FATAL ACCIDENTS.

Table showing Fatal Accidents in District No. 1, for the biennial period ending June 30, 1899.

DATE.	NAME OF DECEASED.	OCCUPATION.	CAUSE OF CASUALTY.	NAME OF COMPANY OR FIRM.	WHERE LOCATED.
September 3, 1897	T. R. Sullivan	Shaft sinker	Rope broke	Sullivan Bros.	Ottumwa.
September 16, 1897	Martin Anderson	Miner	Fall of roof	Scandinavian Coal Co	Centerville.
October 4, 1897	Robert Fenrolck	Miner	Fell under car	Star Coal Co	Ottumwa.
December 16, 1897	Lincoln Perry	Miner	Fall of roof	Chrisholm Mine	Chrisholm.
January 11, 1898	Clarence McCreary	Miner	Coal from shot of adjoining room.	Iowa Central Coal Co	Hickory.
February 22, 1898	Carl V. Swanson	Miner	Fall of roof	Wapello Coal Co	Hiteman.
March 11, 1898	William Secreast	Miner	Fall of roof	Smoky Hollow Coal Co.	Avery.
April 8, 1898	Samuel Toplin	Miner	Fall of roof	Wapello Coal Co	Hiteman.
September 26, 1898	Mike Semancik	Miner	Coal from shot	Smoky Hollow Coal Co.	Avery.
November 14, 1898	Joseph Fletcher	Miner	Fall of roof	Smoky Hollow Coal Co.	Avery.
April 6, 1899	Thomas G. Davies	Miner	Fall of roof	Achon Coal Co.	Mystic.
June 14, 1899	Bryan Dale	Miner	Fall of roof	Wapello Coal Co.	Hiteman.

BIENNIAL REPORT

OF THE

SECOND DISTRICT,

EMBRACING

Jasper, Jefferson, Keokuk, Mahaska, Scott and Van Buren Counties.

JOHN VERNER, INSPECTOR.

LETTER OF TRANSMITTAL.

Hon. L. M. Shaw, Governor of Iowa:

SIR—I have the honor to submit to you the report of the Second inspection district, covering the biennial period ending June 30, 1899. The fact of my being only recently assigned to this district has prevented me making the report as complete as it should be; and that I am enabled to present it in its present form is partially due to the assistance furnished me by Mr. Miller, my predecessor. He has kindly given me needed information and necessary data, and I hereby gratefully acknowledge his help.

JOHN VERNER,
Inspector Second District.

REPORT OF SECOND DISTRICT.

The Second inspection district during the last two years included the following counties: Scott, Keokuk, Mahaska, Jasper, Jefferson and Van Buren. These counties produced, in the two years, 3,546,706 tons of coal of all grades. This output was furnished by ninety-five mines, giving employment to 2,332 miners and 1,009 day men. There was quite an increase in tonnage over the preceding biennial period. Since my appointment as inspector in April, 1899, I have done what I could to acquaint myself with the condition of the mines in the district. I can say that the requirements of the mining law are fairly well complied with, and that, where I had to call attention to existing deficiencies, they were remedied to a satisfactory extent.

At present the demand for coal is good; the miners have steady employment, and the future outlook is promising.

At the majority of the mines the eight-hour working day is now in force, and, I believe, the fact that the miners have been able to gain this concession from the operators without a struggle has greatly strengthened the friendly relations between them, and there is no indication now that those relations will be disturbed in the near future

Naturally the daily output of the mines, where the shorter working day has been adopted, is less than it was under the old system of working ten hours. This fact, and the further one that the operator's expenses per ton of coal produced are greater now than formerly, will necessarily bring about an advance in the selling price of coal; but it is only fair to say that the mine operator is justly entitled to a reasonable advance.

In the recent past, very little money has been made out of the coal business; a fact partially due to the action of the operators themselves. Close competition reduced the profits to such extent that in many cases they were insufficient to pay even moderate interest on the capital invested in the business, and there was no money left to put in the sinking fund that must be provided for to enable the operator to redeem the outstanding indebtedness by the time his mine is exhausted.

But the signs for a change for the better are favorable, and the general prosperity prevailing now will materially assist the coal operator to carry on his business in a more satisfactory and profitable manner.

TABLE No. 1.

Showing the number of mines, output of coal, number of miners, and other employes, etc., in District No. 2, for the year ending June 30, 1898.

NAME OF COUNTY.	Number of mines.	Number of tons of coal of all grades produced.	Number of miners employed.	Number of other employes.	Am't paid miners.	Amount paid other employes.	Amount paid for timber, tracking, etc.	Average price paid for mining per ton of lump coal.	Av selling price of ton of lump coal at mine.
Jasper	19	157,430	250	82	$ 96,500	$ 53,100	$ 11,300	$ .75	$1.25
Jefferson	8	4,000	20	5	3,600	625	400	.90	1.75
Keokuk	15	209,093	274	97	128,000	51,850	11,845	.75	1.25
Mahaska	38	1,279,940	1,641	789	762,635	440,300	47,600	.75	1.22
Scott	8	11,250	48	8	11,70[illegible]	2,355	600	1.00	1.60
Van Buren	6	11,200	26	8	10,080	1,840	600	.80	1.35
Total	94	1,672,913	2,259	989	$ 1,012,315	$ 550,070	$ 72,345		

TABLE No. 2.

