



Reports

Cokedale Mine

02/09/1911

COKEDALE EXPLOSION

February 9, 1911.

Owner & Operators
American Smelting & Refining Company.
(Carbon Coal & Coke Co.)

Report by

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Department of the Interior,

Bureau of Mines.

Denver, Colo.,

June 14, 1912.

INTRODUCTION:

An explosion occurred in the Cokedale Mine at about 9 o'clock p.m., February 9, 1911, which resulted in the death of 17 men:

Seven shotfirers, eight miners (entry men) and two rescue men.

GENERAL INFORMATION:

Location & Ownership: The Cokedale Mine is located in the town of Cokedale, Colorado, in Reilly Canyon, S25, T33S, & R 65W. It is nine miles west of Trinidad, Colorado, in a spur of the D. & R. G. R. R., and reached by trolley from Trinidad, with cars running to and from, every hour.

The mine is owned and operated by the Carbon Coal & Coke Company, a subsidiary of the American Smelting and Refining Company.

The officers are; Franklin Guiterman, General Manager, Denver, Colorado, and F. H. Bayless, Superintendent, Cokedale, Colorado.

GEOLOGY & CHARACTER OF COAL:

Geology: The coal bed is known as the Cokedale Seam and lies in the upper cretaceous.

The coal is of the bituminous variety and makes an excellent dense coke.

The vein lies practically flat and averages 6 feet in thickness, varying from 4' 6" to 8' 6", with persistent shale partings, varying from 1/2" to 6" in thickness.

The immediate roof is draw slate, varying in thickness from 6" to 18". It weathers on exposure to air and consequently requires a good deal of timbering. It frequently comes down with the coal.

The main roof is sandstone and stands well.

The floor is a smooth hard shale, but rolling; faults and rolls being very frequent.

There is no workable coal above this seam but a good vein 180' below, which it is expected will be worked in the future.

DESCRIPTION OF MINE AND METHODS OF OPERATION:

Method of Working: The mine is worked with double entry, room and pillar system. It is laid out in blocks, A, B, and C, (See Map) and the rooms are driven and pillars pulled on the retreating plan; each block being pulled as soon as the rooms are finished, from the inside.

The entries are 10 feet wide; the main pillars are 25 feet and the side entry pillars 30 feet. the rooms are 20 feet by 300 feet, with 25 foot pillars.

Equipment - Surface: The outside equipment consists of steam hoist, operating the H. & P. chain haul from the slope; washery containing picking tables to pick out the larger pieces of slate, crushers and Pittsburgh jigs and storage bins with a capacity of 1800 tons. The refuse from the jigs, containing from 40 to 50% combustible material, is carried by an aerial tram and stored in piles for possible future use, the washed coal being stored in the bins, and carried by larry to the coke ovens. There are 350 - 13 foot Beehive coke ovens in batteries of 190 and 160 ovens, which are pulled by mechanical pullers. The coke is not forked or screened, but coke, breeze and everything is shipped direct to the smelters. There are fully equipped machine and electric shops, store houses, and everything necessary to do any and all sorts of repairs.

Seven boilers of 150 H. P. each; an ~~Capell~~ fan with a capacity of 65,000 cu. ft. of air per minute, with an average water gage of .9 inches.

The camp (town) is beautifully located and well laid out. The sanitary conditions are excellent and great care is exercised by the management to keep it so. The buildings are all built of coke breeze, concrete blocks, with nice, well kept yards surrounding each and all containing water, sewerage and electric lights.

There is a handsome well kept store, office building, club house, with baths, etc. Boarding houses for single men, a saloon, run under the supervision of the Company, and an excellent school house, an excellent sanitary barn and large run for mules. There is a good water system and a well organized fire protection, with hydriants and hose houses, well placed, and a well drilled fire department.

The mine was equipped with three Draeger helmets, but training work was not kept up and there were no trained men at the mine, except the shotfirers, all of whom were in the mine at the time of the explosion.

Equipment - Underground: The haulage system consists of mules, motor and chain haul.

Mules are used for bringing coal from the rooms to the main haulage roads, it is then handled by 10 ton electric locomotives, two in number, operated by 240 volt direct current. It is then brought to the foot of the slope where the H. & P. chain haul transfers it to the washery. The slope was put in through rock to the coal in order to get sufficient elevation to have the coal go to the crushers

and jigs by gravity. The rails in the entries are 30 and 40 lbs. and in the rooms 20lbs. The cross ties are 4" x 5" x 5-1/2, of pine and the props are pine and spruce. All stoppings in the main entries are built up of coal breeze concrete blocks. The pit cars are built of wood, weight 1600 lbs and have a capacity of 4000 lbs. One pump takes care of all the water in the mine and is driven by electricity. The main roads are lighted by electricity, 110 volt, D. C.

The coal was all supposed to be undercut by hand, but after the explosion a number of holes were discovered " on the Solid" with no mining whatever.

A complete sprinkling system of pipes and hose was installed in all the entires except the First and Second West B and 12 Imperial Sprays #642 were in continuous operation in all the intake entries. The sprinkling system did not extend into the rooms. A complete and elaborate electric firing system had been installed. Details and blue prints of this system are attached herewith and form part of this report. About two months prior to the explosion, this system had been temporarily abandoned, the reason given being that they had trouble with the men cutting the wires, resulting in a large number of missed shots. The explosives used at the time of the explosion were 40% nitro-glycerine, dynamite and some Altria B was being tried out.

There was one chief and eight (8) assistant shot firers. The miners were not allowed to handle explosives, but the loading and tamping of all holes was done by the shot firers. The explosives were carried in on a car to a central point (about 450 lbs. each day)

sometime in the original box and sometimes in sacks, and distributed among the shot firers by the chief, each man carrying his allotted portion to his particular district, loading and firing his holes, and any unused explosives brought out and checked in by the chief shot firer.

Adobe (Clay) was used exclusively for tamping. This was carried into the mine and kept at convenient places.

The powder magazine in which were stored from 30 to 40 tons of dynamite, is located about 1000 feet from No. 5 opening and the thaw house in which one days supply only was kept in about 200 feet from this opening.

The checking system for men was very complete; all men entering the mine through the check house at No. 5 opening. (This opening was used only for men and timber)

Each man received a check from the board on entering the mine and was compelled to deposit same on coming out.

The shot firers entered the mine through the check house, if any check was missing from the board, they did not enter the mine until this man was located.

As soon as a man was employed, cards were made out in duplicate, one being kept in the office and the other in a receptacle on the check board showing the same number as his brass check. Each card showed the date, man's name, age, nationality, married or single, number of children, prior occupation, appearance and working plan in the mine.

Ventilation: The ventilation is induced by a 15 x 7 double intake, reversable, Bapel fan having a capacity of 60,000 cu.ft.

of air per minute, placed at the collar of the fan shaft, leading from the fourth north entry. This shaft is sunk in rock 60 feet to the coal and is concreted (re-inforced) the whole way. Full details of the fan installation are shown on the accompanying blue print. Air is taken in from three openings or intakes: First; - The main slope is used as a haulage way and all the coal is brought out at this point. Second; - No. 5 (Fifth East) opening is used as a man way and for hauling in timber and other supplies, including explosives. The mules also travel this manway. Third; - The Japan opening is so named from the fact that this district is worked entirely by Japanese miners and is used only as an air way. The opening is closed by an iron grating to prevent men going in and out.

The ventilating current is continuous, with concrete and solid rock over and under-casts on the ~~main~~ main entries and wooden doors in the newer or advanced workings. These wooden doors, I am told, are temporary and will be replaced by overcasts later.

The air throughout the mine was good, even in the faces of the rooms, and though I am told that small amounts of gas had occasionally been found in some portions of the mine, I made careful search during my investigation and failed to find any with a Wolf lamp. I had no sample bottles and consequently could not take any air samples for analysis.

The stoppings on all the main entries are built of coke breeze concrete blocks and the cross cuts are mostly gobbed with rock.

STORY OF THE EXPLOSION:

I received notifications of the explosion at 7 o'clock on the morning of the 10th at Oak Creek, Colorado.

I immediately got in communication by wire with the officials of the Moffat Road and arranged to move the car on the 9:00 a. m. train for Denver. I wired the Carbon Coal & Coke Company that we were coming and received a reply from Mr. Guiterman stating that his representative would meet me in Denver with full details. I wired the C. & S. R. R. asking them to hold their 7:45 train and received reply that they had no train of their own, that the 7:45 was a Santa Fe through train and they could not hold it. I then wired the D. & R. G. R. R. asking them to hold their No. 15 and received reply stating that they would do so. The Moffat train was two (2) hours late in arriving in Denver and we found the D. & R. G. waiting for us. We arrived at Pueblo at 2:00 a. m. and left on C. & S. for Trinidad arriving at 8:00 a. m. on the morning of the 11th. I took an automobile and went at once to Cokedale, arriving at the mine at 10:00 a. m. Saturday the 11th. On arriving at the mine I discovered that all the bodies had been recovered except two, which had already been located and were brought out at 12:00 o'clock.

The Explosion: The explosion occurred at about 9:00 o'clock on the night of February 9, 1911. Dense volumes of flame, smoke and dust came out of the main ~~shaft~~ slope and fan shaft, with frightful violence. Cars and timbers were hurled out of the slope for hundreds of feet and the shock of the explosion was felt in all the houses in the Camp and even as far as Trinidad, 9 miles away.

Considering the violence of the explosion, the damage to the property was comparatively slight - very few falls occurred and the fan did not stop working. The explosion doors worked perfectly and the top of the fan shaft, which was built of wood, was simply

lifted off and came down almost in the same place.

The explosion was caused, I believe without a doubt, by a blown-out shot in Room 21, off the First West B, accentuated by the detonation of a sack of dynamite left near the face of the room and propagated by coal dust scattered throughout the entries and rooms of the mine. Details of this will be taken up when giving the results of the investigation.

Rescue and Recovery Work: The work of recovery was started immediately, under the supervision of Mr. E. A. Sutton, Asst Supt. of the mine. The slight necessary repair at the fan shaft were made and the rescue party, headed by Mr. Sutton, went down the main slope to the steel doors connecting the slope with the Third North entry and Main air course. These doors were set in concrete and it was found that the doors, concrete and all had been carried away by the force of the explosion and were found about 75 feet from this original position in the Third North Entry. The doors were badly bent and twisted. A temporary brattice was put up and the party soon were able to establish an inside station at the junction of the 8th West B and the Main slope or Fourth North Entry.

The Carbon Coal & Coke Company, was the first Company to install helmets in the State of Colorado, but they made the mistake of installing three helmets only and of training only the shot-firers and from what I can learn, even these men were not thoroughly trained. No one else at the mine except Mr. Sutton had ever had the helmets on and he had only worn the helmets on two previous occasions for periods of about one-half hour each and did not thoroughly understand it.

Mr. Charles Chambers, Supt of the Sopris mine, now arrived on the scene and he and Mr. Sutton determined to put on the helmets and make the investigation prior to the arrival of the helmets and men from the C. F. & I. Company and the Victor-American Fuel Company, both of which Companies immediately started their men with helmets from Trinidad and Hastings. Chambers got up out of a sick bed where he had been confined for 10 days with LaGrippe and was in no condition to wear a helmet. The third helmet was not used for lack of a wearer, although I was told that they held this third helmet back as a reserve. When Sutton and Chambers reached the First Slant haul on the Fifth West B, Chambers saw Sutton, who was about 150 feet ahead fighting at his helmet and suddenly drop. Knowing that in his weak condition he could not possibly bring him out, he went out for help. After considerable delay, Robert Meeks, a track layer from Starkville and another man volunteered to go in without helmets and bring Sutton out. When within about 100 yards of Sutton the other man remarked to Meeks, who was considerable ahead of him, "Meeks, this gas is getting me, I must go out"; Meeks answered, "come on, I'm all right" and immediately dropped over and lay apparently dead. The other man then came out. According to the memory of those present, fully 30 minutes elapsed before the men from the C. F. & I. and Victor-American Companies arrived with helmets and brought out the bodies of Sutton and Meeks and the Doctors stated that they were both dead. Although they were both worked on for fully an hour with the Pulmotor, they showed no signs of life.

Upon examination of Sutton's helmet, it was found that one of the Potash cartridges had not been screwed on at the bottom, but was

simply set in place and screwed on at the top. This premitted the injector to pull in the outside air, which presumably contained CO. The tube leading to the cooler, was pulled out, but whether this was done during his struggles to get the helmet off or prior is unknown. The type of helmet used by Sutton and Chambers was the #1 Draeger.

Immediately upon the arrival of the rescue car of the C. F. & I. Company and the helmets and men from the Victor-American Fuel Company, which was about 11:30 that night, regular helmet crews were organized under the direction of Mr. F. H. Bayless, Supt. of Cokedale mine, and Mr. J. S. Thompson, Div. Supt. of the C. F. & I. Company, and a systematic search was made of the whole mine with the result that by noon of Saturday, all the bodies had been recovered and brought to the surface and the air of the mine restored to its normal condition, so that it was possible to explore the whole mine without helmets.

The position of the men in the mine at the time the explosion occurred and when found by the helmet men, is as follows:

Jas. Carelli and Zanot, entry men, working in face 3rd West C.

Tretter and Gheggi, " " " " " 4th " "

All four of these men were found in the 4th West B. entry, between rooms No. 5 and No. 6. They were traced by their tracks in the dust.

Hoxbox and Zazudek, entry men, working in 8th West C.

Siliga and Pozzorsky, " " " " 7th " "

All four of these men were found in 8th West B, between the 3rd and 4th crosscuts.

Klapick and Rawovski, shot firers were working in Room 5,

First West C and their bodies were found in Second West B, near the 4th South.

These ten men, if they had only stayed in their working places, would have been saved and the death roll would have been seven men instead of seventeen.

The doors on the 5th South were blown open by the force of the explosion and the foul air did not penetrate to this entry.

Farish and Mokoosh, shot firers, were working in room No. 20 off the 3rd West B and their bodies were found about 50 feet from where they were working.

Malach, head shot firer, and Francis and Piecha, shot firers were presumably in room 24, First West B.

These three bodies were found in Second West B entry, near the two shot firers who were working in the C block.

These last five men apparently had no chance for their lives. While none of them showed any signs of being burned, the poisonous gases resulting from the explosion filled all the entries and undoubtedly penetrated the rooms in which they were working.

The two rescue men, Sutton and Meeks were found in the Fifth West B, near the First slant haul.

Two shot firers, the only men in the mine who escaped, were in the Sixth West A) Used as a man way) at about room 17. They stated that they were struck in the face by a blast of cold air and almost immediately knocked down by a blast of hot air. Their lights of course were put out, but they succeeded in working their way out through the No. 5 opening.

Condition of bodies and probable cause of death: None of the

bodies showed any signs of violence or burning and that together with other evidence seems to show conclusively that the men were all in rooms or entries, into which the flame or force did not penetrate. The faces of the men were pale and there was no swelling or inflation of any portion of their bodies, no bulging of the eyes or protusion of the tongues and no signs of struggling on the part of any of them.

Although no analysis of the blood was made, the doctor who examined them stated that they died of CO poisoning. Some of the men traveled nearly 2000 feet before dropping and apparently died where they fell without a struggle, others only got about 100 feet.

INVESTIGATION:

The investigation was started on Sunday morning by the writer, assisted by Mr. Thos. Harvey, Mr. Thos. Tweeddale and Mr. Geo. S. Parker of the C. F. & I. Company Rescue car. Mr. Parker had previously worked for the Carbon Coal & Coke Company, as driver in the Cokedale mine and as the local management had no one familiar with the mine whom they could spare to assist in the work, Parker was employed at their suggestion.

On Monday morning, at the request of Mr. Bayless, Mr. Geo. F. Duck, Western Editor of Mines and Minerals, joined our party and rendered valuable assistance by his suggestions and in other ways.

The result of the investigation showed that though the heat and force resulting from the explosion was intense and great, the damage done to the mine was slight, due to the wet condition of certain portions of the mine and the good roof, much of which required no timbering. The almost total absence of ~~fall~~ falls in the entries rendered the work of recovery comparatively simple and easy.

Shooting off the Solid and Blown-out shots: Although the management stated to me that "shooting off the solid" was strictly forbidden and that there had never been a blown-out shot or windy shot reported, except one and then the shot firer was badly burned. I found 18 blown-out shots and a still greater number of shots "on the solid". In looking over the shot firers records, I found occasional records of "rejected shots" averaging one per day, but the reason being in every case "dirty hole", not one instance of "on the solid" or improper mining".

I was also told that it was a regular practice of the shot firers to load and fire any sort of shots for their fire inds, but to reject shots of others on the least provocation. This may be only talk but tends to throw some light on the whole subject.

Blown-out shots were found as follows: Room 21 - First West B, rooms 10, 12 (2 blown-out shots) and 28 - Second West B. Air course off Second West B paralleling Fifth South, 2 blown-out shots; Room 1, First West C, room 25 Third West B, Air course being driven from Third West B to connect with Second West B, 2 blown-out shots, Rooms 13, 17 and 23, Fourth West B and Rooms 9, 12, and 21, Sixth West B.

Humidity Conditions: Main Slope (Fourth North Entry) Dry. Eighth West going East, dry to cross leading to First South going west, dry to Eighth North and standing water in C block.

Seventh West damp throughout with standing water in A and B blocks, as indicated on map.

Fifth and Sixth A, damp throughout.

First, Second, Third, and Fourth West A, abandoned and caved.

Fifth and Sixth West B, dry except when humidifiers were running.

Second West B, dry up to room No. 9; wet to room No. 4 in the C block.

First West B, very dry up to room No. 20 and from this point up to room 8, there was standing water from 1" to 6" deep; From this point, (room 8) to Room 1, the entry was caved tight. This entry had been abandoned, as will be explained later, and the caves occurred prior to the explosion.

The C block was wet throughout all the rooms and entries, with standing water in all the entries from the Fifth South for distances varying from 300 to 600 feet.

First and Second South; wet.

Third South; dry up to the Second West and from that point out to room No. 5 Japan entry was very wet, although the rooms of the Japan entry were very dry.

Fourth South; dry up to Eighth crosscut and from that point to the eleventh crosscut was very wet and sloppy and dry from that point up to Second West or Slant leading to Japan entry.

Fifth South, was very dry in places, but there was noting but rock dust on the entry as it had been brushed down to make grade.

All the veidence points to blown-out shot in Room No. 21 - First West B, as the initiating cause of the explosion and in describing in detail, we will start from this point.

First West B. : About one year prior to the explosion this entry had been abandoned, the rails, ties and pipe all pulled, the reason being that the coal was poor and dirty. About nine months

later the Company needed more coal than they were getting from their other workings and this entry was re-opened and the track laid temporarily, but the piping was not replaced and the entry was sprinkled occasionally with a water car. I am told that the entry had not been sprinkled for three weeks prior to the explosion.

Room No. 21: This room was heavily timbered, prior to the explosion but upon reaching there it was found that there was not a single timber standing. All the props had been blown out into the entry and portions of the room had caved. The face of the room showed that two shots had been put off, one of which was a blown-out shot and the other did its work well and brought the coal down in good shape. Twenty foot from the face and in a direct line with the blown-out shot, was a hole in the floor two feet deep and three feet in diameter. At this point a cross cut had been started toward room No. 20. This cross cut was in 10 feet. The track was torn up for 15 feet in each direction from the hole and the rail nearest the cross cut was bent into same and one piece of the rail 12 inches long was broken off and found lying on a bench in the cross cut. The balance of the other rail for a distance of two feet was blown off and found on the other side of the room. Cross ties were splintered and ~~broken~~ broken and scattered through the room. One half of one tie was found at the face partly buried under the broken coal. This room was supposed to have been fired with Altna B powder, which was being tried out, but a careful review of the powder records indicated clearly that all the Altna B taken into the mine had been used up before reaching this point. So we are forced to conclude that 40% dynamite was used here.

The only theory we can deduce from the above facts is that the shot firers left a sack of dynamite on the track and either forgot it or did not have time after lighting the fuses to take it out with them. The flame or concussion from the blown out shot caused the dynamite to detonate and this set fire to the dust in the room which propagated to the dust in the entry.

The condition of the room clearly indicates that the blown-out shot went first and the shot which broke the coal went after the explosion had started.

This was the last shot fired in this district as the tamping bar was found in the cross cut between rooms 23 and 24. Room 22 was not working. Timbers were strewn in the entry both ways from room 21, and the entry was very wet, standing water 1" to 6" deep, From room 20 to room 8 and from that point in was caved tight. Two cars standing on the entry in from off room 20 showed coke on inbye end, and both cars were thrown off the track. Timbers were down to room 12 where all signs of force ceased, showing that the explosion was checked in this direction by the standing water. None of the inbye rooms showed any signs of heat or force. The force and flame went in the other direction on this entry and passed through the cross cut opposite room 20 to the Second West B. and the other cross cuts, but did not penetrate into the rooms on this (First West B) entry. The cross cut designated #7, was stoppe d with canvas brattice which was blown into Second West B entry and heavy coke 2" to 3" thick was found on timbers holding this brattice. The other cross cuts between these entries showed similar conditions. All showing the force and flame coming through, the cross cuts from First West B to

Second West B.

