

REPORT OF STATE INSPECTOR OF MINES.

OFFICE OF INSPECTOR OF MINES,
INDIANAPOLIS, IND., January 20, 1900.

PROF. W. S. BLATCHLEY, *State Geologist*:

DEAR SIR—I have the honor to submit to you herewith the annual report of the Inspector of Mines for the year 1899, as required by section 7454 of the Revised Statutes of Indiana by Burns.

JAMES EPPERSON,
Inspector of Mines.

INTRODUCTION.

In his letter of transmittal, dated January 17, 1899, accompanying his annual report for the year of 1898, my predecessor, whose term of office, as Inspector of Mines, did not expire until March 11, 1899, declared his purpose of filing a supplemental report, covering the balance of his term. This, however, he failed to do, but agreed to furnish the necessary data for that purpose, when the time came to make up my annual report. Mr. Fisher's sudden death precluded him from doing so. I have been unable to find a number of papers and reports for that period of 1899 included in his term, which would have assisted me in getting up my report. Among other data which I have been unable to secure, is the list of persons who were examined at Brazil in February, together with the names of those to whom certificates of competency were issued at that examination; also the list of persons to whom he had issued service certificates during that period.

This report includes, or covers, the following topics or subjects, arranged in the order enumerated: Introduction, review of coal trade, table of production, table of wages paid employes, labor troubles, general table, mine maps, table showing the owners of mines and addresses, examinations, list of mine bosses and addresses, new electric motor, table of fatalities and tonnage by years, legislation, legislation recommended, table of accidents, abandoned mines, description of new mines, and Indiana Mining Institute.

REVIEW OF COAL TRADE.

The condition of the coal trade during the past year has been, as a whole, very satisfactory. In tonnage, it makes the largest production in the history of the State, exceeding 1898 by 718,053 tons, that year having the next highest record in number of tons produced, making an increase of about 14 per cent. This, too, notwithstanding that a good many mines in the southern part of the State lost considerable time during the spring and summer, on account of being involved in strikes, as noted in another part of the report; and notwithstanding that the winter, so far, has been exceptionally mild. The block coal operators depend to a considerable extent (now much more than formerly) upon domestic trade for a market for their coal, the tendency of manufacturers and other consumers at the present time being to use a cheaper coal, whenever possible.

During the past year the price of this product has not only been good, but the market has been firm, and the demand in excess of the supply. The prospect is that the coal trade will remain in a healthy condition throughout the ensuing year.

The probabilities are that the production of coal, during the present year, will greatly exceed that of last year. The number of new mines reported in this report is very much fewer than in last year's report, but there are a number of new ones almost ready for operation, that have not, as yet, reported to this office, and these, together with those reported, will exceed the number opened last year.

Nine new mines have been reported as completed for operation during the past year, distributed as follows: Clay County, 1; Fountain County, 1; Greene County, 1; Parke County, 2; Sullivan County, 4; total, 9.

Several other new mines are in contemplation, and a number of the older mines have largely increased their output by improvement and development. Not only are large sums of money being spent in equipping mines, new and old, in improved machinery, but capital is actively seeking investment in this industry, and much coal land is being purchased.

The Indiana Southern Railroad, built during the year through Greene, Sullivan, Clay and Vigo counties, has tapped a new coal field

that will, no doubt, be developed, and add to the supply of coal. It is probable, however, that by the time this is developed the production of some of the present coal producing fields will have been reduced somewhat by exhausted mines, and that this new field will not largely affect the total tonnage of the State.

As noted in another part of this report, the mine workers and operators are better organized than in years. Each of these organizations has learned wisdom and conservatism by past experience, and it is believed that no serious controversy will arise during the present year. This will have a tendency to increase the output of the State, and inure to the general benefit of the industry. A fair and equitable scale, observed throughout the State, will give to every operator a competitive chance in the coal market, enabling him to keep his mine running steadily, to the benefit of all concerned. Experience has demonstrated, time and time again, that lack of uniformity in the price paid for mining coal inevitably results in disaster to the coal trade.

TABLE

Showing the Wages Paid to Employes in Indiana, During the Year 1899, at Mines Employing More Than Ten Men, by Months and by Counties.

