveling to the face by means of jugular manways which were also the travelling courses for the air to the faces of the breasts.

The men employed all worked with safety lamps, but the amount of gas encountered was far less than in many other collieries in this neighborhood, and the amount of air passing through the level workings was fully up to the legal standard. The accident occurred between breasts 91 and 100, or along the inside 200 yds. of gangway. These breasts had all been worked up to the anticlinal axis, or saddle, a distance of about 50 yds. on the pitch, from the gangway.

After these breasts were finished the pillars between were taken out from the face down about half way to the first heading, except in the case of the pillar between breasts 99 and 100. This was not touched. After this was done, it was customary to widen the manway, in the pillar stump, to shute width, and drive up through the portion of the pillar remaining and pull it back, taking out all the coal except that in the gangway stumps or pillars.

At the time of the accident, all the pillars from breast 91 to the face had been robbed more or less, except that between 97 and 98, which was not taken out, but all preparations were made for starting it. The pillar between numbers 96 and 97 was taken out at the upper part, and the shute was driven a short distance up into the lower part of it, and three shots had been fired in it the night before the "start it," i.e. to cause the whole mass to move and run down to the shute for loading in the mine cars. The seam at this point dipping about 40°. These shots did not have the desired effect, and the men were at work in that neighborhood on the fatal day, just as usual, and as was customary in such cases.

At about 1 o'clock, the pillar started of its own accord and ran, and at the same time there was a rush of "wind," as the miners describe it, that knocked them all down, extinguished their lights, and knocked around everything portable in that portion of the gangway. This was followed by two more lighter concussions. The first blast must have been a powerful one, as it worked against the main air current and reversed it for a few minutes. The news of the disaster soon reached those on the surface and great excitement immediately prevailed. The colliery officials, assisted by the miners from other portions of the colliery immediately proceeded to effect a rescue, and succeeded in bringing to the surface twenty men who were more or less affected by gas and considerably knocked about and bruised, and the bodies of the following persons who were suffocated:

A fire boss, a starter, a driver, a laborer, and a door boy.

Some of those brought out alive were unconscious, and for a day or two there were grave doubts as to their recovery, but fortunately the death list grew no larger.

The Mine Inspector says the cause of the accident, in his opinion, was that the pillars being robbed, left a large open space that filled with gas, and the air current naturally crossing the worked out area at its lowest point and consequently by the shortest route, left the gas undisturbed. The top rock being exceptionally strong did not break at first, but when the pillar between breasts 96 and 97 ran, its weight was too great and it fell in a large mass, and forced the gas all down on the gangway, as there were no openings above through which a portion, at least, might have escaped. Or, the pillar running may have released a sufficient quantity of gas, and forced it down on the gangway, to produce the disastrous results. Fortunately the gust came with force enough to extinguish the lights, for had they not all been extinguished at once there would have most likely been an explosion far more disastrous in its results, both to life and property.

### October 23, 1891; Richardson Colliery; Glen Carbon, Pa.; 7 Killed

(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, pp. 274-276)

Seven persons lost their lives and three others were seriously injured. This accident occurred on the twenty-third of October and resulted from a fall of coal in a breast that had been worked up about forty feet and was drawn empty or nearly so on the day of the accident. A large body of coal fell, forcing the battery and timbers out of the chute, knocking five sets of timber out in the gangway, closing it, and shutting the seven unfortunate victims in between the face of the gangway and the outer world, there to be suffocated by the large volume of gas displaced by the fall of coal. The other three unfortunates luckily were on the outside of the fall. The injuries they sustained resulted from the force of the air and gas being suddenly displaced by the fall.

According to the testimony of the inside foreman of the colliery, this breast No. 7 had been driven by the miners only forty feet, when the face of the coal commenced to fall, or what is more generally known among the mining community of the anthracite coal region, where the veins of coal stand on high angles, the face of the coal had run by its own weight or its gravity, which is not an unusual occurrence in large, steep pitching veins.

In fact all of the breasts up to No. 7 after being driven a short distance, ran and continued to run as the coal was loaded out, until the openings fell through to the old gangway on the lift above. This, as a natural consequence, relieved that part of the workings from a great source of danger, because it made an exit for any explosive gas that might have existed in the breast previous to running through, to escape, relieving both officials and workmen of more or less anxiety.