Room No. 23: No shots fired and no holes loaded and tamping car (Wooden) found in cross cut leading to room 24 showing that the shot firers, Francis and Piecha were in this room at the time of the explosion and dropped their stick and ran. As Mallach, the head shot firer, was found on the entry with these two men and showed no signs of being burned, it is assumed that he was with them at the time of the explosion. There was no powder (dynamite) in this room and the scraper was found in one of the holes.

Rooms Nos. 25 - 28: These rooms showed no signs of heat or force, but the slant haul leading to Second West B showed force and heat passing that way and at the junction of this slant haul and Second West B a mule was found dead near a powder car. The mule had broken loose from the car and was badly burned. There were 14 sticks of dynamite still in the car in a sack. Thirty feet inbye the car and lying on the floor of the entry was a sack containing 80 sticks of dynamite. The sack was singed but the dynamite was intact. It would appear that the mule was hitched to the car somewhere at the First West B and started to run when the explosion took place and got as far as the junction where he dropped and broke the trace chain. One sack of dynamite fell out of the car and the flame burned the sack, but was not sufficiently hot to ignite the dynamite.

Second West B: The flame and force came through from the First West B and seemed to divide at the cross cut opposite room 21, going in both directions, dying out at room 9, where the entry was very wet and sloppy. The rest of the entry from room 9 out was very dry and dusty.

Room No. 20: Car in neck of room showed coke on inbye side of doors and both ribs of room showed coke for 15 feet in from neck as well as on timber.

Sample No. 20483 of road dust taken on entry directly opposite this room showed the following analysis:

Proximate Analysis:

	Coal	Coal	Coal	% referred to
	(Air dried)	(As rec'd)	(Moisture Free)	coal.
				(Moisture &)
				(ash free)
Moisture	.90	2.88		
Volatile matter	23.05	22.59	23.26	35.46
Fixed carbon	41.95	41.11	42.33	64.54
Ash	<u>34.10</u>	<u>33.42</u>	<u>34.41</u>	
	100.00	100.00	100.00	100.00

Ultimate Analysis:

Sulphur	.50	.49	.50	.76
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Room No. 19: Shot down in good shape. Coke on ribs of neck, but did not penetrate into room. Entry showed force coming inbye.

Room No. 18: Face clean and coal mostly loaded out. Two holes; the one three feet deep with two feet of mining and the other in the cross cut four feet deep "on the solid". These holes had not been loaded or fired and were probably rejected by the shot firers although no record was made in their books to this effect.

Room No. 17: Pulling pillars. On shot which brought down the coal in good shape.

Room No. 16: Two holes ready to load and in good shape.

Rooms Nos. 15, 14 and 13: Two holes ready to load and in good shape.

Room No. 12: Showed two blown-out shots, one foot apart; both shots square in the solid. It looked as if one shot had been fired on some previous night and had blown out and the other had been put beside it on the following day and fired with the same result, but I do not believe either of these shots were fired on the night of the explosion. Another hole in the face of this room was in the solid, six feet deep, with one foot of mining in the upper coal, five foot on the solid with no chance to break. Still another hole was in six feet deep pointing straight in, with three feet of mining.

Room No. 11: Not working - finished.

Room No. 10: One clean blown-out shot. This was probably blown out at some previous time, as there were three other holes in this room ready to load and well placed.

Room No. 9 to 1: These rooms were all finished and pillars pulled and rooms caved.

Second West B: (Con't): The entry showed heat and force coming inbye to room No. 9, although the flames did not propagate into the rooms. At room 9 and inbye the entry, being very wet, the flame died down but the expansive force scattered mud on the ribs and roof at the junction of Fifth South and timbers, but no further signs of force or violence.

A sack of dynamite was found at the junction of Fifth South and Second West, covered with mud.

Air course being driven off Second West B to connect with Third West B was in 50 feet. This entry was 3 feet wide and two blown out shots were found in the face, , the one 6 feet and the other 5 feet deep. The mining in this case was 2 feet deep.

Room No. 21: Not working and no signs of heat or force in room though timbers and coal in entry showed force and flame going outbye.

Room No. 22: Slight coking on inbye rib; face of room in good shape.

Room No. 23: Car in neck of room showed coke on inbye side of doors. Timbers 10 feet outbye this room in entry showed slight coke on inbye sides. The room was in good shape.

Room No. 24: Room not working. A car in neck of room showed coke on sides and ends.

Room No. 25: All shots had been fired and coal had been brought down in good shape.

Room No. 26: Not working. Slight coking on ribs near entry and on entry at this point.

Room No. 27: No shots had been fired in this room on the night of the explosion, as the miners had apparently not prepared any holes. The coal had been shot down on some previous night, probably the night before and was only partially cleaned up.

Room No. 28: Coal was shot down in good shape at the face, but a blown-out shot on the rib. The shot was put in straight and "on the solid". It was $5\frac{1}{2}$ feet deep. There were no signs of heat or force in this room however, except at the neck and in the entry and then only slight coking on the ribs.

Room No. 29: Coal shot down well and no signs of force or heat, except slight coking on ribs at neck and in entry.

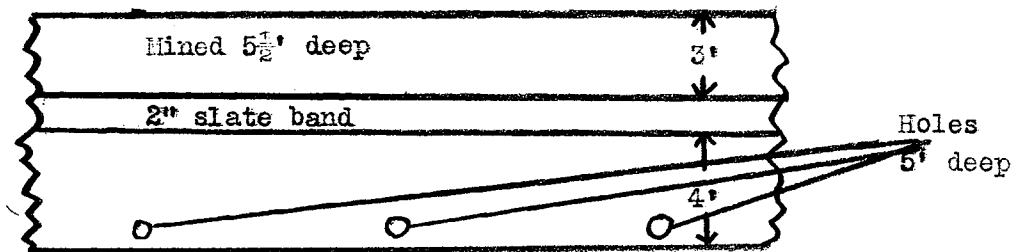
Third Cross-cut: Here was shown rock stopping undisturbed with slight coking on ribs. There are no rooms between this

and room 32.

Room No. 32: This room showed coke on ribs, timbers and at the face. The coal was shot down in good shape and there were no evidence of force in the room. The flame was propagated into the room and up the face.

Room No. 33: Coke on ribs for 10 feet in. A roll of fuse was found on a bench 20 feet in, undisturbed. Room was well mined and holes well placed ready to load and shoot.

Room No. 34: Car in neck of room showed coke on sides and ends. Heavy coke on both ribs for 30 feet in. The props in the room were undisturbed, but showed coke on inbye sides. The face was in good shape; the coal well mined and three holes ready to load as per sketch:



Room No. 35: Not working. No signs of heat or force slight except/coking on ribs near entry and coke on entry.

Cross-cut on First West between 35 and 36, gobbled with rock and undisturbed.

Room No. 36: No signs on heat or force in the room, but slight coke showed on ribs and entry.

The bodies of five shot firers, Mallach, Piacha, Francis, Klapick and Ranovski, were found on this entry between room 36 and the Fourth South entry, but none of them showed any signs of being burned. Clearly showing that they came there after the explosion,

and were killed by the afterdamp. Very little heat or force was in evidence on this entry, but all indications pointed to the explosion coming out this entry into the Fourth South.

Fourth South Entry:

Slant haul to "Japan" entry: This slant haul and the Japan entry up to room No. 5 were very wet, with standing water, and there were no indications of heat or flame propagation but considerable expansive force.

A pit car was found 75 feet beyond the junction of Slant haul with Third South into the Japan entries, turned completely over, one door and one wheel broken off and carried 20 feet further, showing conclusively that the force came out this entry with considerable force.

Japan Entry: The rest of the Japan entry, including the rooms was very dry and dusty, but the flame did not propagate on account of the wet zone which killed it down.

This entry beyond the junction with the Third and Fourth South showed no signs of heat and force. A careful examination was made of all the rooms leading from this entry and except for its dry and dusty condition, everything was found in excellent shape.

Fourth South and Third South: The explosive wave came out of the Fourth South toward the main opening, part going through Cross cut 20 and 19, and toward the Japan entry, but died out before reaching this point on account of the large amount of standing water between this cross cut and Japan. The rooms on this entry had been abandoned. The portion going out the Fourth and Third West and sweeping through the cross cuts, all of which were open.

There was intense cokings and signs of intense heat in both these entries and in all the cross cuts to Third West. The Third South was used as a haulage way for empty cars and between cross cuts 15 and 19, there were 32 empty cars, all showing heavy coke on all sides and ends. The bottoms of the timbers (Caps) in both Third and Fourth South were scorched and heavy coke from $\frac{1}{2}$ " to 3" thick on outbye sides of timbers and props. The coal on the ribs of cross cuts 16, 17 and 18, was coked in places some of it 2" deep. The heat at this point was intense, though the force exhibited did not seem as great as at other places in the mine.

Sample of coke was taken from first set of timbers inside cross cut 16, off Fourth South; coke at this point was 2" thick.

The sample was numbered 20720.

THIRD WEST B.

This entry was used up to cross cut 4, as a storage and haulage way for empty cars. There were 31 empty cars on this track and on the turn leading to the Fourth South. These cars were all thrown off the track and jumbled up in a mess and the end cars jambed up against corner at the intersection of the Fourth South and Third West. Heavy coke showed on sides and ends of cars, but heavier on outbye ends, and all timbers showed heavy coke on outbye sides. All indications seem to point to the force coming outbye. Timbers were thrown outbye up to the Third cross cut (III). Slight falls occurred in this entry.

It is difficult to understand why the force came outbye at this point, as the force certainly went inbye at the the Fourth West B, as will be shown later.

The straight entry (Third West B) leading to the Fourth South was bratticed off with a wooden brattice and was blown out into the Fourth South.

It seems possible that the explosive wave came into the Fourth West B from the Fourth South and propagated through the cross cuts 1, 2, and 3, and came out the Third West B, as the cross cuts all showed the force coming from the Fourth West B.

Cross-cuts 4 and 5: These cross cuts showed no signs of heat or force at the entry.

Rooms No. 29 and 28: Caved and abandoned. No signs of force or heat.

Entry from cross cuts 4 - 6, very wet with standing water

Room No. 27: Caved at neck but being worked through room 26. Coke on timber in entry and on ribs of cross cut 6 and copious coke on ribs and timbers of room, showing flame to have entered through room No. 26.

Room No. 26: Car in the neck of this room showing heavy coke on inbye side of doors and on ribs and props into the face and on ribs of cross cut into room 27. There were three holes in the face of this room filled with dust and fine coal and one of the holes was plastered with coke. These holes had not been loaded and two of them were on the solid $3\frac{1}{2}$ feet and 4 feet deep. Car on cross cut into room 25 (cross cut not yet holed through) showed heavy coke on inbye side, and heavy coke was found on ribs, timbers and gob.

Room No. 25: Car 10 feet in the neck of the room off the track and against the outbye rib. Heavy coke on car and ribs and on inbye sides of props up to within 10 feet of face of room. Five holes

in the face ready to load, in good shape. In the face of inbye cross cut was found a blown out shot. This shot broke down some coal, but the hole was still three feet in the solid. This probably happened the night before the explosion as this district was not fired on the night of the explosion.

Room No. 24: Car in neck off the track, blown against the outbye rib, showing coke on inbye sides of doors. Heavy coke on ribs and inbye sides of timbers up to within 10 feet of the face of room and on both sides of cross cut to room 23. A roll of fuse was found in this cross cut burned.

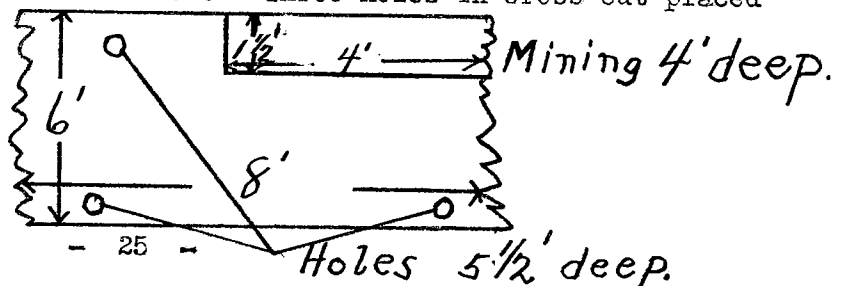
Cross-cut No. 7: This cross cut showed slight coking on ribs, but nothing to indicate the direction of force.

Room No. 23: Car at neck off track, blown against outbye rib showing heavy coke on sides and ends. Props down, blown inbye with heavy coke on inbye sides.

Room No. 22: Coke on ribs and inbye sides of timbers. The ^{coke} ~~heat~~ was not so heavy as in the other rooms and the heat was not so intense. A roll of fuse was found in the room, which was scorched but not burned. Four holes were well placed and ready to load.

Room No. 21: Coke on both ribs and slight on inbye side of timbers. Four holes in face ready to load and in good shape and one in cross cut.

Room No. 20: Coke on both ribs and slight on inbye sides of props, which were not disturbed. Three holes in cross cut placed as per sketch:



Cross cut No. IX: or slant Haul to Fourth West B; opposite room 20 was very thick with dust, but showed no coking. Dust was blown into Third West and timbers were thrown out of cross cut into Third West B and against the inbye rib and outbye Third West B with great violence, indicating that force came out of Fourth West through this cross cut into Third West B. Dust sample No. 20735 was taken at this point.

Rooms No. 19 and 18: Pulling pillars. No signs of force or heat in this room or in the entry.

From this point out to Fifth South, the entry was wet and the explosion wave and flame ~~XXXXXXXX~~ died out for want of something to feed on.

Air course was being driven opposite cross cut 18, to connect with Second West B, and was in 30 feet. Two blown out shots were found in the face of this entry. The holes were $4\frac{1}{2}$ feet deep and straight in on the solid. Two picks and an axe were found 20 feet from the face covered with dust and fine coal, but there were no evidence of the explosion having started at this point.

At Slant haul into Fourth South timbers heavily soaked on all sides, but slightly heavier on outbye sides. There was no timbers down at this point so it was not possible to determine absolutely the direction of the force at this place, but further in all indications point to the force coming into this entry from the Fourth South.

Cross-cut No. 1: This cross cut showed coke on both ribs and on all timbers in the entry.

Cross-cut No. 2: Coke on both ribs and in entry. In entry at this point timbers blown and thrown inbye.

Cross-cut No. 3: This cross cut was used as a storage place of timbers and near this point in both Third and Fourth West B entries, timbers were strewn in all directions. I am told that all these timbers were stored in this cross cut, prior to the explosion.

Cross-cut No. 4: Heavy coke on both ribs, but no distinct evidence as to direction, but in entry coke on ribs and timbers and indications point to force coming inbye.

Cross-cut No. 5: This cross-cut showed coking on ribs and force going into Third West. At this cross-cut a detour was made on account of a fault and all the rooms up to 14 were opened up off this entry.

I will describe the conditions found in the main entry first and then come back to the detour and the rooms leading off it.

The condition of the other cross-cuts up to and including No. 9, has already been described under Third West B, showed the same at this entry, all indications showing force coming from Fourth West B into Third West B. The entry showed slight coking on ribs and timbers, but no evidence of intense heat or force until the slant haul leading to room 15 was reached.

Room No. 15: At this point the slant haul forming neck of room 15 was caved and car was found on the track with end door smashed inbye as if with flying timber and heavy coke on inbye ends as well as on inbye sides of props and caps.

Rooms No. 15, 14, 13 and 12: These rooms were caved tight at neck and had to be approached through the other rooms. The conditions found in these rooms will be described later.

Rooms No. 10 and 11: Not connected with this entry.

Entry between 14 and 8: Showed decided coking on ribs and inbye side of timbers and the cross-cuts showed coke on ribs but no evidences of force going through to Third West B, although the cross-cuts were all open. The water in the entry (Third West) and in the cross-cuts probably accounted for it.

On the entry between rooms 12 and 13, were found pieces of strap iron from a pit car, part of the door and one wheel were found in cross-cut No. 12, a piece of wheel found six feet in the neck of room 8 and the body of the car thrown against the inbye rib of the neck of room 9. A piece of the hub of the wheel was found in front of room No. 6. It looks as if the car was standing on the entry at room 13 and was carried by the force of the explosion to the point where found. This is the car which the paper stated was loaded with dynamite, which exploded and was the prime cause of the trouble. It is my opinion that there never was any dynamite in this car, for if there had been even so small an amount as 10 sticks of dynamite, exploded in the pit car, all the body of the car, would have been splintered.

From room 12 to room 9, all the timbers in the entry were blown inbye with considerable force and quit heavy falls occurred as a result.

The fire died out at room 6 as the entry was very wet from that point in to Fifth ~~XXX~~ South. The explosion did not penetrate the rooms from this entry but was confined to the entry and died out on account of water.

Fourth West B - Detour at Cross-cut 5:

Room No. 29: Was not worked by was very wet and showed no signs of heat. The entry was wet up to ~~entry~~ room 22. Timbers were blown inbye the entry with considerable force and the first evidence of heat was at room No. 24.

Room No. 24: All evidence goes to show that the flame ~~jump-~~ed across the wet zone, about 150 feet, and picked up at Room 24. Timbers in the neck of this room blown inbye and heavy coke on inbye side of props and caps, up to last cross-cut. Two shot firers, Farish and Makoosh were found, the one outbye and the other inbye the first cross-cut to the right. A car standing near this cross-cut showed heavy coke on inbye sides of doors. This cross-cut showed heavy coking on ribs and timbers within 10 feet of the car. This cross-cut was 12 feet wide and showed two holes loaded and two holes ready to load. A stick of dynamite was found on the floor with cap and fuse attached as if the men were preparing to load the third hole when the explosion took place. They evidently dropped it and ran, but succeeded in getting only a short distance, when overcome by the gas. Neither of these men was burned. The timbers throughout the room to within 40 feet of the face were covered with coke and heavier on inbye sides.

First cross-cut leading into room 23; Showed heavy coke on both ribs and same with the Second cross-cut. This room (23) broke off at fault (see map), but the inner portion of the room, connected with room 24 by cross-cut, showed no signs of heat or flame, which only penetrated into cross-cut for 30 feet.

Room No. 23: The flame entered room 23 from 24 through both the first and second cross-cuts, and the ribs, roof and timbers of this room were heavily coked on all sides. The timbers were not

displaced in this room probably due to the opportunity for explosion of the gases. The flame swept through the cross-cut to room 22.

Room No. 22: The same conditions were found with the addition of festoons of precipitated carbon which were hanging from the roof and covering the timbers. Upon blowing this away it was found that the timbers, roof and ribs were covered with a thick coating of coke, showing that an intense heat had existed in this room and upon cooling the carbon had precipitated out. There were no falls in this room.

Room No. 21: Showed the same conditions as room 22. The cross-cut leading to this room showed coke plastered on ribs and roof $\frac{1}{2}$ inch to 1 inch thick. Sample No. 20368 was of coke taken from this cross-cut. As there were no timbers in this cross-cut, there was nothing to indicate the direction of the flame.

Room No. 20: Showed heavy coke on timbers near the cross-cuts, but less in either direction from them. Heavy falls occurred in both ends of this room, but whether on the night of the explosion or prior, could not be ascertained as this room was not working and no one seemed to know. This room was holed through to ~~XXXX~~ Fifth West B. There was an entire absence of precipitated carbon in this room. The flame came through both crosscuts with terrific force into room 19. The ribs and roof were heavily coked. The floor of the cross-cut near the middle of the room was swept as clean as if it had been done with a broom.

Room No. 19: This room showed very heavy coke on ribs and timbers throughout the entire room up to the face and in all the cross-cuts. Coking was very heavy on ribs of all the cross-cuts and scouring

action all in the direction of room 16, was very pronounced. Flame came through all the cross-cuts to room 17.

Room No. 17: The heat and force seemed to increase in violence in this room. Timbers were blown down and coke was in evidence throughout the room and some heavy falls occurred. A blown out shot in the working cross-cut not yet holed through to room 16, but it seemed to me impossible for the explosion to have started at this point, as the shot firers who were firing this district were known to be in room 24 at the time of the explosion and could not possibly have gotten there before this shot went off. I am inclined to the opinion that this shot was not fired on the night of the explosion, as no record was made of it in the shot firers book which was afterwards found and examined.

Room No. 16: The flame passed through all three cross-cuts of room 17 into this room and the same heat and falling of timbers and roof occurred in this room as in 17. Heavy coking was in evidence everywhere.

Rooms No. 15 and 14: Showed the same conditions except that the force and violence seemed to concentrate itself in room 14 and the gases rushed through room 14 with tremendous velocity carrying away every timber in the room, many of which were piled up in the cross cut leading to room 13.

Room No. 13: This room was cut off by a fault, but was again continued through room 12 (see map). Heavy coke was found on ribs and timbers. A car in the cross-cut leading from room 14 was driven off the track 6 feet with heavy coke on its ends (sides of doors) and timbers were driven into the room from 14. Heavy faces in

this room and up to within five feet of the face. A blown out shot in the face which seemed not to have been fired on the night of the explosion but previously.

Room No. 12: Heavy coke on ribs and timbers and heavy caves in room cross-cut nearest Fourth West caved tight. The flame swept through this room with terrific violence carrying timbers with it and causing some heavy falls, all of which showed the fire going toward room 10 off the Fifth West B.

Room No. 11: Showed coke on timbers and in cross-cut from room 12 showing that forces from this room and room 12 came together at room 10, - Fifth West B.

Room No. 10: Was heavily coked from a point 40 feet inbye the neck for 75 feet and timbers were hurled out of the room into the Fifth West B entry, with great violence. This room will be described again in describing the results in Fifth West B.