Showing the number of mines, output of coal, number of miners and other employes, etc., in District No. 2, for the year ending June 30, 1899.

NAME OF COUNTY.	Number of mines.	Number of tons of coal of all grades produced.	Number of miners employed.	Number of other employes.	Am't paid miners	Am't paid other employes.	Amount paid for timber, tracking, etc.	Average price paid for mining per ton of lump coal.	Av. selling price of ton of lump coal at mine.
Jasper	20	188,800	270	88	$ 119,600	$ 55,300	$ 13,200	$ .75	$1.25
Jefferson	8	4,500	23	6	4,050	750	450	.90	1.75
Keokuk	15	281,395	453	156	169,417	79,877	11,410	.75	1.25
Mahaska	38	1,374,798	1,581	762	790,692	412,628	48,940	.75	1.25
Scott	8	11,800	49	8	11,800	2,500	600	1.00	1.60
Van Buren	5	12,500	30	8	11,250	2,030	700	.80	1.35
Total	94	1 873,793	2 406	1,023	$ 1,106,809	$ 553.08	$ 75,300		

TABLE No. 3.

Output of coal of the counties comprising District No. 2, for the past five years.

COUNTIES.	1895.	1896.	1897.	1898.	1899.
Mahaska	902,430	1,100 900	1,184,840	1,279,940	1,374,798
Keokuk	260,000	222,300	201,600	209,093	281,395
Jasper	160,300	121,200	153,000	157,430	188,800
Scott	10,100	13,[illegible]00	13,500	11,250	11,800
Jefferson	4,000	4,200	5,000	4,000	4,500
Van Buren	11,000	15,000	14,300	11,200	12,500
Total tonnage	1,347,830	1,476,700	1,572,240	1,672,913	1,873,793

Table of all the shipping and the larger of the local mines of District No. 2 doing business during the two years ending June 30, 1899.

NAME OF COMPANY, FIRM OR OPERATOR.	SUPERINTENDENT.	POSTOFFICE ADDRESS.	Kind of mine.	PLAN OF WORKING MINE.	HOW VENTILATED.	Power used.	Shipping or local.
SCOTT COUNTY.							
Frank D. Moore	F. D. Moore	Jamestown	Shaft	Room and pillar	Furnace	Horse	Local.
John Hanlon	John Hanlon	Jamestown	Shaft	Room and pillar	Furnace	Horse	Local.
Buchmeler & Carlin	J. Buchmeler	Jamestown	Shaft	Room and pillar	Fan	Steam	Local.
Blackwell & Fridley	William Fridley	Jamestown	Shaft	Room and pillar	Furnace	Horse	Local.
Henry Metzger	H. Metzger	Jamestown	Shaft	Room and pillar	Furnace	Horse	Local.
John Sass	J. Sass	Jamestown	Shaft	Room and pillar	Furnace	Horse	Local.
Theodor Kautz	T. Kautz	Buffalo	Shaft	Room and pillar	Furnace	Horse	Local.
VAN BUREN COUNTY.							
Findley Bros.	H. Findley	Douds	Shaft	Room and pillar	Furnace	Horse	Shipping.
W. R. Carson	W. R. Carson	Douds	Shaft	Room and pillar	Furnace	Horse	Shipping.
JASPER COUNTY.							
Jasper County Coal Co	Henry Thomas	Colfax	Shaft	Room and pillar	Fan	Steam	Shipping.
Thomas Hanson	Thomas Hanson	Colfax	Shaft	Room and pillar	Furnace	Horse	Local.
John Gunter	John Gunter	Colfax	Shaft	Room and pillar	Furnace	Horse	Local.
Brown & Brice	Rob. Brown	Prairie City	Shaft	Room and pillar	Furnace	Horse	Local.
Walker mine	John Waddel	Vandalia	Shaft	Room and pillar	Furnace	Horse	Local.
William White	William White	Vandalia	Shaft	Room and pillar	Furnace	Horse	Local.
Snooks Coal Co	William Snook	Newton	Shaft	Room and pillar	Furnace	Horse	Local.
Robert Carson	R. Carson	Newton	Shaft	Room and pillar	Furnace	Horse	Local.
French Coal Co	E. P. French	Newton	Shaft	Room and pillar	Furnace	Horse	Local.

KEOKUK COUNTY.

