FIRST

ANNUAL REPORT

OF THE

STATE INSPECTOR OF COAL MINES,

TO THE

GOVERNOR OF THE STATE OF COLORADO,

FOR THE

YEAR ENDING JULY 31, 1884.

PUBLISHED BY AUTHORITY.

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To His Excellency,

JAMES B. GRANT,

Governor of Colorado:

HON. SIR:—In compliance with the requirements of an act providing the means "to regulate the working and inspection of coal mines" of Colorado, with the object to secure the health and safety of persons employed therein, and promote the interests of coal mining, approved the 24th day of February, A. D. 1884, and came in force the 24th day of May of said year, I being examined and recommended according to law by a Board of Examiners, and your Excellency conferring upon me the appointment as State Inspector of Coal Mines, therefore have the honor to submit to you the first annual State report made on coal mines in Colorado.

Now, as coal mining forms one of the most considerable items in the industrial category of our State, you would naturally anticipate receiving an elaborate recital, seeing that the range of topics that can be discussed in relation to this kind of mining is so extensive, either as regards the extent of our coal resources, the methods adopted in working them, or the sanitary regulations in vogue in the mines. But my report for this year must necessarily be limited, as I have neither clerk nor assistant to aid me in the discharge of my duties, the last General Assembly, by an oversight, not making any provision for such, scarcely cognizant of the vast importance of the coal interests, and how multifarious the details of this office, the subject being new to the walls of that house, the efforts at legislation in this direction, initiatory steps, and the appointment of Coal Mines Inspector in 1883 being the first in Colorado.

I find from experience that it is next to an impossibility to accomplish the entire routine of these responsible duties without an assistant. The mines are so far apart, it takes a great deal of travel to get around the State, there being coal mines 450 miles away, and two-thirds of my time, when from the office, is spent in railroad cars and other

conveyances to reach the mines, making it incumbent on me to travel by night to and from many of the mines in order to attend to my office work, to which I have not the time to do justice, and thus many of my official correspondents are for some time neglected.

.The correspondence with this office is steadily increasing, and there is also a monthly report and a quarterly map from all mines coming under the act; and my attention is often required in the office after hours in an endeavor to keep up with the work.

Trusting, however, that the next General Assembly will give their careful attention to what I have advanced respecting the important requirements of this office, I hope your Excellency will find some atonement for the shortness of this report in its pith.

In entering upon the duties of Mine Inspector, I was fully aware of the responsibility of the office, of the condition in which I should find many of the mines, and fully anticipated the hard struggle the first Inspector would have in getting the mines in working compliance with the mining laws.

I, therefore, fully prepared myself for the varied and arduous services in which I have vigorously endeavored to employ all my time and faculties, and anxious also to repay for the manifestation of the confidence you reposed in me.

To commence: The coal mines of this State, as a rule, have hitherto been worked in a rude, miserable, and even reckless, manner. Upon examination of many mines, I could find no trace of an attempt to work after any system to suit ventilation or drainage; rooms and entries were worked into one another, and an insufficiency of pillars left, causing a creep or crush of the entire strata over the coal, folding and breaking into fragments, resulting in caves. The pillars are, in cases, left in such a position that they are irrecoverable, thus thousands of tons of coal are lost to the State, the land owner and the operator annually, the object being only the immediate extraction of the coal in view, and every applied exertion becomes a barrier to the end of placing a mine upon the plane of its fullest producing capacity, and by such a miserable cut-up mode of work it is almost impossible to circulate a sufficient current of pure

air, thus entailing physical suffering upon the miner and gradually undermining his constitution by being compelled to follow his occupation in an atmosphere laden with carbonic acid and other foul gases met with in coal mines.

It has advanced into the magnitude of an axiom that the most economic method in the long run of developing this kind of mining is the one that guarantees the fullest measure of health and safety to the operatives, and the interests of our coal mines and the welfare of its workers are two elements which are inseparably intertwined; and so, under the faulty methods of procedure hitherto prevalent, the production of coal must fall far short of the number of tons that have been figured on paper to the acre by some coal companies.

It is much to be regretted that we are so far behind the age in the true methods of mining in a State that boasts of its mines as its greatest wealth. It is true that we teach a theoretical knowledge of mining in some of our institutions of learning, but it is one only in theory, for when their graduates are called to take charge of a mine, their want of a practical knowledge of mining soon becomes apparent.

In Great Britain a mining engineer, or colliery manager, must have a practical as well as a theoretical education in mining before he is permitted to take charge of a mine. The mining law of England provides that young men wishing to follow the profession of a mine manager must serve a regular apprenticeship of at least two years at the practical work in and around the mines; and so, being constantly employed in every operation incident to the trade, they become in every sense proficient. They see what their foreman does in all cases of emergency that occur. They are taught the methods of sinking and timbering shafts, from actual experience in striking the drill, fixing and firing the blast, handling the plumb-line and putting in the pumps, and fixing the timber in the shafts. In this way a thorough and practical training is obtained. Now, as to what their scientific requirements are before they can qualify fully: the candidate must understand the chemistry of coal mine gases, and figure out to the Board of Examiners the difference of pressure being down-cast and up-cast shafts by aid of the shaft's temperature and its barometrical pressure, etc.; he must be prepared to answer a large number of questions on sinking, pumping, breaking strains of steel, iron, and hemp

ropes, chains, timber, etc.; a great many questions are asked on the practical working of the coal seams, ventilation, drainage, fire-damp, haulage, etc.

I have known young men personally who worked hard in the study and science of coal mining for seven years before they were successful in receiving their certificates as mine managers. If mines are to be conducted with regard to the safety of workmen and of economy to the owners, managers must be obtained for their operation, accomplished with a knowledge of the practice and theory of mining. A class of managers so qualified would be unequaled, and redound to the benefit of the State.

In this country a condition of things prevails which is a great many removes from this. A company will buy or lease some coal lands, and if they wish to start up operations, they must have a superintendent. He will be chosen, not because of his practical training or knowledge of mining, but, in many instances, because he is a relative or friend of one of the company. He may have been an intelligent and shrewd manager in some other profession, but in his new undertaking entirely in the wrong place, and his knowledge of conducting the operations of a coal mine very limited. The result is that thousands of dollars are thrown away in misdirected labors, even to the extent sometimes of involving sacrifice of life. I can cite an instance that came under my observation lately, where a coal company took up the pumps out of their shafts and abandoned all operations after expending much money and receiving no returns. The reason was mismanagement. The coal seam was good in quantity and fair in quality, but it was opened by a poor method, and in the wrong part of the field. Now, by properly directed efforts the enterprise could have been successful and money have been made.

I am proud to say, however, that there are notable exceptions to this method of transacting business. There are some companies I know who have been trying to operate their works on some scientific basis, and it will be only fair to them to say that they have for their superintendents practical men, they again taking precaution to have the same class of men as mine bosses, and thus mining with such companies must be a success.

For several months after assuming duty, complaints were sent to this office from many parts of the State about

defective ventilation. Every communication was promptly attended to, as far as my time would permit. The mines complained of were visited by me and inspection made of them. I found everything alleged of such mines only just and well founded. They were in a miserable condition and poorly ventilated. The attention of the superintendents of them was called to the facts, and assurances were given me that the necessary improvements would be made; but in many cases it was only a promise to the ear, for on my next visit I found but little changes had been wrought. In some cases ignorance of the mining laws would be pleaded as an excuse. Forthwith I had a few hundred copies of the mining laws printed and sent to all coal mine superintendents in the State.

So much of this specious nature of business took up considerable of my time, and consequently prevented me from making circuits of the State as often as I would have liked, for much attention was needed during the first few months of my administration to place things on a working basis.

I am, however, glad to be able to say there is better ventilation prevailing in many of the mines, and greater satisfaction existing among the miners on that point since I assumed duty.

After having visited the mining districts of the State and satisfying myself, by investigation and inquiry, as to the condition of the mines, the following circular was issued from this office:

OFFICE OF
STATE INSPECTOR OF COAL MINES,
DENVER, COLO., November 2, 1883.

To Mine Operators, Mine Superintendents and Working Miners of Colorado Coal Mines:

The undersigned, State Inspector of Coal Mines, recommended by a Board of Examiners, and appointed by His Excellency, James B. Grant, Governor of Colorado, on July 31, 1883, has, since assuming duty, visited the various mining districts of the State, and finds, by investigation, that the mining law in many of its important provisions, has not as yet been complied with.

The attention of all concerned is respectfully and earnestly called to the following facts: Defective ventilation prevails in many mines over part or the whole of the working places; frequently to such an injurious extent at room faces that the combustion of the miners' lamps can only be maintained with difficulty. In some mines there are no artificial means of producing ventilation whatever, and even in such places the natural current is often crippled by poor, neglected airways. Where furnace, fan, or other ventilating power is applied to increase the ventilation, a good reading on the anemometer is generally obtained at inlet or outlet of the mine, but in many cases the current is poorly conducted in and around the workings by having poor stoppings and badly hung doors, and too much distance between cross-cuts.

I have found miners at work 200 feet ahead of the ventilating current. When I looked in this close and dirty hole, I could hear the miner's pick striking the coal, but at that distance I failed to see the miner, but knowing from experience if I went in there I would find him, I ventured in a little over 100 feet in this densely thickened air, and I could just see a glimmering light, which, on approaching closer, looked as if there were a great many lightning-bugs around it.

When I arrived at the face of this place, I found that the miner had his lamp hanging downwards, on the rib side, to enable it to give light. The air was almost stagnant to the feeling and densely charged with coal dust, and in a few minutes I could feel the effects of carbonic acid gas, better known to miners as black damp.

This gas is given off from the lungs, from the combustion of the workmen's lamps, from decaying timbers and from explosions of blasting powder. It also exudes from the fissures of the coal and from the floor and roof of the mine. In its pure state it is a most deadly poison, and will neither support life nor combustion.

The following notes are taken from Roy, on coal mines:

T. E. Foster, a British inspector of coal mines, in an examination before a royal commission appointed to inquire into the condition of mines in 1874, gave the following answer in regard to this gas:

"It is my opinion," said he, "that there are quite as many men killed where there is nothing but carbonic acid gas as where there is inflammable gas. The men's health is naturally destroyed. They do not go immediately, but they go on for a few years and die."

Andrew Roy, an eminent inspector of mines, says:

"Asthmatic diseases at an early period of life, are the unfailing results of bad ventilation, and when miners are attacked in their lungs, the shoulders rise, making the head look like sinking, as in ordinary consumption. The breathing apparatus becomes clogged up, and there is expectorated a black spit, which finally results in the black lungs or coal miners' consumption."

Professor Graham examined the lungs of a miner, the greater part of which were obliterated with a black, solid matter, like lampblack, and above one ounce of charcoal was obtained out of the mass.

Dr. William Thompson has recorded a number of cases of miners' lungs which were infiltrated with black matter. The following are some of the cases:

D. C., aged 58 years; miner 12 years; lungs uniformly black, and a carbonaceous color.

D. D., aged 62 years; miner from boyhood; lungs uniformly black, not a vestige of natural color left; refers his disease to breathing an irrespirable atmosphere.

G. H., aged 54 years; miner all his life; whole lungs dyed with black matter.

Al[illegible] pathologists do not agree, says Dr. Hutchinson, about the exact cause of this carbonaceous matter, whether caused by the mechanical inhalation of black matter, or by a chemical action of breathing carbonic acid gas, matters little to the miner. All agree that the lungs are blocked up with carbonaceous matter by foul air and something peculiar to the art of mining; and all agree that the more pure the air the more healthy the lungs. These facts call for more air to circulate and better ventilation in mines.

I would say that from fifty to eighty feet, according to the nature of the mine, would be a reasonable distance

between cross-cuts, and that all breaks through, except one at face of entry, be closed up and made air-tight, brattice, trap doors or otherwise, so that the air may sweep to the cross-cut last made, as provided in section 4 of mining laws, and all mines governed by this statute shall be provided with artificial means of producing ventilation.

Men and boys are in the habit of riding up slopes and shafts on loaded cars, contrary to law. This practice must cease. All future offenses will be dealt with as provided by law. Many boys under 12 years of age, and between the ages of 12 and 16 years, if they cannot read and write, must be removed from all mines in accordance with section 5, which reads as follows:

"No young person under 12 years of age, or woman or girl of any age, shall be permitted to enter any coal mine to work therein, nor any minor under the age of 16 years, unless he can read and write."

There are in many cases cages used to hoist and lower men in shafts that have no approved safety catches thereon. I will state that this important part of section 3 must be complied with at once.

The miners' attention is called to section 10, which reads as follows:

"Any miners, workmen, or other persons who shall intentionally injure any shaft, lamps, instruments, air courses, or brattice, or obstruct or open airways, or open a door and not close it again, or carry lighted pipes or matches into places that are worked by safety lamps, or handle or disturb any part of the machinery, or enter any place in the mine against caution, or who intentionally and wilfully neglects or refuses to securely prop the roof of any working place under his control, or disobey any order given in carrying out the provisions of this act, or do any other act whereby the lives or health of persons, or the security of the mines or machinery is endangered, shall be guilty of a misdemeanor, and may be punished by fine or imprisonment at the discretion of the court."

I will state that the several committees of miners at mines need not make any monthly inspection, if they have every reason to believe that the boss has already complied

with the law; but where the law is utterly disregarded, I want to be notified.

All the provisions of the law will be faithfully and impartially enforced as far as it is in the power of the inspector to do so.

JOHN McNEIL,

State Inspector of Mines.

Crested Butte Disaster.

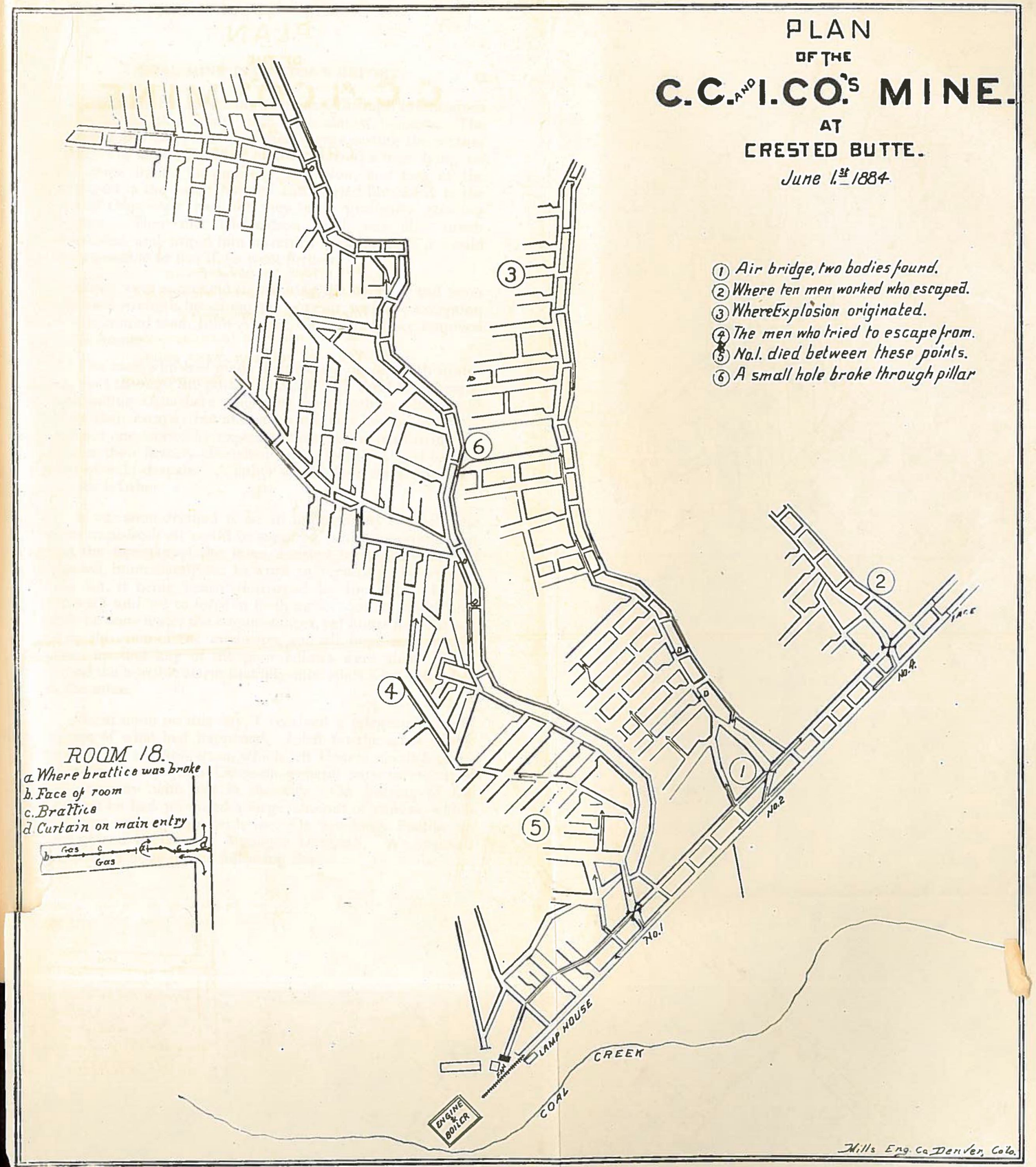
The disaster at Crested Butte is, doubtless, yet fresh in the minds of most of us, it being one of the most destructive of human life that has yet marked the annals of mining in Colorado.

It occurred on the morning of the 24th January, 1884, at about 8 o'clock, shortly after the unfortunate men had commenced their daily labor.

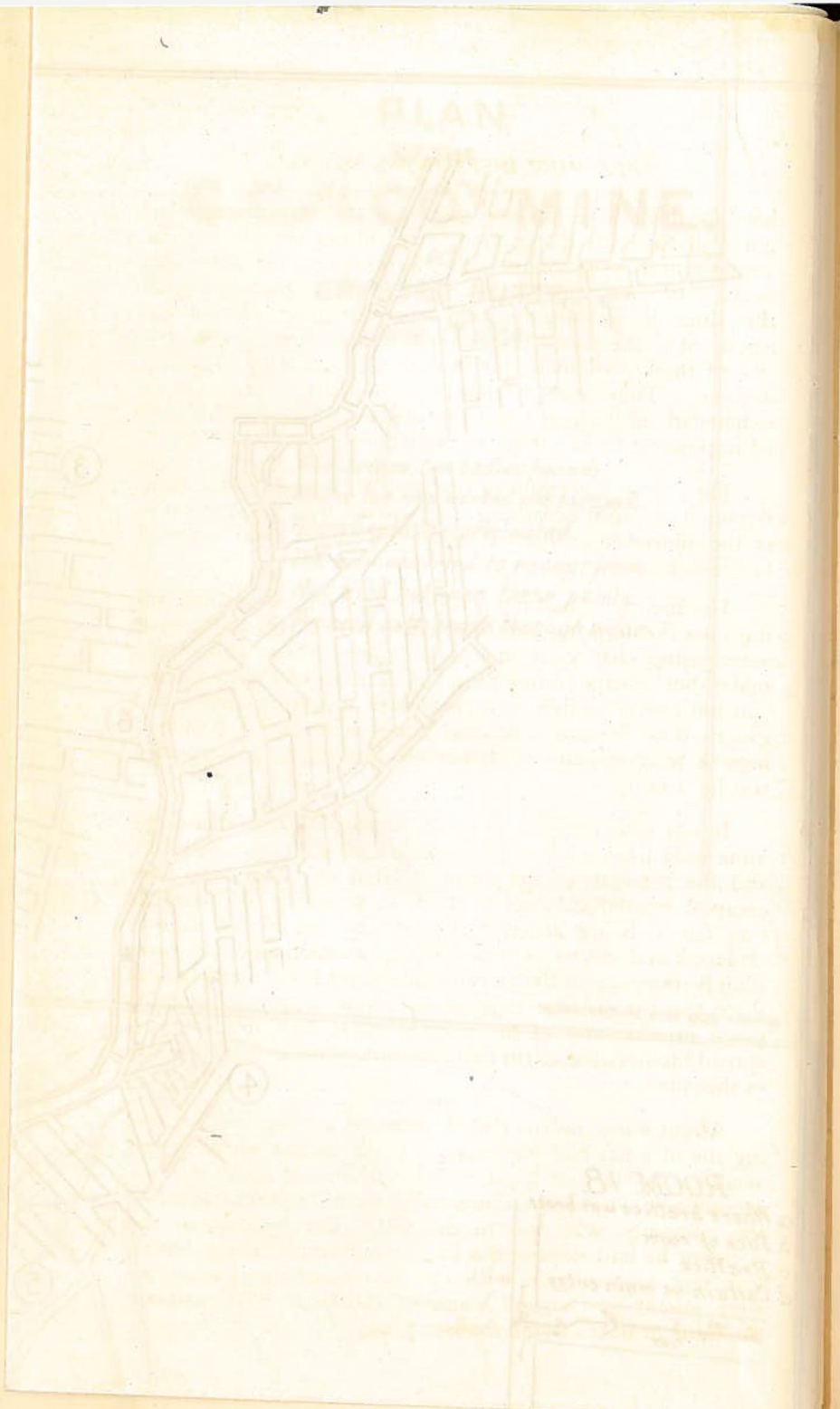
The fire boss, Luke Richardson, had, just a short time before, finished the round of his duties, examining the workings of the mine and reported to the miners, as was his custom, that their respective working places were free from gas, with one exception, and that place was No. 18 room, No. 2 level. He informed the man who worked in this room, John Anderson, that the brattice leading to his working face was broken near to room entrance, and that a quantity of explosive gas had accumulated during the night, and that he should not enter it until he (Richardson) had fixed the brattice. Anderson asked for a few nails, with which the fire boss supplied him, and says that he offered Anderson a safety lamp, and he refused to take it, promising that he would not enter the room. Anderson then went down the slope with his naked light, and entered No. 2 level.

Richardson had procured the necessary materials to repair the broken brattice, and was about to enter the mine when he heard the report and crash of the explosion, and at once remarked that Anderson must have gone into his place among the gas. He did not think the explosion was of such a serious nature, and at once seized his safety lamp and rushed down the slope. When but a short distance in he found the dead body of John Rutherford, the trip-runner, and some broken mine cars which had been carried for some distance before the blast.

About this time the ten men who escaped from No. 4 level came up the main hoisting slope. They had battled



Scale: 250 feet to the inch.



hard for dear life in making their way through the noxious gases of the after-damp, and were almost helpless. The younger and more robust of them were assisting the weaker ones. On their way they had discovered a man lying on the slope in an unconscious condition, and two of the strongest in the party dragged and carried him away at the risk of their own lives, for they were gradually growing weaker. They met Richardson, who was also much exhausted, and urged him to return with them as it would be impossible to live if he went further.

They were successful in reaching the opening and soon regained strength breathing the pure air, with the exception of the injured man, John Angus, who was at once removed to his home.

The men who had made their escape peered with straining eyes through the portals of death with throbbing hearts, anticipating that there might be many others who would make their escape; but after a few minutes had passed away and not one anxiously expected form appearing astride the gloom, their fiercely cherished hopes were changed to feelings of wild despair. A father was looking for a son and a son for a father.

It was soon deemed to be an impossibility to enter the mine until fresh air could be supplied, so the superintendent and the foreman of the mine, assisted by those who had escaped, immediately set to work in repairing the ventilating fan, it being nearly destroyed by the blast. It was replaced and set to force in fresh air as soon as could possibly be done under the circumstances, yet hours had elapsed since the time of the explosion, and all hope was already given up that any of the poor fellows were alive. Then spread the horrible alarm that fifty-nine souls were entombed in the mine.

About noon on this day, I received a telegram informing me of what had happened. I left for the scene of the accident by the first train, which left Denver about 8 p. m., accompanied by John Cameron, general superintendent of the company, who was in the city. On hearing of the accident he had procured a large amount of canvas, which was sent on the train with us. On reaching Pueblo we were joined by General Manager Danforth. We reached the mine at noon of the following day.

On meeting Mine Superintendent J. K. Robinson and his assistant, John Gibson, I could see that they were worn out with fatigue from the severe and fearfully hazardous labors undertaken with their party in their melancholy task of searching for the bodies of the dead.

Seeing Robinson's condition, I at once offered my services and took full charge of affairs. After organizing a fresh party, I commenced to search No. 1 level. I found that Mr. Gibson and party had already explored this level, and found some of the bodies on the main entry, which had been exposed to the full force of the blast, and in several cases arms and legs were found broken and bodies otherwise battered by being thrown against the jagged walls.

In this entry was also found the carcasses of nine mules which lay swollen on the track. As it was known that many bodies yet remained somewhere on this level, I therefore directed my party in the searching of the rooms, but found no bodies there, and it looked evident from the surroundings that the unfortunate men had fled from their working places. I then ordered the search to be made by the way of the in-take air course, thinking it very probable they would try to make their escape by that way, and in a short time after searching in that direction we found eighteen of the missing bodies huddled and piled in little groups in indiscriminate confusion, and the men had evidently been making their escape before the deadly after-damp checked their attempt, when but a few hundred feet from air. Some of them had battled hard for dear life, and had tried such devices as their ingenuity could evolve to prolong their strength to enable them to reach the opening near to the ventilating fan. They had no doubt selected this as their best way of escape, and would certainly have been successful in reaching day had not the ventilating fan been doomed to destruction.

Many of these poor fellows had placed a piece of cloth over their mouths and had evidently been breathing through it. Some were found with their hands placed firmly over their mouth and nose, while others had selected or dug a little hole where there was water and had placed their mouths over it when unable to go further.

Two young men had put up a canvas on a room

entrance and went up to the face of it, thinking that the covering might keep back the after-damp. They had with them a dinner bucket containing water. They had crawled on top of the lower bench of coal and had placed flannel over their mouths; it was quite apparent they had lived for some time. These two bodies were the last to be found, special search being kept up for three days to find them, after the other bodies had been found.

At 6 p. m. thirty-four bodies were found, and were conveyed to the double parting of No. 1 level. Saturday, 26th, and by 4 a. m., these thirty-four bodies were taken up out of the mine and placed in a row on two long platforms which had been erected in the blacksmith's shop near the entrance to the mine. I then directed the air current to be cut off from No. 1 level and conducted to No. 2 level. The work was necessarily slow in doing this, owing to the stoppings being all blown out, and the workings were more or less charged with fire-damp, thus causing us to erect temporary stoppings.

On entering No. 2 level I was accompanied by Peter S. Galloway and James S. Stewart, the rest of the party being left on the main slope until we could make investigation. We found the air bridge utterly destroyed and nearly blockading the entrance. On making our way over these obstructions we found two bodies; their limbs were broken and they were otherwise disfigured. Galloway, on looking ahead, called my attention, almost in a whisper, to look at something in the distance; and there, very much to our dismay, we saw a smouldering fire, which had been ignited by the explosion. Stewart, who was an experienced miner, and many years our senior, was the first to speak. His words were: "Let us keep cool, boys." We all at once realized our precarious position, for we knew that No. 4 level was full of the fire-damp, and was making its way slowly up the slope, and was then within fifty feet of No. 2 entrance, so we knew that prompt action was needed. We had a bucket with us, carrying nails, which we emptied out and procured water at a short distance, and the fire was soon extinguished, very much to our relief. A thorough search was then commenced through the workings of this level. The stoppings were speedily repaired, the company having on hand an abundance of timber and canvas for the purpose.

We reached the face of the level that evening. We here encountered a quantity of gas which was in proximity to the place where the explosion is supposed to have happened. Many of the bodies found here had been blown out of their rooms on to the main entry and were very badly burned. The surroundings at this point did not indicate that the force had been very violent, as would have been expected. It was evident that the blast had increased in force greatly as it traveled, working greater and greater havoc. The rest of the bodies were soon located, and were conveyed on stretchers to the entrance of the level and raised to the surface late that evening and placed with the others.

Two bodies were still known to be in the mine; search was kept up diligently, but were not found until Wednesday morning, the 30th.

The company made such disposal of the bodies as the relatives desired, and defrayed expenses of transportation.

General Palmer, president of the company, on hearing of the accident, at once telegraphed $1,000, a personal donation, to be divided amongst the suffering families.

An inquest was begun at noon of the 26th. A coroner's jury was impaneled by Coroner N. S. Snyder, who reviewed the bodies. The following are the names of the jurors: Patrick Daley, H. C. Newton, W. Harris, W. H. Wadsworth, F. B. Woodhouse and Frank Brennan.

A great many witnesses were examined. Any and all who had anything to say respecting the accident were requested to attend. I adduce here the salient features of the testimony:

John Cameron, general superintendent, said:

That most of the men came to their death from the after-damp following the explosion. At this mine the company had a Murphy fan, eight feet in diameter, made in Chicago. When the explosion happened they were forcing air into the mine at the rate of 55,000 cubic feet per minute. Current was split, so that a portion of air went into first level and another portion into second, there being regulators governing quantity of air into each entry. Did not know the exact condition of air channels and regulators immediately before the explosion, but knew they were in

good condition six weeks before, on my last visit; said it was the duty of fire and mine boss to keep these in order; thought explosion occurred in No. 2 level. It was the duty of Luke Richardson to examine every portion of the mine, and notify the men if he found any gas; against rule for any man to enter a room where there is gas with a naked light.

James K. Robinson, superintendent of mine, explained the workings of the mine to the jury, and stated he gave positive orders that no miner should go into the mine without receiving orders from the fire-boss, so as to know positively that there was no danger, and when fire-damp was found, safety lamps were always insisted upon; said that old miners considered it the worst they ever saw for gas; some of the rescuing party who went in as quickly as possible thought they smelt fire, and immediately concluded that something might be on fire; I had brattices put up to exclude the air and let the fire die out; I was in the mine seven or eight times on the day when the explosion occured; after Inspector McNeal arrived, I surrendered all charge to him, and afforded him all the assistance possible; saw some twelve dead men in the mine when I first entered it; did not move them at the time, as it is usual to see if there are any living men in the mine first before the dead are removed.

Garvin Dickson, sworn:

Am a coal miner, have been for twenty-four years; was working in No. 4 entry at the time of the explosion, had a sensation of tingling in the ears, and immediately lay down on the ground, thinking it was a local explosion. I now think explosion occurred in room 18, level No. 2; a man named John Anderson was working in the room, he had a naked light that morning; I went into the mine with him; he is dead. Anderson was a practical miner, but think he did not know much about gas. Heard fire-boss Richardson tell Anderson that the brattice was knocked down, and there was gas in his room; the conversation occurred in fire-boss' lamp room. When Richardson told him, Anderson said, I can take nails and fix it; the nails were given him. Anderson afterwards went in with a naked light; do not consider the fire-boss did all that he should have done; he should not have allowed him to go down until he had preceded him; thought at the time Richardson was a little

careless, but said nothing, as I supposed there was only a small body of gas. Anderson's body was taken out of No. 18 last night. The uniform condition of the mine has been good; there was plenty of air to drive the gas out at any time. I have thought the mine boss was at times over cautious in ordering us to use safety lamps; miners are oftentimes careless, and do not always obey the rules. Think the explosion occurred through a naked light.

John Calderwood, sworn:

Am a coal miner and have been for sixteen years; have been in the employ of this company eighteen months; was at work in No. 4 entry at the time of explosion; first felt a sensation in the ear, and told my partner, Dickson, he had better go; picked up the safety lamp and got out.

The rest of this witness' evidence corroborates the previous witness in his testimony.

Charles Davis, sworn:

Am a fireman, and was on day shift at the time of explosion. Richardson generally gets to the mine about 4 o'clock in the morning, and stays in till about 6 a. m.; fan was working properly until a few moments before explosion.

Joseph Smith, sworn:

Am a coal miner, have been for seven years, and working for this company since October; was working at time of explosion; saw Richardson before going in; he supposed everything was all right; took a safety lamp and went in, and was working about five minutes when explosion took place; did not feel effect of explosion, only afterdamp; am sure explosion took place in No. 2 entry; think the mine the best ventilated one that I ever worked in, and perfectly safe with safety lamps; think explosion was caused by a naked light.

John Naylor:

Am a coal miner; was working in No. 4 entry when explosion happened. Saw Richardson, fire-boss, before entering the mine; he said my room was safe; saw no indication of fire or lack of air in that entry; my first intimation was a shock; saw some men who went into No. 2 that

morning and went into the main drift with them; left them at entry No. 2; they had naked lights; the explosion occurred half an hour after I left them; think one of them was a green miner; his name was Barrett.

David Owen Hughes, sworn:

Have been a miner thirteen years; worked for this company since January 8; saw Richardson, fire-boss, before going to work that morning; he said my room was safe; I worked in No. 4 entry; heard Richardson tell one Jones to be careful, as there was gas in No. 2; first I knew of accident was a sound and rumbling noise in my ears; afterwards in the blacksmith's shop saw a body, which I supposed to be Jones; so far as I knew there was plenty of air in the mine; if I had thought it unsafe I would not have worked in it.

Thomas Harris, sworn:

Have been a coal miner since 1846; I worked on the night shift; saw Richardson that morning as I was coming from work at room 12 or 13, level No. 2; were using naked lights that night; examined air a dozen times that night and found it good; never saw any deficiency of air in entry No. 2 since I worked there; have seen times when fan was not working properly, but men were always called out of mine before it was stopped.

Luke Richardson, fire-boss, testified:

That on morning of accident he had found two boards broken from the brattice on No. 18 room, level No. 2, and there was considerable gas in the room, and he gave man Anderson positive orders not to enter said room till he returned and repaired the brattice; he was just getting his tools ready to go back when the accident occurred; he said mine was very much troubled with gas, but considered safe when brattices were all in order.

Patrick McElwee:

Have been a miner eighteen years; worked for company nine days; went to work morning of explosion at half past six; saw fire-boss, who told me there was gas in my room, and gave me a safety lamp; was at work in No. 4 level; first I knew of explosion was a shock; made the best of my way out; do not know where explosion occurred; think it

might have been in No. 2; found fire-boss' chalk mark in my place; do not think mine dangerous; air is good; have gone in rooms when gas was marked on the shovel; was working in Blantyre mine in Scotland, where 260 men were killed by an explosion; was one of twenty-two who escaped; since accident in that mine safety lamps are only used.

John L. Young, engineer, testified:

He was running engine at time of explosion; began work at 7 a. m., and in about forty minutes after saw flash and dodged to escape the flying sticks and stones; then went to fan, which was stopped; fan was shattered and side-boards all blown off; fan was running three minutes before explosion; fan was in operation two and a half hours after explosion.

A great many more witnesses were examined, but their evidence was all to the same effect, with the exception of one witness, John Gallagher, who had worked there some time previous, and who stated that he had noticed carelessness on the part of the drivers in not keeping trap doors closed, and that there was laxity of discipline throughout the mine, but on being re-examined the following day admitted that he might have been mistaken in his statements respecting the trap doors.

John McNeil sworn and deposed:

I am state inspector of coal mines; worked in and around coal mines for twenty-one years; have been state inspector six months; heard of accident about 12 o'clock noon, on the 24th; arrived here at noon of 25th; found the mine in horrible condition from effects of explosion. When I arrived temporary stoppings had been put in No. 1 entry, where I found eighteen bodies. They were suffocated by after-damp, making their escape through return air course leading to fan; overcome by the damp when half way out. I then turned the air current from No. 1 and put it in No. 2, and found twenty bodies; they were very badly burned with the exception of three bodies. The explosion took place in No. 2 entry; can't say what room, think it was 16, 17 or 18; found them sometimes two and three together, and six men near room 11; there was more gas in No. 2 than in any other part of the mine; visited this mine on or about the 4th of December, and found no gas

in it—inspecting all parts of the mine—and everything in good condition; but advised caution and suggested some improvements as to cross-cuts, and on no account, whatever, to allow any standing gas in the mine, either in working places or abandoned workings; also gave instructions that the fire bosses should visit all parts of the mine, whether being worked or abandoned; do not think they were carried out; think there had been carelessness to cause such an accident, but cannot locate it; it is difficult for the most expert miner to locate carelessness after an explosion.