The foreman stated that when the face of No. 7 breast ran away the place was practically sealed against any further examination, and in accordance with the custom that had hitherto been carried out in the colliery he ordered his subordinates to load coal from breast No. 7. He also stated that they continued to load coal from No. 7 until the day of the accident, and that up to that time four hundred and twelve cars of coal had been loaded out, when it was reported to him that the breast was empty, which he subse-

quently qualified by stating that there remained from ten to fourteen feet of loose coal on the battery, but he was not positive on that point. One thing however he was sure of, that the breast had not run through to the old gangway as the outside breast had done previously. He was also aware, that the place was filled with gas, and that the face of the coal was liable at any moment to fall away in large bodies thereby suddenly displacing the large volume of gas with the probability of an explosion, inasmuch as the velocities of the elements so displaced would very probably force the flame through the gauze of the safety lamp.

He also stated that he was standing at the tunnel, about two hundred yards from where the accident occurred, and his first impression was that the gas had been exploded in the manner above mentioned, and he reported such to be the case in a telegram which he sent to the Pottsville office.

In this he was undoubtedly mistaken from the fact that none of the victims of the disaster showed any sign whatever that there had been an explosion of gas, but the source of danger from that element under the circumstances, knowing that the empty breast was charged with gas, and knowing that if a fall occurred, a large quantity of gas would be suddenly forced down out of the opening to the section of the mine where the men were engaged, it would be quite natural for him to come to such a conclusion, because his past experience in similar cases together with experiments made by scientific men, have demonstrated this fact that when an inflammable body travels at the rate of eight feet per second the Davy lamp is unsafe, because the high velocity is sufficient to force the flame through the gauze of the lamp.

The officials of the colliery were not the only persons who entertained an apprehension of danger from that source, in fact it was quite evident that the workmen themselves were more or less apprehensive, as it was seldom that a sufficient force could be had to run the colliery to anything near its full capacity.

It is true beyond question that there are many difficulties to contend with in collieries of this character and to cope with them requires more than ordinary care and forethought on the part of the workmen, as well as the colliery officials. It is true that accidents are liable to happen, even when the greatest diligence and the best of judgment are being displayed, and a lack of either is sure to bring about disaster sooner or later. That this accident resulted in consequence of an error cannot be doubted, but we are fully convinced that neither the officials nor the workmen ever for a moment anticipated the closing of the gangway as it was.

#### October 11, 1894; Henry Clay Colliery, Shermokin, Pa.; 7 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1894, p. 264)*

On the morning of October the 11th, at about 7:30 o'clock, one of the most disastrous boiler explosions which has occurred in the history of mining, happened at the Henry Clay colliery. The plant, which was almost a new one, contained 34 cylinder boilers. Twenty-seven of these, without any apparent cause, exploded, killing 7 men and injuring 2, and utterly demolishing the boiler house, besides doing damage to the surrounding buildings. Boiler experts from all sections of the country visited the scene, but none could give any satisfactory reason, or no two agree, as to the cause of the explosion. All agreed, however, that the material in the boilers was first-class and that

the explosion was not due to this cause. A strange thing which may be mentioned was that 15 boilers on one end and 12 on the other, exploded, while 7 in the center remained in position and did not explode. The closest investigation on the part of the company and also by the coroner's jury, failed to place the cause, consequently it will have to be classed among the many of the strange happenings for which no satisfactory reason can be assigned.

#### May 25, 1904; Williamstown Colliery; Williamstown, Pa.; 10 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1904, p. ix)*

About 3:00 p.m., on May 25, 1904, an unusual accident occurred in the Williamstown tunnel. While a steam locomotive was shifting a mine car loaded with plank, the loaded car jumped the track. About this time there were some men waiting for an accommodation car which the company had been in the habit of providing them for transportation to the end of the tunnel on the line of route to their homes. Thinking that it would be some time before the car would be placed on the track, they decided to walk through the tunnel. At a point of about 200 feet from the end of the tunnel ten men were suffocated by fumes from the steam driven (coal fired) locomotive.