NAME OF COMPANY, FIRM OR OPERATOR.	SUPERINTENDENT.	POSTOFFICE ADDRESS.	Kind of mine.	PLAN OF WORKING MINE.	HOW VENTILATED.	Power used.	Shipping or local.
Crescent Coal Co	James Chew	What Cheer	Shaft	Room and pillar.	Fan	Steam	Shipping.
Columbian Coal Co	W. A. Durfee	What Cheer	Shaft	Room and pillar.	Fan	Steam	Shipping.
Cedar Rapids Coal Co	E. M. Trescuth	What Cheer	Shaft	Room and pillar.	Fan.	Steam	Shipping.
Lambert Bros. & Co	Ed Spavin	What Cheer	Shaft	Room and pillar.	Fan	Steam	Shipping.
J. M. Olive	J. M. Olive.	What Cheer	Shaft	Room and pillar.	Furnace	Horse	Shipping.
Thompson Coal Co	Thomas Thompson.	What Cheer	Shaft	Room and pillar.	Jet	Steam	Shipping.
Thomas Bros	John Thomas	What Cheer	Slope	Room and pillar	Furnace	Steam.	Shipping.
Wm. Blatt.	William Blatt	What Cheer	Slope	Room and pillar	Jet	Steam	Shipping.
Grudge in Bros		What Cheer	Shaft	Room and pillar.	Furnace	Horse	Local.

MAHASKA COUNTY.

NAME OF COMPANY, FIRM OR OPERATOR.	SUPERINTENDENT.	POSTOFFICE ADDRESS.	Kind of mine.	PLAN OF WORKING MINE.	HOW VENTILATED.	Power used.	Shipping or local.
Consolidation Coal Co	B. C. Buxton	Muchakinock	Shafts	Room and pillar.	Fans	Steam	Shipping.
American Coal Co	W. A. McNeill.	Oskaloosa	Sh & Sl.	Room and pillar	Fans	Steam	Shipping.
Oskaloosa Coal and Mining Co	J. H. Ramsay	Oskaloosa	Sh & Sl.	Room and pillar.	Fans	Steam	Shipping.
Iowa Fuel Co	F. L. Lofland	Oskaloosa	Shaft	Room and pillar.	Fans.	Steam	Shipping.
Whitebreast Fuel Co	C. A. Traer	Pekay	Shaft	Room and pillar.	Fans	Steam	Shipping.
Garfield Coal Co	Geo. H. Ramsay	Oskaloosa	Slope	Room and pillar.	Fans	Steam	Shipping.
M. B Foster Coal Co	R. F. Montgomery	Leighton	Shaft	Room and pillar.	Fans	Steam	Shipping.
Lost Creek Coal Co	J. Timbrell	Lost Creek	Shaft	Room and pillar.	Fans	Steam	Shipping.
Hoover Coal Co	C. A. Hoover	Oskaloosa	Shaft	Room and pillar.	Fans	Steam	Shipping.
Klondike Coal Co.	F. Sheppard	Oskaloosa	Shaft	Room and pillar.	Fans	Steam	Shipping.
Long Bros	H. Long	Oskaloosa	Shaft	Room and pillar	Jet	Steam	Shipping.
Kennebeck Coal Co.	A. Love	Muchakinock.	Shaft	Room and pillar.	Fan	Steam	Shipping.
Hawarth Coal Co	D. Hawarth	Oskaloosa	Shaft	Room and pillar.	Jet	Steam	Local.
Economy Coal Co.	B. F. Evans	Oskaloosa	Shaft	Room and pillar.	Fan	Steam	Local.
Guthrie Coal Co.	J. D. Guthrie	Oskaloosa	Shaft	Room and pillar.	Fan	Steam	Local.
Oskaloosa Fuel Co.	W. B. Rogers	Oskaloosa	Shaft	Room and pillar.	Fan	Steam	Local.
Smith Bros	J. H. Smith	Oskaloosa	Shaft	Room and pillar.	Furnace	Horse	Local.
Wm. Evans	William Evans	New Sharon	Shaft	Room and pillar.	Furnace	Horse	Local.
M. Carey	M. Carey	Rose Hill	Shaft	Room and pillar.	Furnace	Horse	Local.
Wm. Paterson	William Paterson	Leighton	Shaft	Room and pillar.	Furnace	Horse	Local.
R. C. Davis	R. C. Davis	Leighton	Shaft	Room and pillar.	Furnace	Horse	Local.

JASPER COUNTY.

The shipping trade of this county is entirely in the hands of the Jasper County Coal company. The company's mines are located on the Iowa Northern railway, and are good producers, their output last year amounting to 179,000 tons of coal of all grades, giving employment to 285 men. The county is well supplied with local mines. Several of them are located east of Colfax, within a few miles of that town, fully able to supply all domestic demands. South and southwest of Newton are a number of mines. Among them Snook's mine, the French Coal company's mine and Carson's mine are the best producers. South of Prairie City and near Vandalia are a number of mines that in the aggregate produce considerable coal that finds a ready market in the surrounding country. A few of the smaller mines have drift or slope openings; the rest are shaft mines.

During the last year the coal trade of the county has been fairly satisfactory. The output was larger than in 1893, and the increase in the last two years over the preceding biennial period amounted to 71,230 tons.

JEFFERSON COUNTY.