The Fourth West Entry except at point indicated was very dry and dusty and the rooms were all dry. No effort had ever been made to sprinkle or wet them except with sprays and these were apparently insufficient in number to accomplish the desired purpose.

Fourth South, from Fourth to Fifth & Sixth West B;

Crosscuts Nos. 4, 5, 6, 7, 9, 10, and 11; were gobbed with rock and not disturbed, but slight coke showed on ribs of cross-cuts and along the entry at intervals, but not very heavy. The entry from cross-cut 11 to 9 was wet and sloppy for a distance of 100 feet from the continual running of a spray, but the flame passed over this and continued on the other side. The slant haul or cross-cut No. 8, was open and timbers were thrown out of this into the Fourth South.

Trolley supports made of 1½ inch pipe set across the entry in hitches in the coal were bent outbye and many of them turn from their moorings and hurled distances varying from 50 to 150 feet. A few of them were still in tact and showed coke on the inbye sides. The timbers in this entry also showed heavy coke on inbye sides, except in the wet zone.

Fifth West B. at intersection of Fourth South: Timbers were knocked out and blown inbye the Fifth West B, and a slight fall occurred in this entry, just inbye the Fourth South and a car standing 20 feet in this entry had its sides smashed in by flying timbers showing the force coming in at this point. There were three cars standing on the curve leading to the Fourth South were piled up and thrown off the track with heavy co ing on inbye ends and sides.

First Cross-cut showed heavy coke on roof ribs and timbers. A car was standing at the neck of this cross-cut which showed heavy coking on inbye ends. One door of this car had been torn off and h hurled against the end of a car standing in the entry 27, ~~but~~ just inbye, smashing the outbye end of the car. There were five cars at this point, the first and fourth of which were thrown off the track the other three still on. All of these cars showed heavy coke on sides and ends but heavier on inbye ends, less on outbye ends.

Second Cross-cut was used as a storage for props. These props were thrown with considerable force against the inbye rib of Third West B. These were forced out of the cross-cut either by the force coming out of the Sixth West B or by the after suction. This cross-cut showed heavy coke on ribs and roof, and I am informed that the timbers were smoothly piled up here prior to the explosion.

The entry between Second and Third cross-cuts showed considerable coke on ribs and roof, and very pronounced scouring action indicating inbye direction of force.

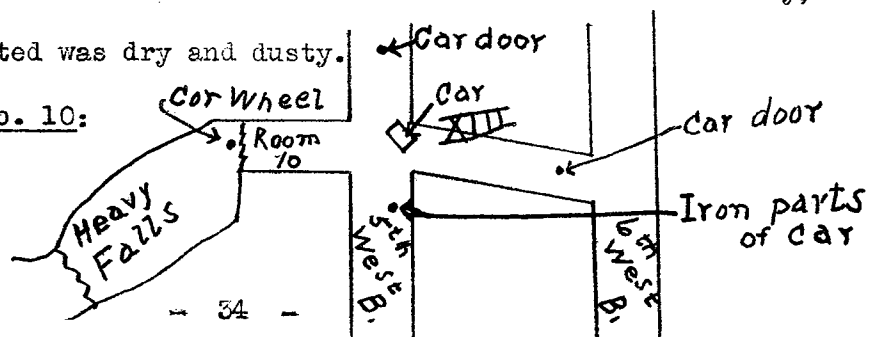
Third cross-cut showed coke on both ribs and on entry.

Fourth cross-cut or Slant haul: At this point the bodies of Sutton and Meeks were found. 50 feet beyond the slant haul for a distance of 50 feet was a sump with standing water, 10 inches - 12 inches deep. The ribs and roof showed no coking above the water but continued afterwards along the entry.

Room No. 27: Opposite cross-cut 6, was in 30 feet to the face and was driven 8 feet wide. Two cars standing in the neck had outbye ends driven in and showed strong coke on inbye ends, slight coking on sides. The coal had been shot down in good shape and the ribs and roof were heavily coked up to the face and heavy coke on broken coal. There were no timbers in this room; no falls; good roof. There were no other rooms off this entry until room 20 was reached, and this room was caved at the neck and was morked through the Fourth West B. The entry showed slight coke on ribs and timbers and in cross-cuts, but no signs of great heat of violence until room 10 was reached. The cross-cuts were all gobbed with rock and will be described later, under Sixth West B.

From cross-cut 10 to 12, was wet and there were no signs of coking on entry between these cross-cuts. The rest of the entry, except as indicated was dry and dusty.

Room No. 10:



Room No. 10, (See Sketch); As has already been stated, heavy falls occurred in this room and timbers were thrown out into the entry, clearly indicating that the force came out of this room into the entry. A car was found in the entry against the inbye corner of the rib at the junction of the Fifth West and the cross-cut of the Fifth West and the cross-cut (XIII). This car was turned bottom up, the side mashed in (had evidently struck the corner with tremendous force). One axle was bent down and both doors and peices of strap iron torn off. One wheel was found 30 feet inbye room 10, on top of the fall; one door in the cross-cut, the other door in Fifth West B entry 20 feet inbye the car, and pieces of strap iron 30 feet outbye the car. It is impossible to ascertain where this car stood prior to the explosion. It is impossible to explain satisfactorily, to my mind at least, all the phenomena which occurred at this point. If we assume that the fact stated by Mr. Dalrymple is true; that is, that the car was loaded with dynamite which exploded in the car, how do we account for the bottom of the car being in tact, and the one side in good shape and the other mashed in? If we assume that the car was in the neck of room 10, it is difficult to account for the car wheel being found in room 10 on top of the fall which must have occurred after the force passed through the room. If we assume that the car was in the entry outbye the cross-cut, it is difficult to explain the presence of the timber from room 10 in the neck of the room and on the entry and in the cross-cut. If we assume that the car was in cross-cut XIII which was used as a haulage cross-cut, it is not possible to account for its position afterward.

Room No. 9: was abandoned and except for slight coking

on ribs of entry, there was no evidence of force or heat.

Room No. 8: Timbers standing in entry and at neck of room were blown into the room. There was no other signs of force and no indications of heat at this point.

Room No. 7: Abandoned and caved. No disturbance or heat.

Room No. 6: Car in neck of room undisturbed.

Rooms No. 5, 4, 3, and 2: Abandoned. No signs of force or heat.

Room No. 1: was used as an air course and showed no signs of explosion having entered it at all.

From room 7 to the Fifth South the entry was wet with standing water.

Sixth West B:

Curve from Fourth South - timbers blown inbye with great force and coke on ribs and roof and strong coking on ribs and roof of cross-cuts up to III, but from this point in to cross-cut IV or Slant haul to the Fifth West entry, no signs of coke. Scattered along this entry from Slant haul for a distance of 40 feet outbye, were a number of timbers. I was informed that these timbers were piled in the Slant haul. If this is true, it indicates a swirl at this point, as all the other evidence show undeniably that the force came inbye this entry. These timbers showed rosin exuding from heat but no coking was found on or around them at this point.

Ten feet inbye the Slant haul were five loaded cars of coal. These were still on the track and indicated no disturbance except on the inbye car. A piece of strap iron $\frac{1}{2}$ " x 2" long was torn from this car and found 6 feet in the neck.

Cross-cut No. V: A portion of the top and the hinges of a shot firer's box were found also in this cross-cut 5 feet inbye the piece of strap iron. The box was in Fifth West B entry 20 feet outbye this cross-cut. This would seem to indicate that the forces either met in this cross-cut or came into the cross-cut from ~~Sixth~~ ~~enth~~ entries at different times. This point I was unable to settle. There was no coke or other evidence of heat in this cross-cut, or on the entry at this point.

Cross-cut No. VI: showed strong coke on inbye rib, none on outbye rib, but both ribs, roof and timbers in entry showed coke all along up to cross cut VII, which also showed heavy coking on inbye rib.

Room No. 23: The props were all knocked down, being blown inbye. Entry showed slight coke on ribs.

Room No. 22: Showed the same conditions as 23. Slight coke on ribs of entry.

Cross-cut No. VIII: Gobbed with rock with slight coking on ribs and roof.

Room No. 21: No indications of heat or force at this point ; no coke in entry and props in room undisturbed. A blown out shot was found in the face. The room had the appearance of not having been worked on day of explosion, but this could not be

verified, as no one knew. A sample of road dust was taken in the entry opposite this room, No. 20452, showing the following analysis.

PROXIMATE ANALYSIS.

	Coal (Air Dried)	Coal (As Rec'd)	Coal (Moisture (free)	% referred to coal. (Moisture & ash free)
Moisture	1.03	2.61		
Volatile matter	19.01	18.71	19.21	37.75
Fixed carbon	31.35	30.85	31.68	62.25
Ash	48.61	47.83	49.11	
	100.00	100.00	100.00	100.00

ULTIMATE ANALYSIS.

Sulphur	.36	.35	.36	.71
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Dust was very thick and dry at this point.

Room No. 20: Props blown down fallin inbye, but no signs of heat or coke either in room or in entry.

Room No. 19: Two cars in neck of room thrown off the track, with coke on inbye ends. Coke thick on ribs and roof of room and on inbye sides of props, 25 feet in room, but props were all standing. Coke on ribs and timbers in entry.

Room No. 18: Car in neck of room blown off the track, with coke on inbye side (end) and coke on ribs and props for 15 feet in. The room otherwise was in good condition with props all standing. Coke on ribs and inbye sides of timber in entry.

Cross-cut No. X: Was gobbed tight with rock, some of which had fallen down on the track. Slight coking was found on rib and timbers in the entry at this point.

Room No. 17: Showed no signs of heat or disturbance and

no coke or signs of heat in the entry until room 15 was reached. At this point coke again appeared on ribs and timbers in entry. A car just barely inside the neck was thrown against the inbye rib with coke on inbye sides, and coke on ribs and inbye sides of timbers for 15 feet into room. The room otherwise in good condition.

Room No. 14: Car in neck of room blown against inbye rib. No other signs of heat or disturbance and only very slight coking on entry. This was the last point in this entry that showed any signs of coke or intense heat.

Room No. 13: Showed no signs of force or heat, nor was there any coking or disturbance in the entry.

Cross-cut No. XII: Was gobbed tight with rock, some of which was pulled down on the track, probably from suction.

Room No. 12: Car in the neck with one end (outbye) thrown against the inbye rib. Blown out shot was found in the face of this room, but no signs of disturbance or heat.

Room No. 11: Car in the neck off the track and against the inbye rib. The room was in good condition.

Room No. 10: Was in good condition and showed no disturbance or heat.

Cross-cut No. XIII: Gobbed tight with rock; in tact.

Room No. 9: Gave no indication of force or heat. Blown out shot was found in the face, but did no damage.

Room No. 8: In good shape. A dead mouse was found in the neck of this room. It showed by its struggles that it had died hard and after the dust from the explosion had settled down, as its tracks were traced for several feet. From room 7 up to the Fifth

South , the entry was very wet and there were no signs of heat or force.

Just why the flames did not propagate beyond room 14, is a little difficult to understand as the entry was very dry and dusty between this point and room 7. I am informed that the whole entry was thoroughly sprinkled on the Tuesday preceeding the explosion and this portion of the entry may have been wet at the time, and dried out in the intervening days.

Fourth South between Sixth and Seventh West B: Heavy

coking continued on this entry on timbers and ribs showing mostly on outbye sides of timbers. All the pipe trolley supports and trolley wires were torn down and blown outbye, with terrific force. The cross-cuts were all gobbled tight with rock and were not disturbed. At the undercast at Seventh West, the track was rock six inches. This undercast was built of concrete heavily reinforced with R. R. iron and showed only slight crack from below, though the whole thing was lifted bodily by the force in the Seventh West. Pump Station was located just off the Fourth South at the Seventh West. The water from the mine was all brought to a sump near the undercase on Seventh West. The pump was supported on two 6" x 6" timbers with a 3" plank floor on top. The pump was enclosed in a wooden housing built of 2" plank. The 3" plank flooring and the 2" housing were smashed into kindling and forced down into the sump. The 6" x 6" timbers were broken , the plunger, outside gear wheel, and the suction and discharge pipes of the sump were all broken and parts of them found in the sump. The curve leading to the Eighth West was timbered with 16" round timbers. There were 10 sets in all. Sets No. 7, 9 and 10 (numbers beginning at Fourth South) were blown

down and outbye, the others were in place and showed heavy coke on outbye sides and very slight coke on inbye sides, the coke in places being 2" thick. Coke Sample No. 20500 was taken from cap of set Nos. ~~xxxxxx20~~ 4, 20 feet outbye the pump house.

Eighth West A to Fourth North - (Main Haulage way): At curve to Fourth South a loaded car was thrown off the track and the inbye end smashed by one of the timbers which was blown out from (pipe) the curve. All trolley supports/and wires ~~were~~ blown down but no timbers were down. Heavy coking on all timbers (outbye sides) and ribs of the entry. All cross-cuts were bodded tight with rock and were undisturbed. Two electric locomotives were standing on the curve leading to the main slope. These were sill on the track, and except for the, carrying away of some small ports easily disconnected, were unharmed.

Main Slope or Fourth North entry: Two steel doors set in ~~the~~ concrete in the slant leading to the Third north entry or Main air course were carried 75 feet into the Third North and the concrete swept clean. The doors were bent double.

Loaded cars at the foot of the Chain haul had their ends (inbye) smashed in by flying timbers and the floor of the Chain haul was ripped up and the timber thrown out of the mouth of the slope. The 14" x 14" timber supporting of the chain was broken in two. The main slope which is in rock was timbered with ~~XX~~ 16" round timbers and these were broken as if they had been straws, and hurled out of the slope for distances varying from 100 to 1000 feet. Loaded and empty cars were picked up bodily from the chain haul and blown out of the slope and thrown out in the gulch. The force at this point must

have been something terrific. It is said by those who saw it, that flame came out of the slope and curled up in the air hundreds of feet and the whole valley was filled with smoke and dust for miles.

Seventh and Eighth West B formed the main air course for the mine.

Cross-cuts I and II: were open and the rest gobbed tight with rock.

The Seventh West from the sump to cross-cut VII was very wet with standing water from 6" to 3' deep. The flame jumped the water and propagated in cross-cut I, passing into the Eighth West B, but did not penetrate beyond this point, as no evidence of heat or force were found anywhere in Seventh West B. There were no room turned on either of these entries and no places working. There was comparatively little heat or force indicated in the Eighth West entry. The trolley supports and wire were blown down and carried inbye up to the Fourth cross cut (IV). The entry to this point was very dry and dusty, but from this point in the amount of dust on the entry was very much less and showed considerable moisture, though not wet until the 13th cross-cut (XIII) was reached. Slight coking was noticed on both ribs of entries and cross-cuts and cross entries, up to cross-cut XII at which point all signs of heat and fire ceased. The rock from all the stoppings in all the cross-cuts was sucked down on to the track in every case up to cross-cut XI. The bodies of the four entrymen who were working in the Eighth West A entries, Hodbad, Gozudek, Siliza and Podzorsky, were found on Eighth West B entry between cross-cut II and III. They died from the

gas, as there were no indications of burns on any of them.

Eighth West A, going from the main slope, showed only slight coking but no force up to curve leading to the First South entry, where all evidence of heat or force ceased. This curve was very wet with standing water for a distance of 250 feet.

No force or heat went into the Second South, but died out at curve on Eighth West A.

Third South, between Fourth and Seventh West B:

Cross-cuts X, XI, and XII; had concrete stopping which were undisturbed and the entry showed heavy coke on both ribs, but no signs of force.

Cross-cut IX: Heavy coking on ribs of entry in cross-cut up to face of concrete stopping which however was not blown or injured in any way. The dust was very thick and dry at this point and sample No. 207D1 of road dust was taken at this point and gave the following results:

PROXIMATE ANALYSIS.

	Coal (Air Dried)	Coal (As rec'd)	Coal (Moisture free)	% referred to coal (Moisture and ash) (free)
Moisture	1.08	2.27		
Volatile matter	19.92	19.68	20.14	33.52
Fixed carbon	39.52	39.04	39.94	66.48
Ash	39.48	39.01	39.92	
	100.00	100.00	100.00	100.00

ULTIMATE ANALYSIS.

Sulphur	.41	.41	.42	.70
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Cross-cut No. VIII: was a continuation of Fifth West A.

This cross-cut was open to the Fourth South and was used as a haulage

way for timber and other supplies, all of which were brought into the mine through the Fifth East or ~~XXXX~~ No. 5 opening. A bell nad magnet on the rib of entry (Third South) 10 feet inbye Fifth East was torn down and thrown 70 feet outbye the entry and the firing wires were also torn down and thrown in the same direction. Heavy coking was noticed on ribs and outbye sides of timbers, but the force was not sufficient to displace any of the timbers. The force divided at this point, part going out Third South and part out the Fifth West A.

Cross-cut No. VII: Showed heavy coke on both ribs of entry and cross-cut, but the concrete stopping was undisturbed.

Cross-cut No. VI: Very little coke was found on entry and this cross-cut seeming to indicate a lessening of the intensity. A small amount of coke on the rib near the roof was all that was found.

Cross-cut No. V: Was open to Fourth South and used as a manway. The shot firing wires where they crossed this point were torn down and thrown in both directions on the entry, indicating that the force came out of this cross-cut from the Fourth South. There was no evidence of any heat at this point nor for 30 feet on the entry. It looked as if the two forces had met in this entry inbye the cross-cut and partically mutuallized each other.

From Cross-cut No. IV to Seventh West entry there were no indications of heat and the only signs of force on the entry were the shot firing wires down, and these may have been pulled down by the force striking them at Cross-cut V.

Fifth West A: Was used only for carrying in timbers and supplies. It was ~~x~~ damp throughout and in many places was standing water. All the coal on this entry and the Sixth West A had been pulled and the rooms all caved. Slight coking was found on outbye sides of timbers from Fourth South to cross-cut III, but no indications of any force and not a timber displaced.

Sixth West A: Was used as a manway, and while it was dry and dusty in places, the entry had been brushed down and there was very little, if any, coal dust mixed with it. There were no indications that any heat or flame entered this manway. The two shot firers who escaped after the explosion, were on the manway between cross-cut III and IV. Their experience has already been described. It is not known whether any smoke or dust came out of the First East opening or not, but the presumption is that they did not as the shot firers who escaped, were not conscious of going through any smoke.

Fifth South: This was used as a haulage entry for all the coal from the C Block and as a return air course for the West portion of the mine.

The entry had been brushed down and portions of it were very dry and dusty (the bulk of the entry was wet) the dust consisted almost, if not entirely, of rock dust.

No damage whatever was done in this entry and the only signs of force indicated was the blowing open of the doors which forced the air into the entries in the C Block.

At the intersection of First and Second West B and First West C, a sack of dynamite was found on the floor near the rib.

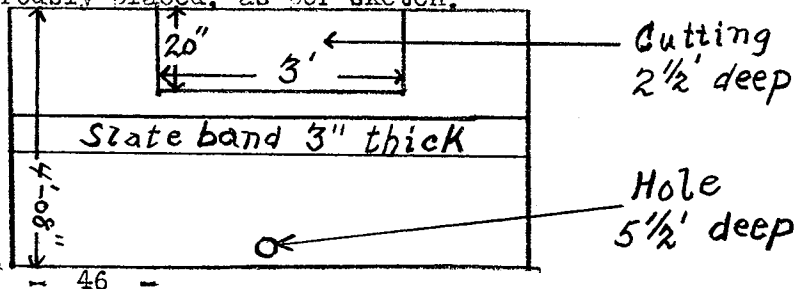
This sack was covered with mud which had been splashed on it by the force of the explosion and mud was splattered on ribs and timbers, clearly indicating that the force came into the Fifth South from the First and Second West B. The door at this point was found open by the first rescue party reaching it and propped open by a rock. Whether this was done by the shot firers before going into the C Block or by some of the rescue men and unknown to my informant, I do not know, but it must have been done by some human agency, as there were no falls in the entry and as the door opened against the air, it would not remain open as long as the air currents were moving, except by putting something in front of it as was done in this case.

First West C: Neither heat or force penetrated to this entry or the rooms off it.

Room No. 6: Was the last room shot in this district and the coal was brought down in good shape.

Room No. 5: Showed four holes ready to shoot and in good shape, with holes well placed and coal properly mined. There were no holes loaded in this room and we assume that the two shot firers, Klaplick and Ranovoski, were in this room as the time of the explosion. Their bodies were found near room 36 on the Second West B entry.

Room No. 4: Showed three holes ready to load, in good shape and one hole dangerously placed, as per sketch:



Room No. 3: Showed one hole in face in good shape and another hole under almost identical conditions, as per sketch above.

Room No. 2: Two holes in good shape.

Room No. 1: Two blown out shots close together; the tamping had blown out and in one of the holes some of the paper was still left in the cracks and this was burned. These holes were evidently not fired on the night of the explosion as the shot firers had not reached this point on their records. At the neck of room No. 1 in the entry, three cars were standing undisturbed and in one of these a roll of fuse and 50 lbs. of dynamite.

Second West C: No signs of heat or force was in evidence in this entry or in any of the rooms. The rooms had all been shot and were in good shape. The cross-cuts leading to First West C were all bratticed with cloth and were undisturbed.

Third and Fourth, Seventh and Eighth West in the C Block:
No work was being done in these entries, except extending them into new territory and this work was being carried on night and day. The entries were very wet and there was no indications of any heat or force in them.

