

REPORT OF EXPLOSION

AT

CARSWELL MINE, NO. 3 SHAFT

OF THE

HOUSTON COLLIERIES COMPANY

KIMBALL, MC DOWELL COUNTY,  
WEST VIRGINIA.

July 18, 1919

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I N T R O D U C T I O N

BRIEF STATEMENT:

About seven thirty o'clock on the morning of the 18th of July, 1919, an explosion occurred in No. 3 Shaft of the Carswell Mine of the Houston Collieries Company, Kimball, West Virginia, in which the mine foremen, M. C. Roberts and five men, whose names are unknown to the writer, lost their lives. It is believed that three of these men were overcome by after-damp, and three were killed by falling slate or timbers due to the force of the explosion. The first report which reached the Bureau of Mines indicated that over two hundred men were entombed in the mine and Mine Rescue Car No. 8, then at Morgantown, W. Va., was ordered to the scene of the accident. Later reports received indicated that the explosion was not as serious as had been believed and that, with the exception of the six men who were killed, everyone had been gotten out of the mine. The car was therefore turned back at Moundsville, W. Va.

LOCATION:

The Carswell Mine is located on a spur of the main line of the Norfolk & Western Railroad about one mile north of Kimball, McDowell County, West Virginia.

OPERATORS:

The Houston Collieries Company, operating the Carswell Mine, is a corporation having its main office at 1522 Union Trust Building, Cincinnati, Ohio. The officers of the company are Mr. T. E. Houston, President, Mr. N. H. Franklin, Secretary and General Manager, and Mr. Benjamin Lewis, General Superintendent.

The officials at Kimball are Mr. E. L. Stafford, Superintendent of the Carswell Mine, Mr. John Maurice, General Mine Foreman, and Mr. John Fitzer who, previous to the explosion had been fire boss, but at the time of the investigation was acting as mine foreman, succeeding Mr. M. C. Roberts who had lost his life.

In conjunction with the Houston Coal & Coke Company, an affiliated company, the Houston Collieries Company operates several mines in West Virginia at Elkhorn, Maitland and Carswell, all in McDowell County.

SEAM OF COAL MINED:

In this part of McDowell County the two seams, Pocahontas No. 3 and Pocahontas No. 4. are about sixty-five or seventy feet apart. The Houston Collieries Company is working both seams simultaneously at their Carswell Mines. The mine in Pocahontas No. 3 seam is known as No. 3 Mine and the one in No. 4 seam is known as No. 4 Mine. The explosion occurred in the lower or No. 3 Mine.

The thickness of No. 3 seam at this mine averages about five feet

and has the usual characteristics of the Pocahontas coal: high fixed carbon, low volatile matter and low sulphur. An analysis of a sample taken from the face of No. 9 Room on No. 2 Right East Entry is attached to this report. The roof is composed of from 6 inches to 24 inches of drawslate over which is a stratum of black slate ranging from 6 inches to 3 feet 0 inches in thickness. Above this occurs the sandstone, and then the Pocahontas No. 4 vein which averages 4 feet in thickness. The floor is a smooth hard blue slate.

The coal dips towards the northwest at a rate varying from two to six per cent and is free from faults and rolls. It is particularly clean and free from any impurities. It has no distinct cleat.

#### VENTILATION:

The mine is ventilated by a 10 ft. x 4 ft. Sirocco fan, driven as an exhaust by a Harrisburg Foundry & Machine Company Engine and making 120 revolutions per minute. Both the mines, the one in the upper seam and the one in the lower seam, are ventilated by this fan which develops about 135,000 cu. ft. of air per minute. Of this amount of air about 75,000 cu. ft. are delivered to the No. 3 or lower mine. The fan is equipped with explosion doors which, at the time of the explosion, operated very satisfactorily.