The coal area of this county is not extensive. Comparatively very little coal has been shipped out of the county since its existence was discovered there decades ago. The largest mine the county ever had was located at Perlee. It was not a success financially, only lasted a few years, and was exhausted and abandoned more than twenty years ago. Since then no railroad mine has been opened in the county. Still, there are good basins of coal in existence. The seam runs from three to four and one-half feet in thickness and is of fair quality. Mining is now carried on in a small way in different parts of the county. South and west of Fairfield several mines are in operation, and their output finds a ready sale at the county seat. South of Libertyville several mines are located, which have a fair trade in cold weather.

KEOKUK COUNTY.

Keokuk county lies along the eastern boundary of the main Iowa coal field; in fact, in the eastern portion of the county the sub-carboniferous formation makes its appearance immediately below the drift. Notwithstanding its somewhat limited coal area, this county has been, and is yet, one of the best coal-producing counties in the state. The center of the producing region is What Cheer, and within a few miles of this town all the principal mines are located. The coal is of a fair quality, and in a few

places is seven feet in thickness. The local basins are, however, of limited extent, due to fault and the erosive action of the elements. For this reason the territory that can be worked from each mine is comparatively small, and were it not for the fact that the shipping facilities are good and the markets available among the best in the state, mining at this time would not be a profitable business in this county. The coal-carrying railroads are the Chicago & North-Western and the Burlington, Cedar Rapids & Northern.

On the Chicago & North-Western railway the following companies have mines located: The Crescent Coal company, Columbian Coal company, Thomas Bros., and Lambert Bros. & Co. On the Burlington, Cedar Rapids & Northern, O. W. Olive and the Thompson Coal Co. have mines. The Cedar Rapids Coal company operated mines on the latter road until recently, but they are abandoned now.

The three largest mines are the Crescent, Columbian and Klondike. The Crescent employs about 170 men, the Columbian 181, and the Klondike 60 men. On account of the shallow covering, considerable water finds its way into the mines, and it requires careful watching to guard against a heavy inflow which may entail a heavy loss and a probable closing down of at least a portion of the mine. Only last winter an immense inflow drowned every mule in the Columbian mine and filled the mine completely, and it took weeks of incessant pumping and an expense of thousands of dollars to unwater the mine.

The local mines, some of them very well equipped, gave employment to a considerable number of men.

The increase in tonnage of the last two years over the preceding biennial period amounts to 66,588 tons.

MAHASKA COUNTY.

For a generation Mahaska county has stood at the head of the list of coal-producing counties of Iowa, and there is no doubt that it will occupy that position for some years to come. Naturally the territory immediately adjacent to the railroads has been worked out to a considerable extent, and future mines will have to be developed further away from them. There are large fields somewhat remote from the railroad in existence in the county, that are as yet practically untouched, but the commencement of work on them is only a question of time. They will be developed as soon as the mines now running show signs of failing. The coal is considered a good steam coal, and is of fair thickness, averaging nearly five feet. The coal measures of the county are shallow, and no workable vein of coal seems to exist below the one that is now so extensively worked. Some of the mines have been opened by slopes, and where shafts were needed they were of limited depth, none of them exceeding 150 feet. Erosion has divided this coal field into a number of small basins, the existence and extent of which can only be ascertained by thorough prospecting.

Railroad facilities are good. Four roads traverse the county, namely, the Chicago, Rock Island & Pacific, the Chicago & North-Western, the Iowa Central, and the Burlington & Western. Over these roads eighteen mines ship their product to markets in Iowa, Nebraska and Minnesota.

The Consolidation Coal company operates four mines, Nos. 6, 7, 8 and 9. They are all located on the Chicago & North-Western railway. No. 6 and No. 7 are developing no new territory. The pillars in these mines are now being taken out and they will soon be finished. No 9 is a comparatively new mine and is a good producer, and the underground workings are carried on in a systematic and creditable manner. This company has in its employ about 550 men.

The American Coal company operates two mines, Nos. 2 and 4, located on the Chicago, Rock Island & Pacific railroad, at and near Evans. No. 2 mine has been worked longer and produced more coal than any mine ever opened in this county. No. 4 mine, one mile west of No. 2, has been somewhat of a disappointment to the owners. A large fault was encountered on the north side of the shaft and after repeated, unsuccessful efforts to work through it, that portion of the mine was abandoned. The average number of men employed at these two mines is 302.

The Oskaloosa Coal & Mining company operates three mines. Nos. 2 and 3 are located west and south respectively from Beacon, on the Chicago, Rock Island & Pacific railway, No. 4 is located on the Chicago & North-Western, and one-half mile south of No. 3. Average number of men employed, 330.

The Whitebreast Fuel company's mine No. 28, is located at Pekay, on the Iowa Central railroad. It is one of the largest mines in the county and gives employment to 273 men.

The Iowa Fuel company operates a mine at Colon, on the Chicago & North-Western railroad, and employs 150 men.

The Lost Creek Coal company employs 200 men. Its mine is located at Lost Creek, and its output is shipped over the Iowa Central and the Burlington & Western railways.

