

TENTH INSPECTION DISTRICT—1918.

COUNTY OF FRANKLIN. J. C. THOMPSON, *Inspector.*

Hon. Evan D. John, Director, Department of Mines and Minerals, Springfield.

SIR: I have the honor to submit to you the annual report of this, the Tenth District, comprising the coal producing county of Franklin.

SUMMARY OF THE ITEMS IN THE REPORT.

Number of counties producing coal.....	1
Number of shipping mines.....	24
Number of local mines.....
Number of men underground.....	9,919
Number of men outside the mine.....	1,695
Total number of employees.....	11,618
Total tons of coal produced.....	12,007,397
Days of active operation, average, all mines.....	224
Kegs of powder used for blasting coal.....	30,685
Pounds of permissible explosives used for blasting coal.....	1,758,610
Pounds of dynamite used for blasting coal.....	1,500
Number of fatal accidents.....	64
Number of nonfatal accidents.....	288
Number of employees to each fatal accident.....	181
Number of employees to each nonfatal accident.....	40
Tons of coal produced to each fatal accident.....	187,616
Tons of coal produced to each nonfatal accident.....	41,692
Ratio of fatal accidents per 1,000 employees.....	5.51
Gain in tons produced, 1918 over 1917.....	689,740

IMPROVEMENTS.

The Old Ben Coal Corporation has put into use the Edison electric safety lamp in the No. 11 mine at Christopher, and built a lamp house and charging station complete, capable of handling and charging batteries for 800 electric cap lamps.

Middle Fork mine of the U. S. Fuel Company has installed a new Jeffery fan capable of producing 300,000 cubic feet of air per minute.

EXPLOSION IN MINES.

The following is a verbatim report of an **explosion at Old Ben Coal Corporation's No. 11 mine:**

To the Honorable State Mining Board of Illinois.

GENTLEMEN: We, the undersigned inspectors having been detailed to make an investigation as to the cause and origin of the explosion that occurred at the old Ben Coal Corporation's No. 11 mine at Christopher on November 29, 1917, by which seventeen men lost their lives, beg to submit to your honorable board the following report:

At 10:30 p. m. on November 29, 1917, a call was sent out from Old Ben Coal Corporation that an explosion had occurred at No. 11 mine at Christopher. The State Inspector for that district sent out a call for assistance

and at once arranged with the railroad company for an engine to take the rescue car from Benton to the scene of the explosion arriving about midnight.

It was found that the fan was not damaged and was still running and the top of the air shaft was covered with boards where the explosion doors had been blown off, and the air was still going down the air shaft and up the hoisting shaft and that there were seventeen men below.

The air shaft was fitted with cage hoists and a stairway, the cage was out of commission and blocked at the bottom by debris; this consisted of about 140 feet of curbing, guides, concrete, partition, steel buntings and steel stairways.

The rope of the hoisting cage was disconnected from the hoisting drum and a bucket was slung into the shaft; after making five trips down the air shaft it was decided that it was impossible to get into the mine by way of that shaft.

It was then decided to go to the hoisting shaft and ascertain what could be done there. It was then found that one cage was blocked in the hoisting shaft while the other was blown up into the tippie and badly wrecked. A temporary sheave wheel was fixed over the hoisting shaft and a bucket was slung; after reaching the bottom of the hoisting shaft a fire was located and extinguished on the northwest side of the cage room; after making four trips to the bottom it was found that the air was coming direct from the air shaft to the hoisting shaft. It was then concluded that in all probability the men were all dead, and after the guides had been examined and found all right at one side, it was decided to disconnect the rope from the blocked cage and erect a temporary cage for the other side. It was then about 10:30 a. m., November 30, 1917.

After the cage was ready a party went down and investigated conditions around the cage room, machine shop and as far as the mouth of the first northwest entry.

It was found that the air was charged with afterdamp to a dangerous degree. It was then decided that it would be safer and quicker to reverse the ventilation making the hoisting shaft the down cast and the air shaft the upcast.

Then the work of getting material down and building brattices, all of which had been blown out, was commenced. Several teams were organized from different parts of the district and a great number of mining men from all parts of the country responded freely and rendered valuable and heroic assistance. A careful search for the bodies was then commenced, and in this search the helmet teams are deserving of the very highest praise. No one except those experienced in such matters can form anything like an adequate conception of the high morale, as well as physical courage, it requires to enable a man to don a helmet and go into that deadly atmosphere and witness all the horrors as well as face the dangers and know that he will have to do it time after time. These men stood nobly to their task and proved their right to rank amongst men who dare do their duty despite dangers and difficulties and they certainly merit the approval of the community.