COUNTY.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Clay	\$103,199 46	\$101,516 89	\$95,022 78	\$52,791 52	\$48,386 75	\$52,893 26	\$63,295 54	\$80,758 04	\$82,012 68	\$100,860 50	\$81,020 28	\$85,666 64	\$947,424 34
Daviess	12,698 34	9,331 35	5,451 19	8,783 93	7,358 04	8,510 18	10,005 93	9,398 78	9,753 95	7,485 01	10,855 13	11,042 38	110,674 21
Fountain	6,267 85	5,400 50	5,830 60	3,708 80	3,258 16	3,534 30	3,635 05	3,098 80	2,144 03	905 00	970 00	850 00	39,603 09
Gibson	5,464 54	5,061 80	2,505 29	2,628 26	Strike.	1,543 89	2,222 97	2,283 95	3,992 79	5,852 04	5,311 70	4,984 00	41,851 23
Greene	36,048 99	34,758 47	24,388 86	27,937 80	21,254 83	19,839 42	15,624 20	31,390 32	30,193 74	42,382 41	41,865 09	41,816 39	367,500 52
Knox	4,216 09	4,141 30	3,512 76	2,079 93	1,188 73	1,186 35	1,182 16	1,325 67	2,257 62	3,139 20	4,888 46	3,643 78	32,762 05
Martin	549 43	487 07	489 00	522 00	496 00	350 80	156 50	282 25	248 00	230 00	276 50	315 00	4,402 55
Parke	56,019 96	50,529 18	58,234 71	43,274 10	29,839 92	37,652 69	44,249 31	52,310 63	55,556 34	63,994 37	54,427 54	68,074 93	614,163 68
Perry	2,026 30	1,722 79	2,378 22	2,190 66	1,952 46	1,812 38	1,451 71	1,713 57	1,179 80	1,336 00	1,553 37	1,900 00	21,217 26
Pike	15,758 33	14,336 15	11,742 32	10,100 41	476 61	282 50	818 75	1,248 25	1,991 99	11,596 68	20,696 45	16,783 25	105,831 69
Sullivan	40,368 90	33,576 87	38,385 38	32,301 70	24,698 72	23,253 34	22,953 69	28,018 96	36,586 52	38,227 43	44,276 97	36,277 61	398,926 09
Vanderburgh	15,175 55	15,509 15	13,175 50	10,845 40	4,698 83	4,975 65	5,222 45	3,688 10	10,464 99	10,192 05	12,066 55	12,224 40	118,028 62
Vermillion	35,350 53	28,122 72	26,358 60	27,421 30	27,584 61	29,430 88	26,066 18	25,981 96	29,871 59	34,382 00	38,356 38	39,891 54	368,818 29
Vigo	51,086 66	47,834 27	52,469 07	46,306 95	41,498 44	45,630 77	42,560 70	40,598 02	44,398 79	54,626 58	58,953 31	58,831 01	584,792 57
Warrick	5,206 37	3,564 80	3,705 91	2,668 60	1,562 46	1,504 00	2,050 00	2,500 00	1,565 00	1,450 00	3,865 85	15,333 21	44,976 20
Total	\$389,437 30	\$355,893 31	\$343,650 19	\$273,361 36	\$214,252 56	\$232,400 41	\$241,495 14	\$284,597 30	\$312,217 83	\$376,659 27	\$379,373 56	\$397,631 14	\$3,800,972 39
Estimated wages of small mines													12,680 00
Grand total													\$3,813,652 39

LABOR TROUBLE.

There were but few strikes of any consequence in the northern part of the State during the past year. The machine mine strike in the block coal field, if it can be called a strike, originated on the first day of April. In fact, none of the machine mines in the block coal field resumed work for about six weeks after the agreement as to the scale of prices was signed, on March 30. Prior to that time the machine miners had been paid by the day, at \$2.25 per day (27 cuts to constitute a day's work); and the cessation of work was to enable both the miners and operators to thoroughly analyze the scale and determine its effect, and occurred with the concurrence of all persons interested.

The next two strikes were at Summit No. 2 mine in Greene County, one of which was the cause of bringing out the entire Linton district, including eight mines. The strike was brought on through a disagreement as to the price paid for machine mining. Both strikes were settled amicably after a few weeks' idleness.

On March 30, the miners and operators of the organized part of the State met in Terre Haute and entered into an agreement as to the prices and conditions which should govern both parties from April 1, 1899, to April 1, 1900. The following is a copy of the agreement:

TERRE HAUTE AGREEMENT.

APRIL 1, 1899, TO APRIL 1, 1900.

The following agreement entered into in the Joint State Convention at Terre Haute, Indiana, March 29, 1899, by and between the bituminous operators and miners of the State, witnesseth:

First.—That the declarations of the contracts by and between the operators of the competitive coal fields and the United Mine Workers of America, entered into at Chicago, Illinois, January 24, 1898, and at Columbus, Ohio, March 10, 1898, and reaffirmed at Pittsburgh, Pennsylvania, January 24, 1899, be and hereby are reaffirmed in the identical terms therein employed.

Second.—That further details and scale of prices for pick and machine mining in the State of Indiana, for one year, beginning April 1, 1899, shall be as follows:

PICK MINING.

(Yardage.)

In entries seven to nine feet wide.....	\$1 37
In entries 12 feet, price shall be five-eighths of narrow work, or	85½

Wide entries shall not exceed 12 feet, it being understood that this applies to entry work only.

BREAK-THROUGHS.

Break-throughs in entries shall be paid for at entry price. Break-throughs between rooms, when sheared or blocked, shall be paid for at entry price, but no break-throughs shall be driven without the consent of the operator. Nothing herein shall interfere with strict compliance with the law governing break-throughs.

ROOM TURNING.

Room turning \$3 30

Room necks to be driven 12 feet in and widened at an angle of 45 degrees when so desired by operator. Any distance in excess of above shall be paid for proportionately.

MACHINE WORK.

(Yardage.)

In entries seven to nine feet wide..... \$0 98

In entries 12 feet wide, five-eighths of price for narrow entries, or 61

When the machine runners in 12-foot entries are paid by the day, and entry is not sheared, the shooters and loaders shall be paid two-thirds of the yardage. It is understood that this applies to entry work only.

BREAK-THROUGHS.