(Evidence of Superintendent Robinson, and miners who had escaped from the mine, was then read to the witness.)

Said, after hearing it, that it seems to indicate that the mine had been well ventilated; his duties, which were defined by laws passed by the legislature, requested him that he should look after the safety of miners, and see that good ventilation was furnished, or at least 100 cubic feet of air per minute per man was supplied; keep account of all accidents and the condition of mines, and make annual report to the Governor; impossible that Crested Butte mine could be worked with the quantity prescribed by law; this mine had six times that amount, but no more than was necessary; think there was sufficient air if properly utilized, and precautions taken; made an official report to General Superintendent Cameron, at the time of visit in December, stating that everything was in proper order; brattices and stoppings in good condition; also advised Mr. Cameron to have extra caution used, as I considered Crested Butte mine a very dangerous one. Took three readings with different anemometers; found average reading of 55,000 cubic feet per minute, twice the amount of most mines in the State, but still it is all needed; the stoppings in this mine are wood brattices and solid walls, canvas being used temporarily; think the stoppings good, but would prefer those of sandstone, where there is gas; I do not know of any better method of working this mine than that employed, as the vein is from seven to ten feet, and would not be favorable for long-wall workings; have no interest of any kind in this mine; think the carrying of naked lights into a gaseous mine indiscriminately is not right; think safer to have safety lamps on all occasions in mines of this class; think that Fire-Boss Richardson, from what Dixon, Calderwood and Stewart say, performed his duty as far as Anderson was concerned; the gas of coal mines is carburetted hydro-

gen, which exudes from the strata, and is generated principally in mines below water level; explosions are caused by a mixture of air and carburetted hydrogen; one part of carburetted hydrogen to nine parts of air is most explosive mixture, but a smaller proportion of fire-damp is less so.

After a careful inquiry the jury found a verdict to the effect that the man Anderson carried a naked light into room 18, No. 2 level, which gave rise to the explosion; and avers that there is a dangerous supply of gas in this mine at all times, and suggests that only safety lamps should be used there.

In all countries where coal mining is extensively engaged in, it has been found that serious and deplorable disasters have more or less marked the annals of this industry, notwithstanding any precautions that may be taken; still casualties seem to be inseparable from the conduct of this business, and continue to produce their annual average. We hear much comment on such disasters, and it is well that such should receive the fullest criticism, in an endeavor to promote the means for the prevention of such, and the diminution of peril to the miner.

After the Crested Butte explosion we could hear numerous causes as to the origin of this accident. I will here endeavor to give as clear and concise a view of my belief of the circumstances to which I attribute this fatality, as I am able.

On the 4th of December I visited this mine and made careful inspection. Found the air current good and quite sufficient to render harmless all gases that would be given off in it; but this, in itself, is not an infallible safeguard against explosion unless there exists a rigid spirit of discipline amongst miners, and a never failing watchfulness to the repairs of the appurtenances of the mine, for it may be in the defect of the brattice, door or stopping, or neglect on the part of one careless man that we may look for the cause explaining these disasters which occur frequently in the best ventilated mines, and where the highest readings on the anemometer are found, and whatever might have been the cause of the above explosion, it certainly was not in a deficiency of the total quantity of air forced in the mine.

During the time of my visit to the scene of this disaster, I formed an opinion as to the probable cause of this accident, which, after the maturest reflections given to it whenever the subject comes uppermost in my mind, apart from the excitement coincident to the explosion, I am obliged to give my fullest consent to, viz.: That the man Anderson did not walk deliberately into the gas after being warned not to enter his room, but think that he set to work with the nails the fire-boss gave him, and nailed the broken brattice up in place, which turned the air in a strong body and drove the whole of the gas out (which was probably equivalent, in force, to nearly 3,000 pounds of blasting powder) more rapidly than the air could render it harmless, and might have been fired on main entry by some unsuspecting party near by. Anderson, as it is stated in some of the evidence, told the fire-boss that if he gave him nails he, Anderson, would fix the brattice, also remarked that he had a car which he wanted to load. Anderson probably thought he was just doing what the fire-boss would have done had he waited until he came, so with a view of saving some time in not waiting for the fire-boss, *he nailed up those boards, which certainly should never have been done until every miner was out of that entry, and not one naked light been in that particular district.* Under this view, if Anderson had allowed the fire-boss to have preceded him, the fire-boss, I am very much afraid, would have done the selfsame thing, as he was already making preparations and getting his tools to go and fix that brattice; thus the accident might have happened at the fire-boss' hands. This is my theory, which I firmly believe to be well founded.

The following is a list of persons killed in the Crested Butte disaster:

David Thomas.	John Price.
John Thomas.	James Driscoll.
Miles Roach.	James Coughlin.
Henry Anderson.	Henry Stewart.
John Williams.	Barney Heffron.
M. J. Stewart.	Larry Heffron.
John Martin.	W. L. Jones.
Thomas Rogers.	John Donnelly.
James O'Neil.	Charles Rodwald.
Jacob Laux.	Charles Sterling.
James Welch.	Thomas Roberts.
Peter Baker.	James McCourt.
William Davidson.	Frederick Becht.

Richard James.
Richard Hughes.
P. McManus.
W. J. King.
John Creelman.
John Hular.
Thos. Williams.
John Shun.
Patrick Barrett.
John McGregor.
John Meyers.
F. W. Smith.
G. B. Nicholson.
William Maroney.
Nicholas Probst.
Thomas Laffey.
John Anderson.
Iber King.
Joseph Weisenberg.
H. Donegan.
Joseph Kranst.
James F. Stewart.
Wm. Neath.
Morgan Neath.
Thomas Glancey.
John Rutherford.
William McCowitt.
A. W. Godfrey.
Daniel McDonald.
William Aubrey.
Benjamin Jeffries.
Thomas Lyle.
Thomas Stewart.

List of Fatal Accidents.

September 20, 1883.—Thomas McKeown, miner, No. 4 shaft, Canon City Coal company, Fremont county, received injuries from which he died October 5, never having been conscious again; left a widow and two children. KcKeown fired a shot, and immediately entered his place before the powder smoke cleared away. It appears that the shot was overcharged with powder, and the coal was thrown out with great force, displacing four or five props set under bad roof at face of roadway; he had but just entered when the rock from the face of the roadway fell, catching the unfortunate man under its weight. James McCart, who was working as partner with him, and present at the time of accident, states that they were both aware of the roof being bad, and thought from the nature of the shot that the props had been knocked out. McCart remarked to him that he should not enter so soon, but he answered he was only wanting to see the result of the blast and he went in. Being notified of this accident, I at once visited the place and found seven to eight tons of rock at face of roadway with a few props lying underneath. A piece of coal weighing about 300 pounds was lying out in road, which had been thrown there by the blast.

This habit of rushing in among powder smoke to investigate the result of a blast is a very daring and dangerous practice, still the same is practiced daily, even amongst intelligent miners, and many lives have been thus lost. Miners should never enter their working place after firing a shot until the air current removes the powder smoke, so that any probability of danger that may exist from result of blast may be apparent. The air current should always be in such a quantity as to carry away the smoke from a blast in a very few minutes.

September 28, 1883.—Daniel Goggins, miner, Starkville colliery, Trinidad Coal and Coking company, Las Animas county; injured and died morning 29th; caused by a fall of slate at working face of his room. I found, on examina-

tion, a glossy slip running across face of said place in the roof. It appears that this slip was over the top of the coal when it was in place, and Goggins was in the act of wedging down the coal which he had just undermined, when the slate, relieved from its sustaining force, fell, breaking away at the props, which were five feet from the face of the working, and catching Goggins. He was a good miner and careful; the room was well timbered, but the slip was hidden from his view by the coal. No bones were broken, but his injuries were internal. He left a widow and six children, some of them grown up.

February 18, 1884.—Michael Bonomi, miner, Trinidad Coal and Coking company, Las Animas county; injured by a fall of face coal, causing internal injuries, resulting in death February 18, 1884. It appears that Bonomi had undermined a body of coal four days before the date of accident, the mine not being in operation during said time, and on the morning of the 4th, he again commenced work to still further undermine the same body of coal to gain a larger fall. He took no precaution to sound or put sprags under the coal to avert any danger from an unexpected fall. There being a slip in the coal behind, by digging it under further, the slip freed still more, and the weight of the already undermined body of coal broke down so rapidly as to catch him under it.

The above is a danger that miners have often to encounter, and for this reason they get so accustomed to it that they run too many chances, even when danger is evident. I have seen many instances of such on my visits to mines. In one case I found a miner undermining coal that had been shot, and looking as if about to fall, to have his partner hold his hands on the coal, so that he said he would be able to warn him should he feel the coal move, instead of taking the precaution to sprag it. This may seem very ridiculous, but there are hundreds of miners who have done this very same thing. Miners, as a rule, have to work very hard in order to make what is only considered a fair day's pay, and risk is sometimes run by them to save a little time, just as is frequently done in many other callings, though not excusable under any circumstances.

November 2, 1883.—E. F. Espie, miner, was instantly killed by the fall of a massive stone in the Walsen mine, at Walsenburg, Huerfano county, belonging to the Colorado

Coal and Iron company. It appears that Espie had been out of the mine just before the accident on purpose to select a pair of rails for his working place, and on his return to his room he rode along with the mule driver, who was taking a trip of empty cars in entry where Espie's room was located, and while on the way this stone fell, catching Mr. Espie and two empty cars under its weight. The mule driver escaped without injury. Upon examination, I found that the stone was seventeen feet long, four and one-half feet wide and two and one-half feet thick, at one side, and tapering down to thirteen inches at the other side. The stone had been broken up and removed when I examined the locality. The above dimensions were taken from the place the stone fell from.

The testimony of the coroner's jury was as follows:

That Mr. Espie came to his death by a fall of slate on main entry, and that said place of accident was, to all appearance, safe.

It appears that the side of stone which was thirteen inches thick overlay the coal a few inches on side of entry, there being a dry slip, which was hidden from view, and here the stone was freed from its sustaining force and the weight of it broke off suddenly. I was informed by the superintendent that an examination of the top and timbers of this entry was made by the foreman a short time before the accident occurred, and that no danger could be seen.

The danger of this stone falling doubtlessly existed, yet it might look, to all appearance (from the nature of the slip), to be a place of safety; but we cannot always tell from an observation when timbers or the roof are likely to give way. The only safeguard for, to provide against such accidents, is for the foreman or other persons to keep a daily careful watch and a continual sounding of the top by a pick or hammer, and when slips are detected running in the roof, such parts should always be timbered, regardless of the sound given, for a large stone may sound solid even when it is about to fall.

Matt Ross, a miner, was instantly killed by a fall of roof in No. 2 mine, Oak Creek, belonging to C. C. & I. Co., October 3, 1883. The deceased fired a shot on the night before the accident, which discharged three props. Matt

Ross and his brother, John Ross, who was working with him at time of accident, commenced working again in this place without replacing the props. They had started but a short time when the roof fell, burying Matt Ross under it, with result stated. John Ross fortunately escaped with slight injuries. On investigating the cause of this accident, I found that the room in which it occurred had very bad roof, being full of slips. It appears on the day before the accident that the mining boss was in this place, and seeing that it was dangerous, he at once instructed Ross to timber the place securely, and stayed with them until such was done. As stated, this timber was discharged by a shot. The testimony of John Ross was that it was their intention, that morning of the accident, to leave the mine, and they thought the roof would stand until they would load out the coal that was loose; this was a daring and reckless undertaking which cost Ross his life. Ross brothers were Italians, and unaccustomed to coal mining, and probably did not realize their danger.

September 17, 1883.—Henry Sanford, a track-layer in Louisville mine, belonging to the Union Coal company, was instantly killed by being thrown from a runaway car. It appears that Sanford and another track-layer by name of Edward Crow got into the track-layer's car on purpose to go down a dip entry to do some work; said entry pitches from three to four degrees; they started off down the grade without putting sprags in the wheels, which soon gained a great and accelerating velocity. Crow jumped off the car, seeing it was running at an uncontrollable speed, and called out to Sanford to jump off also; but unfortunately he remained in the car, which, after running six hundred feet, jumped from the track, throwing the unfortunate man against the side of the entry with great force, his head striking the coal with the effect already stated.

List of Non-Fatal Accidents.

John Quine, mule driver, Cañon City Coal company, Fremont county, had his foot crushed between two loaded cars. Quine was riding on front end of the rear car of two. The front car jumped off the track, and the rear car also jumping the track and following the front car, caught his foot between the bumpers.

February 21, 1884.—Henry Stradman, miner, Trinidad Coal and Coking company, Las Animas county, was working night shift in an entry, and he and his partner were both standing close to coal face, wedging down a fall of coal, when it fell suddenly, catching Stradman a little above the ankle and breaking his leg. He was a single man.

September 26, 1883.—Ben Reese, a track-layer in No. 1 shaft of the Cañon City Coal company, received serious personal injury by being caught under a descending cage. Reese having cause to cross from one side of the shaft to the other, tried to cross by way of cage. seat just as cage was nearing the bottom, it struck him on the head and crushed him under its weight. The company, in compliance with section 7 of mining laws, had a manway around the side of shaft. Reese disregarded this way, and was responsible himself for the accident.

November 23, 1883.—Cañon City Coal company, No. 1 shaft, Fremont county, Robert Smith, miner, received slight injury by a piece of coal falling on him.

April 30, 1884.—Trinidad Coal and Coking company, Thomas Willcox, repairsman, had his right hand badly cut up while engaged removing a fall of slate; a piece fell from the roof, catching his hand between it and shovel he was using.

April 3, 1884.—Trinidad Coal and Coking company, Las Animas county, Gabriel Tonorio had his back severely bruised by a fall of slate in shape of a pot hole in roof, at face of his working place.

January 25, 1884.—Cañon City Coal company, Fremont county, Rosalie Andrews, miner, had his back bruised and his ankle sprained by a fall of rock in No. 4 shaft.

April 2, 1884.—Coal Creek slope of the C. C. & I. Co., James Coady, mule driver, had his foot sprained by being caught with a loaded car.

April 5, 1884.—Robert Parry, dumper on top of Coal Creek slope, C. C. & I. Co., had his foot badly bruised while dumping a loaded car of coal, the car falling back on his foot.

January 2, 1884.—Walsenburg Cameron mine, Huerfano county, C. C. & I. Co., Edward McFadden was slightly burned by an explosion of fire-damp ($C. H._4$). It appears that McFadden was working in a place which was ahead of the air current, and while out of his place taking dinner, a quantity of gas had accumulated. He was aware that the gas was present, and took his coat to brush it out, but having left his naked lamp burning in the roadway, and as soon as he brushed the gas on his lamp, an explosion took place. I will here state that brushing out gas is a ridiculous and very dangerous practice; many a serious and fatal accident has happened in this way. This system of removing explosive gas should only be remembered with regret; that at one time such a practice did exist, but should certainly not belong to this age when mining laws are enacted for the miners' protection. Whenever gas accumulates in any quantity, just so soon should brattices be put up so as to convey the air current to render the same harmless. Miners should refuse to work in a place where this gas is given off; should the brattice not be up to the face, and any carelessness or lack of precautions on part of mining boss should be reported to inspector's office at once by miners' committee. The inspector will be ever ready to enforce the law in such a case.

November 14, 1883.—Coal Creek slope, C. C. & I. Co., John Donaldson was slightly injured by a fall of top coal, which fell at the face of his working place.

December 27, 1883.—Crested Butte mine, C. C. & I. Co., E. L. Jones was crushed seriously by a fall of coal. It appears that Jones had some top coal propped up; at the time of accident he was engaged taking down some bottom coal which rolled over, and knocked out the props from under top coal which fell on him.

January 17, 1884.—S. R. Collier, miner, was slightly injured by a fall of slate from top of entry at Coal Creek mine of C. C. & I. Co.

January 24, 1884.—Chas. Cowan, Jr., mule driver, had his right leg caught between car wheels and was badly bruised, in the Coal Creek slope of the C. C. & I. Co.

March 17, 1884.—Coal Creek slope of C. C. & I. Co., Adam Morris, miner, had his jaw broken in two places and was otherwise seriously injured by a fall of slate at the face of his working place.

March 17.—Coal Creek slope of C. C. & I. Co., Hopkin Ludwig had his head cut and slightly bruised by a fall from the roof of his working place.

November 28, 1883.—Frank Durtin received personal injuries from a fall of coal in the Baldwin mine, belonging to the Union Coal Co.

November 14, 1883.—P. Twomey received serious injuries by premature blast, in the Baldwin mine, Gunnison county, belonging to the Union Coal Co.

February 21, 1884.—William Easton, a mule driver in No. 3 shaft of the Cañon City Coal Co., was kicked by a mule on the face, knocking out four teeth and broke part of his jaw.

February 26, 1884.—Cañon City Coal Co., James Shortridge had his back bruised by a fall of slate in No. 3 shaft.

December 20, 1883.—D. E. Jones, miner, had his leg hurt slightly while bearing in the coal. He had his leg and hip under the mining when coal gave way, catching him under his weight, at No. 1 shaft of Cañon City Coal Co.

April 4, 1884.—Coal Creek slope of the Colorado Coal & Iron Co., Phillip Davis, mule driver, was kicked on the mouth by his mule, which knocked out four or five teeth, and damaging his mouth otherwise.

April 2, 1884.—Coal Creek slope of the C. C. & I. Co., Chas. Searing, mule driver, had his foot bruised between the wheels of a loaded car.

November 15, 1883.—Como slope No. 1, U. C. Co., Fe Ling (Chinaman) slightly bruised by a fall of coal.

November 15, 1883.—Louisville mine, Union Coal company, Peter Amhoff, face cut by a fall of slate.

July 18, 1884.—Louisville mine of U. C. Co., Edward Brown, shoulder knocked out of joint and hand cut, by a fall of slate from the top in his working place.

November 8, 1883.—Coal Creek mine, C. C. & I. Co., D. J. Lewis slightly injured by a fall of top coal.

November 14, 1883.—Northrop mine, U. C. Co., Wm. Nickles, scalp wound and upper jaw fractured, by a fall of slate in his working place.

November 22, 1883.—El Moro mine of C. C. & I. Co., John Tenet had his back slightly injured by a fall of coal.

February 23, 1884.—Oak Creek mine of C. C. & I. Co., Lewis Barbary received scalp wounds by a piece of slate falling from top.

January 3, 1884.—Oak Creek mine No. 2, of C. C. & I. Co., Thomas Gregory, trip-runner, had his ankle slightly bruised by car leaving the track.

January 8, 1884.—Oak Creek mine No. 2, of C. C. & I. Co., Henry Mellor, driver, had calf of his leg badly cut by car leaving the track.

January 24, 1884—John Angus had a severe shock and seriously burned in the Crested Butte disaster. He was the only injured man who came out alive. It was thought for some time that he could not live, his injuries were of such a serious nature. However, he has recovered sufficiently to be around, but his nervous system is so broken up that it is doubtful if ever he will get finally over such a shock.

October 24, 1883.—Garfield Coal mine, Garfield Coal Co., Erie, Weld county, Colorado, Joseph Manly, spine injured by a fall of roof in his working place.

October 1, 1883.—Anthracite mine, Anthracite Mesa Coal Mining company, Crested Butte, John Dillon had his leg broken by being caught between the cars.

March 31, 1884.—Mitchell Coal mine, Mitchell Coal company, Ernest Lloyd, driver, had his collar bone broke by mule turning suddenly around, catching him against side of entry.

May 6, 1884.—Mitchell Coal mine, Mitchell Coal Mining company, F. Woodruff had his foot slightly injured by a fall of slate.

September 26.—Northrop mine, U. C. Co., James McDowell, cut over the eye by a piece of slate falling from the roof.

February 14, 1884.—El Moro mine, C. C. & I. Co., Julian Lonteen, driver, hand badly hurt, two fingers amputated by car jumping off the track.

November 29, 1883.—Nicholas McArdle, Hugh Frill, Luke Richardson and John Webb, while engaged working night shift in entry No. 4, of Crested Butte mine, belonging to C. C. & I. Co., Crested Butte, were all seriously burned by an explosion of fire-damp, ($C. H._4$) on the night of the above date, at 9 o'clock. After being removed from the mine they were all, as soon as convenient, sent to the company's hospital for treatment, where Mr._____died in a few days from the effects of his injuries.

Soon after this accident I made a careful inspection of the mine, and to inquire into the cause. On reaching the part of the mine where the explosion took place, I found it giving off a large quantity of gas ($C. H._4$) from a blower in the roof at face of entry. Also a quantity of said gas was giving off from the coal at different points convenient to the face of entry. There was a cross-cut through to air-way, ten feet from entry face, and a ventilating current of 14,700 cubic feet passing through same, being a split from main current. As I thought it impossible for gas to accumulate at that point with such an air current close up to the face, I at once came to the conclusion that some door, stopping or other ventilating apparatus had been neglected, and the air current cut off from reaching face of entry, as no defect could be found at point where explosion took place. The rooms convenient to face of entry were then bratticed care-

fully. I took the testimony of three miners who said the brattice was the same and in place before the explosion. I then went through the old workings of the entry above, thinking that there might be some standing gas, from which a quantity might in some way be driven down upon the men in the entry below. But upon examination of same I could find no standing gas. Was also informed that the fan was running at its usual speed. Sometime afterwards I saw one of the men who was burned in this explosion. He informed me that just before the explosion took place he noticed that the air current had almost ceased to circulate to that point, and that the gas blower in the roof ignited from one of their lamps; they experienced some difficulty in putting the same out. I was also informed that the after-damp and smoke from this blower while burning came back on the entry outside of cross-cut, where the current of air should have been circulating. This being the case, it would indicate that the ventilation had in some way been cut off from reaching said place. As there was a supposition that powder had aggravated the consequence of this explosion, I asked this party how much powder they had on hand when the explosion took place, and the answer was that *they were then out of powder entirely.*

September 13, 1883.—Andrew Linberg, miner, had his leg broken by a fall of roof in El Moro mine, Las Animas county, belonging to C. C. & I. Co. Limberg was engaged in driving an entry and met with a piece of bad roof, and while engaged securing the same with timber, a piece of slate fell on him with result stated.

GASES MET WITH IN COAL MINES

CARBURETED HYDROGEN, SYMBOL C. H_4.

This gas is the fire-damp found in coal mines, and is the lightest of all hydro-carbons. Its molecular weight is 16. (C=12, H_4=4; 12+4=16) or 25 per cent. hydrogen and 75 per cent. carbon; its specific gravity is .555, taking air as one. In works on chemistry this gas is most frequently called marsh gas, which is given it from the fact that low, marshy lands, containing organic matter in a state of decomposition, are constantly evolving it. It is tasteless and inodorous. It being nearly half as light as air, it always rises to the highest points, and must be searched for next to the roof and high places in a mine where falls have taken place. Its presence can be detected on the small light of a safety lamp, where one part of fire-damp is mixed with forty-five parts of air, a small, brownish colored cap is observed on the flame. When one part is mixed with twenty-five parts of air, the flame is surmounted by a cap of light blue; when one to fifteen, it will burn in the lamp; one to nine is its most explosive mixture; one to seven is less explosive; one to four it will not explode, but to the contrary it will then extinguish lights.

The light of the safety lamp is enclosed by a wire gauze of 784 apertures to each square inch; when the lamp is brought in contact with fire-damp, the gas rushes through the fine wire gauze, and immediately ignites and burns inside of the gauze; the chill of the fine wire gauze prevents the flames from passing through to ignite the gaseous mixture outside, except in cases where the velocity of the air current would be over eight feet per second. It has been found that the light of a Davy lamp will pass through the gauze, when introduced in air at this velocity. The Davy lamp is the best known indicator of the presence of gas, but there are other lamps that will stand exposure to a higher velocity without the flame passing through the gauze, and are not necessarily so good an instrument in denoting the

presence of gas, but are much safer in the hands of the careless or inexperienced.

WHITE DAMP.

Carbonic oxide, C. O., is frequently met with in mines in this State, where the fine coal and refuse are subject to spontaneous combustion, and where a large amount of blasting powder is used in getting the coal.

Carbonic oxide is an exceedingly poisonous gas, acting almost instantly upon the system as a narcotic. Its effects on animal life are much more deleterious than that of carbonic acid gas. Air containing as large per centage as 8 to 10 per cent. of carbonic acid may be breathed for a short duration without very serious effects, but the inhalation of air containing a much smaller amount of carbonic oxide will very soon produce unconsciousness, which will result in death unless active restorative measures are immediately adopted. White damp (C. O.) is seldom found unmixed with other gases, and when produced by gob fires or explosions of powder, it is always accompanied with more or less carbonic acid gas; its specific gravity is .976, being little less than air, and is composed, by weight, of 57 per cent. of oxygen and 43 per cent. of carbon. One of the worst features of this gas is that there is no trustworthy method of detecting it; a miners' lamp will burn amidst a deadly atmosphere.

BLACK DAMP.

Carbonic acid gas, $C. O._2$ is found in greater or lesser quantities in all coal mines. Some of our mines in the northern part of the State give off large quantities of this poisonous gas. Its specific gravity is 1.524, or about one and a half times as heavy as air. It is composed of, by weight, 73 per cent. of oxygen and 27 per cent. of carbon. Lights burn badly when containing 5 per cent., and it is unsafe for a person to be in an atmosphere containing 8 to 10 per cent. Its effect on the miner is such as to produce a feeling of numbness, or dull pains in the joints of the legs and arms, followed sometimes by a violent headache and a feeling of a drumming sound in the ears, accompanied by deafness, and will surely impair the strongest constitution in a short time. This gas is given off either mixed with

fire-damp or separately, and is produced by the gradual oxidation of gob in old workings, by the exhalations of men and mules, by combustion of lamps and blasting powder. Some mines in this State give off this gas profusely from smouldering gob fires in the old workings which have been neglected and not properly walled off.

SULPHURETED HYDROGEN $H._2$ S.

The composition of this gas is 94 per cent. of sulphur and 6 per cent. of hydrogen. Its specific gravity is 1.177. It is a condensable gas, and becomes liquid under a pressure of 17 atmospheres, and is capable of being frozen into an ice-like mass by the application of cold. It is a colorless gas, and like carbonic oxide, C. O., a light will burn well in an atmosphere capable of causing fatal results. It can be detected by its very disagreeable odor, which can be plainly felt when present, even in very small quantities. It is itself combustible, but does not support combustion. It is irrespirable, and when existing in large proportions in air, it exercises a poisonous action on animal life. Its effect produces sickness, giddiness, weakness and loss of sensation. Like carbonic oxide, it appears to act on the blood and brain, but it is not considered so fatal as carbonic oxide. It is found chiefly in old worked-out portions of coal mines, and more especially when partly filled with water. It may be generated by the action of oxygen dissolved in water, with timber undergoing decomposition, and in many other ways in a mine.

Spontaneous Combustion

AND GOB FIRES.

We are not without this great destroyer of mining property. There are three collieries in this State in which spontaneous combustion is going on. The most fierce of these mine fires can be found in the Marshall coal fields, Boulder county. This fire in part originated fourteen years ago, and now extends over many acres. The old mine is abandoned and new openings made, so as a pillar of coal is left between the fire and the new workings; but as combustion is going on quickly and surely, it will evidently break through in time. It is now impossible to extinguish this fire, as it has burned so long that the argillaceous slate overlaying the coal is burned to within a few feet of the surface, and the carbon, smoke and other gases from the fire emptying themselves through chimneys reaching to the surface in many places, make it look like a group of burning volcanoes. The suction of this fire pulls fresh air down through the broken strata which supports combustion; thus thousands of tons of coal are destroyed by this mine fire.

Mine fires will take place often under the most careful management, yet, with proper care and precautions on the part of the mine superintendent, they can be put out before they grow to any ruinous extent. In all cases where gob fires are known or even suspected to exist, a careful inspection should be made daily of the workings.

Gob fires can be localized by the indication of an increase of temperature, also a peculiar smell is given off. Whenever these be detected there should be no time lost; prompt action is needed in the matter, for one of the worst features of gob fires is that this smell is but seldom perceptible until the fire has actually set in, but it may be in a small quantity. Getting the fire at this stage we may be successful in removing the heated gob, or by water thrown on the heated parts it may be extinguished. But if the fire is permitted to get under good headway it is impossible for

us to extinguish it in that way, and other methods must be adopted which require good skill, courage and energy to fight a mine fire at this stage, as it is not the fire alone we have to contend with, but the smoke and gases generated by the burning mass of coal, slate, etc., and to breathe these gases it is almost instant death. Therefore it requires to exercise good judgment and skill in carrying the air current with brattice in such a way as to drive these dangerous gases off so that they will not come in contact with the men while building up the stoppings to exclude any air from getting through to the fire. These stoppings should be in as close proximity to the fire as possible, and carefully built in with the ends put back into cuttings made in the coal. These stoppings should be built with double walls, and filled in with sand closely tamped in the center, so as to fill up all cracks and crevices, then the outside wall to be plastered carefully with lime and cement. The fire would thus be isolated from any oxygen, and die out. Stoppings of a concave or convex shape are best for such purposes. Flooding gob fires should be avoided if possible, as it has been found by experience to be a very expensive and ruinous method, as it softens the bottoms under the timbers which get discharged, causing caves, besides, after the water is removed, the gobs are left wet, which swell and heat, and spontaneous combustion again takes place.

THE BAROMETER, ITS USE IN MINES.

This instrument is used to obtain the atmospheric pressure in different states of the weather. The mercury in the tube of the barometer is balanced by the weight of the atmosphere. When we find a low reading on the barometer the atmosphere is light, and when high it is heavy. It is during the former state that pressure is removed from the face of all substances, therefore the compressed gases which were confined in the strata by a heavier atmosphere will give off, regardless of the quantity or velocity of a ventilating current. We find from practice that a certain atmospheric pressure may be sufficient to prevent the outbursts within the strata in one mine, while it may be sufficient in the adjoining mine on the same coal field to confine the gases. The reason of this may be due to many sources. The mine giving off the largest quantity of explosive gases may be due to the dip of the coal field, and have a much heavier cover of strata overlying the vein, which would confine the gase; more effectually than in the mine nearest the crop, or it may be that one mine has been opened longer than the other, and the gases drained off to such an extent that the weight even, of a light atmosphere may be sufficient to confine the explosive gases in the porous rocks and coals. The gases in this same mine might have greatly overpowered the weight of the atmosphere when first opened, escaping profusely. Again gases vary in quality in mines as well as quantity.

The barometer varies in its readings from light and heavy atmospheres about 2½ inches; it also varies a little with the rise and fall of the thermometer. To find the weight of the atmospheric pressure, the following formula may be considered near enough for all practical purposes: Z=height of barometer in inches, then Z×.4908=weight of atmosphere per square inch. Again, the mercury varies with the altitude, and practically we find a fall of one inch on barometer for every 900 feet of ascent. The atmosphere is forty-five miles high, and becomes less dense as we ascend

toward its surface, and the weight of air remaining above diminishes in the same ratio, the barometer falling as we ascend, and every inch of fall reduces the atmospheric weight .49, or nearly one-half pound. If a low barometric pressure is an indicator of unfavorable conditions in mines, we must then be mining in Colorado under the disadvantages of a light atmosphere, as our coal mines are at an altitude of from 5,000 to 10,000 feet above sea level; and, unfortunately, there are a few of our mines give off explosive gases. At present the most gaseous mines we have to contend with are at an altitude of nearly 9,000 feet; therefore we have a very low barometric column; the words rain, storm, etc., are of no use as signs, and the height of the mercury gives no indication as to the weather expected; for during a fair and heavy atmosphere is when our barometer would come near registering storms; so the main object (if anything is to be observed from it) for our safe guidance, would be to note whether the barometer has remained steady or fallen or risen since we took our last reading.

But it is difficult to infer just what relation exists between barometrical pressure and colliery explosions; for it is true that little dependence can be placed on what is termed colliery warnings The barometer is certainly too slow in its movements, and is not so sensitive as gas in denoting the atmospheric changes, for gas frequently makes its presence felt a few hours before the barometer shows a sign of falling. From a table containing a number of colliery disasters which have taken place in Great Britain, it shows that the majority of them happened with a rising barometer, and a belief exists among many eminent engineers that a rising barometer is a source of danger to miners, although fire-damp undoubtedly appears in greater quantities in a mine where there is a decrease of atmospheric pressure; and fire-bosses should always be on the alert during any atmospheric disturbance.

COLLIERY EXPLOSIONS.

WITH METHODS OF WORKING AND VENTILATING MINES GIVING OFF EXPLOSIVE GASES.

The present year finds no parallel in the annals of American mining for disastrous colliery explosions.

It was our sad misfortune to have the first of these mining catastrophes occur in our own State. By the explosion of the Crested Butte mine, on the morning of January 24, fifty-eight souls were hurled into eternity, and only ten out of the entire force of the mine were saved from the deadly blast. The second disaster of the year was at Leisenring, Penn., on the 20th of February, in which nineteen persons lost their lives. The third and most dreadful of these disasters was the explosion of the Pocahontas mine, in Virginia, in which the entire force was lost, and their bodies entombed in the burning pit for two weeks. The number of lives lost in this catastrophe is said to be no less than one hundred and thirty.

My official duty called me at once to the scene of the Crested Butte disaster. On reaching that little mining village I could see a feeling of sadness and gloom visible on the faces of the many who had already arrived from other mining camps to render assistance in rescuing the entombed men or recover their bodies.

On entering the mine with an exploring party, by the aid of a safety lamp, the light glimmering as if through a fog, I looked in silent awe on the dead lying in solemn rest amidst the ruins of the ruthless blast. Mules lay swollen on the track, and mine-cars, stoppings and air-bridges were dashed to pieces, and it was clearly discernible, from the appearance of the bodies, how far the fire-damp had wrought the work of death, and to what extent the after-damp had finished the sad havoc. The greater part of these poor fellows had escaped the fire to fall victims to the other fell destroyer, after-damp.

The fearful loss of life which these accidents entail should teach us to investigate the cause and effect of these mining disasters. It should awaken a desire to make ourselves acquainted with a knowledge of coal mine gases and the scientific systems of ventilation, and the various effective methods devised for the purpose of regulating, conveying and dividing the air-currents in coal mines.

After explosions, we hear much comment and many theories and suppositions as to their causes—such as sudden outbursts of gas, trap-doors being left open, falls from the roof destroying the air-courses, stoppings and air-bridges, miners disobeying the orders and regulations of the mine officials; and still another new theory is advanced in the Pocahontas explosion, in which a coal mine is compared with a flour mill, and that the explosion was caused by the firing of fine coal-dust, just as it is stated that fine flour-dust has exploded several mills.

No doubt some of the above theories would and have explained serious explosions, and it is to be regretted that the miners are, in some cases, reckless, and accidents do, no doubt, happen, when with proper care on their part they might have been averted.

We find it, too, in all callings, the more a man grows accustomed to danger the less he dreads it. But withal I will venture to say that these theories and suppositions are sometimes given to the public when the true causes could be traced either to insufficient ventilation, carelessness and lack of rigid discipline in carrying out an energetic ventilation, and other precautions needed to be enforced in a mine giving off explosive gases. And just to what extent the presence of fine coal-dust had to do with the Pocahontas fatality it is difficult to infer. I have read with much interest the results obtained by English and French scientists experimenting on the influence of coal-dust suspended in the air upon explosive or otherwise non-explosive gases. They seem to point to the following conclusions: That the presence of coal-dust may act in two ways—first, by aiding and taking part in the explosion; second, by prolonging the flame of a powder blast otherwise too short to reach an explosive mixture of fire-damp and air, situated at some distance from where the shot is fired, but they seem rather doubtful whether coal-dust is capable of forming an explosive mixture with pure air. Mr. Galloway, a British

inspector of mines, in his report on the Llan explosion, appears to attach much importance to the presence of coal-dust as being the means of causing an explosion when the per centage of fire-damp was very low. He observed that he discovered some three or four months previous that a mixture of air and fire-damp that could not be ignited by a naked light, immediately became inflammable when coal-dust was mixed with it. M. Vital, a French mining engineer, goes on to describe the result of an explosion which took place in the Campanac colliery in 1874, in the apparent absence of fire-damp, and was said to be caused by the effect of a shot raising a cloud of coal-dust, which it is alleged became ignited and gave rise to the explosion. I will ask, how many practical mining engineers could be gotten to indorse this theory? I think very few.