The Garfield Coal company has a slope mine northwest of Beacon on the Chicago, Rock Island & Pacific railroad, and employs 150 men.

The M. B. Foster coal company operates a mine at Fishville, on the Chicago Rock Island & Pacific railroad, where sixty men are employed.

The Hoover Coal company until recently operated a mine at Carbonado on the Iowa Central railway. It is now abandoned.

The Klondike Coal company commenced operating a mine five miles south of Oskaloosa, on the Chicago & North-Western railway, in 1898. A fair field of coal has been developed and 110 men are now employed.

Long Bros. have a small plant on the Burlington & Western railway.

A considerable number of small mines are in operation throughout the county. Some of them are giving employment to a small force of men the year around, but the majority of them are worked only during the winter season, to supply coal for home consumption.

The output of coal for the year ending June 30, 1899, exceeded that of the previous year by 94,854 tons, and during the two years ending June 30, 1899, the increase over the preceding biennial period amounted to 369,000 tons.

SCOTT COUNTY.

The coal area of this county is small. Nearly all of the mines now worked are located between eight and ten miles west of Davenport, close to the Mississippi river and in the vicinity of Buffalo and Jamestown. The coal field has no connection with the Des Moines field. It is probably an outlier of the Illinois basin. None of the mines have railroad connections. The coal is reached by shafts varying from 75 to 125 feet in depth. No mules are used in the mines. The miners deliver the loaded cars at the shaft bottom, and as the roads are low, only a limited area can be excavated around each shaft. The coal is of good quality, from three to three and one-half feet thick, and finds a ready market in Davenport and the surrounding country.

VAN BUREN COUNTY.

Some years ago considerable coal was taken from this county, but recently very little coal produced in the county has left its borders. The only mines shipping in a small way are located at Douds, where it is hauled by wagon and then loaded on the railway cars. Mines to supply the local demands are operated near Farmington and Hillsborough. The coal occurs in small pockets and has a thickness of three to four feet.

During the last two years twelve fatal accidents occurred, and twenty-eight non-fatal were reported. As usual, the largest number of fatal accidents were due to falls of roof. One death occurred for every 295,560 tons of coal produced.

FATAL ACCIDENTS.

Table showing Fatal Accidents in District No. 2, for the biennial period ending June 30, 1899.

DATE.	NAME OF DECEASED.	OCCUPATION.	CAUSE OF CASUALTY.	NAME OF COMPANY OR FIRM.	WHERE LOCATED.
August 4, 1897	Ed. E. Brown	Miner	Falling roof	Crescent Coal company	What Cheer.
August 19, 1897	George Reed	Miner	Hit by coal from shot	Crescent Coal company	What Cheer.
August 27, 1897	Ora M. Snare	Miner	Falling roof	Crescent Coal company	What Cheer.
September 22, 1897	A. Nelson	Miner	Falling coal	Consolidation Coal company	Muchakinock.
February 17, 1898	J. W. Shipp	Miner	Falling roof	Dan Haworth's Coal comp'y.	Oskaloosa.
May 12, 1898	I. S. Little	Miner	Falling roof	Garfield Coal company	Oskaloosa.
June 9, 1898	D. D. Perry	Miner	Falling roof	Iowa Fuel company	Oskaloosa.
June 15, 1898	Helmuth Nelson	Driver	Fell under car	American Coal company	Oskaloosa.
July 14, 1898	Wm. Lewis	Miner	Falling roof	Consolidation Coal company	Muchakinock.
October 15, 1898	Elmer Moore	Driver	Fell under cars	Consolidation Coal company	Muchakinock.
December 21, 1898	Charles Rhoades	Driver	Caught head between car and roof	Columbian Coal company	Rose Hill.
January 19, 1899	Wm. Chapman	Miner	Crushed by car	Iowa Fuel company	Oskaloosa.

NON-FATAL ACCIDENTS.

Table showing Non-fatal Accidents of District No. 2, for the two years ending June 30, 1899.