The ventilation in No. 3 Mine is divided into two splits, one of about 47,000 cu. ft. of air going to the West Side of the shaft and about 30,000 cu. ft. to the East Side. The double entry system of one intake and one return is used. The cross entries are driven in pairs and in the main east entries there are four sets of cross entries all ventilated by the same split. The air goes up the main east aircourse through the last breakthrough and down the entry to a stopping, provided with a door, which is placed across

the entry between the last pair of cross entries; then up the aircourse, through the breakthrough and down the entry and rooms to the main entry again; thence to the next pair of cross entries; and so on until it finally reaches the fan. This system of ventilation requires a door on the main entry between each set of cross entries. As far as the writer could observe, there were few, if any, overcasts on the Main East Entries.

The stoppings are built of two walls of slate, possibly sixteen or eighteen inches apart, the space between being filled with fine material and the outside of the walls plastered with cement mortar.

#### DRAINAGE:

The water which accumulates in the mines is pumped to the surface, there being five steam and sixteen electric pumps at the plant.

#### HAULAGE:

The haulage system is entirely electric, seven locomotives being in service. The trips are brought to the main partings by gathering locomotives and the loaded cars are then hauled by heavier motors to the shaft. There are two main haulage motors, three Jeffrey cable-gathering motors and three Iron-ton Storage Battery locomotives. The trolley locomotives operate on a voltage of 250 volts. The tracks are of 44-inch gauge and on the main haulage entries are laid with 60-pound rail on hard wood ties, averaging 4 in. x 6 in. in size. In the rooms, twenty and thirty pound rails are laid.

The mine cars are of steel and when empty weigh about four thousand five hundred pounds and have a capacity of about two and a half tons.

On the East Side of the mine the haulage, especially on the cross entries, is on the return air current. and as before stated, it is necessary

to open a number of doors in order to allow the trip to pass down the entry.

#### HOISTING EQUIPMENT:

The coal is hoisted by means of a Danville Steam Hoist made by the Danville Foundry & Machine Company, Danville, Ill. The cage is of the self-dumping type. The tippie is of steel, equipped with 8-ft. bar screens,  $1\frac{1}{2}$ -inch space between the bars.

#### LIGHTING:

The shaft bottom is lighted with electric incandescent lights, while closed Edison electric lamps are used by the miners. The mine foremen and fire bosses carry flame safety lamps, believed to be of the Wolfe type, for the purpose of testing for gas. As far as the writer knows, none of these safety lamps are magnetically locked.

#### MINING METHODS:

The mine is worked on the room and pillar system and is divided into two sections, one going in an easterly direction from the shaft, known as the East Section. and the other developed in a westerly direction from the shaft, known as the West Section. The explosion occurred in an entry in the East Section. The Main East Entries are two in number, one used for an aircourse and one for haulage. From these main entries a cross entry and aircourse are turned at intervals of about 350 feet. They are driven from 15 to 18 feet wide; on the entry the drawslate is taken down over about one-half its width and piled on the other side to serve as a partial support to the slate still remaining. Wherever needed, posts are set along the edge of the piled up slate to further protect the entry from falls of slate. In a number of places the drawslate projected out over these posts and over the track. The pillar

between the entry and aircourse is about sixty-five feet in width. The rooms are turned from one cross entry only, the parallel being simply an aircourse. These rooms are about twenty feet in width and spaced on eighty-five foot centers.

As the mine is a comparatively new operation, all of the mining is advance work, no ribs or pillars having been drawn.

The coal is undercut by electric chain machines of the shortwall type, one being a Jeffrey and the other a Goodman. As far as known, neither of these sets is of the "permissible" type, as defined by the Bureau of Mines.

The air shaft is common to both mines, but the hoisting shafts are separate. It is the understanding of the writer that in case of the disabling of the hoisting equipment in No. 3 shaft, through an explosion or otherwise, it is possible for the miners to go up the air shaft to No. 4 Mine and thence to the surface by way of No. 4 shaft. Conversely, if the No. 4 shaft is put out of commission, escape for the men in No. 4 shaft can be effected by going down the air shaft to No. 3 Mine and out by No. 3 shaft.