I will state that I am well acquainted with a coal district in Scotland where at least one-tenth of the coal mined is left in the mine, for the reason that it was nearly fine coal-dust, and not fit for market. The workings were uniformly dry, and in parts very dusty. Shot firing was common. These coal fields have been in operation for upwards of one hundred years, and are still, and there never has been recorded to this day one coal-dust explosion. The class of coal is bituminous. There has never been found in these particular coal fields any fire-damp, which may explain the fact that there have been no coal-dust explosions. Mr. Galloway's theory bears the semblance of truth, but M. Vital is surely off.

I do not wish to be understood, however, in saying that there is no danger in coal-dust, for I really think different, and would say that precautions should be taken to avoid such from accumulating in a mine generating fire-damp, and when any quantity of fine coal-dust is observed in an entry, air-course or room, it should be made damp and be removed from the mine, and thus keep every place as free from dust as possible, for there can be no doubt that coal-dust greatly aggravates the consequences, when an explosion of fire-damp does occur, for we know that when an explosive mixture has been ignited, it expands to an enormous extent, on account of the intense heat during the combustion of the hydrogen gas, and compresses all gaseous mixtures immediately before it, to a greater and greater extent as combustion proceeds, and, like a wind tornado, sweeps mine-cars, timber, etc., before it.

At this stage of the explosion we must admit that all coal-dust and other fine powders will be swept before the blast, and the same must undergo combustion. Thus the flames will be prolonged into a living mass of fire, carrying death and destruction before it until the flames shall empty themselves out of the mouth of the pit or slope, as the case may be.

I regret that I had the sad experience to witness an illustration to the above, after the Crested Butte mine explosion. On examination of the mine, I found at the point where the explosion took place that it was not so much marked from the destruction of the blast as what would have been generally expected at that point.

The bodies there found were burned badly, but the surroundings did not indicate that the force or concussion had been so very violent in its nature, for there were some of the stoppings at this point unharmed, and at a convenient distance inside the point of explosion there was some board brattice still standing. But upon following up the course of the blast we found that it had certainly increased with great force, and traveled mostly in the direction of the in-take air-way, demolishing air-bridges, stoppings, etc., with more force as it traveled, and when but a few hundred feet from the ventilating fan, the force was so great as to dislodge wooden chocks, and strew the props around like matches before a storm.

I could notice places where the floor was swept by the blast as clean as if done by a broom; and beyond such points was found in heaps the charred remains of the coal-dust, scorched into the props, etc., showing that there had been intense heat developed. Many places of this kind were found along the course that the blast had passed.

I firmly believe that the fatal gases ($C.O._2$ and C. O.,) given off from the combustion of such quantities of coal-dust has a deleterious effect, in combination with the after-damp, in destroying the lives of the poor fellows who tried to make their escape through the in-take air-course.

We read from able authors that a mixture of fire-damp and air are of such a limit to become explosive that it is impossible for anything to be left after the explosion to support life, (this is true) or the explosion would not have happened. Yet we know from experience, that under some

extra favorable circumstances, that many lives have been saved from the fatal effects of the after-damp by timely aid. So, in reaching the minimum, I thought it necessary to give it consideration. It should be compulsory that every known precaution should be strictly enforced in a mine generating explosive gases. A system of bratticing close up to the face of each and every place in the mine from the cross-cut last made (whether gas should just then show its presence or not) which should not be apart more than fifty or seventy-five feet, according to the nature of the mine. Stoppings in all cross-cuts between parallel entries should be built with stone and lime (or cement), with double walls, each wall to be formed as a concave ground-arch, with ends cut back into the solid coal, and the centers keyed with key-stones on both sides of stopping just as carefully as you would a water dam that had to stand some hundred tons of water pressure. This work to be done by a stone mason, and one who may understand his business as such.

In a mine of this class it becomes again very important for the safety of life and property to divide the air-currents into separate splits or divisions. For to do this judiciously and completely it is necessary to carry one air-current over or under another, by the aid of an air-bridge. Such an air-bridge should be driven over or under the entry to be crossed in the solid strata where convenient, so as it would be perfectly air-tight, and also stand a strong shock from concussion. This is something that is seldom done in such mines in this country. It is either from a lack of knowledge, or a view to false economy, that such bridges are not adopted. In some cases an iron bridge would suit the purpose very well.

The bridges most commonly used are constructed from wood, forming an overcast over the entry to be crossed; such an air-bridge cannot be made air-tight, and would not stand the concussion of ten pounds of powder, far less an explosion of fire-damp; and such a bridge in a short time costs more for repairs than would drive a tunnel over in the solid strata. Again, ventilating fans, even in mines giving off explosive gases, are frequently put over the top of the up cast or down cast shaft, as the case may be. This is something that should be avoided at all hazards. The fan should be placed off to the side of the shaft, at least thirty feet, and an air-flume run from the mouth of the shaft to an opening made under the fan. There sealed doors, made perfectly

air-tight, put over the mouth of the shaft, but same to be made as light and frail as possible. Where a fan is placed at the mouth of a slope or drift, the strata should be removed in places in top of the tunnel (or slope) before reaching the fan, and doors of same character placed therein also; the tunnel could extend beyond the fan, and for further safety a door of the same class could be there. Care should be taken to have always duplicate doors in readiness should they have the misfortune to be required. The question may be here asked, what precaution would such strong stoppings, tunnel, air-bridges and the ventilating fan set off to the side of the shaft be, in saving life and property? I will answer by claiming, in the event of an explosion, that such stoppings and air-bridges as described would stand a severe shock from concussion, and could stand the test of an explosion that would knock the ordinary stopping and air-bridge to pieces.

The ventilating fan being set off to the side of the shaft would insure its safety from the blast, as the concussion and debris that would be thrown up with great force before the blast would empty itself through the frail doors on top of the shaft, thus saving the fan from being destroyed. We know that the greatest part of the lives lost in explosions is caused from the effects of after-damp. In the Crested Butte explosion there were twenty men succumbed to the deadly effects of this death-destroying agent, after making their way to within a few hundred feet of the ventilating fan. Some were found with their dinner buckets near them, and had evidently taken time to put on their coats after the concussion or shock of the explosion. Many of that number had torn a piece of cloth from their clothing and tied it over their mouths, and selecting or digging a little water hole, they had placed their mouths over the water, and had evidently been breathing through the cloth; some had their hands over their mouths, as if they had breathed between their fingers; two young men put up a canvas on the mouth of a room, then went up to the face of same, thinking that the after-damp might be kept back by the canvas; they had with them a dinner bucket, with water in, and tore flannel from their shirts, and tied it over their mouths to breathe through. If the ventilating fan had not been destroyed in this instance, there was no doubt whatever but all these twenty men at least would have certainly been saved.

The superintendent of the mine had the fan put back in place and repaired as soon as it could possibly have been done under the circumstances, but it was hours before it could be run, and by that time all had perished in the after-damp. How important it is then, for us to use every precaution to save the ventilating power from destruction and have at hand the necessary materials so we can force and conduct fresh air into the mine immediately after the explosion. Again, I have noticed where the vein of a coal mine pitches to any extent and explosive gases given off, that it is very difficult to keep gas out of room faces in rise workings, for the reason that gas is much lighter than air; it has the same natural tendency to flow to the highest points, just as water will to the lowest places. This fact all coal miners are acquainted with, yet it is seldom that we see coal fields laid out to guard against such difficulties. The most common mode of working such mines coming under my observation is that of running the parallel entries across the pitch, and all the rooms to the raise. By this method of work you will readily see that the fire-damp given off in such places at once rises to the high points of room faces, where nearly the entire force of the miners are at work. I will ask if even where there may be a good current of air, if you do not frequently find gas lying in such places, and is it not a common remark made by fire-boss in the morning, after making examination of the workings, to say Jack, Dick or Tom, (as the case may be) "There's fire in thy place up in the far corner, but it is just a wee bit and thee can brush it out with thy jacket, lad."

But we know Jack, Dick and Tom, and jackets and all have often got burned very badly by this very same practice, as it is a very dangerous one to drive out standing gas when there are naked lights in other places near by. I would say that in a coal mine of this class, all rooms should be worked as near water level as possible. This can be done in the most of mines, by driving the main levels from the shaft or slope across the pitch, and at the required distances the entries can be turned off at right angles to the levels that will put all the entries on the dip or rise of the coal seam, and rooms can be turned off from them at such an angle so as they will be water levels. The objections generally raised to not adopting such work are on the question of haulage, and that in coal seams where the pitch is over five to seven degrees, that mules could not work to

any advantage, and that the cars would run off and kill mules and raise havoc generally. I will say there is no reason why we should use mules in such places, for we have within our reach a far better and cheaper method of haulage by only introducing self-acting planes and the endless rope system, which has become so greatly in use in some of the Eastern States in the last few years.

I will state that the British colliery manager is to-day thought behind the age if he be not able to reduce the original cost of horse power in the shape of haulage, by introducing improved machinery into the mines.

This mode of working should be adopted in mines giving off gas, for is it not a fact that a great many explosions can be traced to have originated in rooms worked up to high places? You will admit that it is at times difficult to get a good force of air up to the face of every room in stoop and room workings, and more so if rooms are worked to the raise.

Is it not then necessary to have our entries always to the highest points? And they should always be kept 200 or 300 feet ahead of where the rooms are being turned off, so as to tap the fissures and drain the gas off to some extent. With the aid of parallel entries and the stoppings between them of such a character as I have already recommended, we then can be sure to have the full force of such split of air right to the face of such entries so as to dilute and render harmless the gases when given off.

But the safest mode of working such coal fields is the long-wall system. Coal seams from two to four feet in thickness can be worked to good advantage by such method of working, and it is the cheapest way to work such, if the top and bottom is favorably adapted for it. Coal seams of five feet and over cannot be satisfactorily worked long-wall.

Much has been said on the prevention of explosions, and numerous theories advanced with a view to prevent the repetition of accidents which are constantly shocking the public ear, but in my estimation all attempts at legislation with this desired end will prove absolutely abortive as long as the primary cause of all explosions—that is, *naked lights* in some form or another, coming in contact with carbureted

hydrogen—is not eradicated from all coal mining in fiery mines.

Legislation has already taken steps in suggesting safety-lamps, and in the prohibition of matches and tobacco pipes, etc., but it is just simply and purely a farce if the use of inflammable explosives, the most dangerous of all naked lights, is to be longer continued. What security is a safety-lamp under such circumstances? I answer, none. We must shut right down on naked lights, and I would recommend the compulsory use of the safety-lamp, and the entire exclusion of all combustible explosives in mining coal from fiery mines.

In some cases this might add a trifling expense to the cost of getting coal, but on the other hand look at the advantages we should gain by the adoption of such a course. We would be saved the pain of listening to those often-told tales of woe and misery that are always abroad, and in a few years coal owners will be wondering how they could have ever allowed their coal to be destroyed, and roofs all shaken up by the use of fiery explosives, and the miner again would find a great benefit in not having to breathe atmospheres laden with the foul vapors of powder smoke, and in being exempt from the many perils of shot-tamping and damaged roofs.

After the Crested Butte explosion, blasting powder has been entirely excluded from the mine. The miners at first could not see how it could be possible for them to mine successfully without its aid. Unpractical men had to migrate, but the experienced wielders of the pick informed me on my last visit that they would not resume its use even if allowed, since they have become accustomed to the sledge and wedge.

But I hardly think that it is absolutely necessary that coal mining and miners should be circumscribed by any limited appliances, if they can advantageously include the use of a blasting agent that shall have none of the vicious properties ascribed to those in common use, and it should be our business at once to cast around for one. There is already one in the market, a lime-cartridge.

I have been thinking that in view of the absolute repression of naked lights in coal mines generating fire-damp, thereby prohibiting the use of combustible explosives in blasting

coal, it would greatly facilitate coal mining operations under these altered circumstances by introducing an effective non-fiery explosive cartridge that could be used with perfect safety, and as it is a question amounting to a national importance, the National Government should be memorialized with a view to authorize a research into the subject by eminent chemists.

I will here pass a few remarks on the position of a fire-boss, which is a very responsible one, and should be filled by a sober, trustworthy and intelligent man, who should know more about the nature of explosive gases than merely telling their presence by a safety lamp. He should be well acquainted with the laws of ventilation and the atmospheric influences on it, and should be able to answer questions given him in relation to the qualities and explosive points of coal mine gases, and how much air it takes to render them harmless. He should never lose sight of the great danger there is in brushing out standing gas from any place in an entry room or level, and should, on all occasions, be satisfied that there is not in all that district one naked light. I will here give a little information for fire-bosses in indicating the extent of the presence of fire-damp. The most conclusive experiments on this point were carried out by Mr. Galloway. The results are recorded in the *Royal Society Journal*, May, 1876, from which the following was extracted:

"The wick of a safety lamp having been carefully trimmed, was drawn down until the flame presented the appearance of a small blue hemisphere, about one-eighth of an inch high, and one-quarter inch diameter at the base, and having a conical speck of yellow in the middle near the top. A mixture of one part of fire-damp with sixteen parts of air gave a voluminous, waving, spindle-shaped blue cap, three and three-eighths inches high; one to eighteen, a similar cap two inches high, which burned more steadily; one to twenty, a cap one and five-sixteenths inches high, with nearly parallel sides, to about two-thirds of its height, and drawn out to a point at the top; this cap was perfectly steady, and more distinct than any of the others; one to twenty-five, a conical cap one-half to five-eighths inch high; one to thirty, a conical cap three-eighths inch high; one to forty, a conical cap three-sixteenths to one-quarter inch high; one to fifty, an exceedingly faint cap one-eighth inch high, the top having the appearance of having been broken

off; one to sixty, it was hardly possible to distinguish anything above the small oil flame."

There are numerous tables and books published by many good mining authorities, which I would advise every miner, who has any ambition to rise in the ranks of his profession, to read and study carefully, and be assured that the time will come when the man with the knowledge and science of coal mining will command the best positions. Is it not really important to all interested in mining that the colliery superintendents should have both a practical and theoretical knowledge of their business? Should he not be to his mine as a captain is to his ship? So that the workmen under his charge could labor with the utmost confidence, knowing that they had for a superintendent a man in whom they could trust in looking after their safety. In England coal mine superintendents must hold a certificate of competency to fill such a position. If the legislatures of our country would enact such a law it would be a step in the right direction to reduce mining accidents to a minimum, and would place a premium on the acquisition of knowledge in American mining, and hold forth a reward to the intelligent operative.

I do not wish to be understood as saying that mining accidents can be wholly avoided any more than railroad accidents or other casualties, but with the above precautions carried out they can certainly be minimized.

TABLE SHOWING NUMBER OF MINES, ETC., IN FREMONT COUNTY.

NAME OF MINE.	Operators.	Postoffice Address.	Kinds of Mines.	Power Used.	Have you a safety catcher on cages?	Have your boilers been inspected?	Have you a map of your mine in Inspector's office?	Mine ventilated by.	Volume of air circulating in cubic feet per minute.	Average No. of persons employed.	Quality of coal.	Thickness of seam in feet and inches.	Production of coal for year ending July 31, 1884, in tons.	Are there iron covers on the cages?	Have you two separate openings?
Coal Creek	C. C. & I. Co...	Pueblo	Slope...	Steam.....	.....	Yes..	Yes	Fan	25000	175	Lignite...	5—0	105405	.....	Yes..
Oak Creek	C. C. & I. Co...	Pueblo	Slope...	Steam.....	.....	Yes..	Yes	Furnace..	24000	125	Lignite...	4—6	56438	.....	Yes..
Rockvale No. 1	C. C. C. Co	Raton,N.M	Shaft...	Steam..	Yes..	Yes..	Yes	Fan	17200	158	Lignite...	3—3	....	Yes	Yes..
Rockvale No. 4	C. C. C. Co	Raton,N.M	Shaft...	Steam..	Yes..	Yes..	Yes	Fan	19000	150	Lignite...	3—5	139033	Yes	Yes..
Rockvale No. 3	C. C. C. Co	Raton,N M	Shaft...	Steam..	Yes..	Yes	Yes	Fan	18000	57	Lignite...	4—6	.....	Yes	Yes..
*Caldwell	C. C. & O. Co..	Denver	Slope...	Steam.....	.....	Yes..	No.....	Furnace..	12000	50	Lignite...	3—8	2987	.....	Yes..
†Thornton No. 1	T & Co.....	Canon City	Shaft...	Steam..	.....	.....	.....	.....	.....	.....	Lignite...	7—0	1000	Yes	.....
†Thornton No. 2	T. & Co	Canon City	Slope...	Steam..	.....	.....	.....	.....	.....	.....	Lignite...	7—0			.....
†Hayes	Hayes.....	Canon City	Slope...	Horse..	.....	.....	.....	.....	.....	.....	Lignite...	3—0	1753	.....	.....
†Carson	C. C. & O. Co..	Denver	Slope...	Horse..	.....	.....	.....	.....	.....	.....	Lignite...	6—2	2000	.....	.....

*This mine shipped coal only a little over one month during the year.

†These mines don't come under the mining laws.

FREMONT COUNTY MINES.

COAL CREEK MINE, C. C. & I. CO.

This mine is situated on the creek of that name, thirty-five miles west from Pueblo, and ten miles southeast from Cañon City, and is reached by the D. & R. G. R. R., distant from Denver one hundred and fifty-five miles. Here is located one of the most extensive coal mines in the State, having been worked extensively for the past twelve years. It can be truly said that it has sent (during that time) much more coal to market than any other one of our mines. The coal seam crops out to the north of Coal Creek. Here the field is opened by a slope which is driven nearly due west (on the dip of the vein which lays very regular on a dip of three to four degrees) a distance of eighteen hundred feet; double entries are turned off at right angles to north and south of slope every four hundred feet, (this mine being nearly free from water); rooms are worked to the dip as well as the raise; the dip rooms leave the lowest one of the parallel entries at an angle of thirty-five degrees, thus running across the dip, making the haulage as light as possible for mules; the rooms to the raise are turned at right angles from entry; the coal seam will average about five feet in thickness; the method of work is room and pillar; cross-cuts are, since the mining law came in force, put through in all entries or rooms from fifty to seventy-five feet apart. It will only be fair to say, in behalf of the management of this mine, that its mode of work in regard to mining in a scientific view, so as to extract the greatest number of tons to each acre of its coal field, by far excels any other mine, worked by room and pillar method in this State. This may appear to some to be a small matter, but to the scientific miner it is a subject of great importance; for here lies the secret, and one of the greatest items in the economy of coal mining. There are entries in this mine that are over four thousand feet in length, and this distance could be sighted with one station of the transit as far as their straightness is concerned.

On my first visit to the mine, I found the ventilation at room faces was very poor, and miners suffered from breathing an atmosphere mixed with noxious gases produced from blasting powder, combustion of the miners' lamps and a quantity of carbonic acid gas, ($C. O_2$), which was given off freely from the broken strata of worked-out parts of the mine. The quantity of air going into the mine was fair, and the currents on main entrance were uniformly good, but for the lack of canvas, or doors on room entrances, to keep the air-current up to the cross-cuts last made, was the reason the miners suffered at room faces. Finding this to be the case, I at once made the fact known to the officials of the company, and earnestly requested them to make all necessary improvements to better ventilation; assurance was given me that such would be done as early as possible. This, however, was only a promise, for on future visits I found that little had been done in the way to conduct air currents to working faces which was so much needed, for the reason that an immense quantity of powder is used in mining this coal, as it is nearly all blasted off the solid. On an average it is safe to say that one keg of powder, of 25 pounds, is used for every 40 tons of coal mined.

April 4, 1884, I wrote general superintendent informing him that it was now my intention to stop operations of said mine, and I handed the case over to the Attorney General. The case was, however, compromised with good results; the company it appeared had already taken steps to carry out my instructions, and had sent for materials needed to better ventilation, but they had been in some way delayed. Since that time the company has spared no expense in putting the mine in condition. The steam power of ventilating fan, (8 feet dia. Murphy), has been increased by the erection of an additional boiler; the air current is divided into separate splits by overcast bridges; canvas is used on room entrances, and the gobs are so built as to leave a space next to ribsides, so in that way the current of air, or a portion of it, reaches the working face, the place where it should be. I have been notified by miners' committee and others that the mine is now well ventilated, and on my last visit of inspection I was glad to find that such was the case.

OAK CREEK SLOPE, C. C. & I. CO.

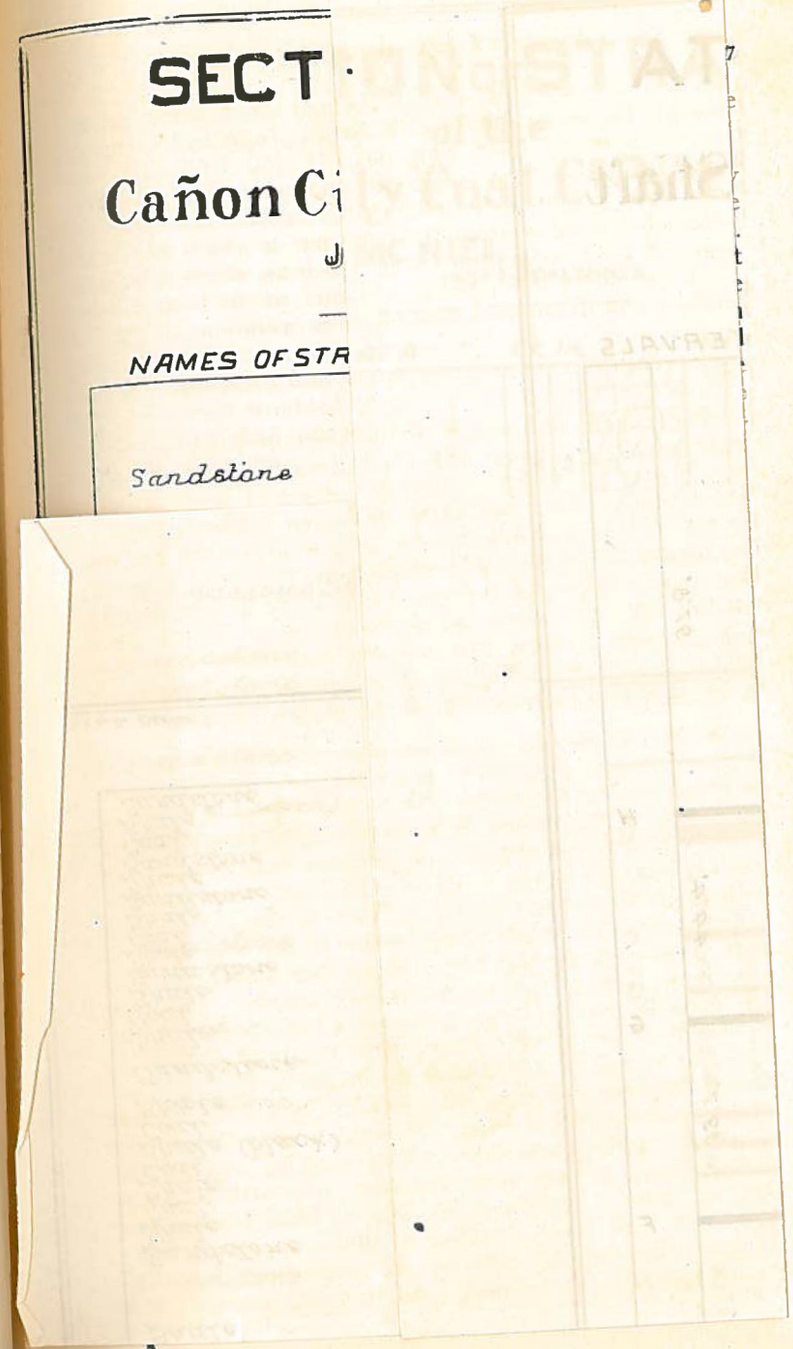
It is located at the town of Williamsburg, one and one-half miles west from Coal Creek; the vein is four and one-

half feet in thickness, and is reached by a slope driven through the strata at a dip of twelve degrees, the dip of coal seam being about four degrees, and lays sixty feet above the Coal Creek vein, and is of an inferior quality. This mine is ventilated by two furnaces in separate splits, and each having a separate shaft, one of which has been sunk and put in operation during the year, which is located in the interior of the workings. Good results from it were obtained and the mine is now in good condition.

CAÑON CITY COAL CO., NOS. 1 AND 4 SHAFTS.

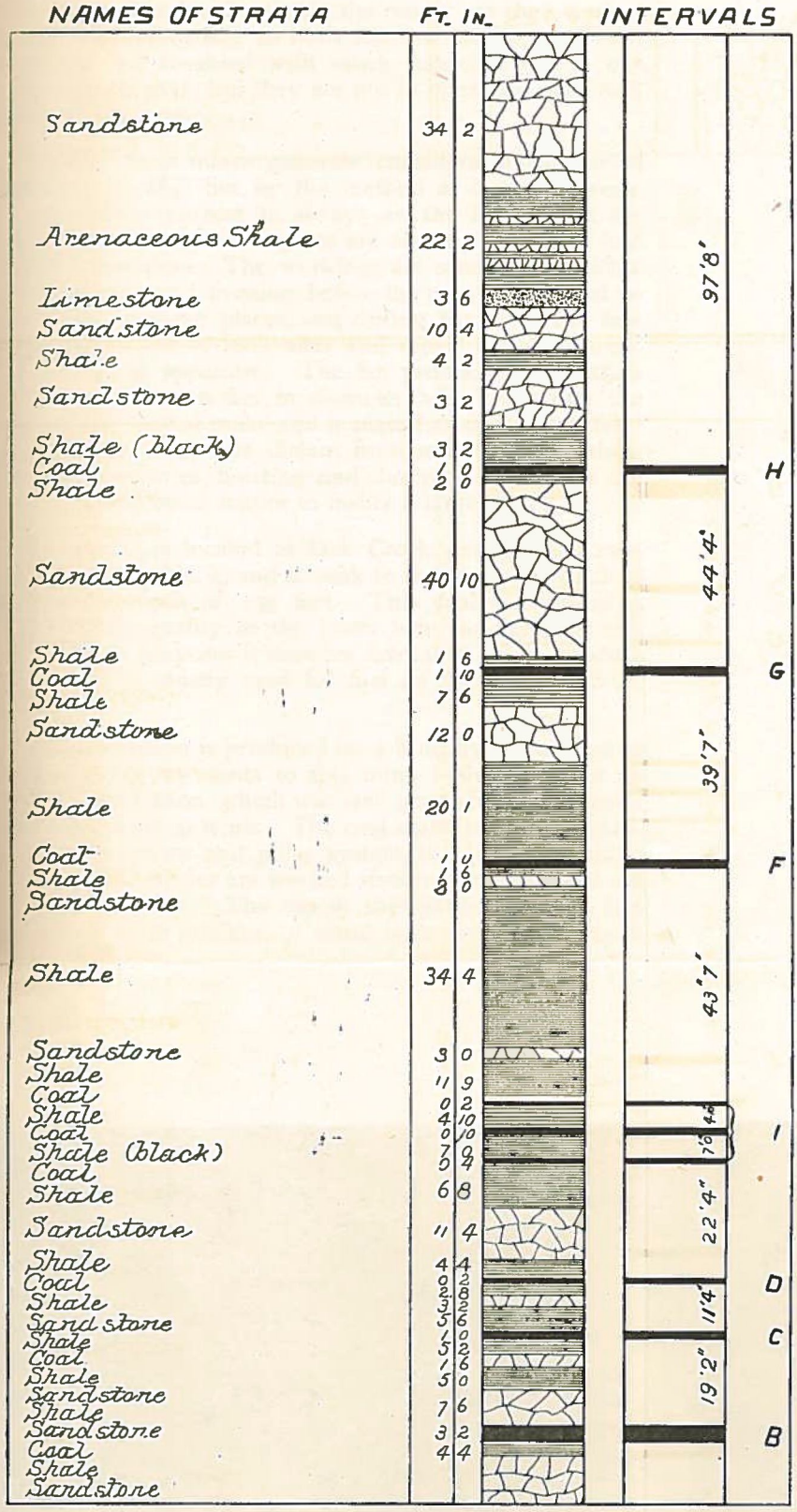
These shafts are located at the town of Rockvale, situated one mile southwest from Coal Creek. The Coal Creek seam is here reached by a shaft at a depth of 300 feet; the coal averages three feet three inches in thickness, and is worked very successfully by the long-wall system, the top and bottom being favorably adapted for that kind of work. The shaft is large and is divided into three compartments, two hoisting ways, and one for ventilation, which is lined with grooved lumber, and covered with sheet iron, thus making it perfectly air-tight. The ventilation is produced by an eight-foot diameter fan of the Murphy make.

When the mining law came into effect, this mine had only one means of egress to and from the mine, but within the time specified in mining laws for second outlet, the same was obtained by means of an entry driven in the coal between Nos. 1 and 4 shafts, the distance being over 2,000 feet in length, having a good and safe traveling way throughout the entire distance. There is now in operation (in No. 1 shaft) a slope, being driven to the dip, which is nearly due west, the dip being about four degrees. This slope when finished will be one mile in length. The company contemplates putting up improved machinery at the top of this slope, which is convenient to the shaft bottom. The plant on top of this shaft is by far the best of any coal mine in the State. The hoisting machinery is large double engines, with conical drums. The engine and boiler house is built of massive stone work. The breaking strain of the hoisting ropes is forty tons (one and one-fourth inches in diameter, steel). The cages are heavily built from strong angle iron, and have attached to them improved safety catches. The mining cars are in proportion large, the amount loaded in them being 3,000 to 4,000 pounds. It is



SECTION OF STRATA
of the
Cañon City Coal Co's No. 1 Shaft

J. MC NIEL
INSP^R COAL MINES.



Mills Eng. Co Denver.

safe to say that the hoisting capacity of this mine can be placed at 800 tons per day.

No. 4 shaft, being on the same vein, is also worked by the long-wall system. This shaft is sunk on or near the company's lines, at the extreme depth of their coal field. The main levels are driven north and south from the shaft bottom parallel to company's boundary lines. Double headings are driven to the raise at right angles to main levels every four hundred feet; the rooms are then worked on one continuous face to both sides of headings. These mines are not troubled with much water. There is one pump in each shaft, but they are not in operation over one-eighth of their time.

Both of these mines generate considerable carbureted hydrogen, (C. H_4) but by the method of long-wall work, the ventilating current is always on the face where the miners are at work. The gases are thereby driven off and rendered harmless. The workings are carefully inspected every morning and evening before the men are allowed to enter their working places, and during the shifts the fire-bosses' duties are to look after and repair the air courses, and ventilating apparatus. The fan producing ventilation in No. 4 shaft is ten feet in diameter, built much after the mode of the Guibal make and is placed at an air shaft fifty-four feet area, thirty feet distant from main hoisting shaft. The top structures, hoisting and dumping appliances are also of an improved nature to insure a large output.

No. 3 shaft is located at Oak Creek, nearly a half mile due north from No. 4, and is sunk to the top vein, which is reached at a depth of 135 feet. This coal seam is of a much inferior quality to the lower vein for domestic use, but for steam purposes it answers favorably. The production of this is mostly used for fuel on the A., T. & S. F. R. R.

The ventilation is produced by a Murphy fan six feet in diameter. On my visits to this mine I always found an excellent ventilation, which was well conducted to all parts where men were at work. The coal seam is worked carefully by the room and pillar system, in squares of three hundred feet; entries are worked sixteen feet wide and are timbered carefully. The top in this particular mine has been found, from practice, to stand better and cave less in

entries of sixteen feet wide, than it would in entries of narrow work, seven feet wide, for the reason that there is a little gas in the roof, which will always cut from the sides more than in a narrow place. This may be found true in many mines.

This company has always shown a desire to take every precaution to insure the safety of their miners and property, and as a rule my suggestions to them were promptly carried out. A small opening belonging to this company, on a very extensive coal field, is located nearly three miles south from Rockvale, but, during the year, there has been no coal shipped.

THORNTON COAL MINE.

The Thornton mine is located near to Cañon City, and is opened on a very fine coal field. This company owns 640 acres, the greater part of which has been found underlaid with coal, varying in thickness from four to eight feet, as far as prospected. A slope was commenced in April, and the coal reached in July, at a distance of four hundred feet, which pitches at an angle of twenty-six degrees. The coal was here found lying at an angle of eight or nine degrees. This is a new opening, and promises fair to be a good one. There is not yet any railroad to the mine, but the expectations are favorable that there will be in the near future. Fine improved machinery has been erected lately by the company at a considerable cost. They certainly mean business.

HAYES MINE.

This mine is located near to Cañon City. There are a few men here engaged in mining coal to supply the market of Cañon City and vicinity. There is no railroad to this mine.

THE CARSON MINE, C. C. & O. CO.

This mine is leased by Thomas H. Davis, and is located four miles southeast of Cañon City. The coal seam is five feet in thickness; is a lignite of good quality, and is opened by a slope. A few men are employed in mining coal to supply the State Penitentiary, and for other country sales. No railroad has yet reached this mine.

THE CALDWELL MINE, C. C. & O. CO.

This colliery is situated near to Coal Creek, a distance

of half a mile to the south of Coal Creek mine, and is reached by a branch from the Denver & Rio Grande railway. The coal seam is the same as that of the Coal Creek vein, and is reached by a slope driven through the strata overlaying coal near to the crop, and is down on the dip of the seam a distance of five hundred feet; also an air-course of the same distance is parallel to slope, with an air-shaft. There are four entries laid off at right angles from the slope, two on the north and south sides; same are worked at distances from two hundred to five hundred feet from the hoisting slope.

This mine has shipped but very little coal, although it has been in operation at different times for the last four years. A large amount of money has been spent on improvements. The railway only reached it but a few months ago, so that it can now be expected to be a fair producing mine. The machinery, hoisting and dumping appliances are fairly good, and would insure a capacity of between two and three hundred tons per day. Coal has only been shipped a little over one month during the year. The ventilation was fair. Some improvements were recommended, and the same were promised to be done as soon as possible.

GUNNISON COUNTY MINES.

TABLE SHOWING NUMBER OF MINES, ETC., IN GUNNISON COUNTY FOR YEAR ENDING JULY 31, 1884.

NAME OF MINE	Operators.	Postoffice address.	Kind of mine.	Power used.	Have you safety catches on cages?	Have boilers been inspected?	Have you a map of your mine in Inspector's office?	Mine ventilated by—	Volume of air circulating in cubic feet per minute.	Average number of persons employed	Quality of coal.	Thickness of seam in feet and inches.	Production of coal for year ending July 31, 1884, in tons.	Are there iron covers on your cages?	Have you two separate openings?
Crested Butte.....	C. C. & I. Co...	Pueblo.....	Slope ..	Steam..	.....	Yes ..	Yes ..	Fan.....	49,000	75	Bituminous	8—0	47,524	.....	Yes ..
Baldwin.....	Union Coal Co..	Denver	Shaft...	Steam..	Yes ..	Yes ..	Yes ..	Steam J't.	9,000	65	Semi-Bit's..	4—6	23,775	Yes ..	Yes ..
*Richardson	J Richardson..	Gunnison	Drift...	Horse..	.....	.....	.....	.....	.....	.....	Bituminous	4—6	500	.....	.....
*Hunter	....	Gunnison	Drift...	Horse..	.....	.....	.....	.....	.....	.....	Lignite.....	.....	500	.....	.....
*Becket	....	Gunnison	Drift...	Horse..	.....	.....	.....	.....	.....	.....	.....	.....	500	.....	.....
†Mesa	A. M. C. M.Co.	Crested Butte...	Drift...	Horse..	.....	.....	Yes ..	Furnace..	20,000	60	Anthracite..	5—8	13,241	.....	Yes ..