The position of superintendent and mine manager immediately after an explosion is indescribably trying, yet, as demonstrated at Old Ben Mine No. 11, they may always count upon the sympathy and willing help of neighboring superintendents, mine managers, rescue teams, mine inspectors and the Department of Mines and Minerals, in the arduous work of rescue and recovery of the mine.

Mr. Evan D. John, Director of the Department of Mines and Minerals, arrived at the mine immediately after the explosion had taken place and assisted in work of recovering and rescuing those in the mine. He brought to bear on the calamity, the skill and experience of a lifetime.

The Rescue Car of the Federal Bureau of Mines was on the ground throughout the work done, and valuable assistance was given by the members of the Federal Bureau of Mines in aiding in rescue work.

The teams which took an active part are the following:

Benton team; Herrin team; Duquoin team; Orion team; Dewmaine team; Carterville team.

Bodies Nos. 1 and 2 were found in the machine shop; No. 3 and 4 were found on main east line close to run-around. Nos. 5, 6 and 7 were found near No. 5 room on 3d east panel on 3d northwest. Nos. 8, 9, 10, 11 and 12 were found on parting on first northeast. No. 13 body, that of Wm. Webb, the pumpman, was found about 142 feet back from face of main east entry. During this time several fires had been encountered and extinguished, but on December 3 a serious fire broke out in the first northeast, and on account of the large amount of gas in the mine and the liability of another explosion it was decided at once to seal off all the entries around the shaft and extinguish the fires before the other four bodies could possibly be recovered.

And in doing this several factors had to be taken into consideration, viz: The possibility of sealing off the fires and yet make it possible to continue the repair work in the shafts, as well as around the shaft bottoms and to repair the main air crossings. To do this, it was found necessary to put in 13 stoppings in all; 1 direct south of shaft; 2 in main and back east; 2 in first and second southeast; 2 in first and second northeast; 2 in main and back west; 2 in first and second southwest; 2 in first and second northwest.

It is obvious that by putting these stoppings well inside it accomplished all that was required, viz: To repair the shafts and round the bottom; maintain the ventilation around this area; subdued the fires and also rendered the breaking of the seals and the recovery of the mine a comparatively easy matter.

It was not until January 16, 1918, that it was found it would be safe to open up the seals, which was done and the work of recovering the bodies of the other men was commenced. On the night of January 17, 1918, three more bodies, Nos. 14, 15 and 16, were found in the first crosscut in No. 5 room off fourth east off of third northwest.

The body of the other man, No. 17, was found on the parting behind some cars on the first northeast on January 29, 1918.

It was not until January 31 and February 1, 1918, that we could commence with our investigation and could then only take those districts where the ventilation had been sufficiently restored to permit us to enter. The districts are dealt with here in the order in which we took them.

Starting point: Fourth southeast at mouth of fourth south on main east entry air crossing was blown out entirely and position of debris showed that force had been exerted from north to south inside cross cut between main and back east entries, and opposite fourth northeast found soot deposits on roof and sides and indications of the coal being slightly calcined and the sides striated; also showing that force had traveled from north to south at second cross cut east of fourth south; a trolley wire hanger was bent towards the west; at 24 feet east of ninth cross cut we found one plate of the motor cover; at 30 feet we found one more and at 12 feet east of the 11th cross-cut on main entry another part of the motor cover was found; motor was found at 12th cross-cut east of fourth south and all indication on the motor showed that it had been struck with terrific force on the east end, showing force traveling west.

The door at the fifth north off main east was blown 10 feet south, but not entirely broken up, indicating that the door must have been open before the explosion.

The sides and roof at the mouth of the fifth and sixth southeast were coked distinctly and showed signs of intense heat; there was no sign of coking on main east entry at this point. At nineteenth cross cut, or cut off between main and back east entries, a canvas door stretched on a wooden frame was found off the hinges, but not destroyed, showing that it must have been open at the time of the explosion or so light a structure would have been shattered. The pumpman's body was found six feet east of the 19th cross cut and his cap and lamp was found 12 feet further east, the cap was partly burned.

At the 19th cross cut the entry makes a rise east of about 12 per cent and a total rise of about 10 feet; midway between 20th and 21st cross cut a miners box was found and the powder inside was burned, but the outside of box showed no signs of burning. This was permissible explosives, nitro-compound. From midway between 20th and 21st cross cuts the entry dips east: at about 12 per cent and a total dip of about 10 feet; there was considerable coking on the main east entry at 21st cross cut; also in the cross cut itself and on the back east entry.

Investigation continued on February 15, 1918. All indications on the 3d northwest showed the force to be traveling from north to south on the motor parting, a long trip of cars were standing, several of which had been thrown off the track.