Break-throughs between entries, same as entry price. Break-throughs between rooms shall be paid for at entry price when similarly driven. This applies to width and not to method of mining.

ROOM TURNING.

Room turning \$2 47½

Room necks to be driven 12 feet in and widened at an angle of 45 degrees, when so desired by operators. Any distance in excess of the above shall be paid for proportionately.

When room necks are driven 12 feet wide, price shall be five-eighths of regular price, or..... \$1 54½

DAY WORK PUNCHING MACHINES.

Machine cutting, when paid for by the day, shall be for—

Cutter \$2 35

Helper 1 85

DAY WORK CHAIN OR CUTTER BAR MACHINE.

When paid by the day shall be--

Cutter	\$2 35
Helper	2 11

It being understood that a day's work shall not be less than twenty-seven (27) cuts. All cuts in excess of twenty-seven (27) shall be paid for proportionately.

PRICE PER TON FOR MACHINE MINING.

When paid for by the ton the price of coal mined by machines shall be three-fourths of the price paid for pick-mined coal, or, \$0 49½

The price per ton after chain machines shall remain the same at the respective mines as during the year ending April 1, 1899.

BLACKSMITHING.

The price of blacksmithing shall be one and one-quarter cents (1¼) on the dollar, excepting after chain machines, where no blacksmithing shall be charged.

GENERAL.

Where the coal is paid for mine run, or on screened coal basis, it shall be mined, and when loaded on the miner's car, it shall, as nearly as possible, be free from slate, bone coal, sulphur and other impurities.

Payment for all labor shall be made twice a month, not later than the 10th and 25th of each month.

It is further agreed that the operators shall offer no objection to the check-off for checkweighman and for dues for the federation, provided that no check-off shall be made against any person until he shall have first given his consent in writing to his employer. This applies to all underground day work, as well as miners.

The time of beginning work in the morning and the length of intermission at noon shall be considered a local question.

It is further agreed that if any differences arise between the operators and the miners at any pit, a settlement shall be arrived at without stopping of work. If the parties immediately affected can not reach an adjustment between themselves, the question shall be referred without delay to a board of arbitration consisting of two operators selected by the operators interested and two miners selected by District No. 11, of U. M. W. of A. In event of these four being unable to reach a decision, they shall select a fifth man, and the decision of a board so constituted shall be final, but no miner or operator interested in the differences shall be a member of said board.

RESOLUTIONS.

Resolved, That while the number of stoppages for various causes during the past year has decreased, it is still the opinion of both miners and operators that sufficient attention has not been paid by either side to the agreement "that if any differences arise between the operators and miners at any pit, a settlement shall be arrived at without stopping work." It is the unanimous opinion of both miners and operators that this agreement should be strictly observed of both. We wish particularly to call attention to the fact that all such differences, even in event of stoppage, have been settled by arbitration and work resumed, and had the agreement been strictly observed, these stoppages would not have occurred, the same settlement would have been secured, and both miners and operators would have been saved the heavy losses caused by these stoppages.

That these resolutions be compiled in the form of a contract and signed by the President and Secretary of the United Mine Workers of America representing District No. 11, and the President and Secretary of the Bituminous Coal Operators' Association of Indiana; that they be printed and a copy sent to each and every mine and posted.

In witness whereof, we have hereunto subscribed our names this 30th day of March, 1899.

Attest:

W. D. VAN HORN,

President U. M. W. of A., District No. 11.

J. H. KENNEDY,

Secretary U. M. W. of A., District No. 11.

Attest:

J. SMITH TALLEY,

President Bituminous Coal Operators' Association of Indiana.

J. W. LANDRUM,

Secretary Bituminous Coal Operators' Association of Indiana.

At that time, however, the organization of miners and operators only extended as far south as the Baltimore and Ohio Southwestern Railroad. South of that point, at nearly all of the mines, the price paid for mining and day work was considerably below that agreed upon at the Terre Haute convention. During the latter part of April and the first part of May, the miners in the southern part of the State organized and demanded the scale prices paid in the northern part of the State, which the operators refused to pay, and the result was a strike at nearly all the mines south of Washington. A number of the mines, however, were idle but a short time, when the operators agreed to pay the scale prices and started their mines. A majority of these, however, were operating small mines. The strike was continued among the larger mines for some time. The Sunnyside Mine, at Evansville, was the first to pay the scale prices and resume work. W. S. Little, of the Little's Mine, and David Ingle, of the Ayershire Mine, were next to

fall in line. The operators of the First Avenue and Ingle mines, at Evansville, steadily refused to conform to the Terre Haute agreement, and continued to operate their mines, to a small extent, with non-union men until about November 1, when they also agreed to pay the scale prices, and are now included among the union mines of the State. This leaves less than one hundred men, working at shipping mines in the State, who are not in the organization.

There was very little disorder during these strikes except at Evansville, where there was some trouble. The most serious disturbance at this point was the lamentable shooting of J. Moore, an operator, while on his way to the mine with a company of non-union men. The shooting was done under cover of darkness, from ambush, and it is not known who did it. Mr. Moore was severely wounded; and, at one time, it was thought his wound would prove fatal; but he has, however, recovered, and is now able to attend to his duties again.