Third North Entry: This was the main return to the fan and was used only as an air course. Except for the blowing of the steel doors from the cross-cut between the Fourth North, there was no damage whatever done in this entry. Slight coking was noted on outbye sides of timbers. The force came out this entry to the fan shaft. The explosion doors at the fan worked perfectly, relieving the greater amount of the pressure, so that the top of the fan shaft which was built of light wood work was lifted slightly

and came down almost exactly in its normal position. The fan was not damaged and continued to work.

Face Samples of Coal from the Carbon Coal & Coke Company's mine at Cokedale, Colorado, were taken at the following places and show the following results:

Sample No. 20512 - Room No. 8 - Fourth West B.

Lab. No. 11768 PROXIMATE ANALYSIS.

	Coal (Air Dried)	Coal (As Rec'd)	Coal (Moisture free)	% referred to Coal (Moisture and ash free)
Moisture	.80	2.39		
Volatile matter	25.48	25.07	25.63	31.38
Fixed carbon	55.69	54.80	56.15	68.62
Ash	18.03	17.74	18.17	
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>

ULTIMATE ANALYSIS.

Sulphur	.53	.52	.53	.65
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Sample No. 20482 - Room No. 21 - First West B.

Lab. No. 11769. PROXIMATE ANALYSIS.

	Coal (Air Dried)	Coal (As Rec'd)	Coal (Moisture free)	% referred to coal (Moisture & Ash free)
Moisture	.76	2.74		
Volatile matter	27.32	26.77	27.52	32.25
Fixed carbon	57.36	56.22	57.81	67.75
Ash	14.56	14.27	14.67	
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>

ULTIMATE ANALYSIS.

Sulphur	.57	.56	.58	.68
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Sample No. 20507. - Room No. 10 - Sixth West B.

Lab. No. 11770

PROXIMATE ANALYSIS.

	Coal (Air Dried)	Coal (As rec'd)	Coal (Moisture free)	% referred to Coal (Moisture & ash free)
Moisture	.53	2.12		
Volatile matter	25.25	24.85	25.39	31.76
Fixed carbon	54.26	53.39	54.54	68.24
Ash	19.96	19.64	20.07	
	100.00	100.00	100.00	100.00

ULTIMATE ANALYSIS.

Sulphur	.48	.47	.48	.60
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A composite sample was made of the above three samples on which Proximate and Ultimate analysis were made and the heat values determined with the following results:

Lab. No. 11771

PROXIMATE ANALYSIS.

	COAL (Air Dried)	COAL (As Rec'd)	COAL (Moisture free)	%REFERRED TO COAL (Moisture & Ash free)
Moisture	.64	2.33		
Volatile matter	26.27	25.82	26.44	32.12
Fixed carbon	55.52	54.58	55.88	67.88
Ash	17.57	17.27	17.68	
	100.00	100.00	100.00	100.00

ULTIMATE ANALYSIS.

Hydrogen	4.51	4.62	4.46	5.42
Carbon	70.34	69.14	70.79	86.00
Nitrogen	1.09	1.07	1.10	1.34
Oxygen	5.96	7.38	5.44	6.60
Sulphur	.53	.52	.53	.64
Ash	17.57	17.27	17.68	
	100.00	100.00	100.00	100.00

CALORIFIC VALUE DETERMINED.

Calories	6973	6854	7018	8525
British Thermal units	12551	12337	12632	15345

CALORIFIC VALUE CALCULATED FROM ULTIMATE ANALYSIS.

Calories	6874
British thermal units	12373

State Mine Inspector's Report is attached herewith and becomes part of this report.

On pages 56 and 58 of this report Mr. Dalrymple gives as the "cause and origin of the explosion", a blown out shot in a working cross-cut in room 17 off the Fourth West B. Although this opinion is concurred in by Messrs. Oberding, King and Douthwaite, the three Deputy State Mine Inspectors, the evidences well in my opinion not substantiate the theory.

My reasons for objecting to this theory:are:

First; All evidence shows that the force and flame entered room 17 from room 18.

Second; The shot firers who were handling this district were found in room 24, off the Fourth West B, and in the face of the cross-cut, which was in 50 feet, two holes had been loaded, and a stick of dynamite was found on the floor with a cap inserted and fuse attached, clearly indicating that the two shot firers were in this cross-cut and ~~THE EXPLOSION~~ in the act of loading the third hole when the explosion occurred. Now I doubt that even if these shot firers had done no other work between rooms 17 and 24, they would not have had time to reach room 24 prior to the shot in room 17 went.

Third; The shot firers book was found but there was no record of his having fired a shot in the cross-cut in room 17, so it is possible that this shot was not fired on the night of the explosion, though of course it may have been.

Fourth; All indication point to the flame and force coming into this district through the detour from the Fourth West B and not from the other direction. (See notes Fourth West B)

Fifth; If the explosion started in room 17, - Fourth West B, it is impossible to account for the fact that the force came outbye the First and Second West B, and the Fourth South between this point and the Fourth West B. Then too, all the timbers in room 21 off the First West B were blown out into the entry and all the evidence show undeniably that the force at this point went in both directions.

I am therefore forced to the belief that Mr. Dalrymple is wrong in his conclusion. On pages 57 and 58 of this report Mr. Dalrymple mentions several cars in various parts of the mine which he thinks contained dynamite which exploded in the cars. To my mind there is no evidence of any dynamite having exploded in any one of the cars. The bottom (wood) of every car was perfectly intact while in every case the sides were broken in and not out. If even as small an amount as 10 pounds or less of dynamite were set off in the wooden pit car, the wood would have been splintered and scattered throughout the entries. Nothing ~~approaching~~ this condition was found in any single case; on the contrary a car on the Second West B was found in a direct line of the explosion with coke on the car and a mule near the car badly burned, and one sack of dynamite thrown on the ground and the sack holding it slightly scorched and yet it did not explode, while the other sack remained in the car untouched and then was more heat indicated at this point, than at any of the other cars.

MINE INSPECTOR'S REPORT:

Denver, Colo., March 20, 1911.

Hon. John F. Shafroth,

Governor of Colorado.

Dear Sir:

Herewith I beg to submit to you my report covering the findings of my investigation of the Cokedale explosion which occurred on February 9th, 1911, at 9 p. m. I arrived at the scene of the disaster on the 11th, and accompanied by Messrs. Oberding and King, proceeded to make a careful examination of the workings of the mine to ascertain the probable cause of the explosion which cost the lives of seventeen men.

LOCATION OF MINE: The Cokedale property is situated in what is known as the Reilly Canyon, nine miles West of the town of ~~XXXXXX~~ Trinidad, Las Animas County, and is connected by a spur with the main line of the D. & R. G. R. R. It is owned and operated by the Carbon Coal & Coke Company with Mr. Frank Guiterman in charge as General Manager and Mr. F. P. Bayless, Superintendent.

DESCRIPTION OF THE MINE AND MODE OF WORKING: The coal seam of this mine is of the bituminous coking variety, and averages about six feet in thickness and is very impure. The mine has been operated about four years, and at the time of the accident, had a daily producing capacity of 1200 tons. The mine is opened by a slope and air course, and is worked by the double entry room and pillar method. The workings are laid out in blocks or sections named alphabetically, and three sections are being worked, to wit: A, B, and C. There are three pairs of entries working in C. which

are being pushed to the boundary line of this section. The idea is to do all the development work in Section C, while the coal in Sections A and B is being worked out, thus the innermost rooms are started first, thereby allowing the extraction of the coal upon the retreating instead of the advancing system. The surface being very irregular, the seam drops out in some parts of the canyon and two entries are driven to the surface on the seam. The slope is equipped with an endless chain for hoisting purposes. Electric motors deliver the coal at bottom of slope. The electric power being shut off at night before the shot firers entered the mine.

VENTILATION: There are three intakes, namely the Fifth East, the Third South and the Main slope, with a 15 x 7 foot exhaust fan. When I inspected the mine on November 7th, 1910, I considered it in a safe and sanitary condition. The ventilation was good and the mine free from explosive gas. The sprinkling system in practice is from pipes under pressure, and in some parts of the mine where the pipes do not extend, a hose is attached to the end of the water pipe and the sprinkling is conducted in this manner to points to where it is desired. I further considered the hygrometric conditions very favorable. At this time the company installed a shot-firing system by an electric battery whereby all shots were fired when all the employees had left the mine, and it was in use when I made my inspection. It seems, however, that there was considerable trouble with this system of firing from missed shots and it was abandoned and shot firers installed again, and apparently shots were fired when other employees were in

the mine.

CHECKING IN AND OUT SYSTEM: At the entrance to the Fifth East where all employees pass, a checking in and out station is situated, and as the men enter the mine, each one is given a check which he returns to the checkman when he comes out.

CHARACTER OF EXPLOSION AND RESCUING: When the explosion occurred it was heard very distinctly in Trinidad, Deputy Inspector King who happened to be there, hurried at once to Cokedale and found that the fan was not damaged, although part of the force came out through the air course and the fan house. He immediately, accompanied by others, entered the Eighth West, reaching the inner workings of Section C about 1:30 a. m. This fact leads me to believe that if the eight miners working in this section had remained in their working places, they would have been saved. Deputy Inspector Oberding was in Walsenburg, when he heard of the explosion, he too hastened to Cokedale, but I was not notified, and learned of it only the next day through the morning papers. I took the first train out from Denver and upon arriving there, accompanied by Supt. Bayles, Fire Bosses Jones and Brown, Deputy Inspectors King and Oberding, entered the mine, and found that very little damage had been done to the property. We made good progress, exploring the entire mine in three days. I returned to Denver on the 14th, but on the 15th I received a telephone message from Mr. Bayles asking me to return to make a further examination of the mine before ~~my~~ preparing my report. I complied with his request and returned at once. This time I was accompanied by Deputy Inspectors Douthwaite and King, and the mine was again care-

fully examined.

METHOD OF HANDLING POWDER AND PRIMERS, AND THE FIRING OF SHOTS:

Powder and primers were handled exclusively by the shot firers, a corps consisting of nine men. The powder was taken into the mine in a car under the supervision of the chief shotfirer, upon reaching the different sections where shots were to be fired, part of the powder was taken out and loaded into other cars and one was hauled to each district. The amount of powder carried into the mine on the night of the explosion was 2157 sticks, of about 540 pounds. Part of it was No. 2 Hercules 40% giant, and part of it consisted of Betna B, a permissible powder, with which it seems they were experimenting with the intention of using it exclusively if it proved satisfactory. The shot firers' records show that they had refused to fire some shots because the miners had not cleaned out the drillings in the holes, and in some cases because of dependent shots. I found many blown-out shots.

FIREBOSSSES AND COMPANY INSPECTORS AND THEIR DUTIES: There were three men employed as firebosses and company inspectors, two acted in both capacities, the other only as inspector. Two of these men examined the mine in the morning before the other employes entered for their day's work. Then one acted from 7 a. m. as inspector until noon, the other as fire boss, while the other started at 7 a.m. and worked until quitting time as inspector. The inspectors had the authority to suspend any miner for disobeying their orders and before being reinstated the delinquent had to promise to obey in the future. However, notwithstanding the authority of the inspectors, the record

of their findings showed that a dangerous rock had been reported for several days, and when I examined the mine I found it still hanging. The record of the fire bosses showed that a little gas had been found in the entries of section C between the third and the sixth of the month. The accumulation of this gas was caused by the too great a distance between crosscuts.

CAUSE AND ORIGIN OF EXPLOSION: Although two of the shotfirers escaped from the mine after the explosion, they could give no information relating to its cause, or in what part of the mine it started. Therefore in determining the point of origin, I had to be guided entirely by the directions the forces traveled, which were indicated by the strewn timbers, the source from which they came and the direction they were blown to. While the forces were conflicting in some parts of the mine, it is my opinion, concurred in by Messrs. Oberding, King and Douthwaite, that the initial point was a working crosscut between rooms 16 and 17 on the Fourth West B which was being driven from room 17. The force radiated from here traveling south to the entry, and east into rooms 18, 19, 20, 21 and 22. In room 21 there was evidently an explosion of powder that had been left in the gob. There was a radiation of the force from this point also. Room 22 was the last room shot in the district. The bodies of two shotfirers were found in room 24, they had tamped two shots in this room and were preparing the third when the explosion occurred. They were the only ones found near where they were supposed to be when the explosion took place. Therefore, I believe these men were nearer the initial point than any of the other employees. On one side

from room 18 to 22, and on the other side to room 11, there was evidence of an intense heat having existed as was shown by the timbers in this locality which were heavily coked on all sides. The force going south divided when it struck the entry, part of it going east the course of which has laready been described above, the other part west, the latter split at room 10 which is connected with the Fifth West B. It traveled northwards up this room, displaced the timbers, allowing the roof to fall, when it reached the haulage crosscut between the Fifth and Sixth B, it struck a car that had evidently contained a considerable amount of powder which it exploded, turning the car up side down and wrecking it. The force from this point traveled north, southh, east and west. The south force which traveled back through room 10 towards the Bourth West B, carried some of the wheels of the car found on the haulage crosscut between Fifth andSixth West B. This wheel was found on top of the roof which had fallen after the first force passed through this room. This proved that the wheel was placed there by the last force. Another car was found on the Fourth West B entry at entrance of room 8, this car also had powder in it at the time of the explosion, as it was badly wrecked and turned up side down. The door of this car was found in an entry cross cut about 100 feet ~~XXX~~ east of the car, while one of the hubs was found at room 7, 72 feet West of the car. The Fourth West B entry from room 13, dips west at the rate of 4%, and it is my opinion, that this car was left standing on the grade and set in motion probably by the concussion of the explosion and the powder it had contained exploded while it was in transit. Another car was found on the Third south that had had powder in it which the

force exploded. The drawbar of this car was bent downward at both ends until the bumpers rested on the floor, indicating that it had been struck by a straight downward force. The body of the car was badly ~~wrecked~~ wrecked. At the junction of the first and second west B, a mule was found badly singed, he had been hitched to a car containing 14 sticks of powder, to which the tail chain was still attached, but the mule had broken loose. Twenty-five feet west of this ~~car~~ was a sack slightly singed with 40 pounds of powder still intact. We discovered numerous blown-shots cause be either the shots being too large, or the charge too small. Some parts of the mine were found in a very dusty condition, namely the First and Second and the Third west B entries, and the rooms off the Japan entry.

CONCLUSION: I believe it was a dust explosion caused by a blown-out shot and accompanied by an overcharged shot. The force of the explosion was augmented by at least five powder explosions in different parts of the mine. The overcharging of the shot was probable due to an irregularity in the roof, which in this instance came down very precipitately but uniformly, thereby reducing materially the amount of work necessary for the charge of powder.

All the victims died from suffocation. Two of them were not in the mine at the time of the explosion, but lost their lives in a effort to rescue their fellowmen. One was E. A. Sutton Assistant Superintendent of the Cokedale mine, and the other Robert Meek, a resident of Startville, who came to Cokedale to aid in the work of rescue.

Below is a table giving the names, etc. of the persons killed:

<u>NAME OF PERSON</u>	<u>NATIONALITY</u>	<u>OCCUPATION</u>	<u>AGE</u>	<u>SINGLE OR</u> <u>MARRIED</u>	<u>NUMBER OF</u> <u>CHILDREN</u>
Rudolph Seliga	Pole	Miner	--	Married	--
Andy Podzorsky	Pole	Miner	--	Married	3
B. Hodbod	Pole	Miner	--	Married	2
Likas Gozndek	Pole	Miner	--	Married	4
Joe Malach	Pole	Head Shotfirer	66	Married	2
Ludwig Klapuch	Pole	Shorfirer	--	Married	1
Karl Piecha	Pole	Shotfirer	--	Married	--
Karl Francis	Pole	Shotfirer	--	Married	3
Andy Ranovsky	Pole	Shotfirer	--	Married	--
John Freisch	Pole	Shotfirer	35	Married	2
Joseph Makrosh	Pole	Shotfirer	35	Married	--
Doniono Tabarelli	Tyrolese	Miner	37	Single	--
Fortunato Zanot	Italian	Miner	33	Married	2
Valantine Tretter	Austrian	Miner	35	Married	4
Joe Ghezzi	Austrian	Miner	--	Single	--
E. A. Sutton	American	Ass't Supt.	--	Married	--
Robert Meek	American	Tracklayer, for C. F. & I. Co., Starkville, Colo.			

Respectfully submitted,

(Signed)

James Dalrymple

State Coal Mine Inspector.

An account of this explosion can be found in "Mines and Minerals", June 1911 number, written by Geo. F. Duck.-Page 658.

RECOMMENDATIONS & PRACTICAL LESSONS TO BE LEARNED FROM THIS DISASTER:

I made the following recommendations: to Mr. Guiterman,
Gen. Mgr. of the Company:

First; A more direct and careful supervision over the men generally and especially over the shotfirers, by a competent inspector both before and after the shots are fired.

Second; The danger of over-confidence.

Third; A bolish the use of dynamite and substitute therefore one or more of the permissible explosives.

Fourth; Perfected organization, and weekly practice of helmet men, who should be thoroughly trained and to include crews of outside, as well as inside men and not confine the training to one set of class of men.

Fifth; Not to permit helmet men to enter a mine after an explosion or to fight a fire in squads of less than 4 and perferably 5 or 6, with a captain at the head and if possible permit no man to join a crew who is not thoroughly conversant with the helmet. Each man be compelled to test out his helmet thoroughly before and after putting it on and the captain of the crew or some other competent person to carefully examine all connections of every member of the crew.

Sixth; At the established reserve station, have a reserve crew with helmets ready at a moments notice to don same and go to the assistance of those on the inside, if necessary.

Seventh; Compell the miner to mine his coal at least six inches deeper than the hole and forbid the shooting off the solid on pain of dismissal.

Eighth; Extend the sprinkling system into the rooms and compell the miners to keep the room wet and to sprinkle the face before leaving for the night and while loading, if the coal is dry and shows any tendency to make dust.

Ninth; Impress upon the men constantly and continuously the necessity for the greatest care in their work at all times, and that if anything should happen, they should stay in their room or entry and brattice themselves off and wait until help comes.

Tenth; Never permit any accumulation of dust in the mine, and keep every part of the mine in a thoroughly wet condition. The wet zones, when of sufficient length in this mine, prevented the propagation of the explosion in several instances, but wet zones of 50 feet or less were jumped with ease.

I am pleased to say that many of these recommendations have been adopted.

Respectfully submitted,

(Signed) J. C. Roberts

Mining Engineer.



Correspondence

C O P Y .

Denver, Colo., March 20, 1911.

Hon. John F. Shafroth,
Governor of Colorado.

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LOCATION OF MINE: The Cokedale property is situated in what is known as the Reilly Canyon, nine miles west of the Town of Trinidad, Las Animas county, and is connected by a spur with the main line of the D. & R. G. R. R. It is owned and operated by the Carbon Coal & Coke Co. with Mr. Frank Guiterman in charge as General Manager and Mr. F. P. Bayles, Superintendent.

DESCRIPTION OF THE MINE AND MODE OF WORKING: The coal seam of this mine is of the bituminous coking variety, and averages about six feet in thickness and is very impure. The mine has been operated about four years, and at the time of the accident, had a daily producing capacity of 1200 tons. The mine is opened by a slope and air course, and is worked by the double entry room and pillar method. The workings are laid

out in blocks or sections named alphabetically, and three sections are being worked, to wit: A. B. and C. There are three pairs of entries working in C. which are being pushed to the boundary line of this section. The idea is to do all the development work in Section C, while the coal in Sections A and B is being worked out, thus the innermost rooms are started first, thereby allowing the extraction of the coal upon the retreating instead of the advancing system. The surface being very irregular, the seam crops out in some parts of the canyon and two entries are driven to the surface on the seam. The slope is equipped with an endless chain for hoisting purposes. Electric motors deliver the coal at bottom of slope. The electric power being shut off at night before the shot firers entered the mine.

VENTILATION: There are three intakes, namely, the fifth east, the third south and the main slope, with a 15 x 7 foot exhaust fan. When I inspected the mine on November 7th, 1910, I considered it in a safe and sanitary condition. The ventilation was good and the mine free from explosive gas. The sprinkling system in practice is from pipes under pressure, and in some parts of the mine where the pipes do not extend, a hose is attached to the end of the water pipe and the sprinkling is conducted in this manner to points to where it is desired. I further considered the hygrometric conditions very favorable. At this time the company had installed a shot-firing system by an electric battery whereby all shots were fired when all the employes had left the mine, and it was in use when I made

my inspection. It seems, however, that there was considerable trouble with this system of firing from missed shots and it was abandoned and shotfirers installed again, and apparently shots were fired when other employes were in the mine.

CHECKING IN AND OUT SYSTEM: At the entrance to the fifth east where all employes pass, a checking in and out station is situated, and as the men enter the mine, each one is given a check which he returns to the checkman when he comes out.