Indications showed that the force of the explosion on the third east panel off the third northwest was from west to east. A motor standing at mouth of No. 2 room on third east off third northwest was badly wrecked; on west end of motor at this point there was heavy deposits of soot. On third and fourth panel west off fourth northwest there was much soot deposited and much coking on roof and sides showing intense heat.

Investigation continued February 16, 1918.

In the first and second west panel off the third southeast the force of the explosion was from east to west and all the stoppings in cross cuts were blown north. On the third and fourth southeast entries the force was from north to south. The force of the explosion on the first and second east and third and fourth east panels off fourth southeast was most generally from east to west.

A most peculiar feature about the first and second southeast showed the force to have traveled from the face of both these entries, stoppings in cross cuts were blown both ways, yet on the third and fourth southeast they were nearly all blown south.

The force on the third and fourth west panel off the third northeast had traveled from east to west. The force on the first and second northeast was north and on the third and fourth west panel off first northeast it was west. The violence ceased at the third cross cut north of the sixth west panel on first northeast.

At a point on the first northeast opposite the fourth cross cut north of the sixth west panel some grading had been done, and the fire clay had been cut through for a distance of 100 feet with an average thickness of 1 foot 6 inches.

And from this point going north the entry was covered with a large amount of sand. There was quite a grade against the load and sand had been used and the used sand had been constantly thrown to the sides and allowed to accumulate for a distance of 400 feet.

Beyond this point going north the force of the explosion ceased and all doors and stoppings going towards the face of the first and second northeast were still intact; the distance from the sand to the face of the first and second northeast entries is about 1,400 feet. We understand that the ventilation was good in these entries before the explosion.

NOTE.—The roadways and sides of roads on the fifth and sixth east panels off the first northwest were sandy for a distance of 300 feet from the first northwest and an evidence of violence was observed on these entries.

NOTE.—There can exist in the minds of experienced men no doubt as to the reason the explosion did not travel into those entries where the track and sides of roadway was covered with sand, as it was a dust explosion and the fine gritty particles of sand and fire clay would be thrown into the air; the flame coming in contact with this cloud of incombustible dust would retard and would of course expand and having no fine coal dust to feed upon, it would be cooled below the temperature necessary to continue its force and so would exhaust itself.

This incident gives us a vivid illustration of the effectiveness of shale dust or sand to stop an explosion or to localize one, should one occur in any district.

The force of the explosion on the main west entries was from east to west and all stoppings were blown north except a few near the face of west entries.

NOTE.—There was no sand used on this entry, the stoppings near the face of main west were blown south. The face of the fifth and sixth also seventh and eighth northwest also fifth and sixth and seventh and eighth southwest, as well as the face of the main west entries showed signs of coking and heavy soot deposits.

Sunday, February 17, 1918.

In the first and second northwest all indications pointed to the fact that the explosion had traveled through the panels from east to west and had crossed the first and second northwest and on west had crossed the third and fourth northwest still going west. There was abundant evidence that as the explosion had crossed the first and second northwest it had expanded and showed indications of having traveled both north and south.

Monday, February 18, 1918. The same condition was observed at the third and fourth northwest.

And these same conditions prevailed on the south side of the main side of the main west both on the first and second southeast and third and fourth southwest.

The same conditions were observed on the first and second southeast of the explosion having traveled through the panels from east to west; especially was this clearly indicated at first and second east panel off first and second southeast, also at third and fourth east panel off first and second southeast.

One very significant feature of this explosion and one that indicates the terrific force as well as showing the high velocity of the explosion, shows the terrible volume of flame when confined to one path; the dust traveling with the blast had actually polished the roof and sides just in the same manner that a sand blast will polish anything.

We found that men had been loading dust on the main east, those numbered 3 and 4, and on first northeast at motor parting, men whose bodies were found there and numbered 8, 9, 10, 11, 12, and 17.

We also obtained evidence that shows that the pumpman was talking through the telephone at the bottom of the shaft to the engineer some 7½ or 8 minutes before the explosion.

Also we are firmly convinced that the door at the fifth northeast and also the canvas door spoken of further east had been open, thus short circuiting the air and allowing gas to accumulate in the main east entries.

The pumpman took the big motor from the shaft bottom and ran into the main east; stopped his motor at the pump and evidently walked from there to go to the valve in the main east and ignited the gas at the high point mentioned—the position of his body indicates this. In taking the motor in he had no doubt raised considerable fine dust and put it in suspension in the air as he must have been running at a high speed and against the air this added to the dust already in suspension in the air, from the point where men were loading dust.

Then the concussion of the exploding gas would put more dust in suspension and the flame of the gas explosion projected into this dust laden atmosphere at a high velocity and intensely not produced what in our opinion was probably the most terrific explosion in the history of coal mining in Southern Illinois.