A very peculiar condition existed in the coal industry during the last fall and winter. Early in the fall, under the influence of the prosperity sweeping over the country, the price of coal, in common with the price of all other products, as well as the price of labor, advanced rapidly. The wages of mine workers, however, was governed by the scale of prices agreed upon at the Terre Haute convention; and they were bound by this agreement to continue working under it until April 1, 1900. In the meantime, many coal operators were reaping a rich harvest by reason of the wide margin between the cost of producing and the market value of their coal. A large number of the operators, however, had existing contracts based upon this scale of prices, and were not benefited by the advancing market, except as to coal which they were able to produce in excess of existing contracts. Under these conditions, it is not very strange that the miners should become restive and desire to have their wages advanced, the same as craftsmen in other industries. The engineers at coal mines, who were bound by no schedule of prices, received a substantial advance in their wages, and some operators, in the spirit of petulance, on account of the advance in wages conceded to the engineers, voluntarily increased the wages of the day men in their employ. All this tended to increase the discontent among the mine workers, especially as they had no means of knowing what prices their employers were getting for their coal. It is to be noted to the credit of the mine workers, however, that they kept faith with the operators by sticking to their agreement. Much credit is due the several officers and leaders of the mine workers for their persistent insistence on the keeping of the Terre Haute agreement. It is highly probable, however, that, before this report reaches

the public, all mine workers will have received a substantial increase in wages. Mine workers have learned from experience that strikes and lockouts, which lead to violence and the destruction of property, are unsatisfactory and ineffective remedies as a rule, and that the mine workers and the operators have a common interest. It is to be hoped that this striking example of fidelity to their agreement, on the part of the mine workers, will inspire confidence in their employers and will bind the two organizations closer together in the bonds of interest and sympathy.

TABLE

Showing the Average Number of Men and Mules Employed, Days Worked, Accidents Occurring, Kegs of Powder Used, Total Coal Produced, Total Wages Paid and the Total Improvements at Each Mine Reporting to this Office in 1899.

CLAY COUNTY.

NAME OF MINE.	EMPLOYED.			Days Worked.	ACCI- DENTS.		Kegs of Powder Used.	Tons Coal Pro- duced.	Wages Paid.	Improvements.
	Men Inside.	Mules.	Men Outside.		Fatal.	Non-Fatal.				
Brazil B. C. Co. No. 10.	23	2	4	40	...	...	49	3,188	\$6,198 68	...
Brazil Block No. 1	91	7	12	234	1	2	1,014	58,715	50,948 13	\$4,715 74
Gart No. 3	85	9	9	162	...	...	1,199	41,164	43,231 27	...
Gart No. 5	130	10	10	210	...	...	1,553	44,609	63,687 82	...
Brazil Block No. 7	...	...	...	...	...	...	...	...	...	...
Brazil Block No. 8	106	10	15	219	...	1	2,331	92,901	82,351 91	...
Brazil Block No. 11	61	5	5	259	...	3	897	43,819	40,274 40	...
Gladstone	70	10	8	217	...	...	1,774	44,209	46,054 42	...
Briar Hill	19	2	5	106	...	...	4,652	6,673	6,673 63	...
Harrison No. 2	43	4	6	196	...	1	818	23,462	20,132 00	...
Harrison No. 3	24	3	3	197	...	1	458	13,004	10,302 00	...
Pratt	61	6	6	164	...	2	...	26,905	25,606 00	...
Crawford No. 3	66	3	6	130	...	...	211	16,223	14,647 13	4,106 27
Crawford No. 4	72	3	5	207	...	1	1,745	39,949	32,165 91	...
World's Fair	34	2	3	195	...	...	1,160	17,046	14,095 75	...
Diamond No. 3	60	3	5	160	...	...	3,446	63,381	56,056 66	...
Eureka No. 2	96	9	6	131	...	7	1,630	39,527	35,856 13	...
Eureka No. 3	63	5	5	200	...	...	837	41,383	34,893 00	...
Monarch	17	3	1	290	...	...	...	7,200	...	...
Brazil	41	3	4	117	...	1	115	14,121	15,525 34	...
Markland	29	4	7	229	...	...	782	14,784	12,844 10	...
Fairview	36	4	3	193	...	1	280	14,806	17,314 84	...
Louise	23	2	3	92	...	...	90	6,528	10,234 89	...
Columbia No. 4	61	3	4	226	...	1	1,594	29,894	32,513 92	...
Klondyke	163	9	9	196	...	2	2,395	133,549	70,145 39	...
Silverwood No. 3	40	3	5	244	...	...	...	27,421	20,648 35	...
San Pedro	47	5	7	259	...	...	787	44,412	24,059 20	...
Rob Roy	36	2	5	...	...	2	384	13,335	10,512 19	...
Columbia No. 5	111	5	6	179	...	...	899	54,365	48,925 38	...
Dewey	81	3	4	166	...	...	294	41,239	35,401 49	...
Crawford No. 5	102	3	7	244	...	6	2,391	51,672	47,606 58	...
Pyrah No. 3	20	2	2	70	...	...	10	2,002	2,021 20	...
Diamond No. 5	23	2	4	40	...	...	49	3,188	6,198 68	...
Cloverland	60	3	3	98	...	...	222	8,838	5,465 27	...
Pearl	13	1	3	53	...	...	72	1,483	2,034 00	...