CHARACTER OF EXPLOSION AND RESCUING: When the explosion occurred it was heard very distinctly in Trinidad, Deputy Inspector King who happened to be there, hurried at once to Cokedale and found that the fan was not damaged, although part of the force came out through the air course and the fan house. He immediately, accompanied by others, entered the 8th west, reaching the inner workings of section C about 1:30 a. m. This fact leads me to believe that if the eight miners working in this section had remained in their working places, they would have been saved. Deputy Inspector Oberding was in Walsenburg, when he heard of the explosion, he too hastened to Cokedale, but I was not notified, and learned of it only the next day through the morning papers. I took the first train out from Denver and upon arriving there, accompanied by Supt. Bayles, Fire Bosses Jones and Brown, Deputy Inspectors King and Oberding, entered the mine, and found that very little damage had been done to the property. We made good progress, exploring the entire mine

in three days. I returned to Denver on the 14th, but on the 15th I received a telephone message from Mr. Bayles asking me to return to make a further examination of the mine before preparing my report. I complied with his request and returned at once. This time I was accompanied by Deputy Inspectors Douthwaite and King, and the mine was again carefully examined.

METHOD OF HANDLING POWDER AND PRIMERS, AND THE FIRING OF SHOTS:

Powder and primers were handled exclusively by the shotfirers, a corps consisting of nine men. The powder was taken into the mine in a car under the supervision of the chief shotfirer, upon reaching the different sections where shots were to be fired, part of the powder was taken out and loaded into other cars and one was hauled to each district. The amount of powder carried into the mine on the night of the explosion was 2157 sticks, or about 540 pounds. Part of it was No. 2 Hercules 40% giant, and part of it consisted on Aetna 3, a permissible powder, with which it seems they were experimenting with the intention of using it exclusively if it proved satisfactory. The shotfirers' records show that they had refused to fire some shots because the miners had not cleaned out the drillings in the holes, and in some cases because of dependent shots. I found many blown-out shots.

FIREBOSSSES AND COMPANY INSPECTORS AND THEIR DUTIES: There were three men employed as firebosses and company inspectors, two acted in both capacities, the other only as inspector. Two of these men examined the mine in the morning before the

other employes entered for their day's work. Then one acted from 7 a. m. as inspector until noon, the other as fire boss, while the other started at 7 a. m. and worked until quitting time as inspector. The inspectors had the authority to suspend any miner for disobeying their orders and before being reinstated the delinquent had to promise to obey in the future. However, notwithstanding the authority of the inspectors, the record of their findings showed that a dangerous rock had been reported for several days, and when I examined the mine I found it still hanging. The record of the fire bosses showed that a little gas had been found in the entries of section C between the third and the sixth of the month. The accumulation of this gas was caused by the too great a distance between crosscuts.

CAUSE AND ORIGIN OF EXPLOSION: Although two of the shotfirers escaped from the mine after the explosion, they could give no information relating to its cause, or in what part of the mine it started. Therefore in determining the point of origin, I had to be guided entirely by the directions the forces traveled, which were indicated by the strewn timbers, the source from which they came and the direction they were blown to. While the forces were conflicting in some parts of the mine, it is my opinion, concurred in by Messrs. Oberding, King and Douthwaite, that the initial point was a working crosscut between rooms 16 and 17 on the 4th west B which was being driven from room 17. The force radiated from here traveling south to the entry, and

east into rooms 18, 19, 20, 21 and 22. In room 21 there was evidently an explosion of powder that had been left in the gob. There was a radiation of the force from this point also. Room 22 was the last room shot in the district. The bodies of two shotfirers were found in room 24, they had tamped two shots in this room and were preparing the third when the explosion occurred. They were the only ones found near where they were supposed to be when the explosion took place. Therefore, I believe these men were nearer the initial point than any of the other employees. On one side from room 18 to 22, and on the other side to room 11, there was evidence of an intense heat having existed as was shown by the timbers in this locality which were heavily coked on all sides. The force going south divided when it struck the entry, part of it going east the course of which has already been described above, the other part west, the latter split at room 10 which is connected with the 5th west B. It traveled northwards up this room, displaced the timbers, allowing the roof to fall, when it reached the haulage crosscut between the 5th and 6th B, it struck a car that evidently had contained a considerable amount of powder which it exploded, turning the car up side down and wrecking it. The force from this point traveled north, south, east and west. The south force which traveled back through room 10 towards the 4th west B, carried some of the wheels of the car found on the haulage crosscut between 5th and 6th west B. This wheel was found

on top of the roof which had fallen after the first force passed through this room. This proves that the wheel was placed there by the last force. Another car was found on the 4th west B entry at entrance to room 8, this car also had powder in it at the time of the explosion, as it was badly wrecked and turned up side down. The door of this car was found in an entry cross cut about 100 feet east of the car, while one of the hubs was found at room 6, 72 feet west of the car. The 4th west B entry from room 13, dips west at the rate of 4%, and it is my opinion, that this car was left standing on the grade and set in motion probably by the concussion of the explosion and the powder it had contained exploded while it was in transit. Another car was found on the 3rd south that had had powder in it which the force exploded. The drawbar of this car was bent downward at both ends until the bumpers rested on the floor, indicating that it had been struck by a straight downward force. The body of the car was badly wrecked. At the junction of the 1st and 2nd west B, a mule was found badly singed, he had been hitched to a car containing 14 sticks of powder, to which the tail chain was still attached, but the mule had broken loose. Twenty-five feet west of this car was a sack slightly singed with 40 pounds of powder still intact. We discovered numerous blown-out shots cause be either the shots being too large, or the charge too small. Some parts of the mine were found in a very dusty condition, namely the 1st, 2nd and the 3rd west B entries, and the rooms off the Japan entry.

CONCLUSION: I believe it was a dust explosion caused by a blown-out shot and accompanied by an overcharged shot. The force of the explosion was augmented by at least five powder explosions in different parts of the mine'. The overcharging of the shot was probable due to an irregularity in the roof, which in this instance came down very precipitately but uniformly, thereby reducing materially the amount of work necessary for the charge of powder.

All the victims died from suffocation. Two of them were not in the mine at the time of the explosion, but lost their lives in an effort to rescue their fellowmen. One was E. A. Sutton, Assistant Superintendent of the Cokedale mine, and the other Robert Meek, a resident from Starkville, who came to Cokedale to aid in the work of rescue.

Below is a table giving the names, etc. of the persons killed:

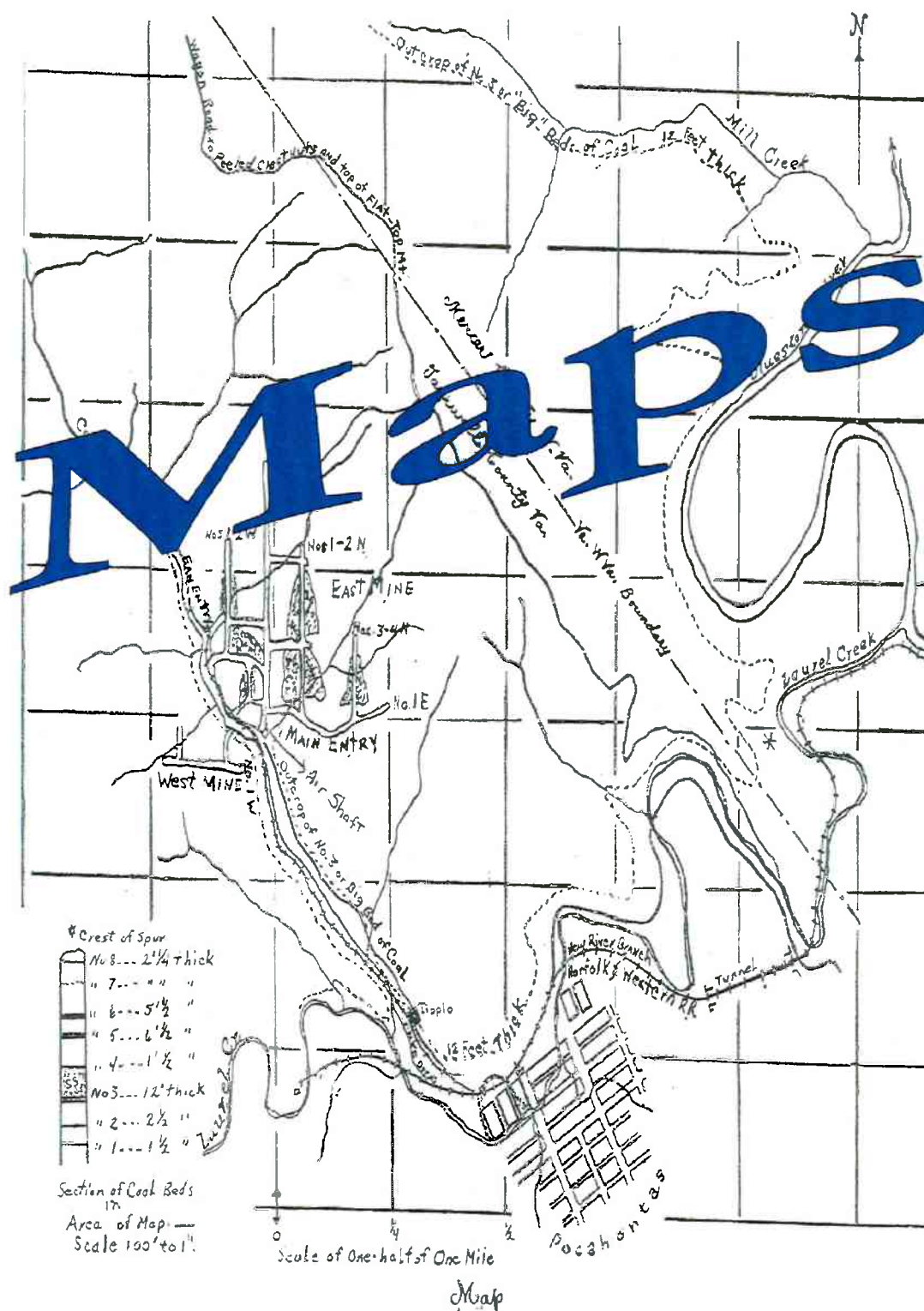
NAME OF PERSON	NATIONALITY	OCCUPATION	AGE	SINGLE OR MARRIED	NUMBER OF CHILDREN
Rudolph Seliga	Pole	Miner	---	Married	
Andy Podzorsky	Pole	Miner	---	Married	3
B. Hodbod	Pole	Miner	---	Married	2
Likas Gozndek	Pole	Miner	---	Married	4
Joe Malach	Pole	Head Shotfirer	66	Married	2
Ludwig Klapuch	Pole	Shotfirer	---	Married	1
Karl Piecha	Pole	Shotfirer	---	Married	---
Karl Francis	Pole	Shotfirer	---	Married	3
Andy Ranovsky	Pole	Shotfirer	---	Married	---
John Freisch	Pole	Shotfirer	35	Married	2
Joseph Makrosh	Pole	Shotfirer	35	Married	---
Doniono Tabarelli	Tyrolese	Miner	37	Single	
Fortunato Zanot	Italian	Miner	33	Married	2
Valantine Tretter	Austrian	Miner	35	Married	4
Joe Ghezzi	Austrian	Miner	---	Single	
E. A. Sutton	American	Ass't. Supt.	---	Single ^{Married}	
Robert Meek	American	<i>Truck driver</i> <i>Chas. D. Williams Co.</i>	---	---	---

Respectfully submitted,

(Signed)

James Dalrymple

State Coal Mine Inspector.

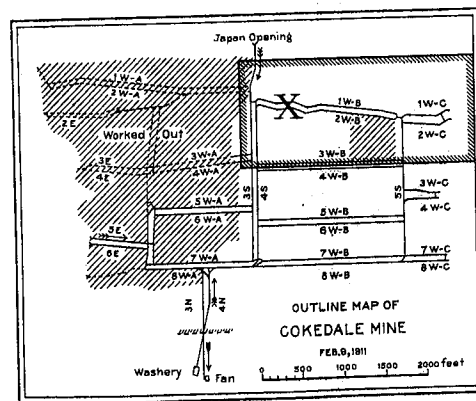
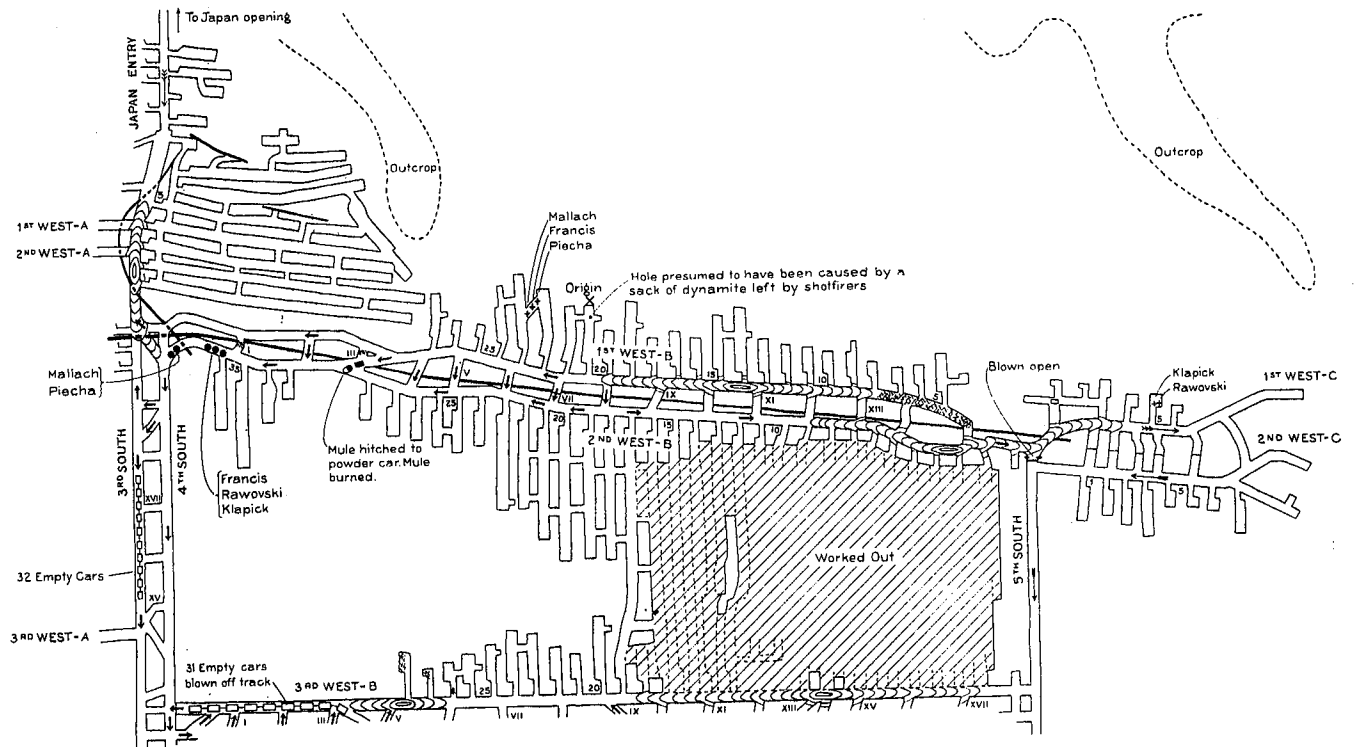


Detail Map of Rectangle X D #5
Cokedale Mine

Carbon Coal and Lignite Co. Cokedale, Colo.

Coal Trust Exhibit Feb. 8, 1911

Located in Pittsburgh Bureau of Mines
Map Repository



DETAIL MAP OF
RECTANGLE X COKEDALE MINE
 CARBON COAL & COKE CO. COKEDALE, COLO.
 COAL DUST EXPLOSION FEB. 9, 1911

Scale in feet
 0 100 200 300 400 500

- | | |
|--------------------------------|------------------------|
| + Man's supposed working place | ←←← Intake air |
| ● Man dead | →→→ Return air |
| ⊙ Mule dead | →→→ Direction of force |
| □ Empty car | ⊥ Stopping blown down |
| ■ Loaded car | ⊥ Canvas brattice |
| ⊥ Door | ⊥ Board stopping |
| ▨ Fall of roof | ▨ Gob stopping |
| ▨ Wet area | |

D# 59

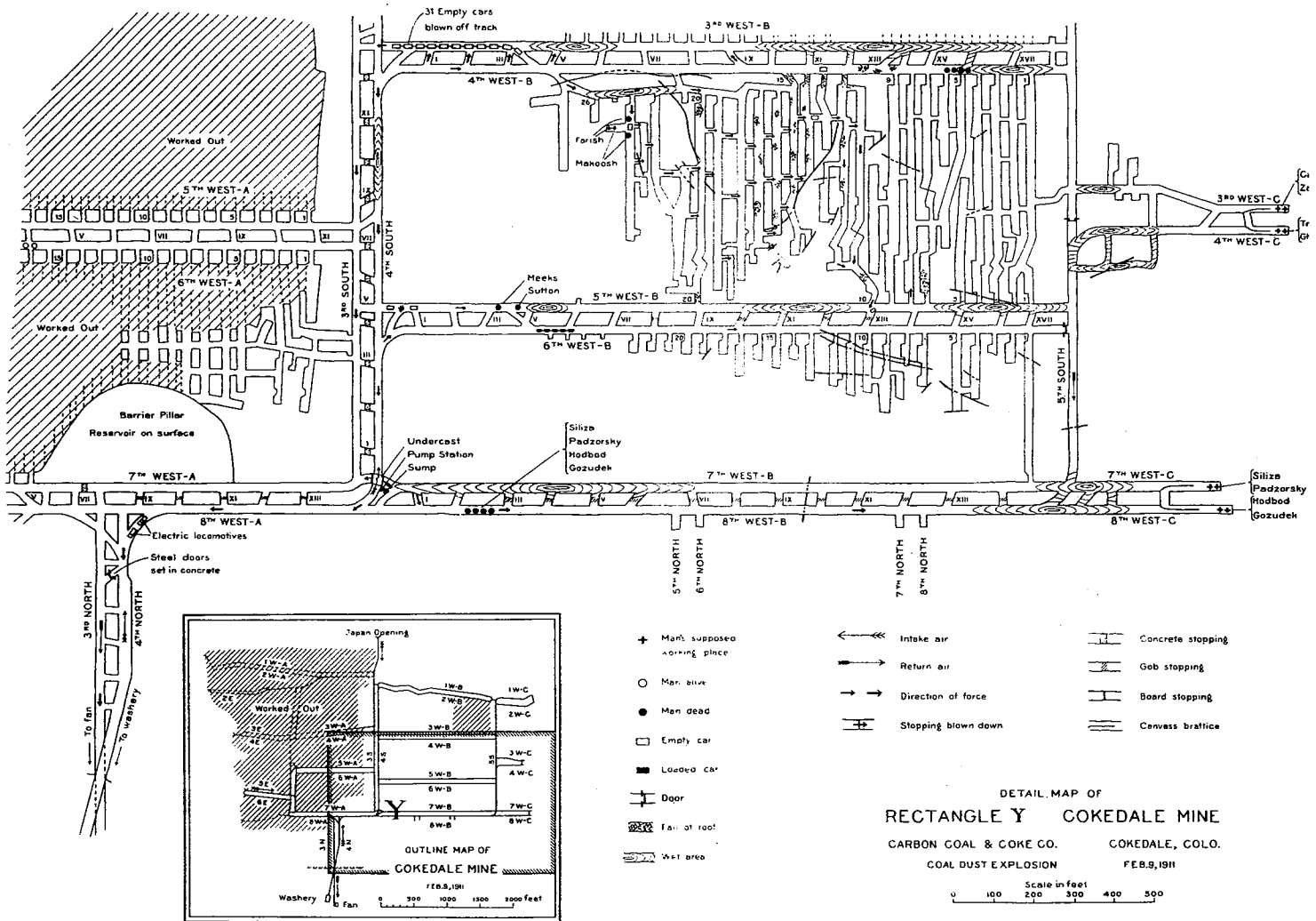
Detail Map of Rectangle Y

Cokedale Mine

Carbon Coal and Coke Co. Cokedale, Colo.

Coal District Exposure Feb. 9, 1911

Located in Pittsburgh Bureau of Mines
Map Repository





Magazine Articles

rolls are driven by an 85-horsepower General Electric motor. The product from the screens and rolls is deposited upon a 30-inch belt conveyor, which carries it to the dust-proof room on the third floor of the washery. As this belt with its load of slack leaves the crusher house en route to dust-proof room, each 25-foot section is automatically weighed and recorded by a Blake-Dennison automatic and continuous weighing machine. Thus the data of results are based upon accurate figures. This belt is 278 feet long, center to center, 76 feet 8 inches rise, has a capacity of 250 tons per hour, and is driven by a 50-horsepower Western Electric motor.

In the dust-proof room water is added by two 5-inch centrifugal pumps to the crushed coal, and the whole is carried in launders to eight jigs of the Stewart type, two double jigs on each side of jig floor. The jig and water-supply tanks are of steel plate, concrete lined. The pumps which supply water to these jigs are driven by two 50-horsepower Western Electric motors.

From the dust-proof room onward the washery plant is built in two units on the east and west sections of the building, and operated independently or together, so that an accident on one side offers no hindrance to the continued operation of the other half of the plant.

The hutches of the jigs, Fig. 5, taper downward, and are connected with two Luhrig elevators by 8-inch pipes. These elevators discharge the refuse into launders, which deliver it to two refuse trommels 4 ft. \times 8 ft. All trommels have $\frac{1}{8}$ -inch perforations, $\frac{1}{8}$ -inch plate, 1.5-inch slope to the foot, and are operated at a speed of 17 revolutions per minute.