DATE.		NAME.	OCCUPATION.	CHARACTER OF INJURY.	CAUSE OF ACCIDENT.	RESIDENCE.
July	14, 1897	Wm. Dale	Miner	Two ribs broken	Falling roof	What Cheer.
August	18, 1897	John Stonehouse	Driver	Dislocated back	Mule stumbled	Oskaloosa.
August	20, 1897	Henry C. Parker	Driver	Right leg broken	Slipped under car	Pekay.
August	27, 1897	G B Nail	Miner	Right arm and hand cut	Shot explosion	Pekay.
September	14, 1897	Elmer Alfkin	Cager	Two fingers amputated	Falling coal	Muchakinock.
September	22, 1897	J. M. Evans	Miner	Back injured	Falling roof	Colfax.
September	24, 1897	John Riley	Miner	Slight fracture	Falling roof	Beacon.
October	4, 1897	John Miller	Miner	Leg broken	Hit by coal from shot	Muchakinock.
October	28, 1897	Edward W. Evans	Trapper	Left arm broken	Fell between cars	Pekay.
November	9, 1897	Victor Peterson	Miner	Back injured	Falling roof	Pekay.
November	9, 1897	Peter Peterson	Miner	Back injured	Falling roof	Pekay
November	9, 1897	Amel Peterson	Miner	Abdomen squeezed	Falling roof	Pekay.
November	26, 1897	C. V Peterson	Miner	Left leg broken	Falling roof	Pekay.
December	10, 1897	C. J. Erickson	Miner	Leg broken	Falling roof	Muchakinock.
April	8, 1898	Lovie Salliz	Miner	Rib broken	Falling roof	What Cheer
April	19, 1898	Moses Calvert	Miner	Head severely injured	Struck by flying coal	Muchakinock.
May	10, 1898	Joseph Lowe	Driver	Leg bruised	Falling roof	Colon.
June	8, 1898	George Stubbs	Miner	Rib broken, back	Falling roof	What Cheer.
June	21, 1898	Sam Watkins	Miner	Two ribs broken	Falling roof	Muchakinock.
June	30, 1898	Rob't Nevins	Miner	Shoulder bruised	Falling roof	What Cheer.
July	8, 1898	Richard Richford	Miner	Dislocation of hip joint	Falling roof	What Cheer.
August	19, 1898	Thomas Conan	Miner	Badly cut and bruised	Shot went off prematurely	What Cheer.
August	19, 1898	Chas. Rupson	Miner	Cut face and arms	Shot went off prematurely	What Cheer.
December	12, 1898	Milton Robinson	Miner	Collar bone and left leg broken	Caught between trip and rib	Lost Creek.
December	15, 1898	John Eagan	Miner	Leg broken and bruised	Caught by cage	What Cheer.
March	24, 1899	Ed. Griffith	Driver	Finger cut off	Hand caught by coal	What Cheer.
March	24, 1899	J. Rowley	Miner	Both legs and collar bone broken.	Fell from cage	What Cheer.
May	29, 1899	John E Williams	Miner	Collar bone and two ribs broken	Hit by flying coal	Muchakinock.

EXPLOSIONS IN MINES.

The following article, written by me, was published in the "Colliery Engineer and Metal Miner" sometime ago. The views and conclusions presented herein are, as I believe, sustained by facts which were developed by close investigation of the more-recent explosions in the mines in this country, and especially those situated in the western states. It is deplorable that even now a dangerous ignorance as to their cause exists in this state among mine men, who ought to be better informed, and, as this report will probably reach every mining camp in the state, the republication of the article may help to clear away some of that ignorance, and thus correspondingly increase the safety of our mines.

It is not the object of this article to advance any new theories or to controvert those that have been fairly well established as true; its aim is to present some facts concerning coal-dust explosions that have been obtained through careful investigation, directed with the purpose to make them of practical value to the miner, and to clear away, in a measure, the mystery and doubt that as yet seemingly surround these explosions.

Experiments, carried on by men whose standing as scientists and mining experts is sufficient guaranty of accurate and thorough research, have shown that the presence of coal dust in any mine, where powder is used for blasting purposes, or where fire-damp, even in small quantities, exists, may, under certain conditions, become a source of great danger to life and property.

We admit that these experiments, investigations and subsequent deductions have been of great value to the mining world, and it is not our intention to attempt to detract in the least degree from their merits, yet, in the light of facts now at our disposal, it seems to us that, in accounting for past explosions, which could not have been the result of fire-damp, undue prominence has been given to the presence of coal-dust in establishing the cause of these explosions, at the expense of another factor that, as we shall try to show, is of greater importance, because, without its presence, the dust will at once cease to be an element of danger. The reason these men had for making dust the prime factor can be accounted for by the fact that their experiments and investigations were mostly conducted with a view to establish the easy inflammability of coal dust. This they did very successfully, but their success in this direction led them to the error of assuming too much in pronouncing dust the paramount factor in a so-called coal-dust explosion. We must consider that conditions, as they exist in an actual mine, necessarily differ materially from those surrounding experiments carried on in an artificial drift or shaft built at or near the surface, and, that being the case, it must be admitted that a proper conclusion cannot be arrived at, or a correct judgment formed, without due cognizance of these altered conditions.

It is generally claimed that blown-out shots were the original cause of nearly all dust explosions that have occurred in the past. While this statement is undoubtedly true, it must not be supposed that every blown-out shot is capable of causing an explosion, even if the mine is dusty and the dust easily inflammable. In Iowa the Chicago and Iowa mine had been in operation sixteen years before a disastrous explosion occurred there. The mine was always free from gas. During all these years blown-out shots were of daily occurrence in this mine; dust was always present to a greater or less extent; the coal contained always a large amount of volatile matter, almost equaling the fixed carbon and averaging nearly 40 per cent. Yet, under these conditions, looked upon as most favorable to the development of a dust explosion, this mine was worked, as stated, without serious mishap for sixteen years, a fact that should conclusively show that peculiar, additional conditions must prevail before the danger of a coal-dust explosion becomes imminent.