TABLE—Continued.

DAVIESS COUNTY.

NAME OF MINE.	EMPLOYED.			Days Worked.	ACCI- DENTS.		Kegs of Powder Used.	Tons Coal Pro- duced.	Wages Paid.	Improvements.
	Men Inside.	Males.	Men Outside.		Fatal.	Non-Fatal.				
Cabel No. 4.....	53	9	7	123	.....	.....	824	24,418	19,614 51	.....
Cabel No. 9.....	118	13	6	231	.....	.....	1,443	69,334	44,549 34	.....
Montgomery No. 1.....	45	2	22	90	.....	.....	2,403	2,403	1,772 36	.....
Montgomery No. 2.....	.....	.....	.....	.....	.....	.....	384	3,459	2,160 75	.....
Montgomery No. 3.....	54	6	13	33	.....	.....	167	3,459	2,160 75	.....
Mutual.....	33	4	6	210	.....	.....	600	15,965	15,706 60	\$1 280 00
Hoosier.....	18	1	4	71	.....	.....	.....	2,644	2,050 00	.....
Union.....	.....	.....	.....	.....	.....	.....	.....	3,230	1,526 22	.....
Hawkins.....	28	4	5	135	1	.....	120	25,930	31,009 84	.....
Wilson No. 4.....	25	2	3	225	.....	.....	.....	13,686	7,378 38	.....
Stuffles No. 3.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

FOUNTAIN COUNTY.

Silverwood No. 2.....	52	8	6	179	.....	2	1,529	40,820	\$23,105 98	.....
Sturm No. 2.....	14	2	3	313	.....	.....	424	14,242	10,496 89	.....

GIBSON COUNTY.

Oswald.....	81	6	12	199	3	2,303	71,604	\$41,850 65	\$500 00
-------------	----	---	----	-----	-------	---	-------	--------	-------------	----------

GREENE COUNTY.

Island City.....	97	10	13	180	.....	1	.....	98,191	\$48,242 21	.....
Island No. 2.....	152	18	20	.....	.....	.....	.....	143,552	74,181 50	.....
Island Valley.....	48	4	6	172	.....	.....	692	39,440	25,440 41	.....
Fluhart.....	96	9	8	128	.....	.....	1,422	75,670	44,973 66	.....
South Linton.....	82	7	8	147	.....	1	1,152	72,754	45,568 29	.....
Summit.....	107	13	12	173	.....	8	2,164	124,351	70,162 74	.....
Templeton.....	97	6	11	87	.....	2	.....	107,098	58,747 88	.....
Summit No. 2.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....

KNOX COUNTY.

Bicknell.....	34	2	4	191	.....	1	778	25,390	\$14,358 00	.....
Edwardsport.....	38	3	8	85	.....	.....	52	7,348	4,371 34	.....
Prospect Hill.....	19	3	5	242	.....	.....	523	15,203	13,055 31	.....

MARTIN COUNTY.

Tunnel.....	20	2	2	260	21	6,798	\$4,392 55
-------------	----	---	---	-----	-------	-------	----	-------	------------	-------

TABLE—Continued.

PARKE COUNTY.

NAME OF MINE.	EMPLOYED.			Days Worked.	ACCI- DENTS.		Kegs of Powder Used.	Tons Coal Pro- duced.	Wages Paid.	Improvements.
	Men Inside.	Mules.	Men Outside.		Fatal.	Non-Fatal.				
Brazil Block No. 12	99	6	9	218	....	4	1,182	47,049	\$43,232 96	.....
Cox No. 3	96	13	20	246	....	3	1,052	107,756	76,630 90	\$4,041 00
Lyford No. 2	127	11	15	183	2	7	3,586	120,725	80,375 48	948 00
Mecca No. 1	44	5	7	280	1	3	2,176	45,568	35,556 42	.....
Parke No. 3	80	8	11	257	1	....	1,410	103,133	61,164 73	.....
Otter Creek	50	11	11	181	....	2	1,306	37,516	32,915 34	.....
Superior No. 1	56	4	5	214	....	....	163	53,767	50,397 67	.....
Superior No. 2	134	7	8	247	1	....	3,367	81,831	71,750 07	.....
Crawford No. 1	69	3	4	181	....	2	171	36,656	30,815 80	.....
McIntosh No. 1	27	2	2	146	....	3	315	16,689	16,016 75	.....
McIntosh No. 3	40	3	6	196	....	....	1,305	31,316	26,934 07	.....
Lucia	78	5	6	221	....	....	3,268	82,560	43,515 17	2,998 00
Standard	74	5	5	17	....	2	....	57,234	48,355 00	.....

PERRY COUNTY.

Cannelton	34	3	6	153	....	....	....	14,768	\$13,270 88	.....
Troy	19	2	2	209	....	1	514	10,471	7,666 44	.....

PIKE COUNTY.

Hartwell	31	5	3	98	....	....	113	5,645	\$5,264 47	\$352 00
Ayrshire	121	22	12	77	....	....	2,198	43,928	44,610 63	.....
Blackburn	39	6	8	16	....	....	1,074	27,462	16,478 05	.....
Littles	99	10	11	132	....	....	2,007	52,389	25,266 33	.....
Carbon	31	3	3	67	....	....	456	14,879	7,133 23	.....
Woolley	....	....	....	....	....	....	....	....	....	....