*These mines do not come under the mining law.

†This mine was shut down six months during the year, owing to exceptionally heavy snows.

There are other small openings in this county, but do not ship coal, as there are no railroads to them.

GUNNISON COUNTY MINES.

The coal fields of this county are very extensive, and are of three varieties—lignite, bituminous and anthracite. The lignites cover a much larger area of land than the other two varieties, and are found at an altitude of from 5,000 to 8,000 feet above sea level. They commence immediately south of Mount Carbon, in a point-like shape, widening out until the field covers an area of sixty miles, extending in length over one hundred miles, terminating in the vicinity of Grand Junction. This field is found near Ouray, and is known as the brown or lignite coal of the tertiary formation, which is never found under the trachyte in place.

The quality of this coal is variable; portions of it are found to be nearly worthless, (such is common in the tertiary formations, especially where the cover of strata is light), while in other portions of the field it is found to be of a superior quality for steam generating or domestic purposes. The cretaceous coals are at an altitude of 8,000 to 9,500 feet, and are always found under the trachyte. Bituminous coals of coking qualities are scarce, and cover a very small area compared with the other varieties, and always found in close proximity to the anthracite coal fields. Its qualities as a coking coal have no superior.

The anthracite coal basin commences north of Mount Carbon, extending twenty miles, and west forty miles. There are in this coal field some small patches of bituminous coal.

The analysis of the anthracite coal of this county shows it to be in every respect of as good a quality as the anthracite of Pennsylvania, although much to the contrary has been said.

MESA MINE, A. M. C. CO.

This colliery is situated on Slate river, four miles north of Crested Butte, and is reached by a branch of the Denver and Rio Grande Railway.

The quality of the coal seam is a very fine anthracite. An analysis of this coal gives the following result:

Water and volatile matter	5.17
Fixed carbon	90.65
Ash	4.18

The vein is opened at the extreme dip of the company's coal field, which point lies at an elevation of about 800 feet above the valley where the railroad track is situated. Also a coal breaker is here located, which is erected much after the mode of the Pennsylvania anthracite breakers, having improved screens and other special appliances for preparing the coal for market. The coal is run down from the mine to the breaker by a self-acting plane, pitch of same being about 30°. On my first and second visits to this mine I found the ventilation very weak. I recommended the company to increase the quantity by some mechanical appliances. They promptly attended to the notice and built a large furnace at the bottom of the air shaft, which I found on my last visit to be capable of producing, if needed, 30,000 cubic feet per minute.

There is no explosive gas found in this mine, (being far above water level), and very little of any noxious gases giving off. The altitude of this mine and vicinity is over 9,000 feet above sea level. Transportation is found to be very difficult from this part in the winter months, owing to the heavy snows that prevail in that locality. The mine ceased operations for several months during the year, owing to exceptional heavy snow storms.

CRESTED BUTTE MINE, C. C. & I. CO.

This mine is situated at the town of Crested Butte, the elevation being about 9,000 feet above sea level. Here the coal seam is opened by a slope, and driven in the vein to a distance of 1,400 feet. Three double entries are turned at right angles from the slope. The seam will average eight feet in thickness, and is bituminous, of good coking qualities, the greater part of which is made into coke at the company's ovens, in close proximity to the mines.

The ventilation is produced by an eight feet diameter Murphy fan. On my visits of inspection the ventilating current would average about 50,000 cubic feet per minute.

This quantity is divided into separate splits or divisions at each entry, by the aid of air-bridges or overcasts. Brattice is used to convey the air current (from entries or cross-cuts last made) as near as convenient to the working faces. These precautions and improved methods of ventilation are an absolute necessity in this mine, for fire-damp is given off profusely in most parts of the workings, and therefore air must be near the working faces, so as to render this fire-damp harmless. Notwithstanding the above good supply of air, and the other precautions taken to guard against the dangers of this life-destroying agent, yet here a serious explosion took place on the morning of January 24, which caused the loss of fifty-eight valuable lives.

(See paper on colliery explosion, page 12.)

BALDWIN MINE, UNION COAL CO.

This mine is located on the Denver & South Park division of U. P. R. R., eighteen miles from Gunnison City. The coal field is here opened by a shaft; the seam is four feet six inches in thickness, and is of a semi-bituminous quality.

The method of working this mine is room and pillar, by the double entry system. On my first visit to this mine I found the ventilation poor, the quantity being far too small. At points on the main entries the anemomenter would fail to register. I notified the mine officials that the quantity of air must be increased. On my last visit, lately, I found that a Murphy ventilating fan was on the premises, but was not in place. The fan, when put in operation, will give good results to both company and miners. The present means of producing ventilation is by a steam jet in the upcast shaft. Coal is found to lay in extensive fields in this locality.

TABLE SHOWING NUMBER OF MINES, ETC., IN WELD COUNTY.

NAMES OF MINES.	Operators	Postoffice Address.	Kinds of Mines.	Power used.	Have you safety catches on cages?	Have your boilers been inspected?	Have you a map of your mine in Inspector's Office?	Mine ventilated by	Volume of Air circulating, in cubic feet, per minute.	Average number of persons employed.	Quality of Coal.	Thickness of seam, in feet and inches.	Production of coal for year ending July 31, 1884, in tons.	Are there iron covers on the cages?	Have you two separate openings?
*Boulder Valley	Union C. Co..	Denver	Shaft...	Steam..	Yes ..	Yes ..	Yes	Furnace..	8,500	78	Lignite	7—0	26,867	Yes	Yes ....
Mitchell	D. & U. RyCo	Denver.....	Shaft...	Steam..	Yes ..	Yes ..	Yes	Steam J't.	9,000	50	Lignite	6—0	20,150	Yes	Yes ....
†Superior	Lambert	Erie	Shaft...	Steam..	Yes ..	Yes ..	.....	Nat draft	3,800	8	Lignite	4—4	3,427	.....	.....
†Baker	D. W. Davis..	Erie	Slope...	Horse..	.....	.....	.....	.....	.....	.....	.....	.....	763	.....	.....
†Eaton	Wm. McCall..	Eaton	Slope...	Horse..	.....	.....	.....	.....	.....	.....	.....	.....	685	.....	.....

†These mines do not come under mining law.

*This mine was not working the first three months of the year.

WELD COUNTY MINES.

BOULDER VALLEY MINE, UNION COAL COMPANY.

This mine is located in close proximity to the town of Erie, and is reached by the Boulder branch of the Union Pacific railway, thirty-five miles from Denver, and twelve miles from Boulder. Frequent complaints have been received about defective ventilation from this mine. On my first visit I found the air current feeble in the main air-course and near to the interior of the mine. The anemometer failed to register. I informed the assistant general superintendent of the same, and requested him to have the mine put in condition. Some improvements were done inside the mine, but the main objection was that the total quantity going in at the downcast was far too small, so the improvements inside were of very little service. On my second visit I was sorry to find the condition of things worse than before. On measuring the air-current at inlet I found 8,000 cubic feet per minute. There were three or four mules in the mine, and about seventy miners. Unfortunately this mine gives off a large amount of black damp, (carbonic acid, $C.O._2$), from the strata, besides that originated from the breathing of men and combustion of lamps and blasting powder.

The result was that the miners had difficulty in maintaining their lamps burning, and the coals lay black on the grate of the ventilating furnace. The foreman and myself lost our lights on the main air-course, which was almost impassable by caves from the roof. Although I had matches I could have no light, for carbonic acid was of such a percentage in the air that it would not allow a match to ignite. I at once notified the miners to cease operations, as I thought they were in danger.

A few days later the assistant general superintendent of this company accompanied me in a tour of inspection through the mine. He informed me that he had no conception that the mine was in such a condition, and that he

would at once take steps to have the mine put in order. An air-shaft has since been sunk beyond the working faces, and a tunnel is now in operation from both sides, and will soon be completed.

MITCHELL MINE, D. & U. R. R.

This mine is situated near the town of Erie, and is opened by a shaft. The coal seam is from five to six feet in thickness, and dips very regularly to the east, at an angle of about three degrees.

On my first visit to this mine I found hardly anything done to conform to mining laws. There were no safety catches on cages, and ventilation was poor. There seemed to be no system carried on to conduct the air to working faces; rooms were worked at distances from one to two hundred feet ahead of the feeble air-current. I did not find a single crosscut between rooms throughout the mine. I at once notified the superintendent as to the state of affairs, and requested him to give the same his immediate consideration.

On my second visit (two months later) I found the same old system of things prevailed, and nothing done to better ventilation. The superintendent was ready to offer an apology. I thought the condition of the mine could not admit of any excuse whatever, so I informed him if the necessary improvements were not under good headway in ten days from that date that I would then take steps to shut down the mine. The State Attorney General notified the company to this effect. Assurance was then given me that all necessary improvements would be at once attended to. This promise, I am proud to say, was kept good, and the mine is now in good condition.

On my last visit I found crosscuts near to room faces, and canvas placed on the room entrances, so as to keep the air current up to crosscuts. The means by which ventilation is produced is by a steam jet, and exhaust from a steam pump at upcast shaft. This mode of ventilating gives a very small percentage for the power applied, compared with a furnace or fan.

It is not pleasant for me to record such facts, but the truth must be told. The inspector has been as forbearing

as possible, knowing that this was the first year that the mining law was in force, and to many his visits were unexpected. But in this case, as well as in many others, forbearance ceased to be a virtue.

BAKER MINE.

This mine is located on the Denver and Utah Railway, about twenty miles north of Denver. The coal seam is seven feet and a half in thickness, and pitches at an angle of 15° in a western direction. The quality of this coal is a little superior to the most of the northern coals. There has been but little coal mined during the year. A few men have been engaged in making developments.

SUPERIOR MINE.

This mine is located one mile from the town of Erie, and is opened by a shaft. There is only one opening made. They are, therefore, compelled to work but a small force. On my first visit to the mine I gave the manager instructions to this effect.

TABLE SHOWING THE NUMBER OF MINES IN JEFFERSON COUNTY

NAME OF MINE.	Operators.	Postoffice address.	Kind of mine.	Power used.	Have you a map of your mine in Inspector's office?	Thickness of seam in feet and inches.	Quality of coal.	Production of coal for year ending July 31, '84.	Have you safety catches on cages and boilers inspected?
†White Ash	G. B. & C. Co.	Golden	Shaft	Steam	Yes	8—0	Lignite	13,792	Yes
†Mount Carbon	Mt. Carbon Co.	Denver	Shaft	Steam		4—0	Lignite		
*Hoyt	C. P. Hoyt	Golden	Shaft				Lignite		
*Pittsburg							Lignite		
*Loveland							Lignite		
*Newcastle							Lignite		
*Rocky Mountain							Lignite		
*North Pittsburgh							Lignite		
†Ralston	R. S. C. Co.	Golden	Shaft	Steam	Yes		Lignite		
*Murphy									
Elighton									

*These mines are at present shut down.

†These mines have been inspected and are in poor condition, but the same do not come under the mining laws.

JEFFERSON COUNTY.

The only coal veins so far known in this county are two pitching veins which are always found in close proximity to each other; a wall of about fourteen feet is generally found between the seams, which dips variably at angle of from 40 to 80 degrees, and runs through the county in nearly due north and south course, cropping out convenient to the mountains, and is found in place with the tilted rocks of the tertiary period, which have every indication of being broken off from the horizontal formation of the brown tertiary lignites, which predominates in Boulder, Weld, and other adjoining counties.

This may be determined by the fossil remains and other indications of the strata which are without any exception the same. In Weld county, where the coal measures are in place, two separate veins of coal in proximity to each other are found, the strata between them vary from ten to twenty feet, which correspond with that between the coal seams of the Mount Carbon, White Ash, Loveland, Rocky Mountain and other collieries. From a conversation had with some of the mining men of this county, I find that the opinion or theory of many is, that if they can get deep enough on this pitching vein, that the basin in its horizontal position will be found. I do not agree with this theory. From my observation during the past year I am led to believe that if it is possible to get deep enough on the coal seam, that a break-off would be found which would be far below the horizontal bed of the brown tertiary coal seams, where the measures have broken and tilted by eruption from their horizontal position, and to reach the same coal vein we would have to go beyond the broken strata, and prospect in the undisturbed measures. This coal varies somewhat in quality according to locality. In Golden it is much harder, and is superior as a steam generating coal.

An analysis of the Golden coal gave the following result:

Water	12.165
Fixed carbon	51.989
Volatile matter	31.776
Ash	3.900
Specific gravity	1.314

There are eleven mines opened in this county, but the greater part of them have been at a stand-still during the year.

DOUGLAS COUNTY MINES.

The only mining done in this county is that which is operated by James Cannon, Jr., & Co. This mine is located about four miles from Sedalia, and is reached by a branch of the Denver & Rio Grande railway. The coal vein is of a uniform width of about nine and a half feet, and pitches at an angle of eighty degrees. A shaft is down on the vein 150 feet. The hanging wall is a massive sandstone rock. This coal is much about the same quality as that of Jefferson county. It has never been worked extensively. They, however, expect to work a larger force as soon as developments are completed. During the year, 6,000 tons were sent to market.

TABLE SHOWING NUMBER OF MINES, ETC., IN LAS ANIMAS COUNTY.

NAME OF MINE.	Operators.	Postoffice address.	Kind of mine.	Power used.	Have your boilers been inspected?	Have you a map of your mine in Inspector's office?	Volume of air circulating in cubic feet per minute.	Average number of persons employed.	Quality of coal.	Thickness of seam in feet and inches.	Production of coal for year ending July 31, 1884, in tons.	Mine ventilated by	Have you two separate openings?
El Moro	C. C. & I. Co..	Pueblo	Drift...	Horse..	Yes	Yes	30,000	200	Bituminous...	8—0	292,695	Fan	Yes..
Trinidad	T. C. & O. Co..	Raton, N. M.	Drift...	Horse..	Yes	Yes	30,500	180	Bituminous..	6—6	157,571	Fan	Yes.

There are a few small openings in this county, working from four to fifteen men.

LAS ANIMAS COUNTY MINES.

EL MORO MINE, C. C. & I. CO.

This mine is situated on the Las Animas or Purgatoire river, at the terminous of the El Moro branch of the Denver & Rio Grande railway, which is eighty-six miles south from Pueblo, and 206 miles from Denver. Here the coal seam crops out at the mountain side, and is opened by two parallel drifts, which run nearly water level, and are driven in a distance of 2,500 feet at present, and are still on their onward march without a crook or curve throughout the entire distance. Double entries are laid off from main drifts 600 feet apart, at such an angle as they will run exactly on the end or butts of the coal. This angle is mostly found to be about seventy-five degrees, leaving main drifts. Some of these entries are now in a distance of over 2,000 feet. Rooms are turned off from both parallel entries at right angles, which angle puts the rooms on the true face or plane of the coal, and are thus worked to a distance of 300 feet on each side, meeting in the center of the 600-foot blocks.

The coal seam is from seven to ten feet in thickness, which lies comparatively level and is free from explosive gas or water. The quality of this coal is first-class, being a very fine bituminous of extra coking qualities. The company own a large number of coke ovens, which are located two miles southeast of the town of El Moro. Here the greater part of the coal mined is made into coke. This coal is found to contain superior qualities for smelting furnaces, for which purposes it is shipped all over the State.

Coal-cutting machines have been long since introduced in this mine, and are worked very successfully and with good satisfaction. The machines are worked by compressed air conveyed into the mine by pipes from a large compressor situated on the surface.

By the air discharged from coal-cutting machines escaping at a very low temperature (below freezing), a good effect is derived from them in lowering the temperature of the ventilating current. On my visits to this mine I found it in good condition. A ventilating current of 30,000 cubic feet per minute is circulated through the workings, which is produced by furnace power. There are very little noxious gases given off from the coal or strata, and as the coal is easily mined, but very little powder is used. Therefore the air is comparatively pure as compared with most of other mines.

TRINIDAD MINES, T. C. & C. CO.

This mine is situated five miles southward from the town of El Moro, and two miles from Trinidad, and is reached by the A. T. & S. F. R. R.

Here the coal seam crops out from the side of the mountains, which are underlaid with an extensive coal field, and is here opened by three separate openings in shape of drifts, driven into the interior of the mine, a distance over two thousand feet. They have been, however, lately connected into one main drift, with a view of reducing expense in haulage. This main drift is now under repairs at night time, in making it of a sufficient area, and is heavily timbered, so as to allow the introduction of a mine locomotive into the interior of the mine, which no doubt will be a success, and effect a decrease in the cost of haulage from the present mode, as many mules and drivers will be abandoned from main drift. The proposed method of ventilating the locomotive tunnel is that of a separate current, which will be entirely independent of the ventilation circulating through the mine.

The manager of this company is an old and knowing one in the coal business, and well understands that the cost of haulage is an item that needs close attention if we take economy into consideration.

This mine is extensively worked by the double entry system. The coal seam will average about six feet in thickness, and is a bituminous of very fine coking qualities. The greater part of the coal mined here is coked in the company's ovens, which are situated in close proximity to the mines. The ventilation is produced by a six feet diameter

Murphy fan, which is located over an air shaft four hundred feet from the main drift entrance. On my visits the ventilation was uniformly good, the amount of cubic feet in circulation, per minute, being about 30,000. The entries are carefully timbered. Coal cutting machines are also here introduced, the same being worked by a seventy-five horse power air compressor, situated on the surface.

PARK COUNTY COAL MINES.

NAME OF MINE.	Operators.	Postoffice address.	Kind of mine.	Power used.	Have boilers been inspected?	Have you a map of your mine in Inspector's office?	Mine ventilated by	Volume of air circulating in cubic feet per minute.	Average number of persons employed.	Quality of coal.	Thickness of seam in feet and inches.	Production of coal for year ending July 31, 1884, in tons.	Have you two separate openings?
Como	Union Coal Co.	Denver.....	Slope...	Steam..	Yes	Yes	Steam Jet.....	23,000	90	Semi-Bituminous	10—0	58,997	Yes..

EL PASO COUNTY COAL MINES.

NAME OF MINE.	Operators.	Postoffice Address.	Kind of Mine.	Power used.	Have your boilers been inspected?	Have you a map of your mine in Inspector's office?	Mine ventilated by	Volume of air circulating in cubic feet per minute.	Average No. of persons employed.	Quality of coal.	Thickness of seam in feet and inches.	Production of coal for year ending July 31, 1884, in tons.	Have you two separate openings?
Franceville	D &N O.R.R Co	Denver	Slope...	Steam..	Yes	Yes	Steam jet.....	15,000	80	Lignite....	8—0	36,518	Yes..

PARK COUNTY MINES.

Coal fields of a superior semi-bituminous quality are found at Garo, situated near Fairplay branch of the South Park division U. P. R. R., one hundred and four miles from Denver and ten miles from Fairplay. Extensive coal mines are opened near the town of Como, and are operated by the Union Coal Company, and are reached by a branch from the D., S. P. & P. R. R.

The coal seam throughout this county lies very irregular, and is much troubled from slips, dikes and other dislocations of the strata, which frequently change the bed of the coal seam, and, when found in place, lay at numerous angles, from 30° to 65°.

COMO MINE, NO. 1.

This mine is opened by a slope driven on the dip of the coal seam, which pitches at an angle of 45° to a distance of 800 feet in an eastern direction. Levels are driven north and south from slope, every one hundred feet. Rooms are worked on the pitch. The coal runs into chutes, from which it is loaded in cars on the main levels. On my visits I found ventilation uniformly good and well conducted; have never had any complaint from this mine. The circulation of air is caused from heat of exhaust steam, but this is a poor method of producing ventilation and should be abandoned. There is another mine at this place where a few men were engaged making developments; it was also found in fair condition when visited.

El Paso County Mines.

The only coal mining done in this county is that which is operated by the Denver & New Orleans railway company. The croppings of this coal field is found about five miles from Manitou Junction in an easterly direction, which can be traced for a distance of eighteen miles, showing that there are extensive coal fields in this county. This coal, however, has never gained much success in our markets, and is considered by many to be of an inferior quality to most of the northern lignites. This, however, is a mistake, and may be accounted for from the reason that a great deal of crop coal has been shipped to market; but most of the coal mined is from a part of the field where the covering of strata overlaying coal vein is only twenty-five to forty feet. Our lignite coals are of such nature that we find them very light, soft, loose in texture, and fragile near to the surface; more especially so where the alluvial deposits constitute the formation over the coal. Such we find to predominate in the tertiary or lignite age in many of our northern counties.

While in Fremont county in which the Cañon lignite coals are located, we find the teritary rocks in general to be well consolidated, consisting of massive and argillaceous sandstones and strong black shales. The coals are thus more confined where such a strata predominates, and the essential qualities of the coal are kept compact until it is reached by the miner. In the neighborhood of Franceville, El Paso county, we find nearly the entire strata overlying the vein to consist of a loose sand, pebbles, boulders and clay, covering a large area, forming the shape of a flat bay, commencing in proximity to the line of croppings, and extending for some distance across the coal fields towards the dip of the measures. Here the surface commences to rise rapidly, forms itself into small bluffs. Beyond this the formation is more compact and consolidated, and as the dip of the seam is toward this point, which lays very regular at about six degrees, the covering of strata will be very much heavier and more confining. So a stronger and much better quality of coal can here be expected, which no doubt will excel some of the northern lignites.

I think I can truthfully state that the coal heretofore mined in El Paso county, is probably from one of the most unfavorable openings that could have been selected.

FRANCEVILLE MINE, D. & N. O. CO.

This mine is opened by a slope which is driven on the vein to a distance of fourteen hundred feet, and pitching at an angle of six to eight degrees. The coal seam will average eight feet in thickness. The system of working this mine is very much complicated; rooms are opened from the main slope in places, and five entries are turned off, from which rooms are worked in any and all directions where a little solid coal can be found. There are no less than thirty openings leaving main slope. This system of working out too much coal in and around the hoisting slope is very wrong. True, it may give a few hundred tons of cheap coal at the time, but it will certainly add expense, like compound interest, to the future output, and the slope is in danger from caves.

There are in the old workings large caves, which are common in all mines, but unfortunately for this mine, it lays in a low part of the coal field, and the cover of strata over coal is so light that when a cave takes place it is sure to show itself on the surface by a break-off from four to six feet; therefore, it is very difficult to keep water out of the mine in time of rain storms.

It is found that very heavy thunder and rain storms predominate in that part about the months of June and July. In July of this year, a very heavy storm took place, and despite all efforts made it broke through these caves, washing hundreds of tons of sand into the workings, filling part of the slope and lower workings up to the roof a distance of nearly three hundred feet from face of slope, leaving large excavations fifty feet in diameter on the surface, which were washed right down into the mine passages. On my last visit of inspection I came out to day through these caves. The company has plowed up breastworks to turn water off, but thinking that they might fail in time of a severe storm, I recommended that strong dams should be built in the mine passages toward caves. The company, after consideration, however, informed me that it was now their intention to abandon the mine altogether, and open in a new part of the field in a short time, and before any danger of water would be expected.

TABLE SHOWING NUMBER OF MINES, ETC., IN BOULDER COUNTY.

NAME OF MINE	Operators.	Postoffice address.	Kind of mine.	Power used.	Have you safety catches on cages?	Have you a map of your mine in Inspector's office?	Mine ventilated by—	Volume of air circulating in cubic feet per minute.	Average number of persons employed	Quality of coal.	Thickness of seam in feet and inches.	Production of coal for year ending July 31, 1884, in tons.	Are there iron covers on the cages?	Have your boilers been inspected?	Have you two separate openings?
Louisvale	U. C. Co	Denver	Shaft	Steam	Yes	Yes	Furnace	12,500	125	Lignite	8—0	88,289	Yes	Yes	Yes
*Northrup	U. C. Co	Denver	Shaft	Steam	Yes		Furnace	8,700	80	Lignite	4—0	16,787	Yes	Yes	Yes
Star Mine	Star Coal Co	Denver	Shaft	Steam	Yes	Yes	Furnace	4,000	16	Lignite	5—0	15,000	Yes	Yes	Yes
Jackson	J. C. Co	Denver	Shaft	Steam	Yes	Yes	Steam jet	8,000	20	Lignite	5—0	10,000	Yes	Yes	Yes
Fox	Fox & P	Boulder	Slope	Steam		Yes	Furnace	13,000	20	Lignite	9—0	19,961		Yes	Yes
Marshall	M. C. Co	Denver	Slope	Steam	Yes	Yes	Furnace	12,000	25	Lignite	8—0	25,750		Yes	Yes
Garfield	J. J. T. & Co	Denver	Shaft	Steam	Yes	Yes	Nat. draft	4,200	15	Lignite	4—4	8,504	Yes	Yes	Yes
Stewart	G. & M	Denver	Shaft	Steam	Yes	Yes	Furnace	15,000	30	Lignite	4—4	18,366	Yes	Yes	Yes

*This mine was shut down the last six months of the year.

The mines in this county all run very slow during the Summer months.

BOULDER COUNTY MINES

WELSH MINE, UNION COAL CO.

This mine is situated at the town of Louisville. Here the coal seam is reached by a shaft at the depth of 186 feet. Thickness of the vein will average about seven feet, and is the best quality of coal yet found in this county. The workings are well laid out on the room and pillar system, the entries are worked on the butt or end of the coal, and the rooms are turned off on the face or plane, and worked to the raise. The hoisting machinery and dumping appliances are very good, and will insure a large output. The ventilation is produced by a furnace placed at the bottom of the air shaft (600 feet from hoisting shaft). Quite a quantity of water is constantly falling down from the sides of this shaft, thus reducing the temperature, and destroys the good effect of the furnace. Water in furnace shafts should be cased off into rings and made as dry as possible, for wet shafts certainly decrease the quantity of the ventilating current. On my visits I found the ventilation fair, but would recommend the total quantity to be increased. The gob in some parts of this mine is on fire; it has never been successfully cased off, thus, some air finds its way to the seat of the fire and supports combustion. If allowed to continue these fires may be the cause of much trouble.

NORTHRUP MINE, U. C. CO.

Is located near to the town of Canfield, and is opened by a shaft at a depth of 105 feet. The vein is about four feet in thickness, and is worked by room and pillar, and ventilated with a furnace. This mine was in a rather poor condition when visited, the drawing roads were badly drained. A portion of this mine had a severe crush, caused from insufficient pillars. The company, for some reason, have ceased to operate it for the last six months.

STAR MINE, S. C. CO.

Is located in the vicinity of Canfield. The vein is reached by a shaft. The mine was poorly ventilated, there being so many leakages through their stoppings. They also depended on natural ventilation. The two shafts were nearly on a level. The anemometer only registered 4,000 cubic feet per minute at the inlet. The superintendent informed me that he would immediately make some improvements.

JACKSON MINE, J. C. CO.

This mine is located in the vicinity of Canfield, and is opened by a shaft. On one of my visits to this mine I found about forty miners at work. There was no second opening, and I at once reduced the force to fifteen men, and notified the company that they would not be allowed to work more than that number until they had a second opening. They at once started operations, and had a second opening made in a few weeks. The mine was otherwise in good condition.

FOX AND PATTERSON MINE.

This mine is located about four miles from Boulder, and is reached by a branch of the Union Pacific railway. This mine when visited was found in good condition. The coal vein is about nine feet in thickness; the roads were dry and in good order. The ventilation is produced by a furnace. Only a small force is employed, therefore the Inspector does not visit so often as in larger mines.

MARSHALL MINE, M. C. CO.

Is located at Langford, four miles from Boulder. The company has, during the year, opened a new slope, and the coal seam is about eight feet in thickness. The old and new mines were visited but once, there being but a small force employed, and I was busily engaged in the larger mines. The ventilation was in a fair condition when visited. Extensive gob fires exist in some parts of the abandoned workings of the old mines, which have been undergoing combustion for many years, and are in places burned to the surface.

GARFIELD MINE, G. C. CO.

This mine is situated about one mile from Erie, and is reached by the Denver & Utah railway. The force of this mine was reduced to fifteen men during the year, there being but one opening. A second opening is now in operation, and the company contemplates putting in a good furnace.

STUART MINE, G. & M. CO.

Is situated near the town of Erie. This mine is in good order, and is the best ventilated in the county. This company has shown a good spirit, and has spared no expense in the way of improvements, so as to fully comply with the mining laws. They realize that such a system of things does not only give comfort to their miners, but is also a benefit to themselves financially.

TABLE SHOWING THE NUMBER OF MINES IN HUERFANO COUNTY

NAME OF MINE.	Operators.	Postoffice address.	Kind of mine.	Power used.	Have your boilers been inspected?	Have you a map of your mine in Inspector's office?	Mine ventilated by	Volume of air circulating in cubic feet per minute.	Average number of persons employed.	Quality of coal.	Thickness of seam in feet and inches.	Production of coal for year ending July 31, 1884, in tons.	Have you two separate openings?
Walsenburg	C. C. & I. Co...	Pueblo...	Slope...	Steam..	Yes	Yes	Furnace..	27,500	130	Semi-bitum's	6—0	63,160	Yes..
Cameron	C. C. & I. Co...	Pueblo...	Slope...	Steam..	Yes	Yes	Furnace..	19,000	50	Semi-bitum's	3—6	17,976	Yes..
*Ryus	D. D. Ryus.....	La Veta..	Drift ...	Horse..	.....	.....	.....	.....	.....	.....	.....	250	.....

*This mine is but a small opening to supply town sale.
There are are a few other small openings in this county.

HUERFANO MINES.

WALSENBURG MINE, C. C. & I. CO.

This mine is situated one and a half miles from the town of Walsenburg, and is reached by the Denver and Rio Grande railway. It is a slope opening. They work on the double entry system, and ventilate with a furnace which gives a circulation of from 26,000 to 30,000 cubic feet of air per minute. This mine is troubled with considerable water. Their pumps are run by compressed air from an air compressor situated on the surface. With a few exceptions, this mine was found in good condition, when visited.

CAMERON MINE, C. C. & I. CO.

This mine is opened by a slope in close proximity to the Walsenburg opening. The same machinery is used to hoist from both slopes. The Cameron coal seam lays under the Walsenburg vein, and is about three feet four inches in thickness, and is of a very fine quality for domestic purposes. It has been developed and put in operation during the year, and has now a second opening, and is ventilated by a furnace which puts in circulation about 20,000 cubic feet of air per minute. This mine was found to be in good condition, when visited.

Coal Production.

The following is a summary of the coal statistics of the State for a number of years:

Year.	*Tons.*
1873	69,977
1874	87,372
1875	98,838
1876	117,666
1877	160,000
1878	200,630
1879	322,732
1880	575,000
1881	706,744
1882	1,061,479

For the year ending July 31, 1884, the returns made to this office are 1,277,373 tons. There are a few small producing mines at different parts of the State that did not report. A fair estimate of their production would not exceed 75,000 tons, thus placing the total production of the State at 1,352,373 tons net, which I believe to be nearly accurate.

Recommendations.

Recommendations for further legislation on the "Act to regulate the working and inspection of coal mines." This act was passed by the last General Assembly of the State, being introduced to the House by Hon. B. F. Rockafellow, of Fremont county, who worked vigorously for its passage, and who deserved admirably the confidence that was reposed in him by the miners of Fremont and adjoining counties. Both this gentleman and all the other esteemed members who supported him in its passage, have earned the sincere thanks of every coal operator and miner in the State; for such an act will, without doubt, be in time acknowledged as existing for their mutual benefit. The act, however, being new, it could not be supposed but that when it was put in force some defects would be found and omissions that would need ultimately to be remedied.

So I will here advance, respectfully, a few recommendations for further legislation, to the careful consideration of the next General Assembly of the State, to be drafted into the Act book, with the following additional section:

"That the owner, agent or operator shall provide that bore-holes shall be kept at least twelve feet in advance of the coal face of all working places (and if necessary on both sides), when such places are known to be approaching in close proximity to an abandoned mine or part of a mine suspected to contain inflammable gases, or to be inundated with water. And all abandoned shafts, or air-shafts, slopes or cave-holes shall be securely fenced off."

From my observation, I believe that the introduction of the above section, will arrest a source of danger imminent in several districts.

Section 4, lines four and five, to be amended to read 100 cubic feet per minute per person employed, and 500 cubic feet per minute for each mule or horse.

I will respectfully refer the legislature to my article on colliery explosions and methods of working and ventilating fiery mines, etc., and hope they will invest the Inspector with discretionary powers to enforce the compulsory use of the safety lamp, and the total prohibition of blasting powder or other fiery explosives in mining coal in such mines; or at least that they will frame a law to the effect that all shots shall only be fired by some party after the force has been withdrawn from the mine. Also, I would call their attention to the special kind of air-bridges and stoppings I have in this article advocated, to be used in the mines in question. Also, I would call their special attention to the manner in which the ventilating fan should be placed, an arrangement calculated to mitigate greatly the loss of life incident to explosions.

I find that section 17 of the act does not authorize the Inspector to have his annual report printed for distribution, but only to be embodied in Secretary of State's report. This is another point to which I would like to draw your attention. It is customary in every other State for the Inspector's report to be printed in separate form for distribution amongst superintendents, and in a view that every intelligent miner should have one for asking. A mine inspector is supposed to stand at the head of his profession, and be ever ready to advise improved methods of working. Therefore, it is essential that his report shall be accessible to and easily obtainable by all parties interested in coal mining, containing, as they do, comments on defective systems and advice on the best methods.

GLOSSARY OF TECHNICAL MINING TERMS.

The following is a glossary of the terms most frequently used by miners throughout the coal mines of the State:

After-damp.—The mixture of gases remaining in a mine after an explosion of fire-damp, which may consist of carbonic acid gas, carbonic oxide, water vapor, (quickly condensed) nitrogen, oxygen, and in some cases free hydrogen, but usually consists principally of carbonic acid gas and nitrogen, and is therefore irrespirable.

Air-pipe, or Air-box.—Square boxes made of wooden boards in sections eight to sixteen feet long for the conveyance of air into tunnels, etc.; also iron pipes used for conveyance of compressed air.

Air-stack.—A ventilating chimney.

Air-way.—Any passage used for passage of air for ventilation.

Anemometer.—An instrument used for measuring the velocity of the ventilating current of air.

Arenaceous.—Sandy rocks are arenaceous when they contain a considerable percentage of sand.

Argillaceous.—Clayey. An argillaceous rock is one that contains a considerable percentage of clay, or has some of the characteristics of clay.

Band.—Interstratified rock in coal.

Bank.—A word often used among miners in referring to the coal mine.

Battery.—Any structure built of timber or plank to keep the coal in the room or prevent it from sliding down a chute, when not wanted. This is used on pitching veins.

Bear; to bear in.—Usually applied to under-holing or under-mining.

Bed.—A regular member of a stratified series deposited or formed after the underlaying, and before the overlaying rock.

Bed rock.—The solid rock underlying the soil, drift or alluvial deposit.

Bench.—A natural terrace, marking the outcrop of any stratum; a division of a coal seam separated from the remainder by a parting of slate, shale, iron pyrites, (sulphur), or other foreign matter.

Bit.—A drilling chisel.

Black-damp, choke-damp.—Carbonic acid gas=C. O_2., thus distinguished from white-damp or carbonic oxide=C. O.

Blossom.—Out crop of a coal bed or mineral deposit.

Blower.—A strong discharge of gas from a fissure.

Blow-out; to blow out.—A blast is said to blow out when it acts like a cannon, throwing out the tamping without bringing down the rock or coal.