The oversize from the refuse trommels passes to rewash jigs of the Stewart type; the undersize is rewashed in four Luhrig jigs, two on each side; the recovery from these jigs joins the washed coal from the primary Stewart jigs, and is conveyed by launders under the jig floor to four dewatering trommels, two on each side, the oversize from which is spouted into two 60-inch Steadman disintegrators, operated at 325 revolutions per minute, where it is crushed to desired size for coke ovens. The east and west side sections of the jigs are each driven by an 85-horsepower General Electric motor.

The undersize from the trommels is recovered from settling tanks beneath by perforated-bucket elevators running 15 feet per minute; and, together with the washed coal from the Stewart and Luhrig jigs, is delivered to a conveyor belt traveling 287 feet 3 inches, to seven 300-ton cylindrical steel storage tanks, each 20 feet in diameter, 40 feet high, and distributed by two drag conveyers operating above the bins, whence it is taken by electric larries to the coke ovens. The rejected material from the various washings and rewashings is picked up by elevators and discharged into the waste tank at the south end of the washery building, whence it is taken by electric trolley cars to the waste dump.

The recovery from the oversize from the refuse trommels carried to Stewart rewash jigs is a product equal in fuel value to the unwashed mine product, and is used as nut coal for domestic or steam purposes. This material is carried by belt conveyor to a circular steel storage bin.

Twenty-seven electric motors, having an aggregate capacity of 1,159 horsepower, are operated in conveying the coal from the tippie and through the crusher house and washery until delivered in the washed-coal storage bins. All motors on the alternation current are three-phase, 25-cycle, 220-volts.

An adjunct common to the mine tippie of mines Nos. 1 and 2 and to the washery is the "run-of-mine" crusher situated at the tippie. The crusher is a McCully gyratory, with a capacity of 200 tons per hour. Should there be any temporary cessation of orders for screened coal for commercial purposes, the whole

product of these mines could be crushed and conveyed to the storage bins to be washed and made into coke.

The washery has proved an eminent success. Even in the experimental stage the fuel value of the waste was as low as 8 per cent., and the average loss of fuel values in the waste from the washery now and hereafter will probably be below 5 per cent. The capacity of the plant is 2,500 tons per day of 10 hours, but as there are not a sufficient number of coke ovens erected to utilize this tonnage, the plant has never exceeded 8 hours in constant operation. The washery is located in Rail cañon, at a common center to the greatest area of the coal lands of the company.

A complete laboratory is in a two-story concrete and iron fireproof building, 38 ft. \times 26 ft. 6 in., opening into the main washery building. The lower story is used for grinding and preparing for analysis samples of coal, coke, bone, and waste; the upper story contains the laboratory proper, which is fully equipped with every modern appliance necessary for the work at hand.

All of the machinery for handling the unwashed coal, jigs,

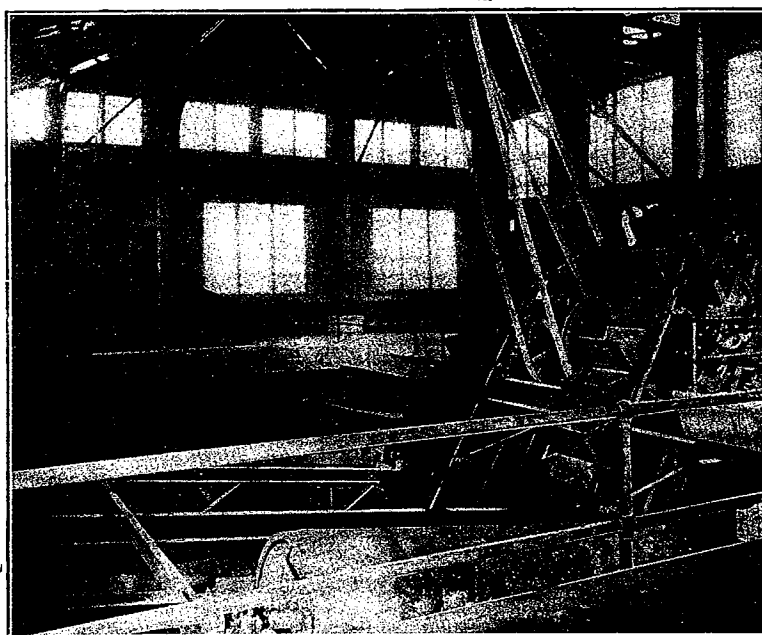


FIG. 6. DEWATERING TROMMELS

and other appliances used in the washing, as well as machinery for handling the washed coal, was manufactured by the Jeffrey Mfg. Co.

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OBSTACLES TO DEVELOPMENT OF ALASKAN COALS

Two influences have held back the development of the Bering River and Matanuska fields. One has been the advances made in the California oil districts, and the other the unfortunate conditions existing in regard to the laws under which Alaska coal lands can be taken up.

During the decade ending with 1908 the annual output of the California oil fields increased from about 2,500,000 to nearly 45,000,000 barrels. As probably 80 per cent. of this petroleum is used for fuel in the Pacific coast states, it has to a corresponding extent decreased the demand for coal.

A far more serious handicap has been the coal-land laws. Though laws intended to enable the individual to obtain title to coal lands have been on the statute books for the last decade, not a single acre of land has yet gone to patent. It is therefore not surprising that progress has been checked in the coal fields and that many who would undertake their development have become discouraged.—*United States Geological Survey.*

THE COKEDALE, COLO., EXPLOSION

Written for Mines and Minerals, by Geo. F. Duck

A few minutes before 9 P. M., February 9, 1911, a quantity of 40-per-cent. dynamite left behind by the shot firers near the face of the twenty-first room on the first west B entry of the Cokedale mine of the Carbon Coal and Coke Co., 8 miles west of Trinidad, Colo., exploded through the agency of a blown-out shot.

Conditions Existing in the Mine After the Explosion and the Conclusions to Be Drawn from Them

In this as in other similar accidents in which large loss of life and destruction of property resulted, care must be taken to distinguish between the initial and secondary or propagating causes. It would seem that the various initial causes have been exhausted in the recent explosions in Colorado. At Primero on January 31, 1910, the explosion, so far as known, was due to marsh gas; at Starkville, on October 8 of the same year, to an electric arc brought about by the short circuiting of the trolley wires; at Delagua, on November 8, to an underground fire; and at Cokedale, on February 9, 1911, to the explosion of dynamite.

In each of the above cases the destruction of life and property by the initial cause and at the focus of the explosion was either nil or relatively insignificant. In no instance would the destruction have extended beyond the point of origin had it not been for the presence of a propagating agent. This agent is found in all these cases in a coal dust high in volatile matter (about 31 per cent.), and of marked and even unusually pronounced coking character.

The Cokedale mine was supposed to be eminently safe and had always been so reported by the state inspectorial staff. It was generally well watered, the ventilation was good, the shot firing system was approved, and inspection was regular and thorough. On the other hand, the mine must have been dusty or the force of the exploding dynamite could not have extended beyond the twenty-first room on the first west B entry.

Two views have been advanced to account for the dust in the Cokedale mine at the time of the explosion. One holds that there was no standing dust generally distributed throughout the workings upon ribs, roof, floor, and timbers, but that all the dust concerned in propagating the explosion of the dynamite was due to that made immediately before and at the time of said explosion by the breaking into minute particles of the very soft coal through abnormally and unusually rapid shot firing.

The second view is the general one; namely, that there was standing dust in the mine and that that actually made by the rapid shooting of the coal played an insignificant part in extending the destructive effects of the exploding dynamite.

Before a decision as to the correctness of either view is permissible, a more detailed study of the conditions prevailing at the time of and immediately prior to the accident must be made.

The surface plant at Cokedale, remarkable in the universal use of concrete, particularly in coke-oven construction, has been described in MINES AND MINERALS.

The coal seam, which outcrops at the tippie site at the level of the railroad track, varies between 4 feet 6 inches and 8 feet 6 inches in thickness, with a fairly well sustained average of 6 feet. It is a member of the Laramie series of the Cretaceous period and is said to be some 200 feet above the bed worked at Starkville, about 4 miles to the east. The seam is universally divided into two members by a parting slate from 2 inches to 8 inches and more in thickness. The upper member of the seam is soft, friable, and of a texture and structure similar to the Connells-ville coal of Pennsylvania. The lower member is harder and more blocky. The coal averages about 31 per cent. in volatile matter, and possesses marked coking qualities. The entire output of the mine, amounting to 1,300 tons daily, is washed and subsequently coked in the plant of 350 ovens, the resultant

product being shipped to the works of the American Smelting and Refining Co., of which the Carbon Coal and Coke Co. is the fuel end.

At the time of the explosion the average number of men employed underground was 275, and outside, 170.

The mine is divided into panels, known as the A, B, and C blocks, by a series of north and south entries from which west entries are turned at right angles. It will be noted that the panels are all connected by entries or rooms. The entries are usually 6 ft. \times 10 ft. with a 25-foot pillar to the parallel entry. The rooms are 300 feet long, 20 to 25 feet wide, with a 25-foot pillar to the next room. Gathering is done by mules, and haulage to the foot of the slope is performed by two small electric motors operated under 240 volts pressure. The slope, which, with the trestle approach to the tippie, is about 600 feet long, is equipped with a chain hoist of 2,200 tons capacity. The entry timbering cannot be too highly commended and is very unusual for a bituminous coal mine.

Because the south entries were driven to their limit before the room entries were turned and because these room entries were also driven to their limit before the first room was turned, the naming and numbering of the entries and rooms is the reverse of that usually followed. The entry most distant from the foot of the slope is numbered one with a letter affixed to denote the block in which it is driven, thus, first west B entry. A portion of the mine beyond the first west B entry is called Japan, by reason of the number of natives of that country working therein.

The men entered at the manway, or fifth east entry, where a careful system of checking in was maintained. By this means, 15 minutes after the accident it was possible to prepare a type-written list of the men in the mine, together with their age, distinctive marks, next of kin, working place, etc.

The method of mining in rooms is unusual, and may be likened to the bench and heading system familiar in tunnel work, but laid out horizontally in place of vertically. The advantage of this system is that, except in the heading or narrow portion of the room, two free faces are always available to the action of a shot, undercutting being therefore unnecessary. On the other hand, unless carefully watched it is obvious that it lends itself to blown-out shots through misplaced holes having too great a thickness of coal to work against. It is practically impossible to maintain the steps at right angles and with a face of just 6 feet.

In the benches, the holes are placed in vertical pairs near the rib, four being needed to square up the face. In the heading, which varies from 6 to 8 feet in width, the coal is rarely undercut the full height of the upper member of the seam. That is to say, it is top-cut near the roof and not undercut at the floor. When cut the full width of the heading one center shot is relied upon to bring the coal down; when undercut partially, one bottom shot near the floor and under the cutting, combined with a vertical pair near the rib are used, and when not cut at all, which is the usual practice, the customary cut and side shots are used. For the reasons given immediately above, as many as seven shots are not infrequently fired in one room at the same instant.

Ventilation is produced by a 15' \times 7' Capell fan which, at 80 revolutions and at .9-inch water gauge was circulating some 55,000 to 60,000 cubic feet of air a minute. The fan is set in reinforced concrete above and to one side of a shaft connected with the third north entry or main return air-course. The return underground, Fig. 1, is driven to the crop where it is closed by double explosion doors. The three points of intake, the direction of the air throughout the workings (indicated by arrows), as well as the location of brattices, regulators, doors, over and undercasts, are shown on the map. An arrow with the letter *E* affixed indicates the direction of advance of the explosive wave.

Two fire bosses are employed who inspect the working

places not more than 3 hours before the men enter and who examine the abandoned portions of the mine once a week. They state that methane is of rare occurrence, although sometimes found at the faces of the advanced workings in the C block. As opposed to this, the analyses by Mr. John B. Ekeley, Professor of Chemistry at the Colorado State University, Boulder, and published in the biennial report of the State Coal Mine Inspector, which appeared April 1, are of interest, as showing

and eighth west C entries which served as the return air-course. An electrical shot firing system was used up to within a short time of the accident. At the time of the explosion the mine was divided as nearly as possible into four shot-firing zones, to each of which was assigned a head shot firer and an assistant. In addition there was a boss shot firer whose duties seem indefinite and of no immediate value, as he naturally could be with but one gang at a time. About 5:45 P. M., after

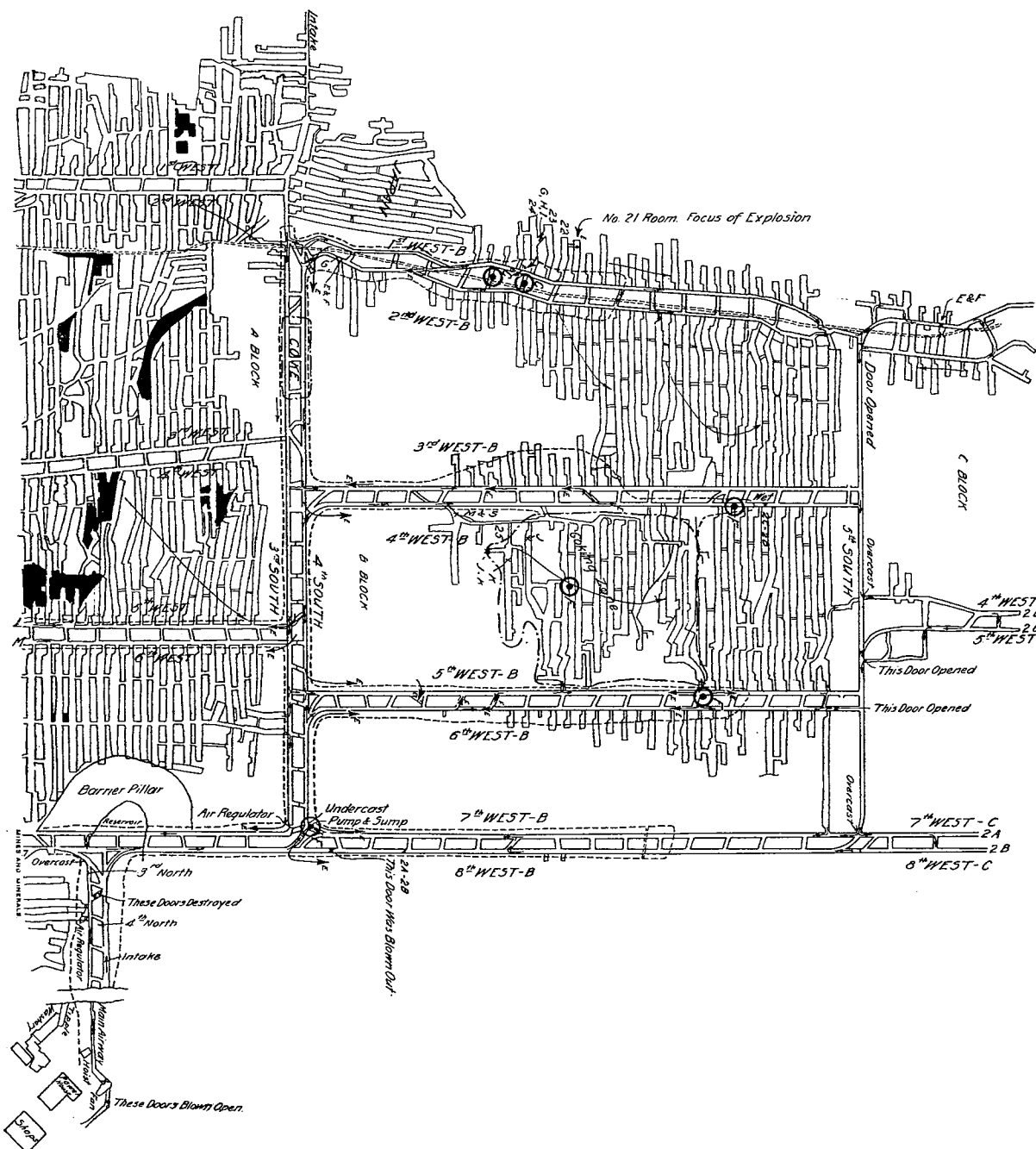


FIG. 1. MAP OF PART OF MINE AT COKEDALE

the more general presence of gas than suspected. Professor Ekeley found .7 per cent. of CH_4 in the pillars in room 10 on the second west B entry; .8 per cent. at the face of the fifth west C entry, and .4 per cent. in the main return airway in the undercast at the fourth south entry. However, it appears improbable that gas figures either in the origin or propagation of the explosion.

It will be noted that the air-current swept practically all over the mine; that brattices between parallel entries were not usual and that all the air gathered at the in-by end of the seventh

the check-board showed that all the men were out of the mine, the shot firing crew met at the small powder magazine on the hill above the manway and received an amount of powder believed to be sufficient for the night's work. This powder, the night of the accident amounting to 648 pounds, was placed in eight or more canvas sacks and loaded into a powder car drawn by a mule. After hanging red lanterns at the mouths of the manway and the main slope the crew entered the mine and at the cap house at the third south entry secured the necessary detonating caps. From a nearby underground telephone,

word was received from the powder house that all current was shut off from the mine. The powder car was then driven into the workings, each shot firer and his assistant removing therefrom at the proper cross-entry the amount of explosive required by them.

When a room was reached the sacks were supposed to be left on the entry, the shot firers taking as much powder to the face in their pockets as they believed would be necessary to charge the holes in the room. At the face, the shot firers were presumed to examine the holes and to reject such as were dirty or tight. After charging and tamping with clay, the procedure varied. In some instances a series of rooms were prepared and the shots fired, room by room, as rapidly as the men could pass from one place to another, while in other cases the room was shot as soon as the holes were ready and then the next room prepared, etc. In no case were sacks of powder to be taken to the face. After all the shots were fired the men left the mine, supposedly about 1 o'clock in the morning, 2 hours before the fire bosses appeared. However, it transpires that the shot firers were rarely in the mine after 11 at night. As it naturally required considerable time to secure the powder and caps, to enter the mine, and to get to the working places and charge the holes, it seems probable that little firing was done before 7. The sustained maximum rate probably was reached about 7:30 and continued to 9:30 or 10 o'clock. In these 2 to 2½ hours, over 600 pounds of high explosive were fired at the rate of 2 to 2½ pounds per minute. As the firing was going on in four sections of the mine simultaneously, a very large quantity of dust was thrown into the air-current at many points. The open condition of the workings combined with the large-volumed air-current permitted the dust stirred up by the rapid shot firing to be disseminated all over the mines.

In order to keep down the dust, water lines were laid throughout the mine, except in the first and second west B entries, which had but recently been reopened after abandonment for some months. At various points on the intake were placed a total of 12 sprays, but these were not always in operation. A water car was also in use. A man known as a sprinkler was employed to wash down the ribs and roof by a hose attached to the main water lines by connections at convenient distances apart. At the inquest this man testified that he washed the places as often as necessary and usually was able to make his rounds once every 4 days. The rooms were not watered. However, as the mine made considerable water, the entries were generally wet and in some places the floor was covered with standing water. The fifth south entry for a large portion of its length is driven through rock shot down to bring up the grade and is naturally wet. The entries in the C block are also naturally wet and the same may be said of the last 500 to 750 feet of all the eight west B entries. The humidity of the return air was determined regularly and ranged from 85 to 95, and even more, per cent.

On the night of the accident, in addition to the eight shot firers and their boss, there were in the mine eight entry men employed two each in the fourth, fifth, seventh, and eighth west C entries, a total of 17 men, of whom two of the shot firers escaped.

The shot firing crew met at the powder house at the customary hour, 5:45 P. M., and there received 648 pounds of high explosive. Of this 166 pounds were two permissibles, which were being tried out, and the remainder consisted of dynamite. After the accident a sack containing one-half the supply of permissible powder was found untouched and the records showed that the remainder of this kind of powder had, with the highest degree of probability, been used up shortly before the explosion. Further, investigation has shown that at the time of the explosion 183 holes had been fired, consuming at the usual rate of 1.4 pounds per hole, 256.2 pounds of dynamite, and this had all been fired in about 2 hours, or at the rate of 2.13 pounds per minute.

At about 8:55 P. M. the two shot firers, who had been accompanied by the boss shot firer, prepared the holes in the twenty-first room on the first west B entry. What happened next is largely conjecture. It would seem from all the evidence at hand that these men, in violation of the rules, carried a sack of powder to a point about 20 feet from the face of this room. How much powder was in the sack is uncertain, but one, well qualified, testified at the inquest it could not have contained less than 20 pounds, and may have held as much as 50 or more pounds of high explosive. It further appears that after the holes were ready the head and boss shot firer started to leave the room, one of them picking up the wooden tamping bar and both overlooking the sack of powder which was in the center of the track. The assistant shot firer, presuming that the other two had taken the powder as was the custom, lit the fuses and went through the breakthrough into No. 22 room, down it to the entry, and was with the others in the cross-cut between the twenty-third and twenty-fourth rooms when the explosion took place. The location of the men at the time is determined by the finding of the tamping bar in the cross-cut mentioned.

Just why the dynamite exploded is uncertain. About 20 feet back from the face, and toward which is directly pointing a shot which blew out both at the back end and the mouth, is a hole in the center of the track of some 6 square feet in area and something over 2 feet in depth in the solid floor. All the timber in the room was blown back from the face and some of it lodged in the mouth of the room and some was thrown out into the entry. The ties were ground to powder and the rails twisted and bent. Sections of the rails were torn out from the web and flanges and thrown considerable distances, and all the evidence points to this having been the focus of an explosion of extreme violence. There were other foci of violence *F*, as shown on the map, in the twentieth room on the fourth west B entry, at the mouth of the eighth room on the same entry, and at the mouth of the tenth room on the fifth west B entry. Aside from the fact that none of these places shows even approximately the violence displayed in the twenty-first room on the first west B entry, there is not known to have been any powder near them or men working in their vicinity. They must be abandoned as points of origin in favor of the one named at the outset. At the origin of the explosion the hole named may have been dirty and the flame from it may have ignited the dynamite, or its detonation may have been caused by a lump of coal thrown against it at high velocity, or possibly by a piece of roof falling thereupon.