SULLIVAN COUNTY.

Caledonia	44	3	4	196	....	1	400	13,774	\$1,440 10	.....
Briar Hill	19	1	5	14	....	....	44	1,551	425 00	.....
Bunker Hill	12	2	3	108	....	....	79	2,405	1,692 76	\$27 00
Dugger	110	70	16	199	....	3	1,113	93,588	46,190 26	.....
Star	94	13	21	23	....	2	1,479	218,060	104,030 66	.....
Jumbo	120	20	....	241	....	....	1,217	161,112	88,952 64	200 00
Phoenix No. 1	151	12	20	219	....	5	1,655	177,281	65,051 31	.....
Hymera	47	5	11	214	....	1	754	61,415	37,834 40	.....
Shelburn	66	8	10	236	....	....	1,169	55,696	38,738 73	.....
White Ash	33	2	3	75	....	....	570	19,655	13,234 00	.....
Ingleside	20	2	5	91	....	....	120	4,538	2,461 94	.....

TABLE—Continued.

VANDEBURGH COUNTY.

NAME OF MINE.	EMPLOYED.			Days Worked.	ACCI- DENTS.		Kags of Powder Used.	Tons Coal Pro- duced.	Wages Paid.	Improvements.
	Men Inside.	Mules.	Men Outside.		Fatal.	Non-Fatal.				
Diamond	21	2	7	186	....	1	574	13,435	\$12,041 72	.....
Union	22	3	5	247	....	1	717	14,877	14,018 55	.....
Ingleside	54	10	9	25	....	....	1,873	40,897	3,469 81	.....
First Avenue	22	4	8	275	....	....	1,020	29,934	21,102 75	.....
Sunnyside	78	16	10	185	....	....	1,040	51,636	35,244 65	.....

VERMILLION COUNTY.

Brouillet's No. 4	120	9	8	267	....	1	10,459	166,056	\$84,332 15	.....
Cayuga	16	2	3	210	....	3	367	7,390	6,785 02	.....
Prince	135	12	11	244	1	....	12,975	218,253	124,345 17	.....
Brouillet's No. 3 .....	....	....	....	....	....	....	367	88,870	46,826 11	.....
Torrey No. 4	90	7	12	78	2	2	4,623	123,940	82,358 21	.....
Buckeye	61	7	7	134	....	1	2,225	56,033	30,800 14	.....

VIGO COUNTY.

Peerless	90	11	9	102	1	3	....	218,253	\$51,013 00	.....
Union	114	18	11	283	1	1	....	211,037	122,311 00	.....
Broadhurst	16	2	2	26	1	1	590	10,495	6,670 91	.....
Ehrlich	55	5	7	265	1	....	2,593	69,527	39,197 46	.....
Nickel Plate	61	7	9	196	....	1	1,397	62,270	47,342 11	.....
Hector	28	6	8	270	....	....	2,254	68,336	33,343 92	.....
Grant	75	9	9	153	....	....	3,450	80,372	51,516 60	\$2,400 00
Parke No. 10	100	11	12	170	....	....	1,342	149,960	66,720 93	.....
Brick Works	13	1	1	256	....	....	254	5,946	3,623 30	100 00
Vigo	24	3	3	66	....	....	86	3,025	1,863 25	.....
Ray	85	8	8	19	....	....	141	98,443	32,647 66	.....
Murray	28	3	4	23	....	....	65	2,370	937 00	100 00
Diamond No. 2	153	13	9	285	....	1	....	138,734	93,854 00	1,200 00
Klondyke	60	3	7	202	....	1	1,337	43,683	28,446 97	.....

WARRICK COUNTY.

Star No. 1	38	4	7	249	....	1	1,484	33,720	\$1,772 50	.....
Gough	14	3	3	97	....	....	271	87,036	2,928 30	.....
Air Line	12	1	3	....	....	....	116	12,231	5,040 92	.....
Big Vein	30	7	6	109	....	....	427	25,880	7,485 55	.....
Caledonia	19	2	3	63	....	....	114	5,155	3,006 51	\$221 00
DeForrest	17	....	....	....	1	1	315	6,199	2,472 32	.....

NOTE.

We call attention to the column of improvements, which amounts to \$22,227.71.

The following companies have put in electric haulage, which represents the greater part of the money expended for improvements:

1. The Brazil Block Coal Company, at their No. 1 and Cox No. 3 mines, two motors each of the improved third rail pattern.

2. Cabel & Co., of Daviess County, have also equipped their No. 9 mine with two motors of the third rail pattern.

The balance of the money expended for improvements has been spent for self-dumping cages, fans, scales, and in improving mines in various other ways.

MAPS.

It requires a good deal of urging on the part of the Inspector of Mines to secure a compliance with the law in regard to maps; but I think the dereliction in this respect is due more to want of attention than to a willful disregard of the law. I apprehend that the persons whose duty it is to furnish the information of this character do not realize its importance. I can not emphasize too strongly the necessity for complete and accurate maps. It furnishes a practical protection from encroachment upon abutting owners; it affords the Inspector a valuable source of reference and necessary information in considering the requirements and conditions of a mine, it being impossible to keep all the details of all the mines in one's mind, without such assistance; and it enables the Inspector to originate many suggestions as to the betterment of mines.