We believe that enough data have been furnished by explosions that occurred during the last eight or ten years to determine, with a fair degree of accuracy, just what conditions must exist and what factors are necessary to cause an explosion in the absence of fire-damp. In our opinion the most essential factors required are:

First.—Intense heat and considerable flame, furnished by a blown-out shot so located and tamped in such manner that the intensely-heated gases, developed by the explosion of the powder in the hole, will be projected into the passing air-current with the utmost force and without any appreciable decrease in their initial temperature.

Second.—A rapidly moving current of pure air of great volume and low temperature.

Third.—Coal-dust, floating in the air of the mine, of such fineness and composition as will promote easy and rapid ignition.

Local conditions have much to do with determining the extent and severity of an explosion, but they do not constitute primary factors; their influence becomes manifest only after an explosion is actually under way.

Next to the first factor mentioned, we consider the second of most importance, and we are emphatically of the opinion that the volume of air entering a mine, its purity and temperature, exert a more powerful influence in bringing about an explosion than the greater or less amount of coal-dust present. We believe that the greater the volume of air in a mine the greater will be the likelihood of an explosion, should the necessary initial force be furnished by a blown-out shot of the kind mentioned above; and we believe, further, that any material decrease in the volume of the ventilating current will also lessen the danger and have the tendency to make an explosion less severe, should one occur. We are aware that these assertions are looked upon by some as faulty, and that we have the theories and views of men against us who claim the very opposite as the truth. That their case may be fairly presented, we submit these excerpts:

In The Colliery Engineer and Metal Miner of June, 1893, page 255, a description of the explosion at Cedar Mines, Iowa, by Mr. J. T. Beard, is given, and in it we find the following: "Let us note here again that the burning will advance all the further in the pit, and cover a greater area, just in proportion as the supply of fresh air is lessened, as it will necessarily have to travel further before finding oxygen enough to burn it out."

An article on the Jack Oak mine explosion, published in the Ottumwa Courier, contains this statement: "It has been suggested that a lessening of the current, either by slowing down the fan or by partially opening the door previous to firing time, would act to destroy to a large extent the force of an explosion, should one occur. Let us see how this would be. We would have less air traveling upon the airways and throughout the workings, and a consequent decrease of pressure in the pit, on the one hand. We have, on the other hand, the same explosive force and expansive energy at the initial point; the same amount of dust will be stirred up and thrown in suspension upon the air in the region of the shot, and practically the same amount of gaseous material will be at hand, depending upon the supply of oxygen to burn it. This is fired from the flame of the shot and rolls out upon the entry, propelled by its expansive force; meeting the current, it feeds upon the oxygen there supplied and continues thus advancing till the outward expanding energy and the inward pressure of the current, aided by the tendency toward a vacuum behind, neutralize each other, when the further progress of the flame is stayed. Now (not to say a wind, but), with the customary amount of air passing, the burning and advance of the flame will be more rapid, the tendency toward a vacuum correspondingly stronger, and opposing pit pressure will be higher; all of these influences will unite to stay the progress of the flames in the entries sooner than when the current of air has been reduced."

We believe the above views to be erroneous and in opposition to physical laws.

The writer of the first quotation certainly promulgates a strange doctrine when he tells the reader that the "burning" (fire, flame) will travel further, and, therefore, continue to burn longer, without a plentiful supply of oxygen than with it—a doctrine that will hardly be acceptable to the physicist.

In the second quotation we are asked to believe that the same force (for nothing is said about it being augmented in any way) can overcome and remove a greater opposing force with more ease and rapidity than a smaller one. The writer also maintains that the formation of a vacuum behind the explosive force will proceed more rapidly, if said force is opposed by a strong current of air, and he holds that such current will materially assist to limit the extent of an explosion. We readily admit that the quicker a vacuum can be formed back of an explosion, the sooner will its advance be checked and the recoil take place, but we cannot admit that this result will be hastened through the inflow of a large volume of air, for a strong current will most certainly offer greater opposition to such advance than a weak one, a greater weight will have to be repelled, consequently the progress of an explosion will be less rapid; thus a strong current of air, instead of hastening the formation of a vacuum, will positively retard it, and we claim that this retardation, slight though it be, is absolutely essential to develop a dust explosion in its greatest intensity. It is only when the heat and flame travel at a comparatively low speed that the latent energy stored in the dust can be fully developed and become an important factor in propagating and intensifying an explosion, by allowing sufficient time for thorough and complete distillation and ignition of the gases it contains. As the force of an explosion gains in strength by this additional heat, the opposing air

current will be pressed back faster and faster until, when finally overcome, the opportunity is given to allow the outward rush of the explosion to go on with such rapidity as to make possible the formation of a vacuum, large enough and strong enough to check the explosion's advance and pull it back inward again.