Bony coal; bone.—Slaty or argillaccous coal or carbonaceous shale, occuring in coal seams.

Bottom.—The landing at the bottom of the shaft or slope; the lowest point of mining operations; the floor, bottom-rock, or stratum underlying a coal-bed.

Bottom lift.—The lowest or deepest lift.

Brattice.—A board or plank lining or partition in any mining passage, to confine air and force it into the working places. Its object is to keep the intake air from finding its way by a short route into the return air-way.

Brattice cloth.—A heavy cloth or canvas often covered with some water-proof material for temporarily forcing air into the face of the room or entry; also used in place of doors on entrances of rooms. They are then frequently called sheets. Such brattice cloth should be uninflammable in gaseous mines; this is, however, not so in many instances.

Bridle chains.—Safety chains to support the cage if the middle link should break. When two chains are used in a slope (instead of attaching the rope by a single chain to the draw-bar of a car) they are also called bridle chains.

Bucket.—The piston of a lifting pump, or a bucket used in sinking shafts.

Buntuns.—Timbers placed horizontally across a shaft to carry the cage guides and column pipes, also to strengthen the shaft timbering.

Butty.—A partner or comrade working with another in the coal mine.

Cage.—A platform on which men and cars are raised to the surface.

Cap, cap-piece.—A piece of plank put on the top of a prop next the roof.

Cap.—The pale bluish elongation of the flame of a safety lamp, caused by the presence of gas.

Carbonaceous.—Coaly, containing carbon of coal.

Carboniferous.—Containing or carrying coal; thus, carboniferous rocks, the carboniferous formation.

Cave, to cave in.—Falls from the roof or sides.

C. H_4.—The chemical notation for carbureted hydrogen or fire-damp.

Chain pillar.—A pillar left to protect the top of entry and air-way, and running parallel between these passages.

Charge.—The amount of powder used in one blast or shot.

Chocks.—Shanties; a building built with logs crossing one another to support the roof in a place where an extra creep of the stratum takes place.

Clanny lamp.—Safety lamp invented by Dr. Clanny. This lamp differs from the Davy in having the lower portion of the covering made of glass instead of being wholly gauze.

Clinometer.—A small pocket instrument provided with a spirit level and graduated arc for measuring the angle of dip.

Coal measures.—The carboniferous formations.

Cleavage.—The property of splitting more readily in some directions than others.

Collar.—The horizontal timber resting upon two upright or inclined legs or props for the support of the roof in an entry or air-way.

Colliery.—This term is used to denote not only the mine, but includes also all the structures that make up the plant of the surface, the mine and all its adjuncts.

Column pipe.—Cast iron pipes through which the water is conveyed from the mine pumps to the surface.

Conglomerate.—The rock formation, consisting of pebbles and fragments of various rocks cemented together.

Creep.—A squeeze or crush, forcing the pillars down into the floor, or up into the roof, which often gives the miner the impression that the floor is raising.

Crevice.—A fissure.

Crib-work.—A structure composed of horizontal frames of timber laid upon one another, built like a log cabin.

Cribbing.—Timbering a shaft with crib-work; commonly extends from the surface down to bed-rock.

Crop.—To come to the surface; an out-crop.

Cross-cut, or cross-heading.—A passage driven for ventilation through the pillar between entry and air-way.

Davy lamp.—A safety lamp invented by Sir Humphrey Davy, with a fine wire gauze enclosing the flame; 784 apertures to the square inch; framework brass.

Dead.—The air of a mine is said to be dead, or heavy, when it contains carbonic acid gas (black damp), or when the ventilation is sluggish.

Dead-work.—Work not in itself productive of enough coal to pay the cost of driving, or producing nothing at all.

Derrick.—The structure erected for a drilling or hoisting process.

Dip.—The angle of inclination of the coal seams or mineral bed or vein, measured from a horizontal line.

Door.—Doors are placed in the passage of mines to prevent the ventilating current from taking a short cut to the upcast shaft.

Door trapper.—A boy whose duty it is to open and close a mine door before and after the passage of a mine car.

Downcast.—The passage or air-way through which the ventilating current passes into a mine.

Draw.—To draw the pillars, robbing out the pillars after the room is exhausted.

Drift.—A level tunnel driven in on the bed from the surface.

Driving.—Excavating horizontal passages.

Dump.—The tipple by which the cars are dumped on the slate or slack dump.

Entry.—A level used for haulage road from which rooms are turned.

Face, or working face.—The place at which work is being done in a room, entry or air-way.

Fault.—The place where the stratum is broken by some upheaval and disappears from the continuous line.

Feeder.—A spring of water encountered in mining operations, or a small blower of gas.

Fire-board.—A board on which the fire-boss indicates by chalk marks where gas is found in different parts of the mine.

Fire-boss.—A man whose duty is to examine the workings for accumulations of explosive gas.

Fire-damp.—C. H_4, light carbureted hydrogen, an inflammable gas, explosive when mixed with air in certain proportions.

Floor.—The rock underlying the coal seam.

Free.—Coal is said to be free when it is loose and easily mined.

Gang.—A set of miners; a shift.

Gas.—Fire-damp.

Gob.—A space from which the coal has been mined, and refuse or waste left therein.

Gob fire.—Fire originating spontaneously from the heat of decomposed gob.

Guides.—Vertical timbers fastened to the buntuns to steady and guide the cage in a hoisting shaft.

Head-frame.—A structure erected over a shaft to carry the sheaves and steady the cage.

Head-gear.—That portion of the winding machinery attached to the head-frame.

Heading.—A term usually given to an entry going to the raise of the vein or cross-heading.

Hog-back.—A short anticlinal axis of limited extent.

Holding through.—Driving a passage through to make connection with another part of the working, or with those of an adjacent mine.

Incline.—A slope; any inclined plane, whether above or beneath the surface.

Indicator.—An instrument or device for indicating the position of the cage in the shaft.

Intake.—A passage by which air enters the mine or downcast.

Keeps, or keps.—Catches or rests to hold the cage when it is brought to rest at the top, or any intermediate landing.

Lagging.—Small round timbers, slabs or planks driven in behind the logs and over the collar to prevent pieces of roof from falling through.

Landing.—Any place where cars are taken off or put on a cage or slope.

Latches.—A synonym for switch applied to split rails; hinge switches.

Leg.—Props on which the collar rests in entry or other timbering.

Level.—A horizontal passage in a mine.

Lift.—The number of entries from which coal is raised in a colliery. This term is referred to the number of pump-lifts also.

Long wall.—A method of working coal where no pillars are left, and the roof is supported by packed walls, gob, etc. This method is often adopted when the coal vein does not exceed four feet.

Loose end.—A place-mining along side of a place previously worked out.

Man-hole.—A small place cut back into the side of self-acting planes, slopes or entries for the safety of the miners during the passage of the mining cars.

Man-way.—A small passage used as a traveling way for the miner; also used as an air-way for rooms on a pitching vein.

Measures.—Rocks, or a series of rocks, having some attribute in common; thus, coal measures containing coal, etc.

Narrow work.—Entries and air-ways, cross-cuts and cross-headings.

Needle.—An instrument placed in a drill-hole during the tamping of a charge, to leave on its withdrawal an opening through which the charge can be fired by a squib.

Outcrop.—That portion of a vein-bed or any stratum appearing at the surface, or occurring immediately beneath the soil, or alluvial debris.

Outlet.—A passage furnishing an outlet for air (upcast, out-take) for miners, for water, etc.

Output.—The product of a mine sent to market.

Overcast.—A passage through which the ventilating current is conveyed over an entry or airway.

Pack wall.—A wall or pillar built of gob to support the roof.

Parting.—A layer of slate or other matter dividing two benches of a coal seam.

Pillar and room.—Pillar and stall; stoop and room, etc., a method of mining.

Pillar.—A mass of coal left to support the roof.

Plane.—Usually applied to self-acting inclines, but any slope or incline on which coal is raised or lowered may be called a plane.

Plat, or plot.—A map of the surface and workings under ground, or of either.

Post.—Any upright timber; applied to timbers used for propping.

Prop.—A timber set upright, or at right angles to the dip to support the roof rock.

Regulator.—A frame with a sliding door to regulate the air passing into any part of the workings.

Rend-rock.—A variety of dynamite.

Rib.—The wall forming a side of any working place or passage; the side of a pillar.

Rob.—To take out the pillars, or to reduce by skipping the side of the pillars left to support the roof.

Safety cage.—A cage provided with an automatic safety catch.

Safety lamp.—A lamp surrounded by a wire gauze to prevent the direct contact of the flame with explosive gases.

Sand pump.—A sludger; a cylinder provided with a stem, (or other) valves lowered into a drill hole to remove the pulverized rock.

Scraper.—A tool used for cleaning out drill holes.

Sheave.—A wheel with a grooved circumference over which a rope is turned either for the transmission of power or for the winding or hauling.

Sheets.—See brattice cloth.

Siliceous.—Containing or having the characteristics of quartz.

Slack.—Small coal, or dust from coal.

Slides.—See guides.

Slope.—An inclined passage driven in the bed or vein, opening up the surface.

Soapstone.—A term incorrectly applied by the miners to an unctuous rock.

Split.—Any division or branch of the ventilating current.

Sprag.—A short billet of wood or iron used to block the wheels of a mine car in place of a brake.

Spring latch.—A spring or automatic switch.

Stopping.—A brattice, or more commonly a masonry or brick wall built in a cross-cut to confine the air to the face workings.

Stratum.—Any bed or layer; plural strata.

Stump.—A small pillar of coal left between the entry and the rooms to protect these passages.

Sump.—An excavation in the coal or rock made below the level of the entry or shaft bottom to collect the mine water; the ditches or drains empty into it and the pump draws it from thence.

Swamp.—A local depression in the coal bed in which the water collects.

Trapper.—A door tender.

Trouble.—A dislocation or fault; any irregularity in the coal seam.

Upcast.—The opening or passage through which the air is taken out of the mine.

Vein.—This term is often applied to stratified beds, but its use should be restricted to mineral deposits.

Water gauge.—An instrument for measuring the ventilating pressure; the term is also used to denote the ventilating pressure in inches.

Whim.—A horse gin used for hoisting.

White-damp.—C. O., (carbonic oxide), a gas that may be present in the after-damp, or in the gases given off by a mine fire, rarely met with in mines under other circumstances.

Winding.—Hoisting coal, etc.

QUESTIONS

PREPARED BY THE BOARD OF EXAMINERS FOR THE EXAMINATION OF APPLICANTS FOR THE OFFICE OF INSPECTOR OF COAL MINES IN THIS STATE, UNDER AUTHORITY OF AN ACT APPROVED FEBRUARY 24, 1883, TO REGULATE THE WORKING AND INSPECTION OF COAL MINES.

What is your age?

How long have you been a citizen of the United States?

Are you at present interested in the operation of coal mines, either as owner, partner, agent, manager or mining engineer?

What has been your occupation up to the present time?

How many years' practical experience have you had in the workings of the coal mines of Colorado?

State particularly how you would lay off a coal mine, so as to conform most effectually with the provisions of this act, and make a small diagram of the same, showing locality of ventilating apparatus, doors, air-splits, overcasts and direction of air currents, from inlet to outlet.

What constitutes ventilation in a coal mine, and what are the methods by which a lawful ventilation can be produced?

Name and describe the methods by which artificial ventilation can be successfully produced in mines.

What are the causes affecting the natural ventilation in mines?

Give dimensions and description of a furnace, shaft and stack required to circulate a lawful amount of air in a mine having 2,000 yards of air-ways, of thirty-six square feet

area, working 100 miners, together with the usual amount of mules and drivers; and what would be the kind and size of a fan to produce the same amount of air-current in such a mine?

How can you produce the amount of circulation in such a mine by natural ventilation?

Describe particularly the methods and instruments by which the velocity of air-currents in mines can be measured.

What is the most reliable instrument or method by which air-currents can be accurately measured?

How much should the ventilating power be increased in order to double the quantity of air passing through the mines, and how much should it be increased in order to treble it?

What are the methods of splitting the air-currents in mines, and what are the advantages to be derived from the same?

What size and width would you drive entries, gangways and rooms, and what size would you have ribs and pillars for safety and economy?

Describe the kind of a furnace you would use to ventilate mines where explosive gases are generated in large quantities, and in what part of the mine would you locate the same?

How can you increase the circulation of air in the mines without changing the ventilating apparatus?

Would you ventilate a shaft mine by using the hoisting shaft for either the up or downcast, and, if so, which would you prefer?

How would you apply the water-gauge in testing the power of a ventilating apparatus? And give a rule for calculating the same.

If the water-gauge shows one and one-half inches, and the quantity of air passing the same point is 50,000 cubic feet per minute, what is the number of horse-power producing the ventilation?

What is the size of a square air-way through which a current of 30,000 cubic feet of air is passing per minute, at a velocity of 500 lineal feet per minute, and what would be the size of two square air-ways to divide the same current into two equal splits, the velocity of each being the same?

Which of the last two arrangements would offer the least resistance, and why?

What instruments should an inspector have to enable him to discharge his duties under the mining "Act," and describe the particular use of each.

Should a syphon be placed in a mine with sufficient fall at the outlet, and on trial fail to work properly, what would be the probable cause?

To what height can water be lifted by a syphon?

What form and size would you make the hoisting shaft of a mine, in order to have the necessary room for two cageways, ladder-way and pumping and steam pipes; and what form and size should the other openings be made in order to conform to the law?

Describe some of the best forms of safety catches, and their mode of action.

What arrangements should be made in shaft and drift mines for the protection and rescue of the miners in case of an explosion?

In approaching old workings that you have no map of, what method would you adopt to insure safety to life and property?

Name the different kinds of rope used in slopes and shafts, and state what is the best kind.

What is the breaking strain of hemp, iron and steel rope? And give a rule for finding the same.

What methods would you use in firing powder blasts where there is much explosive gas present?

If from any cause a mine should take fire, and the workings become thereby endangered, how would you deal with it?

Name the most frequent causes of serious accidents in coal mines and your methods for preventing the same.

What advantage is there in piling gob against ribs and pillars?

Name and describe the various gases found in coal mines by giving their composition, specific gravity, and their effects on the miners while working in the same.

Where are these gases generally found in the mines, and how can their presence be detected previous to any serious results?

What has been your experience and observation in mines where dangerous gases are evolved?

What kind of a safety lamp would you recommend, and why?

At what depth does a fan and a furnace become equal as regards the amount of air propelled around the workings?

Make sketches showing the best methods of making and fitting timbers for shaft, slope and drift.

QUESTIONS FOR MINE MANAGERS.

The following are some of the questions selected at random, which have been prepared by examining boards for candidates for examination for a certificate of competency as mine manager:

Explain the ordinary conditions for adopting the long-wall and pillar and room working.

Draw a free hand sketch, or describe the mode you would adopt in laying out the workings of a colliery from the pit bottom, giving the dimensions and showing ventilation by arrows.

Explain difference between pillar and room and long-wall workings, more especially as relates to the ventilation, timbering and production of coal.

What is ventilation, and why is it required in mines?

Describe the method of measuring the air of mines by means of powder smoke and by an anemometer.

What is the cause of friction of air in mines?

How does friction increase or decrease?

How does splitting the air affect the quantity passing through a mine?

What is the meaning of the pressure of the air?

How does the pressure of the atmosphere affect the velocity of the mine currents?

State the rule for finding the weight of a column of air.

What is fire-damp, and what are its component parts?

What other gases besides fire-damp are met in coal mines? Give an account of the nature and properties of the various gases of coal mines.

Explain the principles of a safety lamp.

Explain the uses of the barometer and thermometer in mines?

What is a water gauge, and for what purpose is it used in mines?

Describe the best method of timbering, walling and tubing a shaft?

Describe the best method of sinking the quicksand.

Explain the action of a syphon, and its use and application in draining mines.

State the various methods of pumping water out of mines.

Write a short essay on the daily operations of a colliery in full operation.

The following again, is a list of questions put to applicants for certificates of competency as mining boss, or underground manager, by the examining board in Edinburg, Scotland:

When underground workings are approaching old wastes of which no plans have been kept, what special dangers are the men exposed to, and how would you provide against them?

State shortly the general rules as to the use of gunpowder and other explosive material in mines where inflammable gas has been noticed.

What is the requirement of the act as to the number of shafts in use at each mine, and state shortly the exceptions to it that may be allowed.

In mines where there is inflammable gas what special precautions are to be observed by the workmen, and by those in charge of the mine?

Give a short account of the requirements of the act regarding man-holes or places of refuge on underground roads.

What limitations does the act impose in the employment in mines of young persons between 12 and 16 years of age?

Explain why artificial ventilation is more reliable than natural.

Describe the different modes of producing artificial ventilation.

For an extensive but shallow working would you adopt a fan or a furnace? Give your reasons.

How do you measure the velocity of an air current, and at what velocity would you have air traveling through the workings?

Give your reasons for making air courses as large as possible. Explain the advantages of splitting the air.

Describe the barometer, and explain how it indicates atmospheric pressure. What is a water gauge, and of what use is it?

Sketch what you consider a good furnace for a pit sixty fathoms deep, with 100 men, giving its dimensions and relative position to the shaft.

Under ordinary conditions as regards gas, what quantity of air would you have circulating in a pit with 100 men, and what are the least dimensions you would have the air courses? Give observations regarding the necessity of having the air course uniformly large.

Explain the ordinary conditions for adopting the long-wall and the stoop and room working.

In a seam having a dip and rise of one in six, and the direction of the plane of the coal being to the full rise,

sketch what you consider a good form of long-wall working for it, having regard to the ventilation, direction of the drawing roads, etc.

Under the same conditions give us a sketch of a stoop and room working by which the greatest percentage of the seam can be got out.

In a four-foot seam of coal, eighty fathoms deep, what size would you make the pillars, having regard to the ultimate extraction of the greatest quantity of coal, combined with safety to the workmen.

Give a rough section showing the different seams of coal in your district.

Under ordinary conditions as regards roof and pavement, give your observations on the cost of working a four-foot seam of coal by stoop and room, and a two-foot seam by long wall, embracing the on-cast necessary in each.

Sketch what you consider the best form of a shaft one hundred fathoms deep, for an output of 300 tons a day, including ordinary provisions for pumps, and showing arrangement of slides and cages with dimensions.

Explain how you would prevent water met with near the surface from getting into the shaft.

How many gallons are there in 1,200 tons of water? And describe the general arrangement and size of pipes for lifting that quantity daily from a pit eighty fathoms deep.

Describe the class of engine best adapted to the above work, size of cylinder, stroke and strokes per minute.

Explain fully the advantages, in a deep shaft, of having a series of lifts, instead of one long lift to the surface.

Explain the action of a syphon, and its use and application in draining mines.

State the various methods you know of pumping water out of a dip working.

Describe the best kind of a boiler for the safe and economical production of steam.

Explain the forces acting on a self-acting inclined plane.

Compare the friction of ordinary tubs on tram-rails with the friction on a well-made railway.

Under the usual condition of tram-rails and tubs, what is the flattest gradient for a self-acting inclined plane, 300 fathoms long, to pass 100 tons in eight hours?

Sketch the best arrangement of it at the top.

Explain the best modes of drawing coal along a level road, or one not dipping sufficiently to take away the rope.

Explain why conical drums are necessary in deep shafts.

Whether chains, wire ropes or hemp ropes are preferable, and give your reasons.

Given the breaking strains of a rope, what is a safe working load for it?

State from your experience what is the cost of haulage underground per ton per mile?

How does it compare with the cost of a mineral railway above ground?

Give your observations on the different modes of hauling known to you, and how you think they might be improved.

Accidents frequently happen at headings where the loaded tubs are taken down with snibbles by the full tub running into the one before it, or an empty one coming up; how would you remedy this and still retain the use of snibbles?

In speaking of machinery, what is meant by horse power?

Sketch on paper, as near as you can, the following bearings of a survey: 82° northeast, 68 links; 51° southeast, 95 links; 63° northeast, 79 links; 20° northeast, 50½ links; 85° northwest, 87 links; 87° northwest, 140 links; 52° southwest, 140 links, and 48° southeast, 85 links.

Describe the compass, and explain the circumstances under which it is unreliable.

Explain what is meant by the scale of half an inch to a chain.

Describe the process of surveying under ground.

Describe how you would plot the same survey on paper, and name the instruments you would require to use.

Why is it necessary to make deductions from the measurements to the rise and dip in steep workings, and how would you find the correct measurements?

Suppose you were driving toward an old waste, which is shown only in a plan twenty years old, explain the precautions to be taken as regards the meridian.

Add together 507 tons, 13 cwts., 12 lbs.; 1,670 tons, 15 cwts., 13 lbs.; 48 tons, 14 cwts., 15 lbs., and 408 tons, 9 cwts., 17 lbs.

How much would be required to pay seventy-five men a fortnight's wages at the rate of 27s. 4½d. each week?

How many cubic feet of air will pass, per minute, through an air-way 5 by 7 feet, when the air-current is traveling at the rate of 20 yards in 15 seconds?

What weight of material will have to be raised in sinking a shaft 15 by 5½ feet and forty fathoms deep, supposing it averages 150 lbs. per cubic foot?

How many gallons of water will be pumped in an hour by an engine making 8 strokes of 7 feet each minute, the diameter of the pump being 15 inches?

How much power would it require to send 10,000 cubic feet of air per minute through an air-course having an area of 40 square feet, and how much would the power require to be increased to do it, if the area was only 20 square feet?

The following questions were prepared by the examining board of the bituminous coal fields, on the passage of the mining law of Pennsylvania, April 18, 1877, for the examination of applicants for the office of Inspector of Mines:

What is your age?

Are you a citizen of the United States?

What is your occupation?

How long have you been thus engaged?

Have you had five years' experience in the workings of the bituminous coal mines of Pennsylvania?

State particularly what opportunities you have had for obtaining a practical knowledge of the workings of mines.

Have you had any experience in mines where fire-damp or any noxious gases have been evolved to any great extent?

How would you lay out a mine to conform with the provisions of the ventilation act?

What are the most frequent causes of accidents in coal mines?

Where should the largest pillars be left, in swamps or on summits?

In the use of powder where there is fire-damp, what plan do you consider the safest?

What effect, if any, does gob heaped against the side of a pillar have on its strength?

Which requires the largest pillars, thick or thin seams of coal, all other conditions being equal?

How would you test the safety of the roof in entries and rooms?

What kind of wood, in practical mining, do you consider best for pit posts?

Name the different gases found in coal mines?

What is the composition and relative weight of carbonic acid gas (black damp), as found in coal mines; how can its presence be detected?

What percentage of carbonic acid gas in the air of a mine will extinguish the flame of a lamp; and what percentage is dangerous to life?

Mention some of the causes which produce carbonic acid gases in mines?

What is the composition and relative [explosive power] of carbureted hydrogen gas (fire-damp), as found in coal mines; and how can its presence be detected?

How is this gas produced, and where is it found in mines?

What is the appearance of the flame of the lamp or candle, when the mixture of this gas and air is near the explosive point?

Will this gas explode unmixed with air?

After explosions, is this gas dangerous to life; and is it heavier or lighter than air?

What is it called after explosion?

What are the component parts of atmospheric air, and the proportions?

What is the weight or pressure of the atmosphere at the earth's surface, nearly?

What safety lamps do you consider the best?

Give a general description of each of these lamps, and how used.

How many holes to the square inch in the gauze surrounding the lamp is considered safe?

What is the reason that the gas, when ignited in the lamp, does not pass through the gauze and ignite the gas outside the lamp?

What velocity of air current will drive the flame through the gauze?

If you were examining a mine, and the gas in your safety lamp should ignite, what would be your method of procedure?

Mention the different modes in use for the ventilation of mines?

Can natural ventilation be relied on at all times?

If so, by what plan? If not, why?

Name some of the best modes of artificial ventilation.

Does the capacity of a furnace depend upon the depth of the shaft to secure the same ventilation?

Where would you locate a furnace to be the most effective?

Where would you locate the upcast, in low or elevated positions?

What advantage, if any, is there in building a chimney on the surface at the upcast shaft?

What is the best form of a shaft or chimney for ventilating purposes?

Can you with safety use a furnace to ventilate mines where explosive gases are generated? If so, describe the kind you use?

How would you kindle a furnace situated at the highest opening, when the exterior air is at the temperature of ninety degrees and that of the mine at fifty degrees, and the current moving in the direction of the lowest opening, to prevent filling the mine with smoke?

How does a steam jet compare with a furnace as a means of ventilation, and how should it be applied?

Describe the different modes of using the fan in ventilating mines; which mode would you prefer, and why?

If you wish to double the velocity of the air current in the mine, in what proportion would you increase the capacity of the furnace, fan or other motive power?

If you consider it any advantage to split the air current in the mines, state your reasons, and the method of doing the same.

What will the volume of air per minute, passing through an opening six feet nine inches by five feet, when the anemometer shows a velocity of 105 feet per minute?

What instruments should an inspector have to enable him to discharge his duties under the ventilation act, and what is the particular use of each instrument?

How does a barometer indicate danger in a mine?

What means may be employed to ascertain the velocity of air currents in mines other than by the anemometer?

What is the cubical contents of a circular shaft whose diameter is five feet and height sixty feet?

Give a description of an approved safety catch and its action.

What test would you give to wire ropes and chain cables used in shafts and slopes?

In a mine having two divisions from the downcast to the upcast, one division being 2,000 yards long, on which is placed a regulator three feet high and four feet wide, what would be the width of a regulator of the same height placed in the other division, which is 4,000 yards long, so that the same quantity of air may pass through both openings, other conditions being the same in both divisions?

What are the dimensions of a square regulator, on the latter division, to allow the same quantity of air to pass?

COAL AND IRON DEPOSITS

OF THE

GUNNISON AND ADJOINING COUNTRY.

BY PROFESSOR J. RICHARDSON.

The coals of the Gunnison country so far as known, are of three varieties. The brown tertiary lignites, the bituminous anthracite coals of the cretaceous and sub-carboniferous periods. All are distinct and separate, and in measures only peculiar to those ages which may be determined by the fossil remains either overhanging in the roof of the coal seams, or in the floor of the same. The lignites in area cover more ground than all the other varieties combined, and are more variable in quality—some of it being entirely worthless in many places, while in others it is very superior as a steam generating coal, and is admirably adapted for domestic purposes, especially for use in heating stoves. This variety of coal has a tendency to slack when exposed to the action of the weather. It will absorb water, and when frozen or dried in warm weather, will fall down into column or slack, and then becomes worthless for domestic purposes. In area it extends from East river on the east, to the boundary of Utah on the west, and beyond. Nearly all of the counties of Montrose, Delta and Mesa, are underlaid with it, and all the portion south of the Elk range, and south of township 15, south of ranges 86 to 102 west. West of the great mesa it will extend north and beyond into Summit county. South of the Gunnison river it is found as far south as the county line and beyond, but not far. It will be found cropping between the Cimarron and Uncompahgre in the foot-hills, near the Los Pinos Indian agency. On the lower Gunnison and Grand, it has been discovered of a very superior quality near those streams and will become valuable to the settlers of that part of the country as a fuel.

From observations professionally made during the past eight years, I am led to believe that there is not less than 800 or 1,000 square miles of this coal in Gunnison and adjoining counties west, and nearly one-half of it will be found of suitable quality for use as fuel. This variety of the Gunnison coal must be used as fresh as possible from the mine, and then it will give good satisfaction for domestic purposes, or a locomotive coal. It is unfit for blacksmithing and will not coke. Its analysis shows from 45 to 60 per cent. fixed carbon, and about 10 per cent. ash; the balance of 100 parts being largely water and volatile matter, it is not considered a good gas coal. Its chief use will be for heating purposes and generating steam, and for these purposes it appears to be well adapted.

The bituminous coal, compared with the other varieties, is very scarce, being confined to less than three townships, which is the central portion of township 14, south of ranges 86, 87 and 88, west of the sixth principal meridian.

This coal has no superior in the United States for any purpose wherein coal may be used. This variety of the Gunnison coal will make excellent coke, will not slack or fall down upon exposure; all is good for some purpose. For blacksmithing it has no equal in the United States, and for fuel it is very desirable, furnishing 94 per cent. in 100 of combustible material; will average 70 per cent. of fixed carbon, and 24 volatile matter, leaving a small per cent. water and ash. This coal will not absorb water owing to its oily nature, therefore it will not fall to pieces from exposure to frost or rain, but will remain firm for years. This variety of coal can be kept in stock and handled without loss, as the fine coal is all used as well as the lumps.

Here in Gunnison it is so well known that anything we might say in its favor would seem out of place.

This little field, (little as compared with other varieties), extends from the south side of Mount Carbon, easterly and northeasterly to Crested Butte, and there stops. It does not extend south of Mount Carbon at all, beyond the mountain proper, but is found west of it on Coal creek, and the North Fork. It is found in places at Mount Carbon, and from there extends north and east through and under Mount Wheatstone. At Crested Butte it is now being mined extensively for shipment and the manufacture of coke,

although limited in area as compared with the other varieties. There will be millions upon millions of tons of this celebrated coal mined and consumed, and it will be a means of employing thousands of men in mining and handling it. As a fuel it is highly prized in Gunnison, and used extensively for domestic purposes.

The anthracite varieties, including the semi-anthracite, are very extensive in area, and lie mostly west of the 107th meridian and north of township 14, south of range 86 west, and as far north as township 11, south of same range, and extends westward about forty miles. In other words it lies north of Crested Butte, the south line of the field being near that place, and extends northward about twenty miles, and crops on the streams flowing into the Grand river, showing extensive beds on Rock creek. The western extremity of this field should be in the vicinity of the grand mesa. Beds of pure anthracite coal have been opened on Anthracite creek, near the towns of Irwin and Ruby, and in the North Fork basin; also on the Slate river, northwest of Crested Butte. The former is a true anthracite, and will carry over 90 per cent. of fixed carbon. That on Slate river is also of fine quality, and may be the same vein of coal, and if so it extends through under the mountain between Slate river and Anthracite creek, and it may extend through under the mountain, north of the head of Slate river to Rock creek. Such may be the case, and I can see no objections to such a theory, as those mountains are entirely aqueous rock, as far as known, and stratified with layers of limestone, slate, sandstone covered with trachyte and porphyry on top, which contains the precious metals. If this be true, the town of Irwin stands 1,000 feet or more above the coal measures. This variety of coal varies somewhat, too, according to locality. Wherever it has been submitted to greater heat and pressure, it is anthracite, but in every instance where the heat and pressure were less, it is a semi-anthracite, and it will vary gradually from one to the other, according to the locality. Where there are evidences of the greatest volcanic action, and where the measures are upheaved the highest, there the coal will be found the best. Already this variety of coal is being extensively mined northwest of Crested Butte, and some 150 tons or more per day are being shipped by the Denver and Rio Grande railway to Gunnison, and over the range to eastern markets.

Such is the beginning of what is soon to become one of

the leading industries of Colorado, and especially of Gunnison county. With two railroads—the Denver and Rio Grande, now running to Crested Butte and the anthracite coal mines; the South Park extended to the Baldwin mine, our coals are all good, and all of them useful for some purpose. Cannel and Albertite coal do not exist in Gunnison county. The measures that should contain these varieties do not exist in this county; but these varieties may be found in Summit county, near Green river, in the carboniferous formations. I doubt if a greater coal field exists in the United States for extent and quality than may be found on the western slope of Colorado, and extending northward into Wyoming; but it seems that it is left for Gunnison county to stand first and foremost as the grand coal center of the west, with its different varieties and grades.

The great wealth of the Gunnison country lies in its coal and iron, not in its silver and gold, as many may think; although our gold and silver mines are unequaled on the face of the earth, and are good things to have, they will in less than four years hence be only of secondary importance towards conducing to the wealth of the Gunnison country. Coal will be first, and will be king of the great Rockies. Iron will be second, silver third, and last in the list of wealth producing products will stand gold.

Much has been said and written on our coal by eastern men, who seem to think that because Gunnison county shows only the tertiary and cretaceous coal measures that we cannot possibly have true anthracite coal. It is true that the carboniferous coal measures do not exist in this county; but the sub-carboniferous and cretaceous do, and afford the best bituminous coal in the United States, which, when subjected to heat and pressure, produced the anthracite variety, and having been metamorphosed from the very best bituminous varieties, cannot possibly have any other form than that of anthracite with the different grades produced by the different conditions due to location.

More Inspectors for England.

FROM "MINING HERALD AND COLLIERY ENGINEER."

It appears that Great Britain is to have more inspectors. A deputation of miners to the home secretary some time ago, urged the necessity of an increased number of these officials, as the production of coal in that country had considerably increased during the past twelve years, while the number of inspectors remained the same. They contended that the tendency of the present day was to engage in operations which render inspection much more important than formerly, and that the pressure of duty did not enable the inspectors to give to individual cases that attention which was desirable in order to secure, as far as possible, immunity from accident. The home secretary replied that a great danger existed in appointing too many mine inspectors; that apart from an increased expense, it would tend to relieve mine owners of the responsibility connected with mine accidents, and place the lives of the working miners in the hands of a few government officials; that the latter are intended to inspect and not to manage the mines under their control. He did not, however, regard the present number of inspectors as precisely what ought to be, and reserved his decision until the matter would be brought before parliament and discussed. The subject was introduced into the house of commons by Mr. Thomas Burt, who put the claims of the miners in the strongest possible light. He showed that since 1851, when the authentic records began, more than 45,000 lives had been lost in English coal mines alone, and that during the last ten years an average of 1,227 deaths occurred annually in the coal and metal mines. In addition to these there were countless minor mishaps. The mines, he said, had increased in depth, number and extent, and it was a physical impossibility, with the present number of inspectors, to give the mines that thorough inspection which they deserve.

The home secretary subsequently consented to appoint an additional number of inspectors, and they probably will be named when parliament is not in session.

The new appointments will mark an important event in the mining history of England, and the new list of inspectors to be made out by the home secretary is being looked forward to with no ordinary interest, as it is feared by some mine owners that the character of the new officials will be somewhat different from those now in office. Mr. Burt desired that they should be taken from the working miners, to which the objection is raised that, as working men only, they would be unqualified for the position, and that should the appointment be made according to Mr. Burt's views, there is reason to believe that the new appointments would give rise to the greatest possible consequences.

Great Britain now employs fourteen inspectors and twelve assistants. The output of coal last year was 156,500,000 tons, and the number of men and boys employed in and around the coal mines is no less than 515,000. In addition there are 50,000 hands employed in metal mines. There are 3,700 or 3,800 mines altogether, or an average of 265 or 270 mines, with an aggregate production of 11,200,000 tons of coal, and over 40,000 employes, in each district.

Adding the assistants to the number of inspectors, there would be over 21,000 employes and 140 mines, with a production of 6,000,000 tons of coal under the supervision of each government official.

In the anthracite region of Pennsylvania there are about 400 collieries, employing 90,000 hands. The production last year was over 31,000,000 tons. This is an average of 15,000 employes and 67 collieries, with a production of 5,200,000 tons of coal in each inspection district. The comparison between the anthracite districts of Pennsylvania and the bituminous districts of England may be considered unfair, but in the bituminous region of Pennsylvania there are only 45,000 employes in six inspection districts, and the number of mines is 600, or an average of 100 in each district. In 1872 the production of coal in Great Britain was 123,500,000 tons, and the number of employes in and around coal mines was 418,000. This is an average of 8,820,000 tons of coal produced, and 30,000 hands employed in each district.

The figures quoted above for last year in England, include the employes and mines under the metalliferous mine law, but we have added them because they are also under the supervision of inspectors. The large districts allotted to each inspector in England, as compared with Pennsylvania, is probably due to the fact that English people place more confidence in the ability of the miners themselves, than they do in a more thorough inspection system. Hence the objections offered by the home secretary to an increased number of inspectors. It was through this view of the matter that the "certificated manager" system, now in force in England, was adopted. Such a view is also gaining ground in this country. Inspectors cannot be in constant attendance to prevent accidents. They must be prevented through the efforts of the mine boss and the employes themselves.