Maps are also invaluable in case of abandoned mines which have filled with water, as a guide in future mining operations in the vicinity of the abandoned mines; but to be of any value, in such case, it is highly necessary that the maps be absolutely correct. I quote briefly from my predecessor, Mr. Fisher, on that subject:

"A great expense and annoyance is occasioned in approaching an abandoned mine, where the extent of the worked-out territory is not known. The survey and map should be made by a practical surveyor, so that the accuracy of the survey could be relied upon. When a mine is worked out and abandoned all trace of it may disappear in a few years. In the case of mines working toward abandoned works, we have had several examples lately of the expense attending approaching them without a map, in one case a bore hole having been kept ahead of the workings for over 300 feet."

Even this precaution does not render the work of the approach to the abandoned mine safe, as a stub of coal may have been left in the vacated mine, for some reason, and the hole penetrate the stub instead of striking the open space. We quote again from the above mentioned report:

"In another case, where apprehensions were felt as to the danger of breaking into an old mine, of which a map had been filed, a survey showed that the workings of the two mines were nearly 500 feet apart, and work was continued for more than a year without the expense attending upon keeping a drill hole in advance. But this does not appeal to mine owners, as the benefit derived from it will be received by future operators. But a correct working map is a present benefit in many ways. It has a tendency to secure a more systematic working of the mine, to keep the workings in such a shape that the greatest possible amount of coal is finally recovered from the pillars and to prevent accidents from shot blowing through the pillars. In many instances, an accurate map of a mine would have prevented costly litigation over property injured by roof falling, on account of insufficient pillars being left to support it, and on account of trespassing on coal out of the proper lines. These maps are also of value to this office, in the assistance they render in understanding the monthly reports of mine bosses, and their use as a guide to the mines on visits of inspection. We have received a great benefit in these maps, and their value to a new incumbent of the office is inestimable."

We fully approve everything stated in the above quotation, and much more could be said upon the subject. While writing this report I received a request from an owner of land adjoining one of our largest mines, asking that a survey be made of part of the mine adjacent to his land, stating that he believed the company owning such mine was removing coal from his land.

LIST OF MINES.

Table Showing the Names and Addresses of Persons and Corporations Operating Coal Mines in the State of Indiana, During the Year of 1899, with the Names of Mines in Each County.

CLAY COUNTY.

NAMES.	ADDRESSES.	MINES.	REMARKS.
Brazil Block Coal Co.	Brazil	Mine No. 1	Abandoned.
Brazil Block Coal Co.	Brazil	Gart No. 3	
Brazil Block Coal Co.	Brazil	Gart No. 5	
Brazil Block Coal Co.	Brazil	Mine No. 7	
Brazil Block Coal Co.	Brazil	Mine No. 8	
Brazil Block Coal Co.	Brazil	Mine No. 10	
Brazil Block Coal Co.	Brazil	Mine No. 11	
Briar Block Coal Co.	Chicago, Ill.	Briar Hill	
Chicago & Indiana Coal Co.	Terre Haute	Harrison No. 2	
Chicago & Indiana Coal Co.	Terre Haute	Harrison No. 3	
Coal Bluff Mining Co.	Terre Haute	Pratt	
Crawford Coal Co.	Brazil	Mine No. 3	Abandoned.
Crawford Coal Co.	Brazil	Mine No. 4	
Crawford Coal Co.	Brazil	Mine No. 5	
C. Ehrlich Coal Co.	Turner	Klondyke	
D. H. Davis Coal Co.	Knightsville	World's Fair	
Eureka Block Coal Co.	Terre Haute	Eureka No. 2	
Eureka Block Coal Co.	Terre Haute	Eureka No. 3	
Diamond Block Coal Co.	Chicago, Ill.	Diamond No. 3	
Goucher, McAdoo & Co.	Brazil	Monarch	See Note 1. Abandoned.
Jackson Coal and Mining Co.	Brazil	Brazil	
Jackson Coal and Mining Co.	Brazil	Dewey	
Andrew, Peter	Clay City	Markland	
Somer, Joseph	Staunton	San Pedro	
Zeller, McClellan & Co.	Brazil	Columbia No. 3	
Zeller, McClellan & Co.	Brazil	Columbia No. 4	
Zeller, McClellan & Co.	Brazil	Columbia No. 5	
Lancaster Block Coal Co.	Terre Haute	Rob Roy	
Brazil Mining Co.	Chicago, Ill.	Gladstone	
Crawford Coal Co.	Brazil	Louise	See Note 2. Abandoned. New mine.
Pyrab, Samuel	Brazil	Pyrab No. 3	
Diamond Block Coal Co.	Chicago, Ill.	Diamond No. 5	
Indiana Bituminous Coal Co.	Terre Haute	Silverwood No. 3	
Zeller, McClellan & Co.	Brazil	Cloverland	
Otter Creek Coal Co.	Brazil	Fairview	
Brazil Block Coal Co.	Brazil	Gart No. 11	
Cloverland C. & M. Co.	Cloverland	Pearl	

DAVISS COUNTY.