No. 4 Mine is laid out to follow closely the general plan of the No. 3 Mine. It is intended to recover the pillars and ribs in the upper seams ahead of the recovery of the corresponding ribs and pillars of the lower seams; so that when the latter are drawn, any subsidence will not injure the coal above.

The posts are of hard wood at least six inches in diameter.

In posting at the face of a room, three props are placed close to the face, the end posts being about four or five feet from either rib. Six feet back of this row is a second row of three posts staggered with the

first row. Between these two rows a post is set close to each rib.

There are about ninety men employed underground in No. 3 Mine and fifty-five in No. 4 Mine. At present No. 3 Mine is producing from four hundred and fifty to five hundred tons per day.

#### EXPLOSIVES:

The coal, after being undercut, is shot down with permissible explosives, Monobel and Tunnelite C being used. The explosive is carried into the mine in a wooden box in which it is kept until needed. The maximum amount which a miner is allowed to take into the mine at any one time is enough for three shots or about four and a half pounds.

The maximum amount used in a charge is three sticks in any one hole, the drill holes averaging about two inches in diameter. The explosive is tamped with clay shipped into the mine from the outside, wooden or copper tamping bars being used.

All shooting is done by electric batteries, the miners themselves doing the shooting whenever their place is ready, as there are no regular shotfirers.

previous  
There have been no explosions in the No. 3 Mine, but on May 27, 1916 an explosion occurred in No. 4 Mine, in which four men were killed; the cause of the explosion was thought to be the ignition of an accumulation of gas by lighted matches. A copy of the report of this explosion is on file in the office of the Bureau of Mines.

#### DUST:

In that section of the mine in which the explosion occurred, there is more or less dust in the rooms and along the entries. Samples of dust were

~~taken and analyses~~ sheets of the same are attached hereto. The bearing of this dust upon the explosion is discussed in another part of this report.

#### POWER PLANT:

The company generates all the power used at the mine, having a boiler plant of about 1500 h.p. and two 240 K.W. generators. A stone power house is now in the course of construction.

#### STORY OF THE EXPLOSION:

On the morning of the explosion but comparatively few of the ninety or more men generally employed underground had gone into the mine because of the lack of cars. Most of those who had gone in were engaged in fixing the haulage ways, putting up brattices, etc.

On making his rounds before the men entered the mine, John Ditzer, the fire boss, claims to have detected gas within eight feet of the face of No. 16 Room on First Right Entry and so reported in the fire bosses' report book. This report book also was signed by Mine Foreman Roberts and by General Mine Foreman John Maurice as having noted conditions.

Later in the morning, General Mine Foreman Maurice met Roberts at the foot of the shaft and reminded him of the presence of gas in No. 16 Room, to which Roberts is said to have replied that he was then going up there with two men to put up a canvas. General Mine Foreman Maurice then left Roberts and went to the West Side of the Mine.

About seven thirty that morning, Mr. E. L. Stafford, the Superintendent of the mine, was standing on the porch of his house which overlooks the plant, when he saw the explosion doors of the mine blown open and then fall back into place. The fan chart registered the explosion at 7:40 a.m.



A rescuing party was formed and the entire current of air from the East Side of the mine was turned into First Right Entry, giving an air current of about 30,000 cubic feet of air per minute. The party proceeded with the air up first right, bratticing up the room necks and breakthroughs as they went. The first body was found on the main side track possibly five hundred feet from the shaft. The head was badly crushed as if by falling slate or timbers. This man had been at work on the track at or near the point at which his body was found. Two more bodies were found on first right just behind the door and were more or less bruised. The next two bodies were found near No. 14 room and were badly burned. Roberts' body was found in a breakthrough which had been driven across to No. 15 Room. This latter room had not been driven up a sufficient distance to reach the breakthrough. The body was lying about thirty feet in by the breakthrough, the head being wrapped in canvas. Lying beside it was a Wolfe Safety Lamp, the lower part of the lamp being unscrewed, the threads intact. With the exception of one gauze and the glass globe, the lamp was uninjured. Later it was put together and burned as good as ever. In the pockets of the clothes which Roberts had on were found six matches and about three hundred dollars. These articles were taken from the body by the mine inspector, Mr. Butler. The bodies were all recovered in a space of probably three hours from the time of the explosion, the party having traveled a distance from the shaft to No. 16 room of probably three-quarters of a mile.