EFFECT OF TOO MUCH INSPECTION.

TAKEN FROM "MINING HERALD AND COLLIERY ENGINEER."

This subject frequently forms the topic for discussion among American miners, and the question is often asked, "How far is a mine inspector responsible for the casualties occurring in his district?" The duty of a mine inspector, and the object sought to be accomplished by his appointment are, in many instances, greatly misunderstood. Perhaps the principal reason why this is the case is because the majority of the workmen are not sufficiently acquainted with the mining law by which they are governed, or the limited power which an inspector has at his command, through imperfections in the law for remedying the evils which he may chance to discover while on a tour of inspection. One of the chief complaints is that an inspector fails to visit the several collieries in his district as frequently as he should. Those who make this complaint entertain the same opinion of inspectors' duties as many of the people of England seem to do, viz.: that an inspector should, in a great measure, manage, rather than inspect the workings of the numerous collieries in his district. It is, therefore, not surprising that we hear numerous complaints in this country when we hear the same objections about the actions of inspectors in a country whose experience has extended over a much longer period, and whose thought and attention is naturally directed to coal mining as its principal industry.

The late application to the home secretary of England for an increased number of inspectors, of which we made mention last week, has brought out many valuable points upon this subject. When it was brought up for discussion in the house of commons, Sir William Harcourt, the home secretary, who has devoted much time and attention to this matter, mentioned the fact that inspection was of very little use unless the precautions recommended by the

inspectors were accepted and enforced by the miners themselves. He admitted that a certain amount of inspection was necessary for security, but that it was quite impossible for the government to undertake such a constant inspection as would in itself be a guarantee of security. If it would attempt to do so, he continued, the responsibility of the managers of mines would be destroyed, and in this exists the real difficulty. To transfer any of the responsibility for the safe working of mines from the owners to the government would be in the highest degree inimical to the safety of the miners.

Experience in Belgium, where official inspection is carried to the extreme limit, has proved not only that no improvement follows, but that the death rate in well inspected English mines is lower than over-inspected Belgium.

The mine owners and workmen must be brought to realize that security can only be had by their own efforts and ability. A colliery may become dangerous in an hour; a single shot may bring with it serious results; therefore no system of inspection can guarantee a mine from a danger that may spring up in a moment. To do this would necessitate the appointment of a government manager for every mine, who would have to be there constantly.

The object of an inspector is not to act in the capacity of a manager, but to visit and inspect within his district sufficiently often to prevent laxity of discipline on the part of the mine owner, so that he may not lose sight of the responsibility resting upon him; to see that the requirements of the law are fulfilled to all intents and purposes, and to act upon the suggestion of those who are wilfully deprived of that security which the law intended they should have.

Mining is at best a dangerous occupation, nevertheless there are other things which perhaps bring about more serious results than are due to the occupation itself, as, for instance, negligence, disobedience and incompetency. To obviate these elements of danger, we think no better course can be taken than that adopted by England, viz.: the issuing of certificates of competency, not to men who are only well versed in theoretical problems, but to the most learned in practical matters and details; or, in other

words, to those who are the most competent to prevent disaster, without resorting to extravagance, without regard as to how they have become so, whether through practical experience or theoretical knowledge. This seems evident when we consider the large inspection districts of England; the dangerous mines with which they have to contend; and yet the low percentage of casualties recorded as compared with other countries.

It seems reasonable to suppose that the best preventive of accident is a high standard of knowledge among miners, coupled with the degree of cautiousness and responsibility, such as is intended that the law should provide; therefore every encouragement should be handed out to secure such a standard, and thus render the expense of a multitude of inspectors and frequent inspection unnecessary.

CANON CITY COAL COMPANY.

ROCKVALE, COLORADO, April 1, 1884.

Hereafter the following rules and regulations will be observed by all employes of this company:

1. To hoist coal, one stroke of bell; to stop, when in motion, one stroke of bell; to lower cage, two strokes of bell; to hoist men, four strokes of bell; all signals must be distinctly given.

2. The engineer will sound the whistle at 5 a. m., 6 a. m., 7 a. m., 12 m., 1 p. m. and 6 p. m. The cages will be run for the accommodation of the employes between 6 and 7 a. m. and 6 and 7 p. m.; at 7 a. m. and 7 p. m. the hoisting of coal will commence, and employes will not be permitted to ride up or down after that hour, except in case of accident. After 4 a. m. and 4 p. m. employes in parties of eight or ten may be hoisted by permission of the mine boss.

3. In no case will more than ten (10) persons be permitted to ride on a cage. Employes will not be permitted on a cage with tools, with empty or loaded pit wagons, or opposite a loaded cage. Employes having tools to send up or down will deliver them to the cager, who will provide for their transportation. The cagers at top and bottom of shaft will be held strictly responsible for the enforcement of this rule.

4. The fire boss will visit all parts of the mine before 6 a. m. and 7 p. m. daily, and mark the day and month on the face of each room and entry. He will then return to the bottom of the shaft and report to the mine boss the exact location of gas or dangerous places, if any exist; he will remain at the bottom of the shaft until all employes have entered the mine, and no one will be permitted to enter the workings until he has seen the fire boss and knows that his place is safe. If the fan stops, the mine boss will send all employes out of the mine and put out all lights.

5. Employes passing through doors in any entry or airway, and neglecting to close the same, will be discharged.

6. Any employe taking tools, timber or material of any kind, not belonging to him, will, for the first offense, be charged with the article or articles so taken and the cost of recovery; for the second offense he will be discharged from the company's employ.

7. The abuse of mules, destruction or waste of company property will not be permitted.

8. Quarrelsome or intoxicated persons will not be allowed in or about the works.

9. No person or persons except those employed therein, will be permitted to enter the engine-room or weighoffice, or to speak to engineers or weighmasters while on duty. Visitors will not be permitted to enter the mine without permission of the superintendent.

10. The company is entitled to and will demand two thousand (2,000) pounds of clean coal, free from slack, slate and dirt from every ton paid for.

11. Any employe discharged from the works will be required to leave his place in good condition, to deliver any company property in his possession to the mine boss; and, if he occupies a company house, to vacate the same before a final settlement and payment for his services will be made. Any employe neglecting or refusing to keep his place in good and safe condition, will be discharged from the works, and the cost of putting his place in proper shape deducted from any balance due.

12. A physician will be selected to the payment of whom each and every employe must contribute a stated sum monthly; this sum will be fixed and collected by the company.

13. To avoid accidents, the company will not knowingly employ inexperienced miners. Applicants are warned that there is gas in the workings, and that a misrepresentation of their knowledge of mining will entail danger on themselves and be followed by prompt discharge upon discovery. All miners are cautioned to timber their places for

their own safety. The mining boss will see that a supply of timber is kept at every working room and entry face. The company will not be responsible for any accident occurring at any working face of room or entry, nor at any other part of the mine, if caused by carelessness or neglect of the party injured.

ROBERT SAVAGE,
Superintendent.

E. G. SAVAGE,
Manager.

Approved:

JOHN MCNEIL,
State Inspector of Coal Mines.

TRINIDAD COAL AND COKING CO.

STARKVILLE, COLORADO, May 1, 1884.

Hereafter the following rules and regulations will be observed by all employes of this company:

1. Ten (10) hours will constitute a day's work, or sixty (60) hours to the week.

2. No person, except the driver, will be permitted to ride on loaded pit wagons.

3. All employes are required to report any unsafe place to the mine boss, who shall at once have the same repaired, and permit no one to enter therein until it is put in proper condition. Reckless persons, or those having no knowledge of mining, will not be permitted in the mine. The mine boss will personally examine the mine and know that all parts thereof are in safe condition.

4. Employes passing through doors in any entry or air-way, and neglecting to close the same, will be discharged.

5. Any employe taking tools, timber or material of any kind, not belonging to him, will, for the first offense, be charged with the article or articles so taken and the cost of recovery; for the second offense he will be discharged from the company's employ.

6. The abuse of mules, destruction or waste of company property, will not be permitted.

7. Quarrelsome or intoxicated persons will not be permitted in or about the works.

8. No person or persons, except those employed therein, will be permitted to enter the engine-room or

weighoffice, or to speak to engineers or weighmasters while on duty. Visitors will not be permitted to enter the mine without permission of the superintendent.

9. The company is entitled to and will demand two thousand (2,000) pounds of clean coal, free from slack, slate and dirt, for every ton paid for.

10. Any employe discharged from the works will be required to leave his place in good condition, to deliver any company property in his possession to the mine boss, and, if he occupies a company house, to vacate the same before a final settlement and payment for his services will be made. Any employe neglecting or refusing to keep his place in good and safe condition, will be discharged from the works, and the cost of putting his place in proper shape deducted from any balance due.

11. A physician will be selected, to the payment of whom each and every employe must contribute a stated sum, monthly; this sum will be fixed and collected by the company.

12. To avoid accidents, the company will not knowingly employ inexperienced miners. All miners are cautioned to timber their places for their own safety. The mining boss will see that a supply of timber is kept at every working room and entry face. The company will not be responsible for any accident occurring at any working face of room or entry, nor at any other part of the mine, if caused by carelessness or neglect of the party injured.

E. G. SAVAGE,
Superintendent.

Approved:

JOHN MCNEIL,
State Inspector of Mines.

San Pedro Coal and Coke Co.

Carthage, N. M., July 1, 1884.

Hereafter the following rules and regulations will be observed by all employes of this company:

1. To hoist trip, one stroke of bell; to stop when in motion, one stroke of bell; to lower trip, two strokes of bell; all signals must be distinctly given.

2. When there is to be work in the mine the steam whistle will sound three times; at 6 a. m. for the day shift, and at 6 p. m. for the night shift; the whistle will sound again at 7 a. m. and 7 p. m., when every employe will be expected to be at his post ready to begin work, and continue until the whistle sounds at 6 o'clock p. m. or 6 o'clock a. m. for the succeeding shift.

3. No person except the trip boss will be permitted to ride on the train, either loaded or empty, under any circumstances whatever. The trip boss will be held personally responsible for the enforcement of this rule.

4. All employes are required to report any unsafe place to the mine boss, who shall at once have the same repaired, and permit no one to enter therein until it is put in proper condition. Reckless persons, or those having no knowledge of mining, will not be permitted in the mine. The mine boss will personally examine the mine and know that all parts thereof are in safe condition. He will see that a proper supply of timber is kept at every working room and entry face.

5. Employes passing through doors in any entry or air-way, and neglecting to close the same, will be discharged.

6. Any employe taking tools, timber, or material of any kind not belonging to him, will, for the first offense, be

charged with the article or articles so taken, and the cost of recovery; for the second offense he will be discharged from the company's employ.

7. The abuse of mules, or destruction or waste of company property, will not be permitted.

8. Quarrelsome or intoxicated persons will not be permitted in or about the works.

9. No person or persons except those employed therein will be permitted to enter the engine-room, boiler-room or weighoffice, or to speak to engineers or weighmasters while on duty. Visitors will not be permitted to enter the mine without permission of the superintendent.

10. Any employe discharged from the works will be required to leave his place in good condition, to deliver any company property in his possession to the mine boss; and, if he occupies a company house, to vacate the same before a final settlement and payment for his services will be made. Any employe neglecting or refusing to keep his place in good and safe condition will be discharged from the works, and the cost of putting his place in proper shape deducted from any balance due.

11. A physician will be selected, to the payment of whom each employe must contribute a stated sum monthly. This sum will be fixed and collected by the company.

12. The company will erect a suitable school house, and a stated sum will be collected monthly from each and every employe, for the support of the school.

13. To avoid accidents, the company will not knowingly employ inexperienced miners. All miners are cautioned to timber their places for their own safety. The company will not be responsible for any accident occurring at any working face of room or entry, nor at any other part of the mine, if caused by carelessness or neglect of the party injured.

John James,
Superintendent.

Approved:

W. W. Allen,
Superintendent Fuel and Mines.

RATON COAL AND COKE CO.

BLOSSBURG, N. M., May 1, 1884.

Hereafter the following rules and regulations will be observed by all employes of this company.

1. Ten (10) hours will constitute a day's work, or sixty (60) hours to the week.

2. No person except the driver will be permitted to ride on loaded pit wagons.

3. All employes are required to report any unsafe place to the mine boss, who shall at once have the same repaired, and permit no one to enter therein until it is put in proper condition. Reckless persons, or those having no knowledge of mining, will not be permitted in the mine. The mine boss will personally examine the mine, and know that all parts thereof are in safe condition.

4. Employes passing through doors in any entry or airway, and neglecting to close the same, will be discharged.

5. Any employe taking tools, timber or material of any kind not belonging to him, will, for the first offense, be charged with the article or articles so taken and the cost of recovery; for the second offense he will be discharged from the company's employ.

6. The abuse of mules, destruction or waste of company property will not be permitted.

7. Quarrelsome or intoxicated persons will not be permitted in or about the works.

8. No person or persons, except those employed therein, will be permitted to enter the weighoffice, or speak to the weighmaster while on duty. Visitors will not be permitted to enter the mine without permission of the superintendent.

9. The company is entitled to and will demand two thousand (2,000) pounds of coal, free from slack, slate and dirt, from every ton paid for.

10. Any employe discharged from the works will be required to leave his place in good condition, to deliver any company property in his possession to the mine boss; and, if he occupies a company house, to vacate the same before a final settlement and payment for his services will be made. Any employe neglecting or refusing to keep his place in good and safe condition will be discharged from the works, and the cost of putting his place in proper shape deducted from any balance due.

11. A physician will be selected, to the payment of whom each and every employe must contribute a stated sum monthly. This sum will be fixed and collected by the company.

12. To avoid accidents the company will not knowingly employ inexperienced miners. All miners are cautioned to timber their places for their own safety. The mining boss will see that a supply of timber is kept at every working room and entry face. The company will not be responsible for any accident occurring at any working face of room or entry, nor at any other part of the mine, if caused by carelessness or neglect of the party injured.

E. L. SAVAGE,
Superintendent.

Approved:

E. G. SAVAGE,
Manager.

UNION COAL COMPANY.

Adopted for the purpose of regulating mining and other employment in and about their coal mines:

1. Every employe of this company will be required to be ready for duty when the whistle blows for work every morning, and will be expected to perform a full day's work in his respective line of employment, unless the foreman of his department orders less time to be worked. Engineers are strictly forbidden to lower any miner or underground laborer into any pit after 7 o'clock a. m., without orders from the pit-boss or person in charge of the pit-head.

2. Employes will not be allowed to ride on empty or loaded cars on any incline, slope or shaft, between the hours of 7 a. m. and 12 m., and 1 p. m. and 6 p. m., except with consent or order of pit-boss.

3. No suspension of work shall take place during working hours, except in case of actual necessity.

4. Any employe feeling aggrieved in any respect, must present his claim to the pit-boss in person. If they fail to adjust the matter in a manner satisfactory to the employe, it may be referred to the superintendent (if either party desire), whose decision, upon the hearing of both sides of the question, will be final.

5. Any employe who may have been discharged by the company, or who, with the consent of the company, may have left its service, shall receive all arrearages of pay due him at once. The company will consent to their miners leaving their service without previous notice, except under circumstances that in their judgment would indicate bad faith. All other employes must give one week's notice of their intention of leaving.

6. No person will be allowed to interfere in any manner with the employer's just right of employing, retaining and discharging from employment, any person or persons

whom the superintendent or pit-boss having charge of the mines for the time being, may consider proper; nor interfere in any way, by threats or menace, or otherwise, with the right of any employe to work, or engage to work, in any way, and upon any terms, and with whom he may think proper and best for his interests, or the benefit of his family.

7. No employe shall be permitted to fill his placy be another man without the consent of the superintendent.

8. Every employe will be paid once a month, at the regular pay day, all wages or moneys he may have earned during the last calendar month previous to such pay day, after deducting any indebtedness which such employe may owe the company, or which the company, with the consent of the employe, may assume to pay to any other person.

9. It shall be the duty of every miner working in the mines to keep his room in said mines in good order and repair; and any miner who shall wilfully, negligently or carelessly suffer his room to get out of order or repair, and who shall not, upon request, immediately put the same in repair, the company may put such room in repair at the expense of the miner in default, and may retain the amount of such expense from the next or any future payment to which such employe would be otherwise entitled, until fully reimbursed for such expense.

10. No miner who has left the employment of the company, whether voluntarily or by discharge, will be entitled to receive any arrearages of pay due him for labor performed, whether on the regular pay day or during interval preceding pay day, until he shall have put his room and roadway in perfect working order, as required by his contract with the company. All miners leaving said employment will be required to procure the certificate of the pit-boss that they have complied with the requirements of this rule as aforesaid, before making application at the company's office for final payment.

11. Any tenant of the company, upon leaving its service, whether voluntarily or by discharge, will not be entitled to receive any part of the wages due him for labor performed, until he shall have vacated the premises occupied by him (should the superintendent or other person in charge of the mines for the time being so elect), and presented the keys of the same at the office.

MINER'S CONTRACT.

This agreement, made this_____day of_____ A. D. 188__, between the Union Coal Company, of Colorado, of the first part, and_____of the second part, witnesseth: That the said party of the second part has agreed, and by these presents does agree, to enter into the employment of the said party of the first part, as a miner of coal, to commence on the_____day of_____ A. D. 188__, and continue therein until the_____day of _____A. D. 188__, and to abide by, adhere to and observe the rules and regulations hereto appended, which are made a part of this contract, and to abide by and observe all other rules and regulations promulgated from time to time by the Union Coal Company, of Colorado, with the consent of the party of the second part, for the purpose of regulating mining and other employment in and about the coal mines of the Union Coal Company, and not to be absent without leave, except in case of sickness or other unavoidable contingency that would prevent him from work; also, to keep his roadway and his room in good working order.

The said party of the second part further agrees to keep the track of his roadway clear, and to remove such irregularities in its surface as may be caused by the upheaving or swelling of the bottom of the said roadway, so that the track may at all times be in good condition for cars to pass safely over it without delay.

The said party of the first part agrees to pay the said party of the second part, for each ton of coal mined by him and delivered on pit cars at the mouth of the room where the same is mined_____cents per ton (of 2,000 pounds) for clean, merchantable lump coal.

Said first party reserves the privilege, however, of closing the mines at any time, or of reducing the number of men by discharging them, or such of them as the superintendent or person having charge of the mines for the time

being may think proper, including said second party. All payments to be made at the regular pay day, and in accordance with the rules and regulations aforesaid; and the pay day will not be later than the 26th of each month.

And it is hereby expressly agreed to and understood by the party of the second part, that should he become a tenant of the party of the first part during the term of his engagement, that in case of its termination, either by his discharge from said company's employ, or in any other way, he will vacate the premises so occupied by him as early as practicable thereafter, upon verbal notice from the company's agent or superintendent, and that he will not be entitled to receive any part of the wages due him for labor performed, should the party of the first part so elect, until the premises are vacated and the keys of the same delivered at the company's office. And the party of the second part further agrees that he will not stop work, join any "strike" or combination for the purpose of obtaining or causing the company to pay their miners or other employes an advance in wages, or pay beyond what is specified in this contract, nor will he in any way aid, abet or countenance any such "strike," combination or scheme, for any purpose whatever, during the time specified in the first clause of said contract. And if the second party shall violate any of the provisions of this contract in this regard, at any time, he shall thereby forfeit all claim for coal previously mined and not paid for, and the first party be released from liability therefor.

In witness whereof the said parties have hereunto set their hands and seals, the day and year first above written.

UNION COAL CO., OF COLORADO,

By_____

_____

Witness:

_____

(Signed in duplicate.)

APPENDIX.

AN ACT TO REGULATE THE WORKING AND INSPECTION OF COAL MINES.

INTRODUCED BY HON. B. F. ROCKAFELLOW.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. That the owner or agent of each coal mine or colliery in this State, employing ten or more men, shall make or cause to be made, within six months after the passage of this act, an accurate map or plan of the workings of such coal mine or colliery, on a scale not exceeding one hundred feet to the inch, and showing the bearings and distances of the workings, with the general inclination of the strata and any material deflection in said workings, and the boundary lines of said coal mine or colliery, which shall be kept for the use of the inspector at the office in the county where such coal mine or colliery is located, and which shall be kept up every three months, and deposit a true copy of such map or plan with the Inspector of Coal Mines, to be filed in his office; and said owner or agent shall cause, on or before the tenth day of January in every year, a statement of the workings of such coal mine during the year past from the last report to the end of the December month just preceding, to be marked on the original map or plan of the said coal mine or colliery; *Provided*, If the owner or agent of any coal mine shall neglect or refuse, or from any cause fail, for the period of one month after the time prescribed to furnish the said map or plan, as hereby required, or if the inspector shall find or have reason to believe said map or plan is inaccurate in any material part, he is hereby authorized to cause a correct map or plan of the actual workings of said coal mine to be made at the expense of the owner thereof, the cost of which shall be recoverable from said owner as other debts are recoverable by law; *Provided*, That if the map or plan claimed to be

incorrect shall prove to be correct in all material points, then aforesaid expenses shall be paid by the said inspector, and may be recovered from him in like manner.

SEC. 2. It shall not be lawful, after six months from the passage of this act, for the owner or agent of any coal mine wherein over 15,000 square yards have been excavated, to employ or permit more than fifteen persons to work therein, except in opening shafts or outlets, unless there are to every seam of coal worked, in each mine, at least two separate outlets, separated by natural strata of not less than 100 feet in breadth, by which shafts or outlets distinct means of ingress and egress are always available to the persons employed in the mine, and air-shafts in which are constructed and maintained ladder ways, shall be deemed and held to be an escape shaft within the provisions of this act, and no escape shaft shall be required; but it is not necessary for the two outlets to belong to the same mine; the second outlet need not be made until 15,000 square yards have been excavated in such mine; and to all other coal mines, whether opened and worked by shafts, slopes or drifts, two such openings or outlets must be provided within twelve months after 15,000 yards have been excavated therein; and in case such outlets are not provided, as herein stipulated, it shall not be lawful for the agent or owner of such mine to permit more than fifteen persons to work therein at any one time. In case a coal mine has but one shaft, slope or drift for the ingress or egress of the men working therein, and the owner thereof does not own suitable surface ground for another opening, he may select and appropriate any adjoining land for that purpose and for approach thereto, and shall be governed in his proceeding in appropriating said land by the provisions of law in force providing for the appropriation of private property by corporations, and such appropriation may be made whether he is a corporator or not; but no land shall be appropriated under the provisions of this act until the court is satisfied that suitable premises cannot be obtained by contract, upon reasonable terms. Escapement shafts, or other communication with a continuous mine, as aforesaid, shall be constructed in connection with every vein or strata of coal worked in such mine or colliery, as provided herein.

SEC. 3. In all cases where the human voice cannot be distinctly heard, the owner or agent shall provide and maintain a metal tube from the top to the bottom of the

slope or shaft, or telephone connection suitably adapted to the free passage of sound, through which conversation may be held between persons at the bottom and at the top of the shaft or slope, also the ordinary means of signaling to and from the top and bottom of the shaft or slope; and in the top of every shaft an approved safety gate and approved safety catch, and sufficient cover overhead on every carriage used for lowering and hoisting persons; and the said owner or agent shall see that sufficient flanges or horns are attached to the sides of the drum of every machine that is used for lowering and hoisting persons in and out of the mine; and also that adequate brakes are attached thereto; the main link attached to the swivel of the wire rope shall be made of the best quality of iron, and shall be tested by weights satisfactory to the inspector of mines of the State; and bridle chains shall be attached to the main link from the cross piece of the carriage; and no single link chain shall be used for lowering or raising persons into or out of said mine; and not more than five persons for each ton capacity of the hoisting machinery used at any coal mine shall be lowered or hoisted by the machinery at any one time.

SEC. 4. The owner or agent of every coal mine, whether shaft, slope or drift, shall provide and maintain for every such mine an amount of ventilation of not less than 100 cubic feet per minute per person employed in such mine, which shall be circulated and distributed throughout the mine in such a manner as to dilute, render harmless and repel the poisonous and noxious gases from each and every working place in the mine, and break-throughs or air-ways shall be driven as often as the inspector of mines may order at the different mines inspected by him; and all break-throughs or air-ways, except those last made near the working faces of the mine, shall be closed up and made air-tight by brattice, trap-doors, or otherwise, so that the currents of air in circulation in the mine may sweep to the interior of the mine where the persons employed in such mine are at work; and all mines governed by this statute shall be provided with artificial means of producing ventilation when necessary to produce a sufficient quantity of air, such as fanning or suction fans, exhaust steam furnaces, or other contrivances of such capacity and power as to produce and maintain an abundant supply of air; but in case a furnace shall be used for ventilating purposes, it shall be built in

such a manner as to prevent the communication of fire to any part of the works, by lining the up-cast with incombustible material for a sufficient distance up from the said furnace. All mines generating fire-damp shall be kept free from standing gas, and every working place shall be carefully examined every morning with a safety lamp by a competent person or persons before any of the workmen are allowed to enter the mine; and the person making such examination shall mark on the face of the workings the day of the month; and in all mines, whether they generate fire-damp or not, the doors used in assisting or directing the ventilation of the mine shall be so hung and adjusted that they will shut up of their own accord and cannot stand open; and the owner or agent shall employ a practical inside overseer, to be called a "mining boss," who shall keep a careful watch over the ventilating apparatus and the air-ways, traveling-way, pumps and timbers, also drainage; also shall see that the miners advance their excavations; also that all loose coal, rock and slate overhead are carefully secured against falling in or upon the traveling-ways, and that sufficient timber of suitable length and sizes is furnished for the places where they are to be used, and placed in the working places of the mines; and he shall measure the ventilation at least once a week, at the outlet and inlet, and also at or near the face of all the entries, and the measurement of air so made shall be noted on blanks furnished by the mine inspector; and on the first week day of every month the "mining boss" of each mine shall sign one of such blanks properly filled and forward the same by mail to the mine inspector, a copy of which shall be filed at the office of the coal company, subject to inspection by the miners.

SEC. 5. No person shall knowingly be employed as an engineer, or take charge of any machinery or appliances whereby men are lowered into or hoisted out of any mine, but an experienced, competent, and sober person; and no person shall ride upon a loaded wagon or cage used for hoisting purposes in any shaft or slope. No young person under twelve years of age, or woman or girl of any age, shall be permitted to enter any coal mine to work therein, nor any minor under the age of sixteen years unless he can read and write.

SEC. 6. All safety lamps used for examining coal mines shall be the property of the owner of the mine, and shall

be under the charge of the agent thereof. The term "owner" in this act shall mean the immediate proprietor, lessee, or occupier of any coal mine or colliery, or any part thereof; and the term "agent" shall mean any person having, on behalf of the owner aforesaid, the care and management of any coal mine or colliery, or any part thereof.

SEC. 7. All boilers used in generating steam in and about coal mines and collieries shall be kept in good order, and the owner or agent as aforesaid shall have said boilers examined and inspected by a competent boiler-maker or other well qualified person, as often as once every six months, and the result of every such examination shall be certified in writing to the mining inspector; and every steam boiler shall be provided with a proper steam gague [gauge], water gague [gauge], and safety valve; and all under-ground self-acting or engine planes or gangways on which coal cars are drawn and persons travel shall be provided with some proper means of signaling between the stopping places and the ends of said planes or gangways; and sufficient places of refuge at the sides of such planes or gangways shall be provided at intervals of not more than fifty feet apart; and there shall be cut in the side of every hoisting shaft, at the bottom thereof, a traveling way sufficiently high and wide to enable persons to pass the shaft in going from one side of the mine to the other without passing over or under the cage or hoisting apparatus.

SEC. 8. Whenever loss of life or serious personal injury shall occur, by reason of any explosion or of any accident whatsoever, in or about any coal mine or colliery, it shall be the duty of the owner or agent thereof to give notice to the mine inspector; and if any person is killed thereby, to the coroner of the county also, and the inspector shall immediately go to the scene of said accident and render such assistance as he may deem necessary for the safety of the men, and shall ascertain by the testimony before the coroner, or by taking other evidence, the cause of such explosion or accident, and file record thereof in his office.

SEC. 9. In all coal mines in the State, the miners employed and working therein, the owners of the land, or other person interested in the rental or royalty of any such mine, shall at all proper times have full right of access and

examinations of all scales, machinery, or apparatus, used in or about such mine; to determine the quantity of coal mined for the purpose of testing the accuracy of all such scales, machinery or apparatus, and such land owners or other persons may designate or appoint a competent person to act for them, who shall at all proper times have full right of access and examination of such scales, machinery, or apparatus, and seeing all weights and measures of coal mined, and the accounts kept of the same; but not more than one person on behalf of the land-owners or other persons interested in the rental or royalty jointly, shall have such right of access, examination and inspection of scales, weights, measures and accounts at the same time, and that such persons shall make no unnecessary interference with the use of such scales, machinery, or apparatus; and the miners employed in any mine may, from time to time, appoint two of their number to act as a committee to inspect, not oftener than once in every month, the mine and the machinery connected therewith, and to measure the ventilating current; and if the owner, agent, or manager so desires, he may accompany said miners by himself, or two or more persons whom he may appoint for that purpose. The owner, agent, or manager shall afford every necessary facility for making such inspection and measurement, but the said miners shall not in any way interrupt or impede the work going on in the mine at the time of such inspection and measurement.

SEC. 10. Any miners, workmen, or other persons who shall intentionally injure any shaft, lamps, instrument, air-course or brattice, or obstruct or throw open air-ways, or open a door and not close it again, or carry lighted pipes or matches into places that are worked by safety lamps, or handle or disturb any part of the machinery, or enter any place of the mine against caution, or who intentionally and wilfully neglects or refuses to securely prop the roof of any working place under his control, or disobey any order given in carrying out the provisions of this act, or do any other act whereby the lives or the health of persons, or the security of the mines or machinery, is endangered, shall be deemed guilty of a misdemeanor, and may be punished by fine or imprisonment at the discretion of the court.

SEC. 11. In case any owner or agent disregards the requirements of this act any court of competent jurisdiction

may, on application of the inspector, by civil action in the name of the State, enjoin or restrain the owner or agent from working or operating such mine with more than twelve miners underground at one time, until it is made to conform to the provisions of this act; and such remedy shall be cumulative, and shall not take the place of or effect any other proceedings against such owner or agent authorized by law for the matter complained of in such action.

SEC. 12. For any injury to person or property occasioned by any violation of this act, or any willful failure to comply with its provisions by any owner, lessee or operator of any coal mine or opening, a right of action against the party at fault shall accrue to the party injured for the direct damage sustained thereby, and in any case of loss of life by reason of such violation or willful failure, a right of action against the party at fault shall accrue to the widow and lineal heirs of the person whose life shall be lost, for like recovery of damages for the injury they shall have sustained.

SEC. 13. The provisions of this act shall not apply to or affect any coal mine in which not more than twelve men are employed underground at the same time; but on the application of the proprietor of or miners in any such mine, the inspector shall make or cause to be made, an inspection of such mine, and shall direct and enforce any regulations in accordance with the provisions of this act that he deems necessary for the safety and health of miners.

SEC. 14. Within four months of the date of the passage of this act, the judges of the district courts shall appoint four reputable coal miners of known experience, and practice at the time, and the governor shall appoint one mining engineer of like repute and experience and practice at the time, who shall constitute a board of five examiners, whose duty it shall be to inquire into the character and qualifications of candidates for the office of inspector of mines under the provisions of this act. The examiners first appointed in pursuance of this section shall meet in the City of Denver on the 20th day of July next, and after being duly organized, having taken and subscribed before any officer duly authorized to administer the same, the following oath, namely: We, the undersigned, do solemnly swear (or affirm) that we will perform the duties of

examiners of applicants for appointment as inspector of coal mines to the best of our abilities, and that in recommending or rejecting said applicants we will be governed by the evidence of qualifications to fill the position under the law creating the same, and not by any consideration of political or personal favors; that we will certify all whom we may find qualified according to the true intent and meaning of the act, and none others, to the best of our judgments—shall proceed to the examination of those who may present themselves as candidates for said office; and they shall certifiy to the governor the names of all such applicants as any four of the examiners shall find competent to fill the office, under the provisions of this act, which shall be filed in the office of secretary of State. The qualifications of candidates for said office of inspector of mines to be inquired into and certified by said examiners, shall be as follows, namely: They shall be citizens of the United States, of temperate habits, of good repute as men of personal integrity, shall have attained the age of thirty years, and shall have had at least one year's experience in the working of coal mines of Colorado, and five years of practical experience in the workings of coal mines in the United States, and have a practical knowledge of mining engineering, and of the different systems of working and ventilating coal mines, and of the nature and properties of the noxious and poisonous gases of mines, particularly fire-damp. The board of examiners shall receive six dollars per day, and the same mileage as is allowed to members of the legislature, to be paid out of the State treasury upon the filing of the certificates of the examining board in the office of the secretary of State, as hereinbefore provided. The governor shall, from the names so certified, appoint the person possessing the best qualifications to be inspector of coal mines, whose commission shall be for the term expiring January 1, 1887, or until his successor is appointed and confirmed by the senate. As often as vacancies in said office of inspector of mines shall occur by death, resignation or malfeasance in office, which shall be determined in the same manner as in the case of any other officer of the State government, the governor shall fill the same by appointment for the unexpired term, from the names on file in the office of the secretary of State, as hereinbefore mentioned as having passed examination. Every four years from January 1, A. D. 1883, the governor shall appoint one mining engineer as before, and shall notifiy the judges of four of the judicial

districts of the State containing coal mines, selecting them in such order as to allow each district an equal share of such appointments, each to appoint one miner, and the five so appointed shall constitute a new board of examiners, whose duties, term of service and compensation shall be the same as those provided for by this section, and from the names that may be certified by them the governor shall appoint the inspector of mines provided for in this act; nothing in this act shall be construed to prevent the reappointment of any inspector of coal mines. The inspector of coal mines shall receive for his services an annual salary of two thousand dollars, and five cents per mile mileage for all distances traveled in discharge of his official duties, to be paid quarterly by the State treasurer, and said inspector shall reside in the State and keep an office at the capitol or other building in which the offices of the State are located. Each inspector is hereby authorized to procure such instruments and chemical tests and stationery from time to time, as may be necessary to the proper discharge of his duties under this act, at the expense of the State, which shall be paid by the State treasurer upon accounts duly certified by him, and audited by the proper department of the State. All instruments, plans, books, memoranda, notes, *et cetera*, pertaining to the office, shall be the property of the State, and shall be delivered to their successors in office.

SEC. 15. The inspector of coal mines shall, before entering upon the discharge of his duties, give bond in the sum of five thousand dollars, with sureties to be approved by the judge of the district court in which he resides, conditioned for the faithful discharge of his duty, and take an oath (or affirmation) to discharge his duties impartially and with fidelity, to the best of his knowledge and ability.

SEC. 16. No person acting as a manager or agent of any coal mine, or as a mining engineer for any coal mining company, or to be interested in operating any coal mine, shall at the same time act as in inspector of coal mines under this act.

SEC. 17. The inspector of coal mines shall devote the whole of his time to the duties of his office; it shall be his duty to enter into and thoroughly examine all coal mines in this State in which more than twenty men are employed, at least once each quarter, to see that all the provisions of

this act are observed and strictly carried out, and the inspector may enter, inspect and examine any coal mine in the State, and the works and machinery belonging thereto, at all reasonable times, by night or day, but so as not to unnecessarily obstruct or impede the working of the mine, and the owner or agent of such mine is hereby required to furnish the means necessary for such entry and inspection; of which inspection the inspector shall make a record to be filed in his office, and which shall show the number of mines and development on the same during the past year, and of persons employed in and about each mine, and the extent to which the law is obeyed, the progress made in the improvement sought to be secured by the passage of this act, the number of accidents and deaths resulting from injuries received in the mines, as also statistics showing the output of coal and development made annually at each mine, with all facts concerning the production and transportation of coal to market, and other facts of public interest coming under the provisions of this act; which record shall, on or before the first Monday of November preceding the biennial sessions of the legislature, be filed in the office of the secretary of State, to be by him included in the biennial report of his department.