A strong air current is not only necessary to intensify the force of an explosion, but it is needed to make an explosion, of any size possible at all. We know that, in order to fully develop the rendering properties of the heated gases generated by an explosion of powder, they must first be confined in a hole closed with a sufficient amount of tamping; and so to bring out the initial force of a dust explosion in its greatest strength, it is necessary to confine it at first to a limited space in order to concentrate the force of heat and flame and prevent an immediate fragmentary scattering of its strength. The inflow of a large volume of air will do this effectually, furnishing , so to speak, the necessary tamping. It will yet do more. It will add to an explosion an energizing element by providing that vital nourishment to flame, a plentiful supply of oxygen.

We stated that the air in a mine to become a prime factor in an explosion, besides being of large volume, must be pure and of low temperature, and we believe that these conditions are absolutely essential and must exist before a dust explosion can occur. There is not a case on record where such explosions ever occurred in a badly ventilated mine; on the contrary, we find that they invariably happened in mines where the ventilation was of superior character and then generally on the intake airway. That low temperature of the air must be regarded as an essential requirement is shown by the fact that these explosions occurred almost without exception in the colder months of the year. There are good reasons why the cold air of mid-winter should be of so much greater assistance in the creation of a dust explosion than the heated atmosphere of the months of July and August.

Cold air, being much heavier than warm air, is by reason of its greater weight, and therefore greater opposing force, better adapted than the latter to concentrate and confine the heated gases and flame of a blown-out shot and to bring out their full force with greater effect. Again, cold air contains more oxygen per cubic foot than warm air, and more oxygen means easier, fiercer and more rapid combustion.

The warm air of mid-summer, flowing through a mine, will act on the dust like a spray; it will saturate the latter with moisture and prevent its rising from the floor and sides and floating along with the air current, while the cold air will absorb moisture, dry out the dust, and permit the finer particles to float readily in the air, providing the easily ignited fuel which feeds and extends a dust explosion.

The mode of ventilation has much to do with determining the severity and extent of a dust explosion. Such explosion, occurring in a mine using a force-fan, will generally extend over more territory and be more destructive to property than one occurring in a mine ventilated by exhaust fan or furnace. The reason for this is not hard to find. With exhaustive ventilation the supply of fresh air to the mine is not only immediately shut off as soon as an explosion is started, but the amount of air back of the starting point of an explosion is steadily reduced by the action of the fan or furnace.

The benefit derived is two-fold. A powerful vacuum will be steadily formed, checking the explosion's advance, and on its recoil it will find a diminished supply of oxygen detracting from its force.

It is quite different should an explosion occur in a mine ventilated by a force-fan. Here a continuous supply of oxygen is furnished and thrown against the explosion in front, while back of it no agency is at work to diminish it, the speedy formation of a vacuum is delayed, heat and flame will be increased, and the explosion's force enhanced. The result is greater destruction extending over a larger territory.

Very seldom indeed does an exhaust-fan suffer destruction from the effects of a dust explosion unaided by fire-damp. For the reason above given its force will be spent before it can reach the upcast. We know of only one instance where an exhaust-fan was destroyed at a non-gaseous mine by such explosion. This happened at Rich Hill, Mo., December 29, 1891; but in this case the mine was new, its workings were yet of limited extent, and the fan was erected in close proximity to the downcast shaft, the upcast and downcast being separated only by a wooden partition.

On the other hand, an explosion traceable to coal-dust, occurring in a mine ventilated by a force-fan, is almost sure to wreck the ventilator. As examples we mention the Pekay, Iowa, disaster of 1892, and the recent explosion at the Vulcan mine in Colorado. In both instances the fans were wrecked, the explosion extended through either mine from downcast to upcast, and in both cases the destruction wrought was fearful.

The latter case seems to furnish a very strong argument in favor of the ground we have taken, that the greater the amount of air going into a mine the more pronounced will be the danger of a dust explosion in the presence of a blown-out shot. Originally the Vulcan mine was ventilated by a force-fan producing about 34,000 cubic feet of air per minute; a few months before the explosion occurred the management added another fan, and the two working together forced into the mine from 54,000 to 60,000 cubic feet per minute. With the less volume the mine had been working in safety; with the greater came death and destruction. In this case the large volume of air present did not only add force to the explosion, but it became also the direct means by which all the men in the mine lost their lives. The excellent description of this disaster by Mine Inspector David Griffiths, of Colorado, leads us to believe that while the force gained through limited ignition of coal-dust and possibly small quantities of gas, and added to the primary force developed by the blown-out shot, was not very great, it was amply sufficient to hurl the great mass of air with such force and rapidity through the mine as to invest it with the violence and destructiveness of a tornado.

This article may appear to some an argument in favor of poor ventilation. It should not be so considered. It should be the aim of all to suppress the occurrence of dangerous blown-out shots and thus eliminate the primary cause of these explosions. That accomplished, the air-current entering a mine, no matter how large its volume may be, can then fulfill its beneficent mission to preserve and sustain life, and there need be no fear that its dangerous forces will be awakened. The proposition to do away with the atmosphere surrounding the earth, to prevent the occurrences of cyclones and tornadoes, would be about as sensible as the suggestion of the idea of inefficient ventilation to prevent a dust explosion in a mine.