NOTES OF EVIDENCE OBTAINED BY THE BUREAU OF MINES:

The writer, L. D. Tracy, and G. W. Grove, of Rescue Car No. 8, reached Kimball on July 21, 1919, and began an investigation to determine the cause of the explosion and to obtain evidence of any explosion hazards which might exist in the mine. The information contained in the foregoing paragraph was gathered from Mr. H. L. Butler, Mine Inspector of the Department of Mines of West Virginia, Mr. Stafford and Mr. Maurice.

The following information was obtained during the investigation by Mr. Grove and the writer:

The mine foreman, Roberts, was said to have first class certificates from West Virginia, Pennsylvania and one other state thought to be Illinois, and was reported to be a careful and safe man.

The fire boss, John Fitzer, reported on the morning before the explosion that First Right East Entry was dusty. After the explosion, a sample, No. 32434, of dust was taken at the point where No. 3 room on No. 2 Right East Entry had broken into First Right Aircourse and a second sample, No. 32435, was taken in the breakthrough between Nos. 3 and 4 rooms on No. 2 Right East Entry. The samples were taken at these points because of the heavy falls of slate in the rooms and aircourse of First Right. Analyses sheets of these samples are attached hereto. An inspection of these sheets will show that the percentage of volatile matter and fixed carbon in Sample No. 32434 is 14.23% and 50.53% respectively, and the ratio of volatile matter to total combustible matter is 21.97%, and in Sample No. 32435 the percentage of volatile matter is 14.98% and fixed carbon 56.98%; the ratio of volatile to total combustible matter being 20.82%. It has been found in extensive experiments by the Bureau

of Mines at its Experimental Mine at Bruceton that at the ratio of volatile matter to total combustible shown in the above samples it would take at least 55% of incombustible material mixed with the total combustible material to prevent the propagation of an explosion when there was no gas present.

The analyses sheets show that sample No. 32435 has 28.04% and sample No. 32434 has 35.24% of incombustible material, both of which are much below the required amount to prevent the propagation of an explosion. In addition, it is probable that there was present a quantity of explosive gas, for the reason that the sample of air taken in No. 16 Room on First Right contained 5.89% methane as shown in the analysis sheet of air, sample No. 11124 hereto attached. At the time this air sample was taken, the air was going up First Right through 17 room, and returning through the remaining rooms to the main return aircourse. A measurement soon after the explosion by the mine inspector of the air in First Right near No. 5 Room showed an air current of 30,000 cu. ft. per minute. Attached to this report is an analysis sheet of sample No. 32433 which shows the analysis of a sample of coal taken from the face of No. 9 Room on No. 2 Right East Entry.

Air sample No. 11121 was taken on the return East split and shows 0.15% methane in a current of about 30,000 cu. ft. or about 65,000 cu. ft. per twenty-four hours. Air sample No. 11122 showing 0.83% methane was taken ahead of the air and about 25 feet from the face of First Right Entry. Air sample No. 11123 with 0.77% methane was taken in the neck of No. 19 Room on First Right.

An inspection of First Right showed that practically all of the stoppings between it and the aircourse had been blown out and almost the entire

entry was filled four or five feet deep with heavy falls of slate, some of the pieces weighing several tons. The tracks were more or less out of place and the trolley wire down. Above No. 16 room, however, there were but slight falls of roof and the posts were standing. All posts were standing in the aircourse and in the breakthroughs. In No. 16 and No. 17 rooms there were heavy falls of slate and the posts were down. In rooms Nos. 13, 14 and 15 there were also heavy slate falls.