SEC. 18. The neglect or refusal to perform the duties required to be performed by any section of this act, or the violation of any of the provisions hereof, shall be deemed a misdemeanor, and shall, upon conviction, be punished by a fine of not less than one hundred dollars nor exceeding five hundred dollars, at the discretion of the court, and all penalties recovered under this act shall be paid into the treasury of the State.

Approved February 24, 1883.

MINING LAWS OF OHIO.

INSPECTOR OF MINES.

(AS REVISED AND AMENDED.)

SECTION 290. The inspector of mines shall be appointed by the governor, by and with the advice and consent of the senate, and shall hold his office for four years; and no person shall be appointed unless he is possessed of a competent knowledge of chemistry, geology and mineralogy, and has a practical knowledge of mining, engineering, and of the different systems of working and ventilating coal mines, and of the nature and properties of the noxious and poisonous gases of mines, particularly fire-damp.

SEC. 291. Before entering upon the discharge of the duties of the office, the inspector shall give bond to the State in the sum of five thousand dollars, with sureties, to be approved by the governor, conditioned for the faithful performance of his duties; the bond, with his oath of office, and approval of the governor indorsed thereon, shall be forthwith deposited with the secretary of State.

SEC. 292. The inspector shall give his whole time and attention to the duties of his office, and shall examine all the mines in the State as often as his other duties will permit, to see that the provisions of this chapter are obeyed; and the inspector may enter, inspect and examine any mine in the State, and the works and machinery belonging thereto, at all reasonable times, by night or by day, but so as not to unnecessarily obstruct or impede the working of the mine; and to make inquiry into the state and condition of the mine as to ventilation and general security; and the owner and agent of such mine are hereby required to furnish the means necessary for such entry and inspection, of which inspection the inspector shall make a record, noting the time and all the material circumstances; and the person having charge of any mine, whenever loss of

life occurs by accident connected with the working of such mine, or by explosion, shall give notice forthwith, by mail or otherwise, to the inspector of mines, and to the coroner of the county in which such mine is situated, who shall hold an inquest upon the body of the person or persons whose death has been caused, and inquire carefully into the cause thereof, and shall return a copy of the finding and all the testimony to the inspector.

SEC. 293. The inspector, while in office, shall not act as an agent, or as a manager, or mining engineer, or be interested in operating any mine; and he shall annually make report to the governor of his proceedings and the condition and operation of the mines of the State, enumerating all accidents in or about the same, and giving all such other information as he thinks useful and proper, and making such suggestions as he deems important as to further legislation on the subject of mining.

SEC. 294. The inspector shall have an office in the State house, in which shall be carefully kept the maps and plans of all mines in the State, and all records and correspondence, papers, and apparatus, and property pertaining to his duties, belonging to the State, and which shall be handed over to his successor in office.

SEC. 295. There shall be provided for the inspector all instruments and chemical tests necessary for the discharge of his duties under this chapter, which shall be paid for on the certificate of the inspector, and which shall belong to the State.

SEC. 296. The owner or agent of every coal mine shall make, or cause to be made, an accurate map or plan of the working of such mine, on a scale of not less than one hundred feet to the inch, showing the area mined or excavated, and the location and connection with such excavation of the mine of the lines of all adjoining lands, and the name or names of each owner or owners, so far as known, marked on each tract, a true copy of which map the owner or agent shall deposit with the inspector, and another copy of which shall be kept at the office of such mine; and the owner or agent shall, every four months thereafter, file with the inspector a statement and plan of the workings of such mine up to that date, which statement and plan shall be so

prepared as to enable the inspector to mark the same on the original map or plan herein required to be made; and in case of refusal on the part of the owner or agent to make and file the map or plan, or the addition thereto, the inspector is authorized to cause an accurate map or plan of the whole of said mine to be made, at the expense of the owner thereof, the costs of which shall be recoverable against the owner, in the name of the persons making the map or plan, which shall be made in duplicate, one copy being delivered to the inspector and the other left in the office of the mine; and he shall, on being paid the proper cost thereof, on demand of any person interested in the working of such mine, or owner of adjoining lands, furnish an accurate copy of any map or plan of the working of such mine.

SEC. 297. It is unlawful for the owner or agent of any coal mine worked by a shaft, wherein over fifteen thousand square yards have been excavated, to employ or permit any person to work therein, unless there are, to every seam of coal worked in each mine, at least two separate outlets, separated by natural strata of not less than one hundred feet in breadth, by which shafts or outlets distinct means of ingress or egress are always available to persons employed in the mine; but it is not necessary for the two outlets to belong to the same mine; the second outlet need not be made until 15,000 yards have been excavated in such mine, and to all other coal mines, whether slopes or drifts, two such openings or outlets must be provided within twelve months after 15,000 yards have been excavated therein; and in case such outlets are not provided as herein stipulated, it shall not be lawful for the agent or owner of such mine to permit more than ten persons to work therein at any one time. In case a coal mine has but one shaft, slope or drift for the ingress or egress of the men working therein, and the owner thereof does not own suitable surface ground for another opening, he may select and appropriate any adjoining land for that purpose and for approach thereto, and shall be governed in his proceeding in appropriating such land by the provisions of law in force providing for the appropriation of private property by corporations, and such appropriations may be made, whether he is a corporator or not; but no land shall be appropriated under the provisions of this chapter until the court is satisfied that suitable premises cannot be obtained by contract upon reasonable terms.

SEC. 298. The owner or agent of every coal mine, whether shaft, slope or drift, shall provide and maintain for every such mine an amount of ventilation of not less than 100 cubic feet, per minute, per person employed in such mine, which shall be circulated and distributed throughout the mine in such a manner as to dilute, render harmless and expel the poisonous and noxious gases from each and every working place in the mine, and no working place shall be driven more than one and twenty feet in advance of a break-through or air-way, and all break-throughs or air-ways, except those last made near the working faces of the mine, shall be closed up and made air-tight by brattice, trap-doors or otherwise, so that the currents of air in circulation in the mine may sweep to the interior of the mine, where the persons employed in such mine are at work; and all mines governed by the statute shall be provided with artificial means of producing ventilation, such as forcing, or suction fans, exhaust steam furnaces, or other contrivances, of such capacity and power as to produce and obtain an abundant supply of air; and all mines generating fire-damp shall be kept free from standing gas, and every working place shall be carefully examined every morning with a safety-lamp, by a competent person, or persons, before any of the workmen are allowed to enter the mine.

SEC. 299. The owner or agent of every coal mine operated by shaft, in all cases where human voice cannot be distinctly heard, shall forthwith provide and maintain a metal tube from the top to the bottom of such shaft, suitably calculated for the free passage of sound therein, so that conversations may be held between persons at the bottom and top of the shaft; and there shall also be provided an approved safety catch, and a sufficient cover overhead, on all carriages used for lowering and hoisting persons, and in the top of every shaft an improved safety gate, and an adequate brake shall be attached to every drum or machine used for lowering or raising persons in all shafts or slopes.

SEC. 300. No owner or agent of any coal mine operated by a shaft or slope shall place in charge of any engine used for lowering or hoisting out of such mine persons employed therein, any but experienced, competent and sober engineers; and no engineer in charge of such engine shall allow any person, except such as may be deputed for

that purpose by the owner or agent, to interfere with it or any part of the machinery, and no person shall interfere or in any way intimidate the engineer in the discharge of his duties; and in no case shall more than ten men ride on any cage or car at one time, and no person shall ride upon a loaded cage or car in any shaft or slope.

SEC. 301. All safety lamps used for examining coal mines, or which are used in any coal mine, shall be the property of the owner of the mine, and shall be under the charge of the agent thereof; and in all mines, whether they generate fire-damp or not, the doors used in assisting or directing the ventilation of the mine shall be so hung and adjusted that they will shut of their own accord and cannot stand open, and the mining-boss shall keep a careful watch over the ventilating apparatus and the air-ways, and he shall measure the ventilation at least once a week at the inlet and outlet, and also at or near the face of all the entries, and the measurements of air so made shall be noted on blanks furnished by the mine inspector; and on the first day of each month the mining-boss of each mine shall sign one of such blanks, properly filled with the said actual measurements, and forward the same to the mine inspector.

SEC. 302. No boy under twelve years of age shall be allowed to work in any mine, nor any minor between the ages of twelve and sixteen years, unless he can read and write, and in all cases of minors applying for work, the agent of such mine shall see that the provisions of this section are not violated.

SEC. 303. In case any coal mine does not, in appliances for the safety of the persons working therein, conform to the provisions of this chapter, or the owner or agent disregards the requirements of this chapter, any court of competent jurisdiction may, on application of the inspector, by civil action in the name of the State, enjoin or restrain the owner or agent from working or operating such mine, with more than ten miners at once, until it is made to conform to the provisions of this chapter; and such remedy shall be cumulative, and shall not take the place of or affect any other proceedings against such owner or agent authorized by law for the matter complained of in such action.

SEC. 304. When written charges of gross neglect of duty or malfeasance in office against any inspector are made

and filed with the governor, signed by not less than fifteen coal miners, or one or more operators of mines, together with a bond in the sum of five hundred dollars, payable to the State, and signed by two or more responsible freeholders, and conditioned for the payment of all costs and expenses arising from the investigation of such charges, the governor shall convene a board of examiners, to consist of two practical coal miners, one chemist, one mining engineer, and one operator, at such time and place as he deems best, giving ten days' notice to the inspector against whom the charges are made, and also to the person whose name first appears in the charges; and the board when so convened, and having been first duly sworn truly to try and decide the charges made, shall summon any witnesses so desired by either party, and examine them on oath, which may be administered by a member of the board, and depositions may be read on such examinations, as in other cases; and the board shall examine fully into the truth of such charges, and report the result of their investigation to the governor; and the board shall award the costs and expenses of such investigation against the inspector, or the persons signing the bond, according to their finding, against said inspector or in his favor, which costs and expenses shall include the compensation of such board, of five dollars per day for each member, for the time occupied in the trial, and in traveling from and to their homes; and the attorney general shall forthwith proceed to collect such costs and expenses, and pay the same into the State treasury, being in the first instance paid out of the State treasury, on the certificate of the president of such board.

SEC. 305. In all coal mines in the State, the miners employed and working therein, the owners of the land, or other persons interested in the rental or royalty of any such mine, shall at all proper times have full right of access and examination of all scales, machinery, or apparatus used in or about such mine to determine the quantity of coal mined, for the purpose of testing the accuracy and correctness of all such scales, machinery or apparatus; and such miners, land-owners, or other persons may designate or appoint a competent person to act for them, who shall, at all proper times, have full right of access and examination of such scales, machinery, or apparatus, and seeing all weights and measures of coal mined, and the accounts kept of the same; but not more than one person on behalf of the miners collectively, or one person on behalf of the land-owners or other persons interested in the rental or royalty jointly, shall have such right of access, examination and inspection of scales, weights, measures and accounts at the same time, and that such persons shall make no unnecessary interference with the use of such scales, machinery, or apparatus; and the miners employed in any mine may, from time to time, appoint two of their number to act as a committee to inspect, not oftener than once a month, the mine and the machinery connected therewith, and to measure the ventilating current; and if the owner, agent, or manager so desire, he may accompany said committee by himself or two or more persons, whom he may appoint for that purpose; the owner, agent, or manager shall afford every necessary facility for making such inspection and measurement, but the committee shall not in any way interrupt or impede the work going on in the mine at the time of such inspection and measurement; and said committee shall, within ten days after such inspection and measurement, make a correct report thereof to the inspector of mines, on blanks to be furnished by said inspector for that purpose; and if such committee make to the inspector a false or untrue report of the mines, such act shall constitute a violation of this section.

SEC. 306. The provisions of this chapter shall not apply to or affect any coal mine in which not more than ten men are employed at the same time; but on the application of the proprietor of or miners in any such mine, the inspector shall make, or cause to be made, an inspection of such mine, and shall direct and enforce any regulations in accordance with the provisions of this chapter, that he deems necessary for the safety of the health and lives of miners.

SEC. 306 (*a*). The inspector of mines may, with the approval of the governor, appoint an assistant, who shall be a practical miner of not less than five years' experience, and who shall perform such duties as may be required by the inspector, and receive a salary at the rate of twelve hundred ($1,200) dollars per annum, and the inspector may, with the consent of the governor, remove such assistant at pleasure and appoint a successor, and may allow the assistant traveling expenses out of his contingent fund.

SEC. 6871. Whoever knowingly violates any of the provisions of sections 298, 299, 300, 301, 302 and 305 of

the revised statutes, or does any act whereby the lives or health of the persons or the security of any mine and machinery are endangered, or any miner or other person employed in any mine governed by the statute, who intentionally and wilfully neglects or refuses to securely prop the roof of any working place under his control, or neglects or refuses to obey any order given by the superintendent of the mine in relation to the security of the mine in the part thereof where he is at work, and for fifteen feet back from the face of his working place, shall be fined not more than fifty dollars or imprisoned in the county jail not more than ninety days, or both.

SEC. 4374. A person owning land adjoining a mine worked for the production of coal, ore, or other mineral substance, or a person having an interest in such mine, having reason to believe that the protection of his interest in the mine, or in like minerals on his adjoining land requires it, upon making affidavit to that effect before a justice of the peace or other proper officer, may enter such mine and have an examination or survey made thereof; but such examination or survey shall not be made until one day's notice thereof is given to the parties in interest, nor at unreasonable times, but in such time and in such manner as will least interfere with the workings of the mine, if the same is being operated at the time.

SEC. 4375. When the affidavit has been made and notice given, the person in charge of such mine shall, on the application of the party giving the notice, transport by the ordinary method in use at such mine for entrance and exit, a surveying party of not more than five persons, furnish to such party a competent guide, and supply them with approved safety lamps; and for every person so transported he shall be entitled to receive, from the person requesting such survey, the sum of fifty cents, unless the shaft exceeds two hundred and fifty feet in depth, when he shall be entitled to the sum of one dollar for each person, and five dollars per day for the guide.

SEC. 4376. If the parties working or occupying such mine, sustain any damage for which compensation should be made, by reason of such examination or survey having been made at unreasonable times, or in an improper or unwarrantable manner, the person making the same, or causing the same to be made, shall be liable therefor.

SEC. 4377. The parties working or occupying such mine shall not hinder or obstruct the examination or survey, when made at a reasonable time, and in a reasonable manner, under a penalty of not less than fifty nor more than five hundred dollars for each offense, to be recovered before a court of competent jurisdiction.

SEC. 4378. The party who makes the application for the survey, may, upon the refusal of the owner or person in charge of the mine to comply with the foregoing provisions, recover judgment, as upon default, in a court of competent jurisdiction, against the owner of such mine, in such sum as such party may declare, under oath, he believes to be justly due him for coal or other mineral belonging to him, taken by the owner of such mine without his permission, and the statute of limitations shall not be operative as against such claim; but the demand and refusal to enter such mine shall be first proven to the satisfaction of the court or jury, and the refusal of the party in charge of the mine, shall be held to be the refusal of the owner.

SEC. 4379. The provisions of this chapter shall be available to any person who, on his oath, states that he is the owner or authorized agent of any owner of land which he believes contains coal, or other valuable mineral substance, within one mile of such shaft, although it do not adjoin any mine of the owner of such shaft; the affidavit required shall be sufficient if it states that the lands in which the affidavit is interested are in the vicinity of such shaft, and not more than one mile distant therefrom; and service upon any owner or superintendent of such shaft shall be sufficient.

OFFENSES AGAINST PROPERTY.

SEC. 6881. Whoever, in mining for coal and other minerals, wilfully and without lawful authority, trespasses upon the lands of another, shall be fined not more than one hundred nor less than five dollars, or imprisoned not more than ten days, or both; and any continuation of such trespass, for twenty-four hours after the commencement of any prosecution under this section, shall be deemed a separate offense, and all prosecutions hereunder shall be commenced within one year from the time the offense becomes known to any owner of the property injured.

OFFENSES AGAINST PUBLIC HEALTH.

SEC. 6925. Whoever throws or deposits, or permits to be thrown or deposited, any coal dirt, coal slack, coal screenings, or coal refuse from coal mines, or any refuse or filth from any coal oil refinery or gas works, or any whey or filthy drainage from a cheese factory, upon or into any of the rivers, lakes, ponds or streams of this State, or upon or into any place from which the same will wash into any such river, lake, pond or stream, shall be fined in any sum not more than two hundred or less than fifty dollars.

FRAUD.

SEC. 7070. Whoever sells and delivers any stone coal, except at the weights and measures prescribed by law, shall be fined not more than fifty nor less than five dollars, or imprisoned not more than thirty nor less than five days.

WEIGHTS AND MEASURES.

Sec. 443. A bushel of the respective articles hereafter mentioned shall mean the amount of weight, avoirdupois, in this section specified, viz.:

Of coke, forty pounds.

Of bituminous coal, eighty pounds.

Of cannel coal, seventy pounds.

SEC. 4444. The standard bushel of stone coal, coke and unslacked lime, shall contain twenty-six hundred and eighty-eight cubic inches; and the lawful measure for measuring such articles shall contain two bushels, and be of the following interior dimensions: Twenty-four inches diameter at the top, twenty inches at the botton, and fourteen and one-tenth inches deep.

SEC. 445. When facilities can be had, all sales of coal shall be by weight, and two thousand pounds avoirdupois, shall constitute a ton thereof; but where coal cannot be weighed, it may be sold by measurement.

SEC. 446. Whoever sells stone coal in violation of the provisions of this chapter, shall be liable to the person to whom

the coal is sold and delivered, in treble damages, to be collected in a civil action before any court of competent jurisdiction; if the defendant in such action does not reside in the county where the mine is located, service may be had upon him by a copy of the summons left at his place of business; and any judgment recovered in such case shall be a lien upon all property of the defendant in the county, from the day of service; but this section shall not apply to any person or corporation mining or selling less than fifteen thousand bushels of coal annually.

SCHOOL OF MINES.

SEC. 8435. That the trustees of the Ohio Agricultural and Mechanical College be and they are hereby required to establish in said college a school of mines and mine engineering, in which shall be provided the means for studying scientifically and experimentally the survey, opening, ventilation, care and working of mines, and said school shall be provided with complete mining laboratories for the analysis of ores, coals and other minerals, with all the necessary apparatus for testing the various ores and coals, and also with the models of the most improved machinery for ventilating and operating all the various kinds of mines with safety to the life and health of those engaged.

(8436) SEC. 2. Said trustees may require one of the professors now authorized to be employed in said institution, to give instruction in the most improved and successful methods of opening and operating and surveying and inspecting mines, and in the methods of testing and analyzing coals and other minerals, especially those found in the State of Ohio. It shall also be the duty of such professor to register all experiments made in testing the properties of coals and other minerals, and such results shall be published in the annual reports of said trustees. It shall also be the duty of said professor to preserve in a cabinet, suitably arranged for ready reference and examination, suitably connected with this school of mines, samples of the specimens from the various mines of the State, which may be sent for analysis, with the names of the mines and their localities in the counties from which they were sent, and the analysis and a statement of the properties attached. It shall also be his duty to furnish analysis of all the minerals found in the State, and sent to him for that purpose by residents of this State.

(8437) SEC. 3. There is hereby appropriated out of the general revenue fund the sum of four thousand five hundred dollars, to be expended in providing apparatus, equipments, cabinets, etc., as mentioned in the first and second sections of this act.

SEC. 4. This act to take effect and be in force from and after its passage.

PENNSYLVANIA MINING LAW.

AN ACT PROVIDING THE MEANS FOR SECURING THE HEALTH AND SAFETY OF PERSONS EMPLOYED IN THE BITUMINOUS COAL MINES OF PENNSYLVANIA.

SECTION 1. *Be it enacted:* That the owner or agent of every bituminous coal mine or colliery shall make, or cause to be made, within six months after the passage of this act, an accurate map or plan of the working of such coal mine or colliery on a scale not exceeding one hundred feet to the square inch, and showing the bearing and distances, which shall be kept for the use of the inspector in the office of the mine of said coal mine or colliery; and said owner or agent shall cause, on or before the 10th of January in every year, a plan of the progress of the working of such coal mine during the year past, to be marked on original map or plan of said coal mine or colliery; and the inspector shall have the right at all times to have possession of any such map or plan at the mines, to draw a copy therefrom for his own convenience; *Provided*, If the owner or agent of any coal mine shall neglect or refuse, or from any cause fail, for the period of two months after the time prescribed, to furnish the map or plan as hereby required; or if the inspector shall find or have reason to believe that any map or plan of any coal mine, furnished in pursuance of the provisions of this act, is materially inaccurate or imperfect, he is hereby authorized to cause a correct map or plan of the actual workings of said coal mine to be made at the expense of the owner thereof, the cost of which shall be recoverable from said owner as other debts are recoverable by law; *Provided*, That if the map or plan which he claimed to be incorrect shall prove to have been correct, then aforesaid expenses shall be paid by the said inspector, and may be recovered from him in like manner.

SEC. 2. It shall not be lawful, after six months from the passage of this act, for the owner or agent of any bitu-

minous coal mine to employ any person at work within said coal mine, or permit any person to be in said coal mine for the purpose of working therein, unless they are in communication with at least two openings, separated by natural strata of not less than one hundred and fifty feet in breadth, if the mine be worked by shaft or slope, and if not less than twenty-four feet if the mine be worked by drift; *Provided*, If the mine be worked by drift, two openings, inclusive of air shaft, shall only be required, if the air shaft can be used for ingress and egress in case of emergency; that not more than twenty persons shall be employed in the mine at any one time after the expiration of the six months until the second opening shall be reached and made available; and in case of furnace ventilation being used before the second opening is reached, the furnace shall not be placed within forty feet of the foot of the shaft, and shall be well secured from danger from fire by brick or stone walls of sufficient thickness, and the mine while being driven for making and perfecting a second opening; the owner or agent shall provide and maintain a metal tube from the top to the bottom of the slope or shaft, suitably adapted to the free passage of sound, through which conversation may be held between persons at the bottom and at the top of the shaft or slope; also the ordinary means of signaling to and from the top and bottom of the shaft or slope, and an approved safety catch and sufficient cover overhead on every carriage used for lowering and hoisting persons; and the said owner or agent shall see that sufficient flanges or horns are attached to the sides of the drum of every machine that is used for lowering and hoisting persons in and out of the mine, and also that adequate brakes are attached thereto; the main link attached to the swivel of the wire rope shall be made of the best quality of iron, and shall be tested by weights or otherwise, satisfactory to the inspector of mines of the district and bridle chains shall be attached to the main link from the cross pieces of the carriage, and no single link chain shall be used for lowering or raising persons into or out of the said mine, and not more than six persons shall be lowered or hoisted by the machinery at one time, and only sober, competent and experienced engineers shall be employed.

SEC. 3. When a second opening is made, one opening shall be set apart exclusively for purposes of ingress and egress, and shall not be clogged or obstructed with machinery, pumps, or currents of heated air or steam; if the opening is a shaft, it shall be fitted with safe and convenient stairs, at an angle of not more than sixty degrees descent, and with landings at easy and convenient distances; all water coming from the surface or out of the strata in the shaft shall be conducted by rings or otherwise to be prevented from falling down the shaft so as to wet persons who are ascending and descending the stairway of the shaft; if the opening is a slope, it shall be provided with safe and available traveling-ways.

SEC. 4. The owner or agent of every bituminous coal mine, whether shaft, slope, or drift, shall within six months after the passage of this act provide and thereafter maintain for every such mine ample means of ventilation, affording one hundred cubic feet per minute for each and every person employed in said mine, which shall be circulated around the main headings and cross-headings to an extent that will dilute, carry off, and render harmless the noxious gases generated therein; and all mines generating fire-damp shall be kept free of standing gas, and every working-place shall be carefully examined every morning, with a safety lamp, by a competent person before any workmen are allowed to enter.

SEC. 5. In order to better secure the proper ventilation of every coal mine, and promote the health and safety of the persons employed therein, the owner or agent shall employ a competent and practical inside overseer, to be called mining boss, who shall keep a careful watch over the ventilating apparatus, the air-ways, traveling-ways, pumps and pump-timbers, and drainage; and shall see that, as the miners advance their excavations, all loose coal, slate and rock overhead are carefully secured against falling in or upon the traveling-ways, and that sufficient timber is furnished, of suitable lengths and sizes for the places where they are to be used, and placed in the working-places of the miners; and it shall also be the duty of the mining boss to measure the current of air at least once a week, at the inlet and outlet, and at or near the face of the headings, and keep a record of such measurement, and report the same to the inspector of his district once in every month. The safety lamps used for examining mines, or which may be used in working therein, shall be furnished by and be the property of the owners of said mines, and shall be in

charge of the agent of such mine; and in all mines generating explosive gases, the doors used in assisting or directing the ventilation of the mines shall be so hung and adjusted that they will close themselves, or be supplied with springs and pulleys so that they cannot be left standing open; and bore-holes shall be kept not less than twelve feet in advance of the face of working place, and, when necessary, on the sides, if the same is driven towards and in dangerous proximity to an abandoned mine, or part of a mine, suspected of containing inflammable gases, or which is inundated with water.

SEC. 6. Any miners, workmen or other persons who shall intentionally injure any shaft, lamp, instrument, air-course or brattice, or obstruct or throw open air-ways, or carry lighted pipes or matches into places that are worked by safety-lamps; or handle or disturb any part of the machinery; or open a door and not close it again; or enter any place of a mine against caution; or disobey any order given in carrying out the provisions of this act; or do any other act whereby the lives or health of persons, or the security of the mines or machinery are endangered, shall be deemed guilty of a misdemeamor, and may be punished in the manner provided in the sixteenth section of this act. All machinery about the mines shall be properly fenced off, and the top of each shaft and the entrance of every abandoned slope and air or other shaft shall be securely fenced off; and there shall be a cut in the side of every hoisting shaft at the bottom thereof, and a traveling-way sufficiently high and wide to enable persons to pass the shaft in going from one side of the mine to the other without passing over or under the cage of the hoisting apparatus.

SEC. 7. If any person, firm or corporation is, or hereafter shall be, seized, in his or their own right, of coal lands, and it shall not be practicable to comply with the requirements of this act in regard to drainage and ventilation by means of openings on his or their own land, and the same can be done by means of openings on adjacent lands, he or they may apply, by petition, to the court of quarter sessions of the proper county, after ten days' notice to the owners, their agent or attorney, setting forth the facts, under oath or affirmation, particularly describing the place or places where such opening or openings can be made, and that he or they cannot agree with the owner or owners of the land

as to the amount to be paid for the privilege of making such opening or openings; hereupon the said court shall appoint three disinterested and competent citizens of the county to view the grounds designated, and lay out from the point or points mentioned in such petition a passage or passages, for air and water, not more than sixteen feet in diameter, by the shortest and most convenient route to the coal of such person, firm or corporation, preferring in all instances an opening through the coal strata where the seam is practicable; the said viewers shall, at the same time, assess the damages to be paid by the petitioner or petitioners to the owner or owners of such land for the privilege of making said openings, which damage shall be fully paid before such opening is made; it shall be the duty of said viewers to give notice by at least three written or printed hand-bills, posted on the premises at least five days prior to the time of meeting, to attend to the duties of their appointment, setting forth distinctly the time, place and object of their meeting, and also to give personal notice to the parties, their agents and attorneys, where it can be done, and shall, within thirty days after their appointment, make report of their proceedings to said court, stating the amount of damages awarded, accompanied by a map or plan of said openings; and if no appeal be taken to said court within ten days after notice to the opposite party in interest of the filing thereof, it shall be marked confirmed by the clerk, and the petitioner or petitioners may proceed to make said opening or openings; the pay of the viewers and other costs shall be the same as in road cases, and shall be paid by the petitioner or petitioners.

SEC. 8. As soon as practicable after the passage of this act, the persons exercising the office of presiding judge of each of the several courts of common pleas in the fifth, tenth and fourth judicial districts, shall appoint one reputable miner of known experience and in practice at the time, (in the fifth district, the president, judge of the court of common pleas number one, shall make said appointment), and the governor shall appoint two mining engineers of like repute and experience and practice at the time, who shall constitute a board of five examiners, whose duty it shall be to inquire into the character and qualifications of candidates for the office of inspector of mines under the provisions of this act.

The examiners first appointed, in pursuance of this sec-

tion, shall meet in the city of Pittsburgh on the fifteenth day of May next, and, after being duly organized, having taken and subscribed, before any officer authorized to administer the same, the following oath, namely:

"We, the undersigned, do solemnly swear (or affirm) that we will perform the duties of examiners of applicants for appointment as inspector of bituminous coal mines to the best of our abilities, and that in recommending or rejecting said applicants we will be governed by the evidence of qualification to fill the position under the law creating the same, and not by any consideration of political or other personal favor; that we will certify all whom we may find qualified according to the true intent and meaning of the act, and none others, to the best of our judgment—shall proceed to the examination of those who may present themselves as candidates for said office; and they shall certifiy to the governor the names of all such applicants as they shall find competent to fill the office, under the provisions of this act, which names, with the certificate and the oath of the examiners, shall be mailed to the secretary of the Commonwealth, to be filed in his office, and shall be valid when recommended by four of the examining board."

The qualifications of candidates for said office of inspector of mines to be inquired into and certified by said examiners, shall be as follows:

They shall be citizens of the United States, of temperate habits, of good repute as men of personal integrity, shall have attained the age of thirty years, and shall have had at least five years' experience in the workings of the bituminous coal mines of Pennsylvania, and, upon the examination, they shall give evidence of such theoretical as well as practical knowledge of the working of coal mines and noxious gases as will satisfy the examiners of their capability and fitness for the performance of the duties imposed upon inspectors of mines by the provisions of this act. The board of examiners shall, also, at their said meeting, divide the bituminous coal counties of the State into three inspection districts, as nearly equal in regard to the labor to be performed as possible, taking into consideration the number of mines and extent of territory; at every subsequent calling of the board of examiners this division may be revised as experience may prove to be advisable. The

board of examiners shall each receive five dollars per day, and all necessary expenses to be paid out of the State treasury upon the filing of the certificates of the examining board in the office of the secretary of the Commonwealth, as hereinbefore provided.

The governor shall, from the names so certified, appoint one person to be inspector of mines for each district, as fixed by the examiners in pursuance of this act, whose commission shall be for four years, to be computed from the fifteenth day of May next. As often as vacancies occur by death, resignation or otherwise, in said office of inspctor of mines, the governor shall fill the same by appointment for the unexpired term, from the names on file in the office of the secretary of the Commonwealth, until the number shall be exhausted; and whenever this shall occur the governor shall cause the aforesaid board of examiners to meet, who shall examine persons that may present themselves for the vacant office of inspector, in the same manner as herein provided, and the board of examiners shall certify to the governor one person to be commissioned by him for the office of inspector for the unexpired term, and any vacancies that may occur in the examining board shall be filled in the district where the vacancy occurred. And every four years the governor shall appoint two mining engineers as before, and shall notify the persons exercising the office of presiding judge of the courts of common pleas of three of the judicial districts of the State, containing bituminous coal mines, selecting them in such order as to allow each district an equal share of such appointments, each to appoint one miner, and the five so appointed shall constitute a new board of examiners, whose duties, term of service and compensation, and vacancies that may happen, shall be the same as those first provided for by this section, and from the names that may be certified by them the governor shall appoint the inspectors provided for in this act. Nothing in this act shall be construed to prevent the reappointment of any inspector of bituminous mines. The inspectors of mines shall each receive for their services an annual salary of two thousand dollars, to be paid quarterly by the State treasurer, and they shall each reside in the district for which they shall be appointed. Each inspector is hereby authorized to procure such instruments and chemical tests and stationery, from time to time, as may be necessary to the proper discharge of his duties under this act, at the

expense of the State, which shall be paid by the State treasurer, upon accounts duly certified by him and audited by the proper department of the State. All instruments, plans, book memoranda, notes, *et cetera*, pertaining to the office, shall be the property of the State, and shall be delivered to their successors in office.

SEC. 9. Each inspector of bituminous coal mines shall, before entering upon the discharge of his duties, give bond in the sum of five thousand dollars, with sureties to be approved by the presiding judge of the district in which he resides, conditioned for the faithful discharge of his duty, and take an oath (or affirmation) to discharge his duties impartially and with fidelity, to the best of his knowledge and ability.

SEC. 10. No person who shall act as a manager or agent of any coal mine, or as a mining engineer, or be interested in operating any coal mine, shall at the same time act as an inspector of coal mines under this act.

SEC. 11. For any injury to person or property occasioned by any violation of this act, or any wilful failure to comply with its provisions by any owner, lessee or operator of any coal mine or opening, a right of action against the party at fault shall accrue to the party injured for the direct damages sustained thereby; and in any case of loss of life by reason of such violation or wilful failure, a right of action against the party at fault shall accrue to the widow and lineal heirs of the person whose life shall be lost, for like recovery of damages for the injury they shall have sustained.

SEC. 12. The inspectors of bituminous coal mines shall each devote the whole of his time to the duties of his office; it shall be his duty to examine the mines in his district as often as possible, to see that all the provisions of this act are observed and strictly carried out, and he shall make a record of all examinations of mines, showing the condition in which he finds them, the number of mines in his district, the number of persons employed in and about each mine, the extent to which the law is obeyed, the progress made in the improvement sought to be secured by the passage of this act, the number of accidents and deaths resulting from injuries received in the mines, and all other facts of public interest concerning the condition and progress of mining in

his district, which record shall, on or before the first Monday of each month, together with all matters and things furnished him in accordance with the provisions of this act, be filed in the office of the secretary of internal affairs, to be by him recorded and included in the annual report of his department; he shall also, from the time of his commission, make strict and careful inquiry and examination into the condition of the ventilation and drainage of the mines.

SEC. 13. That the inspectors may be enabled to perform the duties herein imposed upon them, they shall have the right at all times to enter any bituminous coal mine to make examination, or obtain information; they shall notify the owners, lessees or agents immediately of the discovery of any violation of this act, and of the penalty imposed thereby for such violations, and in case of such notice being disregarded for the space of ten days, they shall institute a prosecution against the owner, owners, agent or lessee of the mine, under the provisions of section sixteen of this act. In any case, however, where, in the judgment of the inspector of either district, delay may jeopardize life or limb, he shall at once notify the inspectors of the other districts, whereupon they shall at once proceed to the mine or colliery where the danger exists, and examine into the matter, and if, after full investigation thereof, they shall be agreed in the opinion that there is immediate danger, they shall apply, in the name of the Commonwealth to the court of common pleas in the county in which the mine may be located, for an injunction to suspend all work in and about such mine or colliery; whereupon said court, if the cause appear to be sufficient, after hearing the parties and their evidence as in like cases, shall issue their writ to restrain the working of said mine or colliery until all cause of danger is removed; and the cost of said proceedings, including the charges of attorney prosecuting said application, shall be borne by the owner of the mine or colliery; *Provided*, That no fee exceeding the sum of twenty-five dollars be taxed in any one case for the attorney prosecuting such case; *Provided, further*, That if said court shall find the cause not sufficient, then the case shall be dismissed and the cost shall be bore by the inspector instituting the proceeding, or the county, in the discretion of the court.