The limits within which evidences of heat, as determined by coking action, and of force, as determined either by the scouring of the ribs or by the destruction and displacement of timbers, brattices, mine cars, and the like, are shown by a dotted line surrounding the area so affected.

Evidences of heat and destructive action are naturally not uniformly distributed throughout this area. The centers of force are shown on the map marked with the letter *F*, and with a single exception are where the explosive wave passed from a larger to a much smaller area of workings, thus gathering in intensity by reason of compression. This exception was met in the twentieth room on the fourth west B entry. At this point forces apparently met from opposite directions and, the room being wide, set up a whirling or rotary motion sufficiently violent to throw out the gob some 4 feet deep in a circle 15 to 20 feet in diameter.

At the mouth of the eighth room on the fourth west B entry, and also at that of the tenth room on the fifth west B entry, mine cars were completely destroyed, the wheels being torn off, axles bent, and frame irons curved out of shape. At the undercast at the fourth south and seventh west entries, where was placed a large electric pump, the violence was severe. The pump house of 2-inch lumber was blown in and down into the sump. The pump was badly damaged, the pipe connections,

plunger shaft, and outside gear being broken. The 3-inch floor and a heavy wooden brattice were blown down into the undercast and two 6"×6" supports to the pump were broken. The undercast being built of heavy reinforced concrete was cracked slightly and showed some leakage where it intersected the coal. The rails over the undercast were raised about 4 inches.

At the foot of the slope the destruction was more complete than elsewhere. The timbers at and near the mouth were thrown out and some broken in two and hurled outside 100 feet or more. Cars on the slope were smashed and thrown outside and the loaded trip at the foot was badly shattered. The wooden floor of the chain haul was ripped out and a 12"×14" Oregon pine timber supporting the sheaves at the bottom was broken in two. Two double steel doors set in concrete in breakthroughs between the main slope and the return airway were blown out toward the fan. The concrete was entirely blown out and the doors, badly bent and twisted, were carried 75 feet.

At the fan no damage was done. The explosion doors were blown open and immediately shut automatically and the light roof on the top of the air-shaft was lifted off and at once fell back into place.

Beyond the limits marked on the map there were no evidences of violence other than the blowing open, without damage, of a door or two. Aside from the two mentioned at the foot of the slope, the few brattices in the mine, which were of concrete were unharmed.

The coking action was as variable in intensity as was the force. On the map the zones of greatest heat unless plainly marked are indicated by the letter *C*. In these zones coke up to 2 inches and more in thickness was very general. On the third and fourth south entries between the second west and third west entries was one extensive heat zone. Here, in addition to coke 2 and even 3 inches deep on the caps, the posts were found to be scorched and the solid rib was coked to a depth of $\frac{1}{4}$ inch in places.

The most extensive area of coking action was found in the rooms on the fourth west B entry. In some of the rooms in this section coke was found on the ribs from roof to floor and from mouth to face, as well as on the roof and floor, and on the timbers, and in one instance was nearly 6 inches thick. In some of these rooms there was an additional deposit of carbon as lampblack in long festoons or whiskers upon the coke, indicating that the oxygen in these rooms had been completely consumed.

The course of the explosion, owing to the open and connected character of the workings was difficult to trace, but it is believed that its direction, as shown by the arrows on the map, has been fairly well determined. It will be noted that in some instances the wave came through some rooms out an entry to be met by an entering wave from the fourth south. Where these waves met there was generally a neutralization of force or else a whirling action through the cross-cuts. In any case the advance of the wave may be plainly traced from the twenty-first room on the first west B entry to daylight.

The effects of the heat wave displayed the usual vagaries. The mule hitched to the powder car which was standing near the mouth of the first west B entry was burned, as well as was a sack containing dynamite in the car itself, but no explosion occurred. In one room a coil of fuse would be found burned and in the adjoining room under apparently identical conditions the fuse would be untouched.

Strictly speaking, the explosion at Cokedale was rather an inflammation or burning of coal dust ignited by an explosion of dynamite rather than a true explosion in the accepted meaning of the latter word. There was most intense heat and but little damage throughout the workings. The writer is forced to the conclusion that the wide area affected by the explosion, aside from the dust generally present, was due to the large amount of oxygen available for burning whatever dust was present and the universal connection of the workings.

Without any exception whatsoever, where the heat action ceased, the stoppage was due to want of fuel in entries, which were not only damp but actually wet and not uncommonly shoe-top deep with mud. In one instance the flame leaped over a wet zone about 150 feet wide but was stopped shortly beyond. In some places the presence of rock in the track dust helped to stop the spread of the inflammation, and in others the same end was accomplished by rock in the ribs and roof where the latter had been shot down in a local swamp.

On the map are given certain combinations of letters and figures as 2*A*, *E*, and *F*, 2*D*, etc. The letters indicate the place where a man or men were working at the time of the accident; the figures, the number in the place in question. A letter without affixed number means that but one man was working there or that, if more than one was employed in the place, the bodies were not found together. It will be noted that two men were working in the seventh and eighth west C entries, denoted by 2*A* and 2*B*, respectively. After the explosion these men started to run out and were a trifle over 1,800 feet from the face when overcome by gas. The four men in the fourth and fifth west C entries (2*C* and 2*D*) were found 1,300 feet away on the fourth west B. The two shot firers (*E* and *F*) who were in the first west C entry were able to go over 1,900 feet, their bodies being found on the first west B entry near its intersection with the fourth south entry, with those of the two shot firers and the boss shot firer (*G*, *H*, and *I*) who were in the breakthrough between the twenty-third and twenty-fourth room on the same entry at the time of the explosion. The two shot firers (*J* and *K*) were working in the newly started twenty-fifth room on the fourth west B entry in the hottest part of the coking zone, and were only able to go 75 to 100 feet before being overcome with the gas.

The evidence at the inquest showed, although no analyses of the blood were made, that all the men died from *CO* poisoning. Their bodies were flaccid and faces peaceful with none of the signs of strangulation apparent in those dying by means of *CO*₂.

Of the 15 miners and shot firers who succumbed to the effects of gas, the lives of 10, those working in the C block, might have been saved. It will be noted that the explosion did not come within 500 feet of the C block at any point. Also the two doors on the fifth south entry used to force the air up the fourth and fifth west and first and second west entries, respectively, were blown open. The poisonous gases, therefore, did not enter the C block at all, and had the men remained in their working places and bratticed themselves off (there was an abundance of brattice cloth and lumber at several places on the fifth south) they could have for all practical purposes remained in absolute safety indefinitely.

The lives of the three men on the first west B and of the two on the fourth west B entry (*G*, *H*, *I*, and *J*, *K*) could not have been saved, as they were either in by a coking zone or immediately in it.

The two survivors were at the time of the explosion near the intersection of the sixth west B and second south entries at the point *L*, *M*, on their way to shoot a few pillars in the A block. Both testified that they first felt a rush of cool air in the face which blew out their lights and which was instantly followed by a hot blast from inside which knocked them down. The hot air had a distinct smell of burning coal. This preliminary inrush of cold air is interesting and is analogous to the experience of two men near the outlet of the Lick Branch, W. Va., mine, at the time of the second explosion there, to which my attention has been called by Mr. John Verner, of Chariton, Iowa.

The rescue cars of the Colorado Fuel and Iron Co., stationed at Trinidad, and that of the Victor American Fuel Co., from Hastings, were on the ground shortly after midnight and their large force of trained men and excellent equipment rendered invaluable service, as the rescue crew of the mine itself, being

composed solely of shot firers, were either dead or, as in the case of the two survivors, incapacitated for further exertion.

As stated before, but little damage was done to the mine and the temporary stopping of the destroyed brattices at the foot of the slope, of the door at the eighth west B, etc., soon restored the normal circulation. The bodies were all discovered in a few hours except two, which were not found and brought out until Saturday noon.

An extremely unfortunate feature of this accident was the death of E. A. Sutton, assistant superintendent at Cokedale, and of Robert Meeks, tracklayer at Starkville, who ventured beyond the rescue station at the fourth south and sixth west B entries, and who were overcome by CO gas in the fourth west B entry at a point about 300 feet in and marked by the letters MS on the map.

It remains then to consider the two theories of dust origin as commented upon at the outset in this article. Was the dust which propagated this explosion that which was made during the few minutes prior to the accident by the abnormally rapid shooting of friable coal, or was it that which had accumulated in the workings as the result of days or weeks of operation?

Draw a line between the twenty-first room on the first B entry and the twenty-fifth room on the fourth west B entry. Whatever dust was created by shot firing on the west side of this line did not figure in the explosion, because the air-current was drawing it away from the initial point, and also the explosion did not travel in by its point of origin. Hence, only the dust created by shot firing on the outby, or east, side of this line could have served as a propagating agent. But there were no shots fired on this outby, or east, side the night in question. Had some been fired in Japan the conclusion would not be affected for the inflammation did not enter Japan for lack of fuel. Hence we must dismiss the idea that the explosion of dynamite in the twenty-first room on the first west B entry can be connected with the next nearest place of shot firing, the twenty-fifth room on the fourth west B entry, by means of newly created dust.

By way of the route of the explosion it is a full half mile between the above points, and in this distance there is one zone of most intense heat and two smaller ones. The first and second west B entries were undoubtedly dry and dusty, being without water lines and were but newly opened up. It is probable that the third and fourth south had not been watered for 3 or 4 days, the sprinkler being then about to reach them on his rounds. It is an easy matter to connect up these points on the supposition of standing dust and impossible to do so on the theory of newly created dust.

Similarly, it does not seem that the intense heat and enormous deposits of coke in the coking zone on the fourth west B entry which covers an area of over 4 acres were due to any thing but standing dust. It is impossible to say how long it would have taken at Cokedale to clear the atmosphere of dust after a shot was fired. The slowly moving air-current was favorable to the speedy deposition of the dust and 10 minutes after firing a shot may have seen it all deposited. As the section under consideration was but one of four shot-firing zones, the rate of fire therein would be one-fourth of the rate for the entire mine. That is, if the average for the mine demanded the firing of 2 pounds of dynamite a minute, this section calls for the explosion of 2 pounds in 4 minutes, or a total of 5 pounds in our assumed 10 minutes. To any one who has seen the deposits of coke in this zone, some of them covering an area of nearly 500 square feet, and varying from $\frac{1}{4}$ to 1 inch, and rising to 4 inches in places in thickness, combined with the festoons of soot in some of the rooms, the view that this heat action was due to the limited amount of dust possible through the explosion of but 5 pounds of dynamite, is untenable. Nothing but standing dust can account for the phenomena.

And finally in this connection, had there been any large amount of dust in suspension in the air in this section it would

have, by means of the air-current, been drawn into the C block workings. That this was not the case is proved by the fact that the explosion on all the west B entries stopped within 600 feet of this block. Had the C block been dusty it would have inflamed.

This theory has been touched upon at length, as it is a most important one, as pointed out in this journal when commenting upon an editorial in the *Mining Journal*, of London, England, treating of the Hulton colliery disaster. Intensity of working, abnormally rapid shot firing and the like, unquestionably favor the propagation of explosions by means of dust created through the rapidity of production. But this was not the case at Cokedale.

It does not seem that the Cokedale accident teaches any new lessons, but it does serve to emphasize some old ones. It shows that open and connected workings combined with an air-current of large volume favor the propagation by means of dust of an explosion otherwise started, by disseminating the agent of this propagation over a large extent of workings and by furnishing a large volume of oxygen (air) for its combustion. It shows that, by reason of the above, to limit the spread of an explosion, the workings should be, as far as possible, not connected, and should be ventilated by separate splits with only as much air as the health of the men demands. It shows that material damage to the mine is done where the wave passes from a cross-section of larger to one of a smaller area by reason of the compression thus set up. It shows that zones of intense heat action are not necessarily connected with zones of violence. It shows that, in the presence of intense heat action, very wet zones up to 150 feet in length may be crossed by the inflammation, and it shows that very wet zones, particularly if in rock or where the floor dust is heavily impregnated with rock, and of sufficient length, will invariably stop the advance of a wave of inflammation.

This accident clearly demonstrates that rescue crews should never consist of less than four men each; that they should be carefully trained, be drawn from men of diversified lines of work, and be equipped with the latest and best apparatus.

It will be admitted that if oxygen (air) be absolutely excluded from a mine there can be no inflammation; if there be no dust, there can be no inflammation regardless of the amount of oxygen (air), and that, regardless of the amount of oxygen (air) and dust present, if this dust be in the condition of watery mud, if the mine be absolutely saturated with water, there can likewise be no inflammation.

When the relationship between these three, oxygen (air), dust, and moisture (water), which must exist in order to render impossible the propagation by means of dust of an explosion otherwise started, has been determined, accidents such as those described herein will be impossible.

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LIBRARY OF THE ENGINEERING SOCIETIES

Attention is called to the facilities offered by the Library of the Engineering Societies, at 29 West Thirty-ninth Street, New York City. The library, formed from the combined libraries of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, and the American Institute of Mining Engineers, contains over 40,000 volumes on engineering subjects. It is open for reference to the general public, without charge, every day and evening, except Sundays.

Those residing in New York City and vicinity are invited to utilize the library in their researches on technological subjects. The library is prepared to furnish references on engineering subjects to persons at a distance, and also furnish transcripts, translations, and photographic reproductions of diagrams and maps. For such work, if extensive, a moderate charge is made. Correspondence is welcomed; telegraphic and telephonic inquiries will receive especial attention.



Newspaper Accounts

11 KILLED, 6 MISSING, IN MINE EXPLOSION AT COKEDALE, COLO.

Denver Post
02/10/1911

Disaster Due to Discharge of Blasting Powder--Two Stagger Out Alive.

Denver Post 2/10/11

PLANT KNOWN AS ONLY SAFE ONE IN
STATE AND WAS CALLED THE MODEL

Deaths All Due to Fire Damp and Not to Con-
cussion--Shock Felt for Miles in All
Directions From Camp.

Trinidad, Colo., Feb. 10.—Eleven men are known to be dead and six others are missing and believed to have been killed, as the result of an explosion that last night partially wrecked the model coal mine at Cokedale, nine miles northwest of Trinidad, owned by the Carbon Coke and Coal company, a subsidiary concern of the American Smelting and Refining company.

Nine of dead were foreigners who were employed as shot firers and entrymen. The other two were Americans—Edward A. Sutton, acting superintendent of the mine, and Robert Meeks, a C. F. & I. company man from Starkville—members of the first rescue gang, both of whom succumbed to black damp early this morning.

Two men were rescued alive after the explosion. They were found all but unconscious from black damp which overtook them as they were fleeing for safety and were revived with com-

fort. The men are John J. Szczerba and Nick Tommebbage, Polish shot firers.

DEAD AND MISSING.

The known dead:

Edward A. Sutton, acting superintendent.

Robert Meeks, rescuer.

Andy Podzorski, Pole, entryman, married.

Rudolph Seliga, Pole, entryman, married.

S. Hodbod, Pole, entryman, single.

Leas Gzondek, Pole, entryman, married.

The missing, the bodies of five of whom have been located, but not yet removed from the mine, are:

Joe Melack, Pole, shot firer.

John Ereish, Pole, shot firer.

Ludwig Kalpuch, Pole, shot firer.

Karl Piercha, Pole, shot firer.

Carl Francis, Pole, shot firer.

Andy Rancuski, Pole, shot firer.

Joe Mokioski, Pole, shot firer.

Fortinado Zanet, Italian, entryman.

Domino Taborelli, Italian, entryman.

Valentine Treter, Italian, entryman.

Joe Ghezzi, Italian, entryman.

OVERCOME BY BLACK DAMP.

Acting Superintendent Sutton, who had been directing the rescue work in the poisoned atmosphere of the wrecked workings ever since the explosion last night, suddenly was overcome by black damp shortly before 5 o'clock this morning. He fell unconscious while some distance ahead of his fellow rescuers and was hurriedly removed to the surface for medical attention.

Meeks was overcome by black damp while assisting in carrying his chief from the mine.

Automatic breathing machines were attached to both men as soon as they were

placed in the C. F. & I. rescue car at the mouth of the mine and oxygen pumped into their lungs, but neither could be revived. Sutton died shortly after 6 o'clock and Meeks' death followed in a

minutes. Meeks is survived by a widow and several children. He was considered one of the best rescue men in the employ of the C. F. & I. company. Sutton is survived by a widow.

VICTIMS SUFFOCATED.

All the men whose bodies have been found died from suffocation. They evidently had attempted to make their way from the mine when overcome.

Little Hope is entertained of finding the six missing men alive. It is believed they were overcome by gas within a few minutes after the explosion. All the dead and missing but two are foreigners.

Superintendent Bayless this morning stated he believed the explosion was due to the discharge of blasting powder.

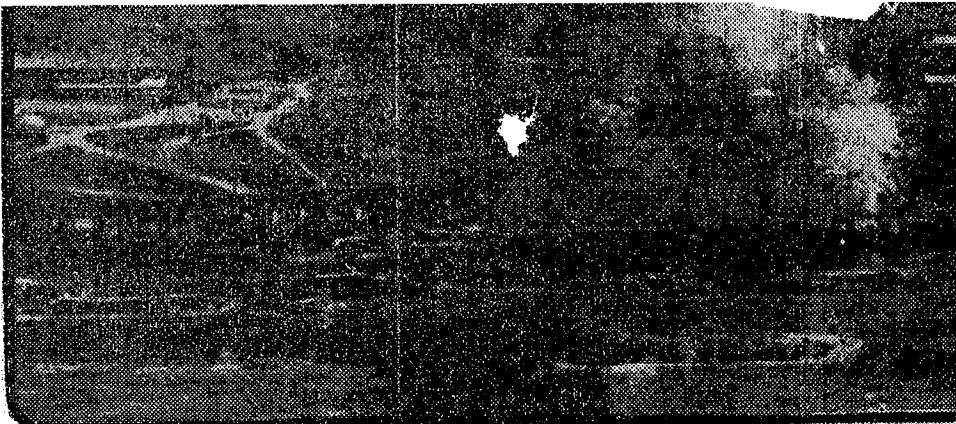
The shock of the explosion was heard for miles around and here in Trinidad, nine miles away, window panes were cracked and broken in residences and dishes jarred from tables. It was nearly two hours after the shock had been heard before the source of the explosion could be learned. Experience with several like disasters within the past year has taught the people of this city what an explosion shock sounds like, and telephone wires were kept hot until the right place was located.

Even the officials said they were unable to give any details regarding the accident. The only telephone line into Cokedale is owned and controlled by the same company that owns the mine.

EXPLOSION TERRIFIC.

The force of the explosion was so great that huge timbers placed about the entrance of the mine were hurled a distance of 200 feet and a large water tank supposed to be securely anchored near the portal, was toppled over. The explosion

(Continued on Page 2—Col. 1.)



View of the main exterior workings of the Carbon Coal and Coke company's mine at Cokedale. The huge timbers around this entrance were hurled 200 feet

Discharge of Blasting Powder Causes Disaster--Rescue Car and Gangs of Men Search for Those Entombed in the Shaft.

(Continued From Page One.)

caused but few cave-ins throughout the mine, none of which are said to be of a serious nature.

As soon as the officials at the mine realized the seriousness of the disaster they began issuing calls for assistance from Trinidad and other nearby coal mining camps. Rescue gangs were organized hastily and put to work, while the C. F. & I. company's rescue car, with its crew of brave men, was rushed from Starkville. A score of automobiles carrying mine officials and rescue men left Trinidad as soon as the call for assistance was telephoned from Cokedale.

Fred P. Bayles, superintendent of the mine, left in the first machine for Cokedale, arriving at the camp shortly before 11 o'clock. He found that Acting Superintendent Sutton already had organized a gang of rescuers and was hard at work in the mine, bratticing as they went.

The first bodies were discovered about 8 o'clock and when they were carried to the surface one of the rescue men announced that one of the victims was still breathing. This announcement brought cheers from the spectators gathered about the entrance. Physicians examined the man and quickly declared that he had been dead several hours. Black damp was given as the cause of the death of the four men. Their bodies were found in the third and fourth passageways near the west entry, within half a mile of the main entrance.

TWO STAGGER OUT ALIVE.

The two men who escaped alive staggered out of entry No. 5 shortly before midnight, but were unable to give anything like a lucid description of the disaster as they had seen it. They appeared to be badly sick but were restored with

They stated that they had been knocked down by the force of the explosion and the deadly after damp settled over them. These two were working in the sixth west passageway when the explosion occurred.

RESCUE CAR RUSHED TO MINE.

There were plenty of men to carry on the rescue work and volunteers by the score offered them assistance. The major part of the work, however, was done by a force of about forty, mostly miners and officials. The C. F. & I. company's rescue car, which was stationed at Berwind, was rushed to the scene of the disaster and their helmet men, working with the Cokedale helmet corps, had a large share in the rescue work. The Victor American company, too, had a special train made up at Hastings and rushed to Cokedale, reaching there at about four o'clock this morning.