In No. 5 Room Neck on First Right a mining machine was standing, which had never been affected by the explosion. In some of the rooms the floor of the breakthroughs had been swept of dust as if by a broom. The writer was unable to find any traces of coked particles. The doors on First Right and on the Main East Entry between First Right and the Aircourse were blown out. The door, however, between Second Right and Second Right Aircourse was not damaged.

The explosion seemed to have shown the greatest force in the rooms from No. 13 to No. 17 Rooms in First Right and in First Right Entry.

It also extended into No. 3 Room off No. 2 Right Entry which had broken through into First Right Aircourse and through the breakthrough into No. 4 Room off Second Right Entry.

Some falls were found on the Main Parting and also some timbers had been blown around, but the damage was slight as compared to that found in First Right.

From an interview which the writer had with the coroner, who is also a physician, it would seem that mine foreman Roberts and the two men who were found near 14 Room on First Right had been finally overcome by the afterdamp. The remaining three men were undoubtedly killed by the force of the explosion

or from falling slate or timbers.

So far as the writer knows, none of the machines used in mining the coal are classed as permissible.

On May 27, 1916 an explosion occurred at this same operation, but in the upper seam, in which four men were killed. This explosion is supposed to have been caused by the lighting of matches.

As has been stated, a report upon this explosion is on file in the Bureau of Mines.

### C O N C L U S I O N S

From the evidence secured, there can be no doubt that the mine foreman Roberts went into No. 16 Room on First Right Entry in order to make an examination of the room previous to making preparations to remove the gas, should any be found. In all probability the light in his safety lamp was extinguished and he was unable to relight it with the automatic lighting arrangement.

He evidently went over to the breakthrough to No. 15 and taking his lamp apart attempted to light it with a match. In doing so, he ignited a body of gas which initiated the explosion. From the fact that the explosion gained force as it spread, and as the greatest evidence was found in the entry, it would seem that dust played a considerable part in propagating the explosion.

The particular parts of the evidence upon which these conclusions are based are the high percentage of gas found in No. 16 Room, as shown by the analysis of mine air sample No. 11124, the finding of the open safety

lamp and the matches on Roberts' body; the explosibility of the samples of coal dust obtained, the fact that the floor and breakthroughs were swept clean of dust and that the farther the explosion traveled the more evidence was shown.

### RECOMMENDATIONS

(1) It is believed that in the future no flame safety lamps should be used in this mine except an approved magnetically locked safety lamp.

Although used by experienced men, this incident shows that even they can not always be trusted.

(2) As long as the custom of piling slate on the side of the entries is continued, applications of rock dust should be made in quantities sufficient to render the coal dust which accumulates thereon inert. It has been found by a large number of experiments at the Experimental Mine of the Bureau that a percentage of 70% shale dust and 30% coal dust will explode. The percentage of volatile matter (moisture and ash free) in the dust samples taken from the Carswell Shaft No. 3 ranges from 20.82 per cent to 21.97 per cent, as shown in analyses sheets of samples Nos. 32434 and 32435. To render this dust non-explosive would require a mixture of about 58% of rock or shale dust, providing no gas were present.

Air samples No. 11122 and No. 11123 taken on First Right show nearly 1% of gas present, and would probably require about 65% shale or rock dust and 35% of coal dust in order that the mixture might be non-explosive.

This method of preventing dust explosions has been in use by some of the large companies in the Illinois and Colorado fields, especially in the

very gaseous and dusty mines, and it has proven very satisfactory.

(5) At the Experimental Mine a great many investigations have been made of the use of rock dust barriers in controlling and preventing the spread of dust explosions. The results obtained have been very satisfactory, as the explosions have been regularly stopped at the point of installation of the barriers.

A full account of these experiments and the results obtained therefrom is given in Technical Paper No. 34 entitled "Methods of Preventing and Limiting Explosions in Coal Mines", a copy of which may be obtained upon request from the Director of the Bureau of Mines, Washington, D. C.

It is believed that rock dust barriers should be installed in every ventilating split near the beginning of the split and perhaps every quarter of a mile thereafter on all dry entries where there is a liability of any accumulation of dust.