SEC. 14. Whenever, by reason of any explosion or other accident in any bituminous coal mine or the machin-

ery connected therewith, loss of life or serious personal injury shall occur, it shall be the duty of the person having charge of such mine or colliery, to give notice thereof forthwith to the inspector of the district, and if any person is killed thereby, to the coroner of the county, who shall give due notice of the inquest to be held. It shall be the duty of the inspector, upon being notified as herein provided, to immediately repair to the scene of the accident and make such suggestions as may appear necessary to secure the future safety of the men; and if the results of the explosion do not require an investigation by the coroner, he shall proceed to investigate and ascertain the cause of the explosion or accident, and make a record thereof, which he shall file as provided for; and to enable him to make the investigation he shall have power to compel the attendance of persons to testify, and administer oaths or affirmations; the costs of such investigation shall be paid by the county in which the accident occurred, in the same manner as costs of inquests held by the coroners or justices of the peace are paid.

SEC. 15. The court of common pleas of any county, in the proper district, upon a petition signed by not less than fifteen reputable citizens, not less than five of whom shall be miners, owners, or lessees of mines, and with the affidavit of one or more of said petitioners attached, setting forth that any inspector of mines neglects his duties, or is incompetent, or that he is guilty of malfeasance in office, shall issue a citation in the name of the Commonwealth, to the said inspector, to appear on not less than fifteen days' notice, upon a day fixed before said court, at which time the court shall proceed to inquire into and investigate the allegations of the petitioners. If the court find that the said inspector is neglectful of his duties, or is incompetent to perform the duties of his office, or that he is guilty of malfeasance in office, the court shall certify the same to the governor, who shall declare the office of said inspector vacant, and proceed in compliance with the provisions of this act to supply the vacancy. The cost of said investigation shall, if the charges are sustained, be imposed upon the inspector, but if the charges are not sustained they shall be imposed upon the petitioners.

SEC. 16. The neglect or refusal to perform the duties required to be performed by any section of this act, by the

parties therein required to perform them, or the violation of any of the provisions or requirements hereof, shall be deemed a misdemeanor, and shall, upon conviction, be punished by a fine of not less than two hundred dollars nor not exceeding five hundred dollars, at the discretion of the court; and all penalties recovered under this act shall be paid into the treasury of the State.

SEC. 17. The inspector shall exercise a sound discretion in the enforcement of the provisions of this act, and should the operator or owner be dissatisfied with any decision at which the inspector may arrive, it shall and may be lawful for such operator or owner to apply by petition to the court of quarter sessions of the county wherein such mine is located, and said court shall thereupon appoint three reputable, competent and disinterested persons, whose duty it shall be to forthwith examine such mines and hear the proofs and allegations of the inspectors and operators or owner, and make such report under oath, to court, of the facts as they exist, together with their opinion thereon; and if said report sustains the decisions of the inspector, then the party making application to court shall pay the costs of such proceedings, and if the report is against such decision, then the inspector shall pay such costs unless the court order otherwise. The report of said board shall become absolute, unless exceptions thereto shall be filed within ten days after notice of the filing thereof to the owner, operator or inspector, and if exceptions are filed, the court shall hear and determine the same and the decision shall be final and conclusive.

SEC. 18. The provisions of this act shall not apply to any mine where ten men or a less number are employed, or to any mine which does not generate fire-damp, black-damp, or other dangerous or noxious gases.

SEC. 19. All laws or parts of laws inconsistent with any of the provisions of this act, are hereby repealed.

AN ACT to amend an act entitled "An act to provide the means for securing the health and safety of persons employed in the bituminous coal mines of Pennsylvania."

SECTION 1. *Be it enacted, etc.:* That the last clause of the eighteenth section of the act of the General Assembly,

entitled, "An act to provide the means for securing the health and safety of persons employed in the bituminous coal mines of Pennsylvania," approved the eighteenth day of April, Anno Domini one thousand eight hundred and seventy-seven. After the word "employed," in the second line of said section, which is as follows: "Or to any mine which does not generate fire-damp, black-damp, or other dangerous or noxious gases," is hereby repealed.

ABSTRACT OF BRITISH MINING LAW.

APPLICATION OF ACT—INSPECTORS—MANAGERS—RESTRICTIONS AS TO EMPLOYMENT UNDER GROUND—RESTRICTIONS AS TO EMPLOYMENT ABOVE GROUND—WHO MAY BE EMPLOYED ABOUT AN ENGINE—PENALTY FOR MISREPRESENTATION OF AGE—WAGES NOT TO BE PAID IN PUBLIC HOUSES—WEIGHING—PROHIBITION OF SINGLE SHAFTS—FENCING ABANDONED MINES—GENERAL RULES—SPECIAL RULES—DANGEROUS PRACTICES NOT EXPRESSLY PROHIBITED—PENALTIES—MISCELLANEOUS—REGISTER, RETURNS, PLANS, ABANDONMENT OF MINES, NOTICES, CORONERS' INQUESTS—EXEMPTIONS—THIN SEAM MINE, SATURDAY HALF-HOLIDAY, IRELAND, WEIGHING PROVISIONS, SINGLE SHAFTS,—GENERAL RULES.

1. The act applies to coal mines, mines of stratified ironstone, mines of shale, mines of fire-clay.

2. *Definition of mine.*—The term "mine" includes every shaft in the course of being sunk, and every level and inclined plane in the course of being driven, for commencing or opening any mine, or for searching for, or proving minerals, and all the shafts, levels, planes, machinery, tramways, and sidings, both below ground and above ground, in and adjacent to a mine, and any such shaft, level and inclined plane, and belonging to the mine. The term "shaft" includes pit. Where two or more parts of a mine are worked separately, each of such parts may, after notice, be constituted a separate mine for the purpose of the act. A secretary of state, however, may object thereto, and the owner or agent must acquisence in such objection, or refer the matter to arbitration.

3. The commencement of the act is, for England and Scotland, 1st January, 1873; for Ireland, 1st January, 1874.

4. Inspectors of mines are to be appointed by a secretary of state, and a district to be assigned to each. The existing inspectors are to continue to act.

5. An inspector may not himself be, or practice, or be the partner of one who is or who practices, as land agent or mining engineer, or as a manager, viewer, agent or valuer of mines, or as arbitrator, in mining cases, and may not be otherwise employed in or about any mine, whether such mine is one to which the act applies or not.

6. In order to ascertain whether the provisions of the act are observed both above ground and below ground, the inspector is authorized to examine any mine by day or by night, so, however, as not to impede the working thereof; and owners, agents and managers, and all employed in or about the mine, are bound to render him every assistance in conducting such examination.

7. He is to make to a secretary of state an annual report of his proceedings, to be laid before parliament, and, when directed, is to make a special report as to any mine accident attended with loss of life or personal injury. Such special report will be made public in the mode, and at the time directed by a secretary of state.

8. *Rule.*—Subject to the exceptions mentioned below, every mine must be under the control and daily supervision of a certificated manager.

9. *Exception 1.*—The rule requiring a manager does not apply to any mine in which less than thirty persons are ordinarily employed below ground, unless the inspector of the district insists upon it.

10 *Exception 2.*—The rule requiring a manager does not apply to any mine, the average daily output of which does not exceed twenty-five tons, unless the inspector of the district insists upon it.

11. *Exception 3.*—In special circumstances, notified to the inspector of the district, a manager may be temporarily dispensed with.

12. The certificate given by a secretary of state, is either a certificate of service, given only to persons who before the 10th of August, 1872, were acting, and have since then acted, in the capacity of manager of mine, or who since the 10th of August, 1867, have acted in a like

capacity for more than twelve months; or a certificate of competency given after examination and upon proof of sobriety, experience, ability and general good conduct. The examination is conducted by examiners appointed by a district board, and the members of such district board are appointed by the secretary of state, and consists of three owners, agents or managers of a mine within the district; three persons employed in or about a mine within the district, not being owners, agents or managers; three mining engineers, agents, managers or coal viewers within the district, and an inspector of mines. The area of a district is fixed by a secretary of state.

13. The owner or agent may nominate either himself or any other person as manager, but the manager must not be a contractor for getting the mineral, or in the employ of a contractor.

14. A secretary of state, on representation made that a certificated manager is, by reason of incompetency or gross negligence, unfit to discharge his duties, or has been convicted for an offense against the act, may order a court of inquiry to be held, and on the report of the court, cancel or suspend the certificate. He may also restore a certificate canceled or suspended.

15. A register of certificated managers is kept under the directions of a secretary of state.

16. Women and girls of any age may not be employed at all.

17. Boys under twelve may not be employed at all, unless the mine is specially exempted by the secretary of state, by reason of the thinness of the seam; when subject to certain conditions, stated in the exemption, boys between ten and twelve may be employed.

18. Boys of twelve and under thirteen, and male young persons of thirteen and under sixteen, may be employed not more than fifty-four hours a week, or more than ten hours a day, and are to be allowed an interval of twelve hours for rest between each two consecutive periods of employment, except between Friday and Saturday, when an interval of eight hours will suffice.

19. A week begins at 12 p. m. on Saturday, and ends 12 p. m. the Saturday following.

20. A period of a person's employment begins at the time of his leaving the surface, and ends at the time of his returning to the surface.

21. The immediate employer of any boy of twelve and under thirteen, and of any male young person of thirteen and under sixteen, is not to take him below ground until he has reported his intention so to do to the manager, or to some person appointed by the manager.

22. Children under ten, of either sex, may not be employed at all.

23. Children of ten and under thirteen, of either sex, may be employed, but not for more than six days a week; and not for more than six hours a day, if employed for more than three days in a week; and not for more than ten hours a day, if employed for only three days or less than three days in a week.

24. For children so employed, an interval of twelve hours for rest must be allowed between two consecutive periods of employment, except between Friday and Saturday, when an interval of eight hours will suffice.

25. *Schooling.*—The parent or guardian of, or person having the custody or control of any child so employed, must see that the child attends school (except in the case of there being no school which the child can attend within two miles of his or her home, or of the mine); such attendance must be for at least twenty hours in every two consecutive weeks of employment, and any attendance is not to count if it is in excess of three hours at a time, or five hours in a day, or of twelve hours in a week, or on Sundays, or before 8 a. m., or after 6 p. m.

26. It will be the duty of the immediate employer, after employing a child for a fortnight, to obtain from the teacher, every Monday morning during the continuance of the employment, a certificate of the child's attendance at the school during the preceding week, and to deliver the certificate to the owner, agent or manager, who must keep

the same in the office, at the mine, for six months, for production to the inspector.

27. Also, the person who pays the child's wages must, after a single application of the teacher, pay regularly every week the cost of the child's schooling (not to exceed 2d. a week, or one-twelfth of the child's wages), and he may deduct from the child's wages any sum so paid.

28. A teacher who is unfit, or who misconducts himself, is liable to be disqualified by an inspector of mines for granting certificates of attendance, subject to an appeal to the educational department.

29. Young persons of thirteen and under sixteen, of either sex, and women above thirteen, may not be employed more than fifty-four hours a week, or more than ten hours a day, and must be allowed an interval of twelve hours for rest between two consecutive periods of employment, except between Friday and Saturday, when an interval of eight hours will suffice.

30. Children of ten and under thirteen, of either sex, young persons of thirteen and under sixteen, of either sex, and women above thirteen, may not be employed between 9 p. m. and 5 a. m., or on Sundays, or after 2 p. m. on Saturdays; also, they are to be allowed intervals for meals, namely: Half an hour during a period of employment which exceeds five hours. One and a half hours during a period of employment which exceeds eight hours. A mine in Ireland may be exempted by the secretary of state from the provisions as to the Saturday half holiday. [See exemption set forth below—paragraph 72.]

31. The person who is in charge of any engine, windlass or gin, howsoever worked, which is used for the purpose of taking persons up or down along any shaft, inclined plane or level (being either an entrance to a mine, or a communication from one part of a mine to another), or who is in charge of any part of the tackle of such engine, windlass or gin, must be a male at least eighteen years of age. If the engine, windlass or gin, is worked by an animal, then, not the driver, but the person under whose direction the driver acts, is to be deemed the person in charge; but in that case the driver must not be under twelve years of age.

32. Any parent or guardian misrepresenting the age of any person, with a view to procuring him employment in contravention of the act, will be liable to punishment.

33. *Not to be paid in public house, etc.*—Wages are not to be paid on any premises used for the sale of intoxicating liquors, or in any place contignous to such premises.

34. Payment by day on yardage is allowed, but in any mine, unless expressly exempted, (see below, paragraph No. 73), where the amount of wages depends upon the amount of mineral gotten, wages are to be paid according to the standard weight in pounds avoirdupois of the mineral gotten.

35. The weighing machines and weights are subject to the inspection of the inspector of weights and measures.

36. *Check-weigher.*—The persons employed in a mine may, if they think proper, appoint a check-weigher at their own cost. The check-weigher must be a person employed either in the same mine or in another mine belonging to the same owner. He is entitled to have every facility afforded to him to take a correct account of the weighing, but he is not to impede the working of the mine, or interfere with the weighing; and in his absence the weighing may be carried on without him. He is liable to be removed by the magistrate for misconduct, and, in that case, another may be selected to fill his place.

37. The weighing provisions expressly sanction agreements to be made between the employers and employed for deductions on account of "dirt" or "shorts," the words of the act being: "Nothing herein contained shall preclude the owner, agent or manager of a mine from agreeing with persons employed in such mine, that deductions shall be made in respect of stones or other materials than minerals contracted to be gotten, which shall be sent up from the mine with mineral contracted to be gotten; or in respect of any tubs, baskets or hatches being improperly filled, in those cases in which they are filled by the getter of the mineral, or his drawer, or by a person immediately employed by him." Such deductions are to be determined by the banks-man, or weigher and check-weigher, or, in the event of a difference, by a third person, to be mutually agreed

on between the owner, agent or manager, on one hand, and the persons employed in the mine on the other.

38. *Rule.*—Subject to the exceptions stated below, and to any exemptions specially granted, every mine must have two shafts or two outlets in communication with every seam of work, which are capable of affording distinct means of ingress and egress to the persons employed in the seam. These shafts need not belong to the same mine. They must be separated by natural strata of not less than ten feet in breadth, though openings may be made through the strata for such purposes as ventilation and drainage. Such openings, however, must, in the case of mines where inflammable gas has been found within the preceding twelve months, be only temporary. Between the two shafts or outlets there must be a communication not less than four feet wide and three feet high. At each of the shafts or outlets, or in the works belonging to the mine, there must be kept, for raising or lowering persons, proper apparatus in actual use, or available for use within a reasonable time.

39. *Exception No. 1.*—The rule does not apply in case of a new mine being opened for the purpose of searching for or proving minerals, so long as not more than twenty persons are employed below ground at any one time in the whole of the different seams in connection with the shaft.

Exception No. 2.—The rule does not apply to any working for the purpose of making communication between two or more shafts, so long as not more than twenty persons are employed below ground at any one time in the whole of the different seams in connection with the shaft or outlet.

41. *Exception No. 3.*—The rule does not, in the case of mines which, before the passing of the act, were not required to have a double shaft, come into operation till the first of January, 1875.

42. In certain cases temporary or permanent exemptions are allowed. (See below, paragraph 74.)

43. Where a mine is abandoned or the working thereof discontinued, (at whatever time such abandonment or discontinuation occurred), the top of the shaft and any side entrance from the surface must be kept securely fenced by

the owner of the mine or the persons interested in the minerals thereof.

44. The act prescribes general rules (set forth at length hereunder, paragraph 70), which are to be observed, so far as reasonably practicable, in every mine.

45. In addition to the general rules, but not at variance with them, each mine must have its own set of special rules, framed to meet the special circumstances of the mine.

46. *Object.*—The object of special rules is to prevent dangerous accidents, and to provide for the proper discipline of those employed in the mine.

47. *Force.*—Special rules have the same force as if they were contained in the act.

48. *How made.*—Special rules are prepared in the first instance on behalf of the owner, and are, together with a notice, to be posted up during a fortnight, on the premises. Such notice to be printed, and to be to the effect that at the end of the fortnight the rules will be submitted to the inspector of mines for the district, and that, in the meantime, any person employed in the mine, is entitled to forward any objection to the inspector at his address, as stated in the notice. On the expiration of the fortnight they are to be signed by the owner, agent or manager, and transmitted to the inspector, together with a certificate that the rules and the notice have been posted up as aforesaid.

49. A secretary of state may, within forty days, object to the special rules, if they are insufficient or unreasonable, and require them to be modified. These requisitions must be complied with, or else referred to arbitration.

50. After forty days special rules, if not objected to, become established, and are to be signed by the inspector of the district.

51. *At what time to be made.*—In mines having special rules in operation on the first of January, 1873, proper steps must be taken before the first of April, 1873, to submit a new set of special rules to the inspector. Meantime the existing special rules will continue in force. In the case of

a new mine being opened, or the working of an old mine being renewed, the act allows three months within which special rules may be submitted.

52. *Amendment.*—At any time special rules may be amended in like manner at the instance of the owner, agent or manager. Also the secretary of state may, at any time, propose amendments, which must be complied with, or referred to arbitration.

53. *Publication.*—A copy at full length of the special rules when made, and also of this abstract, together with the name and address of the inspector of the district, and the name and address of the owner, agent or manager of the mine, must be kept posted up on the premises, and a copy thereof supplied gratis on application.

54. Any person who pulls down documents so posted up, is liable to punishment.

55. If, in any respect, a mine is carried on in a manner which, though not expressly forbidden by the terms of this act, or by special rules, is, nevertheless, dangerous, the inspector may require the matter to be remedied, and the owner, agent or manager is bound to comply with the requisition, or else submit to a reference to arbitration.

56. Breach of a general rule by any person, or a special rule by any person bound to observe the same, is an offense against the act. And in the event of such an offense being proved to have been committed, the owner, agent and manager will also each of them be guilty of an offense against the act, unless he proves that he had taken all reasonable means to prevent the offense by publishing, and to the best of his knowledge, enforcing rules. A like liability arises with respect to other provisions of the act, the breach of which is declared an offense against the act.

57. The penalty for an offense against the act (except when another penalty is expressly specified) is if the offense be committed by a person employed in or about the mine not exceeding £2; if committed by the owner, agent, or manager, not exceeding £20, and a further penalty not exceeding £1 per day day for every day that such offense continues to be committed, after a written notice from the inspector.

58. Where, however, the court is of the opinion that the offense is one which is reasonably calculated to endanger the safety of those employed in or about the mine, or to cause serious personal injury or dangerous accident, and was committed wilfully by the personal act, personal default, or personal negligence of the accused, and that pecuniary penalty will not meet the circumstances of the case, the punishment may be imprisonment, with or without hard labor, for three months.

59. An appeal lies in case of imprisonment, or half the maximum penalty has been adjudged.

60. An offense can only be prosecuted within three months after the date when it was committed.

61. An offense by an owner, agent or manager cannot be summarily prosecuted, except either by an inspector of mines or with the consent of the secretary of state.

62. The owner, agent, or manager may be sworn and examined as an ordinary witness, if charged in respect of any contravention or non-compliance of another person.

63. Penalties for neglecting to send notices of accident, or for any offense against the act, which has occasioned loss of life or personal injury, may be directed by a secretary of state to be paid to the sufferers, or to relatives of deceased sufferers, but not to any person who has contributed to the neglect or offense.

64. A person who is the owner, agent or manager of any mine in which the coal mines regulation act applies, or the father, son or brother of such owner, agent or manager, is disqualified from summarily adjudicating on any offense committed against the act.

65. *Register.*—The owner, agent or manager must keep in the office at the mine, a register containing particulars prescribed by section thirteen, as to all persons whose hours of employment are regulated by the act; and, also, a memorandum of the certificates of school attendance. The register is to be produced to the inspector who may inspect or copy it.

66. Returns are to be sent annually by the owner, agent or manager of each mine, to the inspector of the district, namely: On January 1st, a return in the form of schedule four to the act, and on or before February 1st, a return, in form to be prescribed by a secretary of state, specifying the particulars mentioned in section thirty-eight of the act.

67. *Plans.*—The owner, agent or manager is to keep in the office at the mine, an accurate plan and section, or tracing thereof, showing the workings up to at least six months previously, and is to produce it to the inspector of mines to examine, but not to copy; and, if requested, is to mark on the plan the workings up to production.

68. *Plans and Abandonment.*—Within three months of the abandonment of a mine, a plan and section, or tracing thereof, showing the boundaries of the workings, are to be sent by the owner to the secretary of state, as a mining record, not, however, to be seen until after the lapse of ten years, except by an inspector, or by consent.

69. Notices must be sent by the owner, agent or manager of a mine to the inspector of mines for the district, as follows: Of the appointment of a manager, together with his name and address, immediately after his appointment; and in case of the temporary appointment of an uncertificated manager, the notice shall state the reason for such appointment; of any accident causing loss of life, or serious personal injury, within twenty-four hours after such accident; of any accident from explosion of gas, powder, or steam boiler, causing any personal injury, within twenty-four hours after such accident; of any death resulting from personal injury, caused by an accident previously reported, within twenty-four hours after the death comes to the knowledge of the owner, agent or manager. The following is to be made within two months after the event to be notified: Of the commencement of any working for the opening of a new shaft; of the abandonment of a shaft; of the recommencement of the working of a shaft after an abandonment of more than two months; of any change in the name of the mine, or in the name of the owner, agent or manager; of any change in the officers of any incorporated company owning a mine. Notice must also be given by the owner or agent (not by the manager), of the fact that two or more parts of a mine are worked separately, with a

view that each may be deemed to constitute a separate mine for the purposes of the act.

70. *Coroner's Inquests.*—In the case of an inquest being held concerning a death being caused by a mine accident, unless the inspector or some other person on behalf of a secretary of state is present, the coroner is to adjourn the inquest, and to send to the inspector four days' notice of the time and place of the adjourned inquest. If, however, only one life has been lost by the accident, and forty-eight hours' notice of time and place of holding the inquest has been sent to the inspector, the inquest need not be adjourned if a majority of the jury think it unnecessary. At the inquest the inspector of mines may examine any witness, subject to the order of the coroner. If the inspector is not present, and evidence is given of any neglect having caused or contributed to the accident, or of any defect in or about the mine appearing to require a remedy, the coroner is to send to the inspector notice thereof in writing. In the event of a fatal accident occurring in a mine and an inquest being held, no person who is employed in that mine, or is concerned in its management, or has a personal interest in that mine, is qualified to serve on the jury.

71. *Employment of Boys in Thin Seam Mines.*—A secretary of state may exempt a thin seam mine from the provisions (see above paragraph No. 17) prohibiting employment, below ground, of boys under twelve. In a mine so exempted, boys of ten and under twelve may be employed under ground, but not for more than six days a week; not for more than six hours a day, if employed for more than three days in a week; not for more than ten hours a day, if employed for only three days or for less than three days in a week. An interval of twelve hours' rest shall be allowed between each two consecutive periods of employment, except between Friday and Saturday, when an interval of eight hours will suffice. The period of such employment of a boy is deemed to begin at the time of his leaving the surface, and to end at the time of his return to the surface. The week is deemed to begin at 12 p. m. Saturday, and to end at 12 p. m. on the Saturday following. The immediate employer of any boy of ten and under twelve is not to take him below ground until he has reported his intention so to do to the manager or to some

person appointed by the manager; boys of ten and under twelve are subject to the same provisions with regard to schooling as are prescribed (see above paragraphs 25, 26, 27, 28) for children under thirteen employed above ground.

72. *Saturday—Half-holiday—Ireland.*—A secretary of state may exempt any mine in Ireland from the provisions (see above paragraph 35) prohibiting the employment below ground of women, young persons or children, after two o'clock Saturday afternoon.

73. *Weighing provisions.*—A secretary of state may grant exemptions from the weighing provisions (see above paragraph 34) or postpone their operation in respect to any mine or class of mines, as to which he is satisfied that such exemption or postponement is requisite or expedient by reason of the exigencies of the case. In any mine so exempted, wages may be paid according to measure or gauge, and local measures and gauges may be adopted, subject, however, to inspection by the inspectors of weights and measures. A check-measurer may be appointed in like manner as a check-weigher.

74. *Single shafts.*—A secretary of state may exempt a proved mine from the provisions (see above paragraph 42) prohibiting single shafts, if satisfied that the quantity of mineral proved is insufficient to repay the outlay of the sinking or making of a second shaft or outlet. In a mine so exempted there must not be employed below ground at any one time in the whole of the different seams in connection with the shaft or outlet, more than twenty persons; or, if the mine is not a coal mine, or mine with inflammable gas, more than such other large number as the secretary of state may allow. If the mine is not a coal mine, or mine with inflammable gas, and the secretary of state is satisfied that sufficient provision has been made against danger from other causes than the explosion of gas, by using stone, brick or iron, in the place of wood, in the lining of the shaft and construction of the side-wall; in a mine so exempted there must not be employed below ground, at any one time, in the whole of the different seams in connection with the shaft or outlet, more than the number of persons the secretary of state may allow. If satisfied that the workings of a seam have reached the boundary of the property, or the extremity of the mineral field, and that it

is expedient to work away the pillars already formed in the course of the ordinary workings, notwithstanding that by so working away the pillars one of the shafts or outlets may be cut off. In a mine so exempted there must not be employed below ground at any one time, in the whole of the different seams in connection with the shaft or outlet, more than twenty persons; or, if the mine is not a coal mine, or a mine with inflammable gas, more than such larger number as the secretary of state may allow, if satisfied by reason of an accident one of the shafts or outlets has become unavailable for the use of the persons employed in the mine; a mine so exempted may only be worked subject to the conditions specified in the exemption. In the case of a mine not at the time of passing the act required to have two outlets, provided that an application is made in England or Scotland within six months after the first of January, 1873, or in Ireland within six months after the first of January, 1874, and the secretary of state is satisfied that the mine is nearly exhausted; if the secretary of state refuse to grant such exemption, the matter may be referred to arbitration.

75. Also in the case of a mine not at the time of the passing of the act required to have two outlets, a secretary of state may grant an extension of time (see above paragraph 41) for providing an additional shaft or outlet, if an application is made to him within six months preceding the first of January, 1875. In the event of the secretary of state refusing such extension of time, the matter may be referred to arbitration.

76. The following are the general rules: An adequate amount of ventilation shall be constantly produced in every mine to dilute and render harmless noxious gases to such an extent that the working places of the shafts, levels, stables and workings of such mine, and the traveling roads to and from such working places, shall be in a fit state for working and passing therein. In every mine in which inflammable gas has been found within the preceding twelve months, then once in every twenty-four hours, if one shift of workmen is employed, and once in every twelve hours, if two shifts are employed; during any twenty-four hours a competent person, or competent persons, who shall be appointed for the purpose, shall, before the time for commencing work in any part of the mine, inspect with a safety

lamp that part of the mine, and the road-ways leading thereto, and shall make a true report of the condition thereof, so far as ventilation is concerned, and a workman shall not go to work in such part until the same, and the road-ways leading thereto, are stated to be safe. Every such report shall be recorded without delay in a book which shall be kept at the mine for the purpose, and shall be signed by the person making the same.

In every mine in which inflammable gas has not been found within the preceding twelve months, then once in every twenty-four hours a competent person, or competent persons, who shall be appointed for the purpose, shall, so far as is reasonably practicable, immediately before the time for commencing work in any part of the mine, inspect that part of the mine, and the roadways leading thereto, and shall make a true report of the condition thereof so far as ventilation is concerned, and a workman shall not go to work in such part until the same, and the roadways leading thereto, are stated to be safe. Every such report shall be recorded without delay, in a book which shall be kept at the mine for the purpose, and shall be signed by the person making the same.

All entrances to any place not in actual course of working and extension, shall be properly fenced across the whole width of such entrance, so as to prevent persons inadvertently entering the same. A station or stations shall be appointed at the entrance of the mine, or to different parts of the mine, as the case may require, and a workman shall not pass beyond any such station until the mine, or part of the mine beyond the same, has been inspected and stated to be safe.

If, at any time, it is found by the person for the time being in charge of the mine, or any part thereof, that, by reason of noxious gases prevailing in such mine or such part thereof, or of any cause whatever, the mine or the said part is dangerous, every workman shall be withdrawn from the mine, or such part thereof as is so found dangerous, and a competent person who shall be appointed for the purpose, shall inspect the mine, or such part thereof as is so found dangerous, and if the danger arises from inflammable gas, shall inspect the same with a locked safety-lamp, and in every case shall make a true report of the condition of such

mine or part thereof, and a workman shall not, except in so far as is necessary for inquiring into the cause of danger, or for the removal thereof, or for exploration, be readmitted into the mine, or such part thereof as was found dangerous, until the same is stated by such report not to be dangerous. Every such report shall be recorded in a book which shall be kept at the mine for the purpose, and shall be signed by the person making the same. In every working approaching any place where there is likely to be an accumulation of explosive gas, no lamp or light other than a locked safety-lamp shall be allowed or used; and whenever safety-lamps are required by the act, or by the special rules made in pursuance of the act, to be used, a competent person, who shall be appointed for the purpose, shall examine every safety-lamp immediately before it is taken into the workings for use, and ascertain it to be secure and securely locked, and in any part of a mine where safety-lamps are so required to be used, they shall not be used until they are so examined, and found secure and securely locked, and shall not, without due authority, be unlocked; and in the said part of a mine a person shall not, unless he is appointed for the purpose, have in his possession any key or contrivance for opening the lock of any such safety-lamp, or any lucifer match, or apparatus of any kind for striking a light.

Gunpowder, or other explosives or inflammable substance, shall only be used in the mine under ground, as follows: It shall not be stored in the mine; it shall not be taken into the mine except in a case or cannister containing not more than four pounds. A workman shall not have in use at one time in any one place, more than one of such cases or canisters. In charging holes for blasting, an iron or steel picker shall not be used, and a person shall not have in his possession in the mine, under ground, any iron or steel picker; and an iron or steel tamping rod or stemmer, shall not be used for ramming either the wadding or the first part of the tamping or stemming on the powder. A charge of powder which has missed fire shall not be unrammed. It shall not be taken into, or be in the possession of any person in any mine except in cartridges, and shall not be used except in accordance with the following regulations, during three months after any inflammable gas has been found in any such mine, namely:

A competent person, who shall be appointed for the purpose, shall, immediately before firing a shot, examine the place where it is to be used, and the places contiguous thereto, and shall not allow the shot to be fired unless he finds it safe to do so; and a shot shall not be fired except by or under the direction of a competent person who shall be appointed for the purpose. If the said inflammable gas issues so freely that it shows a blue-cap on the flame of the safety-lamp, it shall only be used either in those cases of stone drifts, stone work and sinking of shafts, in which the ventilation is so managed that the return air from the place where the powder is used passes into the main air-course without passing any place in actual course of working, or when the persons ordinarily employed in the mine are out of the mine, or out of the part of the mine where it is used.

Where a mine is divided into into separate panels, in such manner that each panel has an independent intake and return air-way from the main air-course and the main return air-course, the provisions of this rule, with respect to gunpowder or other explosive, inflammable substance, shall apply to each such panel in like manner as it were a separate mine. Where a place is likely to contain a dangerous accumulation of water, the working approaching such place shall not exceed eight feet in width, and there shall be constantly kept, at a sufficient distance, not being less than five yards in advance, at least one bore-hole near the center of the working, and sufficient flank bore-holes on each side. Every underground plane on which persons travel, which is self-acting or worked by an engine, windlass or gin, shall be provided (if exceeding thirty yards in length) with some proper means of signaling between the stopping places and the ends of the plane, and shall be provided in every case at intervals of not more than twenty yards, with sufficient man-holes for places of refuge.

Every road on which persons travel under ground where the load is drawn by a horse or other animal, shall be provided, at intervals of not more than fifty yards, with sufficient man-holes, or with a space for a place for refuge, which space shall be of sufficient length and at least three feet in width between the wagons running on the train-road and the side of such road.

Every man-hole and a space for a place of refuge, shall be constantly kept clear, and no person shall place anything in a man-hole or such space to prevent access thereto.

The top of every shaft which for the time being is out of use, or used only as an air-shaft, shall be securely fenced.

The top and all entrances between the top and bottom of every working or pumping-shaft shall be properly fenced, but this shall not be be taken to forbid the temporary removal of the fence for the purpose of repairs or other operations if proper precautions are used. Where the natural strata is not safe every working or pumping shaft shall be securely cased, lined or otherwite made secure.

The roof and side of every traveling-road and working-place shall be made secure, and a person shall not, unless appointed for the purpose of exploring or repairing, travel, or work in any such traveling-road or working-place which is not so made secure.

Where there is a downcast and furnace-shaft, and both such shafts are provided with apparatus in use for raising and lowering persons, every person employed in the mine shall, upon giving reasonable notice, have the option of using the downcast-shaft.

In any mine which is usually entered by means of machinery, a competent person of such age as prescribed by the act, shall be appointed for the purpose of working the machinery which is employed in lowering and raising persons therein, and shall attend for the said purpose during the whole time that any person is below ground in the mine.

Every working-shaft used for the purpose of drawing minerals or for lowering or raising of persons, shall, if exceeding fifty yards in depth, and not exempted in writing by the inspector of the district, be provided with guides and some proper means of communicating distinct and definite signals from the bottom of a shaft and from every entrance for the time being in work, between the surface and the bottom of the shaft, to the surface, and from the surface to the bottom of the shaft and to every entrance for the time being in work between the surface and the bottom of the shaft.

A sufficient cover overhead shall be used when lowering or raising persons in every working shaft, except where

it is worked by a windlass, or where the person is employed about the pump or some work of repair in the shaft, or where a written exemption is given by the inspector of the district.

A single-linked chain shall not be used for lowering or raising persons in any working shaft or plane, except for the short coupling chain attached to the cage or load.

There shall be on the drum of every machine used for lowering or raising persons, such flanges or horns, and also, if the drum is conical, such other appliances as may be sufficient to prevent the rope from slipping.

There shall be attached to every machine worked by steam, water or mechanical power, and used for lowering or raising persons, an adequate brake, and also a proper indicator (in addition to any mark on the rope) which shows to the person who works the machine the position of the cage or load in the shaft.

Every fly-wheel, and all exposed and dangerous parts of the machinery used in and about the mine, shall be, and be kept, securely fenced.

Every steam boiler shall be provided with a proper steam gauge and water gauge, to show respectively the pressure of steam and the height of water in the boiler, and with a proper safety valve.

After dangerous gas has been found in any mine, a barometer and thermometer shall be placed above ground, in a conspicuous position, near the entrance of the mine.

No person shall wilfully damage, or, without proper authority, remove or render useless any fence, fencing, casing, lining, guide, means of signaling, signal, cover, chain, flange, horn, brake, indicator, steam gauge, water gauge, safety valve, or other appliances or thing provided in any mine in compliance with the act.

Every person shall observe such directions with respect to working as may be given to him with a view of complying with the act or the special rules.

A competent person, or competent persons, who shall be appointed for the purpose, shall once at least in every

twenty-four hours, examine the state of the external parts of the machinery, and the state of the head-gear, working-places, levels, planes, ropes, chains and other works of the mine which are in actual use, and once at least in every week shall examine into the state of the shafts by which persons ascend or descend, and the guides or conductors therein, and shall make a true report of the result of such examination; and such report shall be recorded in a book to be kept at the mines for the purpose, and shall be signed by the person who made the same.

The persons employed in a mine may from time to time appoint two of their number to inspect the mine at their own cost, and the persons so appointed shall be allowed, once at least in every month, accompanied, if the owner, agent or manager thinks fit, by himself or one or more officers of the mine, to go to every part of the mine and to inspect the shafts, levels, planes, working-places, return air-ways, ventilating apparatus, old workings and machinery, and shall be afforded by the owner, agent and manager, and all persons in the mine, every facility for the purpose of such inspection, and shall make a true report of the result of such inspection, and such reports shall be recorded in a book to be kept at the mine for the purpose, and shall be signed by the person who made the same.

The books mentioned in the General Rules, or a copy thereof, shall be kept at the office of the mine, and any inspector, under the act, and any person employed in the mine may, at all reasonable times, inspect and take copies of and extracts from any such books.