A conspicuous figure about the scene of the mine was J. S. Thompson, division superintendent of the C. F. & I. company, who arose from a sick bed as soon as he heard of the explosion and rushed to the mine. He directed the energies of his band of rescuers until forced to leave from exhaustion.

The work of the rescuers is easy from the fact they have not been impeded by serious rock falls. Franklin Guiterman, president and general manager of the Carbon Coal and Coke company, who was in Denver at the time, was notified by Superintendent Bayles and immediately ordered a special train, on which he arrived here at 7 o'clock.

The United States mine rescue car No. 2, which has been at Oak creek, Routt county, was notified of the accident this morning and left immediately for Denver and the south. The car is in charge of Professor J. C. Roberts.

FAN NEVER CEASED TO WORK.

One fact that has lent so much encouragement to the rescue work is that the fan has never at any time ceased to work. The force of the shock blew off the safety cap from the fan house, but could not damage the apparatus within. This makes it possible to keep a good supply of fresh air in the mine at all

times and prevent black damp from spreading, as it would otherwise do.

The explosion has so far been free from the customary heartrending demonstrations of sorrow and grief that have at other times marked these affairs, and what few women have gathered about the mouth of the mine seem to be taking the affair calmly.

WAS HELD MODEL MINE.

Cokedale is the last camp people of this part of the state believed could blow up. It has been widely advertised as "the model mine of Colorado" and one of the few real safe mines in the entire country. The miners are compelled to check in and out, and in getting into the mines must all use one long, narrow passageway and all enter from one side. The property has been in operation four years, the entire output being shipped to the various smelters operated in Colorado by the American Smelting and Refining company. This is the first serious accident that has occurred since the mine was opened.

It was one of the mines visited late last year by the state mining commission appointed by Governor Shafroth and composed of Dr. Victor C. Alderson, James A. Dalrymple and Prof. John B. Eckley, all of whom appeared enthusiastic over the condition in which the workings and the entire camp were found. The company claims to have spent more money in improving this mine than most companies do in installing equipment in the first place.

Cokedale Known as Only Really Safe Mine in Colorado

Franklin Guiterman, general manager of the American Smelting and Refining company, to which the Carbon Coal and Coke company is subsidiary, left for Trinidad at midnight last night.

Guiterman, as well as the other officers of the company, is bitterly chagrined over the explosion. The company had tried to make the mine a model one so far as modern appliances would allow.

They say fourteen men are imprisoned in the mine and probably will die before they can be rescued," said Guiterman before he left last night. "Well, I do not know. The company has done everything in its power to prevent such an explosion, and to reduce the fatality in case of one.

"We were the first people in Colorado to install the modern rescue apparatus. We always have been careful to take every precaution about the lighting of matches in the mine. We have installed every known safety device.

"Three hundred men are employed in the mine. The output amounts to 1,200 to 1,500 tons daily. Every ton mined comes to the smelting company.

It is a fact that the Cokedale mine has been known throughout the state as the "model mine." In its report to the governor the commission of which Dr. Victor Alderson was chairman, referred to the mine as the only one in the state that could be called entirely safe.

The mine has been operated for four years. The present is the first disaster that has marred its even course.

CHRONICLE-NEWS AUTO PUSHES LEADERS TO THE SCENE OF LAST NIGHT'S DISASTER

Sutton was about 35 years of age and is survived by a widow, who is overcome by his tragic death. Mack was about 45 years of age, and is survived by a widow and six children living at Starkville.

There was no confusion. Each man toiled as if in the heart of the mine that had just claimed its toll.

Del Monte, Cal., Feb. 10.—The annual Bench Show of the Del Monte Kennel Club opened today and will continue over tomorrow. The exhibition this year exceeds all of the previous shows here, both in the number and high class of the entries. The exhibits include prizewinning dogs from many of the most famous kennels in the west.

Jack Perres vs. Art Godfrey. for
10 rounds, at Superior, Wis.

DR. FORHAN, VETERAN COMPANY PHYSICIAN
SEVERELY INJURED BY FALL FROM TRESTLE

Dr. Forhan, with other doctors, had been at the mouth of the mine all night long waiting to be of assistance in case any of the men were rescued alive. About four o'clock in company with Prof. Earl Morand he

The disaster was probably caused by an explosion of a large quantity of powder in charge of some of the shot firers which liberated a gas pocket of unusual size. Never in all the eventful history of Colorado mine explosions has there been a

AT LEAST NINE KILLED IN MINE

Trinidad, Colo., February 10.—The bodies of four shot firers have been removed from the Cokedale mine, wrecked by an explosion last night; five more bodies have been discovered and six more were still unaccounted for today.

A. E. Sutton, assistant superintendent in charge of the rescue work, was overcome by gas and was carried to the surface. He probably will die.

Supt. Bayless declared this morning he believed the explosion was due to the accidental discharge of blasting powder. Little hope is entertained of finding the remaining six men alive. All the dead and missing are foreigners.

NEARLY A SCORE OF MEN ENTOMBED IN MINE'S DEPTHS

Denver Republican
02/10/1911

Explosion in Cokedale Colliery Wrecks the Plant and Shuts Them Into What May Be Tomb.

Denver Republican

Seventeen Shot Firers the Victims and Fifteen of
Them Are Still in the Mine—Two Rescued Alive
by Prompt Work—Black Damp Impedes Rescue
Parties and Little Hope That the Imprisoned
Men Will Be Gotten Out.

TRINIDAD, Colo., Feb. 9.—(Special.)—Seventeen men were en-
tombd in the Cokedale coal mine of the Carbon Coal & Coke company
by an explosion at 8:55 o'clock tonight.

Two of them were rescued by herculean work, but the other 15 can-
not be reached and if not dead are likely to be overcome by foul gases
and perish before the mine is cleared of black damp, or penetrated by
the oxygen helmet brigade.

The Cokedale mine is one of the best equipped in the country and
was considered perfectly safe from such a disaster.

The company operating it is a subsidiary of the American Smelting
& Refining company and no expense was spared in making it as safe
as human ingenuity could make it for men to work in.

The entombed men are shotfirers and the only theory regarding
the cause of the explosion is that some one or more of them, grown
careless from long immunity or from confidence in the mine's equip-
ment and safeguards, made a fatal mistake in handling lights or powder
and in an instant the blast which meant death and ruin followed.

HEROIC RESCUING PARTY IS DRIVEN BACK BY DEADLY BLACK DAMP AFTER SAVING TWO LIVES

TRINIDAD, Colo., Feb. 10.—(Special.)—
The bodies of four other miners were re-
covered from the mine at 3:15 this (Fri-
day) morning.

They were all Polish entrymen and had
been killed by black damp. All were mar-
ried men.

No hope is held out that the other men
in the mine are alive.

TRINIDAD, Colo., Feb. 9.—(Special.)—
By a severe explosion, the cause of which
is unknown, 17 shot-firers employed
by the Carbon Coal & Coke company are
entombed deep in the workings of the
Cokedale mine of that company, nine
miles northwest of here.

Two other shot-firers, engaged in break-
ing down coal after the day shift had
gone off work, were rescued within half
an hour after the explosion, which oc-
curred at 8:55 o'clock tonight.

These men were found in Entry Six,
west. They were barely alive when
found, having suffered from the effects
of the dread deadly black damp which
followed closely on the heels of the blast.

TIMBERS WERE BLOWN FIVE HUNDRED FEET.

So great was the force of the explosion,
which apparently occurred within a few
hundred feet from the mouth of the main
slope that timbers from the slope were
blown 500 feet from the entrance of the
mine, the engine house and other small
buildings near by were badly damaged.

Within twenty minutes after the ex-
plosion a crew of forty men under the
direction of the mine manager entered
the working, finding the air sufficiently
good to enable them to proceed to Entry
Six, West, where they knew two of the
employees were working. There they found
the two men, unconscious, hurried them
to the surface and soon revived them.

Attempting to go further, the rescuing
party was driven back by the encroach-
ment of the black damp.

BELIEVE MEN ARE DEEP IN WORKINGS.

The 15 men remaining in the mine are
believed to be deep in the workings,
where the day shift, which is the only
one working there at present, is tak-
ing out a seam of extra good coking coal
for the Guggenheim smelters, which
take the entire product of the mine.

The force of the explosion was so great
that it was felt in Trinidad, several win-
dows being shattered by the concussion.

In spite of this the huge fan which sup-
plies air to the workings was not dam-
aged, and for this reason officials at
the mine believe there is an excellent
opportunity that the entombed men may
be rescued within a few hours.

The safety cap of the fan-house, which
is but one of the many appliances pro-
vided by the company for the safety of
its employes, was blown off by the blast,

but after a temporary cessation, the fans
were again working, pushing good air
into the mine, and pulling the deadly
black damp out.

Immediately after rescuing John Kris-
ten and Nicol Pomcavage, the shot-fir-
ers taken alive from entry 6, west, the
rescuing party was driven to the open
air. There it re-organized, secured ma-
terial for brattices and again entered the
mine, pushing forward over the debris
near the mouth of the slope and ventur-
ing far within the workings.

Among the most mine disasters in this
state, and particularly in this
the fall of rock and shale was in consid-
erable, in spite of the fact that the tim-
bering was blown from the walls by the
explosion.

WORK OF RESCUE

PROCEEDED QUICKLY.

As a result the work of rescue pro-
ceeded with greater rapidity than has
been the case in other mines.

With the brattices to protect them
from the possibility of danger from fall-
ing rocks and from the black-damp, the
rescuers pushed forward and at 2 o'clock
this morning were several hundred feet
in.

Assistant Superintendent A. S. Suttors
had charge of the rescue crew and it was
largely due to his efforts that the two
men rescued were reached in time to
save their lives.

The C. F. & I. rescue car, which is
stationed here, and the government res-
cue car at Berwind were rushed to the
scene as soon as the crews could be
gathered, and the experienced men are
aiding greatly in the work. J. O. Rob-
erts is in charge of these men.

The Cokedale mine has been considered
by all coal mining experts as the safest
mine in Colorado, if not in the entire
Western coal fields, and the news of the
explosion and probable deaths of 15 men
caused much surprise and comment
here.

The company, which is a subsidiary of
the American Smelting & Refining com-
pany, has spent more money safeguard-
ing the mine and protecting it in every
possible manner from the probability of
such accidents as have marked the past
year in Colorado coal mining circles than
most other coal companies in the state
have expended in their entire workings.

Every safety appliance known to mod-
ern coal mining, and which was consid-
ered necessary in a district where gas
is unknown, was installed by the com-
pany, the mine workings were kept clear
from dust, and the miners were not per-
mitted to use dynamite in the mine, the
shot-firers, 15 of whom are now entombed
in the mine, being experienced and
trusted men who worked after all miners
had left the workings that even the
danger from the powder blasts might be
minimized.

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Nearly a Score of Men Entomb

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Of this care for the welfare of its miners, the state commission sent to Governor Shafroth a short time ago commented favorably, holding up as a model the mine which was devastated by explosion tonight.

Because of the absence of dust in the mine the cause of the explosion is difficult to determine by even the experienced rescue workers here. The mine has been operated four years and during that time there has been no apparent danger from dust, as at all times the work has been kept clear of this dangerous substance at great expense to the management.

Superintendent Fred Bayles was at the Trinidad club at the time of the explosion, and immediately the news reached here he left for the mine in an automobile.

Reaching the mine he took direct charge of the work.

Franklynn Guttermann, the general manager of the company, was in Denver today. He was immediately notified of the accident and left at once for Trinidad, chartering a special train to make the run.

COMPANY NOT RESPONSIBLE FOR DISASTER IS VERDICT RETURNED BY CORONERS JURY

*Cause of Explosion Remains Mystery--Verdict
Decides That 17 Men Lost Lives From
Suffocation*

MINE DECLARED TO HAVE BEEN SAFE

VERDICT OF JURY

State of Colorado, County of Las Animas, SS.

AN INQUISITION holden at Trinidad, in Las Animas County,
State of Colorado, on the 15th day of February, A. D. 1911,
before B. B. Sipe, Deputy Coroner of said County, upon the bod-
ies of

JOE MALICH
LUDWIG KLAPUCH
KARL FRANCIS
JOSEPH MOKROSZ
VALENTINI TRETTER
RODGARSKY ANDY
JOE G. LIZZI
RUDOLPH SELEGA

JOHN FREISH
KARL PIECHA
ANDY KANOVSKI
DOMINCIO TABARELLI
BOGUNIT BOBBOD
LUKASZ GOUDEK
F. ZANOT
EDWIN A. SUTTON

ROBERT MEEKS

there lying dead, by the jurors whose names are hereto sub-
scribed; said jurors upon their oaths do say: That the de-
ceased came to their deaths at Cokedale, Las Animas County,
Colorado, on February 9, 1911, from suffocation by poisonous
gases generated by an explosion in the coal mine of The Carbon
Coal and Coke Company, on that date, but that these jurors are
unable to determine the cause of said explosion, as the mine had
been kept, and was on that date, in an apparently perfect condi-
tion as regards the safety of the men employed therein.

IN WITNESS WHEREOF, the said jurors have hereunto set
their hands, the day and year aforesaid:

J. C. BALDWIN, Foreman.
W. W. JONES,
W. E. RIZER,
C. G. HUNGERFORD,
HENRY ANDREWS,
C. H. KNICKERBOCKER,

Jurors.

COMPANY NOT RESPONSIBLE SAYS JURY

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and remembered only the odor of dust and the sensation of nausea and the feeling of a wave of hot air.

Superintendent Bayles was on the stand for more than four hours. Resuming his testimony in the afternoon, he told of conditions as he found them upon reaching the mine after the explosion and the result of his first hurried investigation, after a consultation with Sutton and after going to the foot of the slope himself.

In telling the jury of the result of his investigations in an effort to ascertain the seat of the explosion, he said there were no evidences in the "C" entry west, of what was known as the Fifth South entry, with the exception of slight evidences on the face of the Fourth West B entry. He stated that he based his conclusions upon the probable direction of the forces by the scarring upon the timbers and ribs and the manner in which particles were deposited. Not much of the timbering was torn down. The evidences of the greatest violence, he said, was near the intersection of the Second West B entry and the Fourth South. In the Fourth South, there was much violence, evidently starting at the Eighth West. He stated that there were no evidences of the explosion in what was known as the "Japan" district, and no damage was done at the exit. Also that there was no damage at the manway near the check house, known at No. 5 entry. In room 10 of the Fifth West B entries, the timbers had been blown into the entry. The timbers were blown out of room 21 in the First West B entry, and there was a fall near the mouth of the room. Some falls were found in the Fourth West B entry, in rooms 14 and 10. All of the disturbances, he said, had the appearances of being local.

The witness stated that all parts of the mine could be reached easily as soon as the air conditions would permit. The chain haul extending up the slope was wrecked. Wrecked empty cars were found in the Fourth and Fifth West B entries

of having been burned. This was the only testimony at the inquest which would indicate that flame might have been present in the mine. No blown-out shot were found.

The witness then told in detail, about the finding of the bodies, many of the men holding their dinner pails in their hands. None were burned and all were evidently on their way out. The witness was certain that no one was at the center of the explosion and that all were alive shortly after the explosion. He stated that it was not possible to determine definitely the origin of the explosion, and did not believe that gas was a factor.

Bayles was followed by Franklin Guterman, who repeated in detail how the policy of the company was to secure safety at any cost, that it was the first rule of the company to protect the miners, that the employees were encouraged to offer any suggestions in this line, and that many of their ideas had been carried out. He stated that he had been recently told by James Dalrymple, state mine inspector, that the mine was probably as safe as it could be made. Ventilation and sprinkling methods were discussed and reference was made to the visit at Cokedale recently of Governor Shafroth's mine commission. Complaint had been made by miners in the past, he said, that the mine was too wet, and also that the officials were too exacting in their rules. Concluding, he said, "The whole matter of the cause of the explosion is an inexplicable mystery."

Mark Brown, the fire boss, explained his duties in detail, the hours he worked. He stated that he had never found gas in quantities and that the mine was well sprinkled. He told of entering the mine after the explosion, detecting the acrid odor and burning sensation of the powder fumes and explained how the air was "short circuited."

"I've been in coal mines since I was twelve years old and have studied explosions in many different mines, but the whole thing is beyond me. It's got me beat."

Roy Gillette was certain that powder had much to do with the force of the explosion, but could offer no solution as to the probable cause. He was one of those who inspected the mine after the explosion and detected at once the odor of dynamite that

at then turned back, expecting every moment to collapse from the fumes, and with the knowledge that nothing could save the two brave men behind him. Driscoll managed to reach help and rescuers hurried back for Chambers and the others but they were too late to save Meeks and Sutton. Driscoll is still suffering from the effects of the gases.

Heroism was also contained in the stories of John Kristen, the shot firer and Nicol Tomcabbage, the two men who escaped alive. Kristen related how Tomcabbage saved his life by dragging him into a pool of water after he had fallen unconscious. Neither could tell how long they lay unconscious or how they finally managed to escape. Kristen told the jury that he had been badly burned in the Cokedale mine about two years ago by a blown-out shot. Both hands are scarred and shriveled from the effects of the fire.

Crystal White Soap 5c

Cokedale mine disaster, in common with the other disasters in this district within the past year, has passed into history and, as far as a public investigation has been able to determine the mystery of the cause is deeper than any of the preceding and probably will remain forever unsolved. The verdict of the coroner's jury, returned this morning, states that the jury was unable to determine the cause. All that is known is that the men died of asphyxiation, from the poisonous fumes given off by powder exploded in the open and not by suffocation from afterdamp. By way of exonerating the company of blame for the disaster, the jury states that it finds every known precaution was taken and all diligence used in an effort to safeguard the miners.

The apparently praadoxical fact that there were three initial points of explosion was adduced from the evidence, or rather three places were found in the mine from which the explosive forces seemed to radiate. As far as the investigation brought out each of these explosions was independent of the others and this inference, improbable as it seems, was left with the jury. From the character of the fumes that filled the mine after the disaster, the appearances around the points from where the forces seemed to radiate it was conclusively established that large quantities of high explosives were set off. Equally large quantities in the mine, however, lying between the points from where the explosion seemed to radiate, were not exploded. This morning's verdict but echos the concluding statement of Franklin Guiterman, general manager of the company, who said "The entire matter to me is an inexplicable mystery," and the equally pointed statement of Mark Brown,

the fireboss, who said, "It's got me beat."

Ten witnesses testified at the investigation. They were: Fred P. Bayles, superintendent; Roy Gillette, representative of the Aetna Powder company; Franklin Guiterman, general manager; Mark Brown, fire boss; John Driscoll, rock man; Thos. Donaldson, pit boss; Dr. Perry Jaffa, chief surgeon for the Carbon Coal and Coke company; John Kristen, shot firer, L. H. Driver, springler and Nicol Tomcabbage, shot firer's helper. There was no conflicting testimony. All the witnesses who took part in the rescue work agreed to the presence in the mine of the acrid, pungent odor of the powder gases. The two foreign miners stated that they did not recall this odor

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At this juncture the witness stated, that, although he had visited every portion of the mine after the disaster, he had been unable to locate the initial point of the explosion to his own satisfaction. At three different points in the mine evidences were found, he said, which showed the forces had radiated from that point. In the Third West entry a piece of car wheel was found 75 feet west of the place where the body of the car was located, a larger piece of the same wheel 175 feet east, with other parts in other directions. Similar conditions were found at two other points. He stated the cars were sometimes used to carry powder into the mine and from place to place, but that it was not the general custom. The body nearest to one of the wrecked cars, was that of John Fries, who, with Joseph Morosh, was found in room 24, off the Fourth West B haulage cut off. The indications were that the men had completed a part of the shooting when the blast came. He told how unexploded powder was found in sacks at different points where it had evidently been left by the shot firers, between the seemingly paradoxical three "initial" points of the explosion. In one place was found a loaded hole where the firer had attached the fuse and to the fuse the fulminating cap, but the fuse had not been cut.

The regular powder car to which was attached the body of the dead mule, was found in the cross cut of the First and Second West B entries. A sack of powder was found in the car and twenty-five feet from it was another sack on the track. The mule's body showed indications

had been exploded in an open place. He declared that the fumes of dynamite, given off after an explosion in the open air, often caused almost instantaneous death to men who had not been injured by the concussion. Gilte said that probably twenty-five pounds of "Hercules" giant powder evidently exploded in room 21 of the First West B entries. He based the opinion upon the discovery of a hole in the solid rock between the tracks more than a foot deep and 20 by 30 inches in size. He also testified that a U shaped piece of steel rail was found on top of the coal knocked down by the shot placed by the firers. This testimony indicated that possibly the concussion of the regular shot by detonation might have set off the mass of dynamite carelessly left in the room. In the entry outside of this room, however, Bayles testified that the force of the explosion pointed toward rather than away from the opening of this entry. The superintendent was recalled upon this point, but the whole inquiry tended to establish nothing but the apparent fact that the explosion in room 21 was independent of every other explosion in the mine.

Tom Donaldson, the pit boss, seemed to have formed more definite conclusions relative to the initial point of the explosion. He said that it seemed to have been near room 9 of the Fourth West B entry, basing his belief upon the fact that the forces seemed to radiate from there. He had noted the wrecked car at this point as well as the splintered and wrecked car in the Fifth West B entry and in room 21 of the First West B.

L. H. Driver simply told of his work as sprinkler and stated that he made the rounds of the entire mine every four days. He said he kept