These barriers are used in some of the large Illinois mines and it has been claimed that in several instances they have been very effective in stopping explosions before any great damage had been done.

~~The photographs attached to this report will illustrate the construction and operation of a rock dust barrier.~~

Photograph No. 13034 shows a barrier which was set up in the open and which was operated by hand in order to illustrate its principles. The curtain of rock dust can be seen falling from the barrier to the floor and Photograph No. 602 shows an end view of the dust cloud.

Photograph No. 5310 is a picture of a barrier installed in a mine. In the foreground may be seen a wire which is connected to the tripping device

and which runs along the roof of the entry for one hundred feet or so and then is connected to a vane which is operated by the wave caused by the explosion.

Photograph No. 428 is a view of the barrier after it has been sprung.

(4) If rock dusting the entries or the use of rock dust barriers is not employed, a systematic method of sprinkling the entries with water should be employed.

It has been definitely proven that dust containing 20 per cent of shale and 80 per cent of coal, 30 per cent of which will pass a 200-mesh screen, requires about 20 per cent of free moisture to render it unexplosive. The above ratio is about that of the dust found in the Jarwell Shaft No. 5.

(5) It is the understanding of the writer that in this mine all shooting is done by the miners. If shotfirers were employed, it is thought that the liability of explosions would be lessened because, with electric cap lamps, the miner is unable to test for any accumulation of gas. In addition, by having a shotfirer make systematic rounds, the coal on any one entry would be shot down within a short period of time, enabling the miners to have their loads ready to be pulled practically at one time. In this way the driver would be assured of a full loaded trip. Where each miner does his own shooting whenever his place is ready, it often happens that a driver will make a trip and find only one or two cars ready to be pulled. Therefore, from an economic standpoint as well as from that of safety, the employment of shotfirers and a systematic method of shotfiring might prove to be an advantage.

(6) It is the writer's impression that the entire East side of the



mine is ventilated by one split, the entries from which rooms are turned acting as a return and the parallel aircourse as an intake. Several pairs of cross entries are ventilated by one current necessitating a door between each entry and its aircourse. As the entry is used as a haulage road, the trolley motors are practically operating on a return current. In making a trip the length of an entry, several doors must be opened and the danger of short circuiting the air is very great. Recently an explosion was investigated in which seven men were killed, the primary cause of which was undoubtedly the short circuiting of the air by an open door. An explosion from a similar cause occurred in the Pittsburgh district in which three men lost their lives.

The ventilating system should be so arranged that the entries from which the rooms are turned should be the intake and the aircourse should be connected by overcasts with the main aircourse as far as practicable.

The attention of the company is called to Section 52 of the West Virginia Mining Laws which states that electric haulage by locomotives operated from a trolley wire in any mines worked by safety or approved electric lamps shall be on the intake air fresh from the outside.

(7) In all future work involving the driving of main entries to any distance, at least three entries should be planned, one for haulage, one for the intake and one for the return. If a large field is to be developed, it would be more desirable to drive four entries, making two of them return aircourses.

(8) In case the company does not think it practicable to change the system of ventilation or to construct overcasts to avoid the use of doors, it would be advisable to install automatic doors so that the danger of leaving a

door open and short circuiting the air will be reduced to a minimum.

ACKNOWLEDGMENTS

The writer desires to acknowledge the courtesy shown and the assistance rendered during this investigation by Mr. E. L. Stafford, Superintendent, and Mr. John Maurice, General Mine Foreman at Carcwell.

Respectfully submitted,

*G. D. Tracy*  
Coal Mining Engineer.