#### October 3, 1911; Drifton Colliery, Freeland, Pa.; 5 Killed

*(From Reports of the Inspectors of Coal Mines of the Anthracite Coal Regions of Pennsylvania, 1911, p. 394)*

On the evening of October 3rd, at the Drifton Colliery, a serious and unexpected accident occurred, by which five men lost their lives. After the breaker had quit work for the day, the breaker foreman was instructed to take down an old stack that stood over an air shaft and was partly surrounded by the refuse bank. The intention, and the instruction given the foreman, was to take the plank off from the top down, but when they arrived at the stack the men refused to go up on the ladder to begin at the top. After some discussion, it was decided to cut the stack around near the bottom, which was done, cutting the stack about two feet above the edge of the bank so as to avoid a rush of the bank into the shaft. After the cut was completed the men got on the north side of stack to push it over. When it was pushed over, the plank about six feet below the edge of the bank gave way and allowed the bank to rush in, sweeping the men into the air shaft, and before they could be rescued from below they were all dead from suffocation. The rest of the party, some on the east side and some on the west side of the stack, escaped when they felt the material going from under their feet. Had the man in charge thought that the plank down in the shaft would give way, I am satisfied he would not have put the men on the north side of the stack.

#### May 6, 1913; Taylor Mine; Beaver Dam, Ky.; 5 Killed

*(From Bureau of Mines report by H. D. Mason, Jr.)*

The accident occurred at 11:00 a.m., May 6, 1913, at an old air shaft, 22 feet deep, in the abandoned workings of the Taylor Mine at Beaver Dam, Ky., in which five men lost their lives by being overcome by carbon dioxide and drowned at the bottom of the old shaft, which was filled with water.

The abandoned shaft 22 ft. 8 in. deep, had filled up with water to a depth of 6 feet from the old entry, 4 ft. 8 in. in height, and a drainage drift was being driven in from the hillside for the purpose of drawing off this water from the old workings. This drainage drift had been driven a distance of 24 feet and there remained a thickness of 28 feet of solid coal between the bottom of the old shaft and the face of the drainage entry. A six foot drill hole had also been bored in advance of the coal face.

The seepage of water through this intervening coal stratum gradually lowered the water level in the old entry, until a 6 inch air space separated the top from the level of the standing water. Through this air space was forced the carbon dioxide gas from the accumulation in the old workings, and this gas at least partially filled up the old shaft. Several days previous to the lowering of the water level in the shaft, a Mining Engineer, had descended this old shaft as far as the water permitted and had noticed no ill effects, nor indications of carbon dioxide.

At 11:00 a.m., May 6, 1913, The Mine Foreman, who had charge of the four men driving the drainage entry, started to descend the old shaft, by means of the 2 x 4 timbers with which it was lined. He fell into the water at the bottom of the shaft, the splash being heard by the General Superintendent, who was standing on the surface about 100 feet distant, conversing with the President of the company.

The Superintendent thought the foreman had slipped and fallen into the water, so ran over at once and

started down the shaft. When part way down he felt that he was being overcome and called for help. The President (an old man) called to the men working in the drainage entry and they at once responded. The Labor Foreman at once started down the shaft but was overcome almost immediately and fell upon the Superintendent who was still clinging to the timbers, and both fell into the water. Two laborers followed with like results, both falling into the water at the bottom of the shaft.

The other laborer from the drainage entry ran to the nearest farmhouse,  $\frac{1}{4}$  mile distant, for aid, and brought several men back with them. Testing with an open light at the top of the shaft, the light was extinguished at a distance of one foot below the surface, and it was then seen how very poisonous the gas was. More help was then secured from the Taylor Mine, two miles distant, and a rope rigged up with a hook attachment, by which means the five bodies were drawn up from the bottom of the shaft.

Over an hour had elapsed since the men had been overcome and there was no sign of life in any of the bodies. All had apparently been drowned. At 2:00 p.m. the State Mine Inspector arrived from Central City with two oxygen helmets and a pulmotor, but it was too late, although the pulmotor was tried on several of the bodies. The unexpectedness and rapidity with which the accident had occurred, combined with the remote situation of the shaft, rendered rescue impossible.