After careful observation we have arrived at the conclusion that this was a typical coal dust explosion caused by the pumpman having ignited some gas in main east entry where it had accumulated, in consequence of the door being left open as already stated, and in doing so we paid due regard to all the important factors that determine the character of a dust explosion. *Viz:*

1. The physical character of the dust—its fineness, inflammability and porosity and its percentage of volatile matter.
2. The free suspension of dust in the air.
3. The temperature and hygrometric conditions of the atmosphere.
4. The condition of the mine with respect to dust and moisture.

NOTE.—1. So far as could be determined the dust was fine, inflammable and flocculent.

2. Dust was also freely suspended in the air.

3. It is well known that the atmosphere conditions were suitable as we had a cold wave coming over, this would help to absorb the moisture from the dust.

4. There was little moisture and large quantities of dust in the mine.

To explain the peculiar freaks of this explosion in apparently traveling in different directions and actually to have traveled back along its own path.

It is only necessary to mention that under favorable conditions in a dust explosion one pound of this fine inflammable dust suspended in the air and subjected to the flame of an explosion of gas would produce a volume of carbon mon-oxide (C.O.) equal to 31.5 cubic feet measured at a temperature of 60 degrees Fahrenheit and an atmospheric pressure of 14.7 pounds per square inch and that this again disseminated in the air would produce an explosive mixture equal to 2,440 cubic feet at its maximum.

It must also be remembered that any carbon dioxide (C.O.) formed by an explosion in an excess of air may be again reduced by the intense heat in contact with unburned incandescent carbon dust to carbon mon-oxide. Thus continuing and extending the explosive range. This to a certain extent accounts for the persistency of a coal dust explosion for wherever the explosion finds a place to expand it will do so, and its velocity is then lowered, the heated carbon mon-oxide C.O. in the trail would draw a supply of oxygen from the rooms or increased area and would again explode and travel back along its own path, this we found from the evidence actually had happened more than once.

In determining whether an explosion was a purely gas explosion or a gas or dust explosion it must be remembered that in a gas explosion it can only extend as far as the amount of gas exploded can expand, and that marsh gas explosion may be extinguished by an atmosphere containing 10 per cent of carbon dioxide (C.O.₂) while it requires an atmosphere containing 24 per cent of carbon dioxide to extinguish the flame of exploding carbon mon-oxide (C.O.).

It must also be remembered that the afterdamp of a dust explosion almost invariably contains much carbon mon-oxide (C.O.) which owing to its wide explosive range is not as liable to be extinguished by the expansion and cooling of the gases in more open workings as marsh gas is.

This accounts for the phenomenon of what is termed the recoil or return flame of a dust explosion.

As the first explosive blast sweeps through an entry it leaves behind it a trail of hot and generally inflammable gases consisting chiefly of carbon mon-oxide (C.O.) and nitrogen. The immediate cooling of these hot gases due to expansion causes a depression or fall of pressure in the entry and as a consequence air rushes out from the rooms or other workings.

Thus a fresh supply of oxygen is furnished and the flame having been arrested in its advance by the increasing effect of the depression behind or by its own expansion and cooling starts to turn back on its own trail, this second burning may be less rapid and violent but is generally hotter than the first blast.

In conclusion we fully realize that we cannot too strongly deprecate or condemn the action of those responsible for allowing the dust to accumulate in this mine to such an extent as to become a menace to the health and lives of workmen and also a source of danger to the property.

And having regard to all the facts we are fully persuaded that in mines known to generate fire damp (C.H.₄) some definite system of examination should be adopted and maintained, so that the workings would be examined by a competent man after an idle day or a holiday before the night crew were allowed to go inside.

Had this been done in this instance those open doors, referred to, would have been noticed, and the accumulation of gas in the main east would have been detected and dealt with and seventeen human lives would have been saved to their families and to the country.

(Signed) JOSEPH C. THOMPSON,
State Inspector, Tenth District.
FRANK ROSBOTTOM,
State Inspector, Ninth District.
T. C. WRIGHT,
State Inspector, Eighth District.
H. T. BANNISTER,
State Inspector, Twelfth District.
JAMES TAYLOR,
Mining Investigator.

REPORT OF THE EXPLOSION OCCURRING AT MINE No. 18 OF THE BY-PRODUCTS
COKE CORPORATION ON JULY 26, 1917.

Hon. Evan D. Johns, Director, Department Mines and Minerals:

The explosion originated on the 5th north panel entry 1st west south at room No. 1 while the motor trip of empty cars was passing into the panel. The gas was ignited either by the light of the motorman or triprider or by