APPROVED:

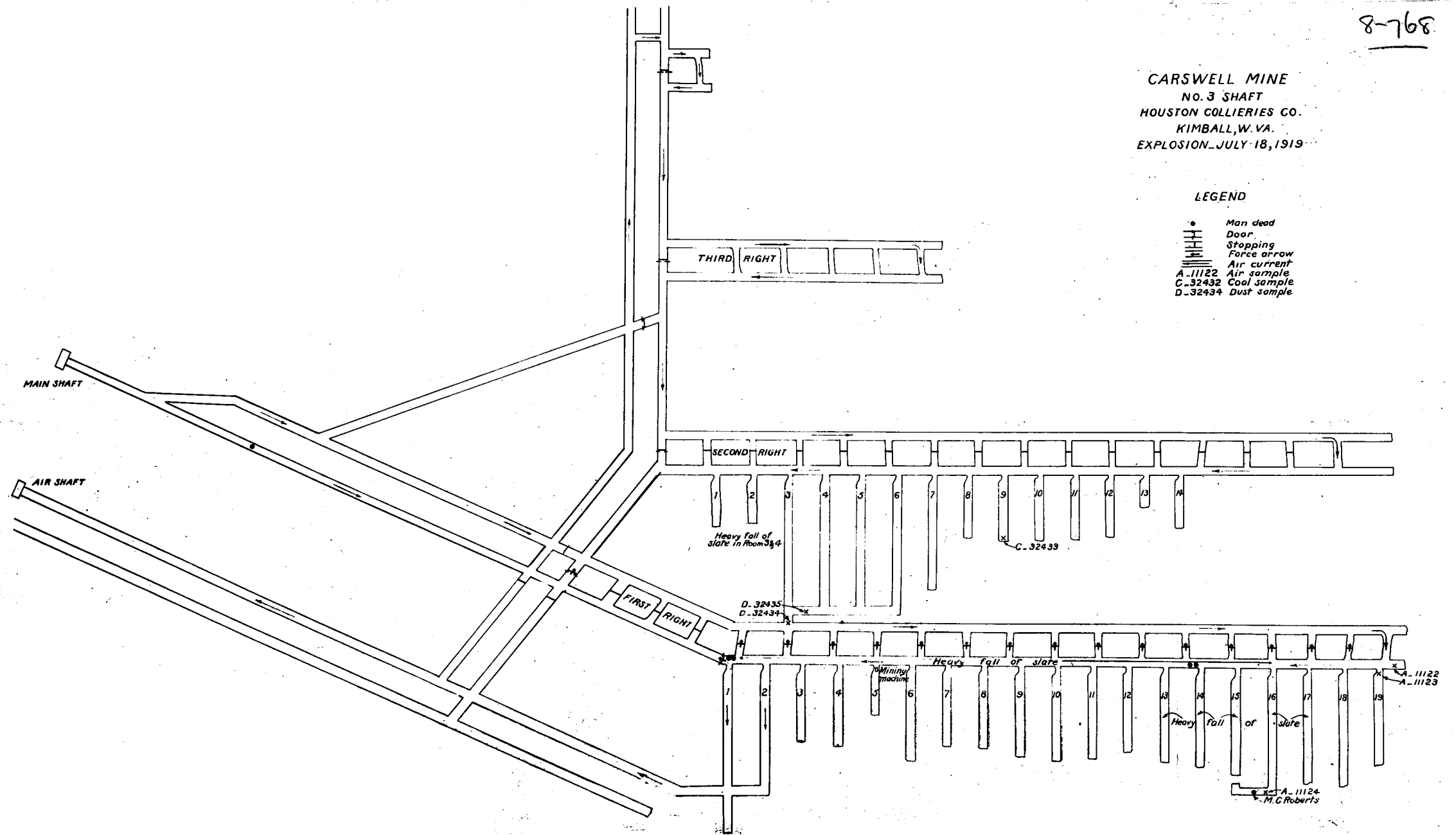
*J. W. Paul*  
Chief of Coal Mining  
Investigations.

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CARSWELL MINE  
NO. 3 SHAFT  
HOUSTON COLLIERIES CO.  
KIMBALL, W. VA.  
EXPLOSION JULY 18, 1919

LEGEND

- Man dead
- Door
- Stopping
- Force arrow
- Air current
- A-11122 Air sample
- C-32432 Coal sample
- D-32434 Dust sample



D-252