Cabel & Co.	Washington	Mine No. 4	Abandoned. See Note 3.
Cabel & Co.	Washington	Mine No. 9	
Daviess County Coal Co.	Montgomery	Mine No. 1	
Daviess County Coal Co.	Montgomery	Mine No. 2	
Daviess County Coal Co.	Montgomery	Mine No. 3	
Mutual Mining Co.	Cannelburg	Mutual	
Raglesville Coal Co.	Raglesville	Hoosier	
Stuffles, James	Raglesville	Mine No. 3	
Washington Coal Co.	Washington	Hawkins	
Washington Coal Co.	Washington	Wilson No. 4	
Winklepleck, Jonas	Raglesville	Union	
			Small mine.

LIST OF MINES—Continued.

FOUNTAIN COUNTY.

NAMES.	ADDRESSES.	MINES.	REMARKS.
Indiana Bituminous Coal Co.....	Terre Haute ...	Silverwood No. 1	Abandoned.
Indiana Bituminous Coal Co.....	Terre Haute ...	Silverwood No. 2	New mine.
Silverwood Coal Co.....	Silverwood.....	Sturm	

GIBSON COUNTY.

Princeton Coal Co.....	Princeton.....	Oswald.....	
------------------------	----------------	-------------	--

GREENE COUNTY.

Island Coal Co.....	Indianapolis...	Island City No. 1	
Island Coal Co.....	Indianapolis...	Island No. 2.....	
Island Valley C. & M. Co.....	Linton	Island Valley.....	
Linton C. & M. Co.....	Linton	Fluhart	
South Linton Coal Co.....	Linton	South Linton	
Summit Coal Co.....	Bloomfield.....	Summit No. 1.....	
Summit Coal Co.....	Bloomfield.....	Summit No. 2.....	New mine.
Western Indiana Coal Co.....	Terre Haute ...	Templeton.....	

KNOX COUNTY.

Bicknell Coal Co.....	Bicknell	Bicknell	
Edwardsport Coal Co.....	Indianapolis...	Edwardsport	See Note 4.
Prospect Hill Coal Co.....	Vincennes	Prospect Hill	

MARTIN COUNTY.

Wampler, F. M.....	Indian Springs.	Tunnel.....	
--------------------	-----------------	-------------	--

PARKE COUNTY.

Brazil Block Coal Co.....	Brazil.....	Cox No. 3.....	
Brazil Block Coal Co.....	Brazil.....	Brazil Block No. 12.....	
Brazil Block Coal Co.....	Brazil.....	Otter Creek	
Crawford Coal Co.....	Brazil.....	Mine No. 1.....	
McIntosh, I & Co.....	Brazil.....	Mine No. 2.....	
McIntosh, I & Co.....	Brazil.....	Mine No. 3.....	New mine.
Otter Creek Coal Co.....	Brazil.....	Mecca No. 1.....	
Parke County Coal Co.....	Rosedale.....	Parke No. 8.....	
Rock Run Coal Co.....	Brazil.....	Lucia	New mine.
Standard Coal Co.....	Terre Haute ..	Standard.....	
Wabash Valley Coal Co.....	Clinton	Lytford No. 2.....	See Note 5.
Zellar, McClellan & Co.....	Brazil.....	Superior No. 1.....	See Note 6.
Zellar, McClellan & Co.....	Brazil.....	Superior No. 2.....	

PERRY COUNTY.

American Cannel Coal Co.....	Cannelton	Cannelton	
Bergenroth Bros.....	Troy	Troy	

LIST OF MINES—Continued.

PIKE COUNTY.

NAMES.	ADDRESSES.	MINES.	REMARKS.
Cabel-Kaufman Coal Co.....	Cabel	Hartwell	See Note 7.
Ingle, D.	Oakland City	Ayrshire	
Potter & Johnson	Oakland City	Carbon	
The S. W. Little Coal Co	Evansville	Blackburn	See Note 8.
The S. W. Little Coal Co	Evansville	Little's	
The J. Woolley Coal Co	Evansville	Woolley	

SULLIVAN COUNTY.

Green Hill Coal Co	Sullivan	Green Hill	New mine.
Sexton & Crowder	Farnsworth	Bunker Hill	See Note 9.
Harder-Hafer Coal Co	Del Carbo	Star	See Note 10.
Hymera Coal Co	Hymera	Hymera	
Indiana & Chicago Coal Co	Dugger	Dugger	
Jackson Hill Coal and Coke Co	Eagle	Jumbo	See Note 11.
Dugger Co-operative Coal Co	Cass P. O.	Briar Hill	
New Pittsburgh Coal and Coke Co	Alum Cave	Phoenix No. 1	
Shelburn Mining Co	Shelburn	Shelburn	See Note 12.
Rainbow Coal and Mining Co	Farnsworth	Caledonia	
Sullivan Coal Co	Sullivan	Sullivan	
White Ash Coal Co	Hymera	White Ash	Small mine.

VANDERBURGH COUNTY.

Diamond Coal and Coke Co	Evansville	Diamond	
Evansville Union Coal Mining Co	Evansville	Union	
John Ingle Coal Co	Evansville	Ingle'side	
Lozier, H. A.	Evansville	First Avenue	
Sunnyside Coal and Coke Co	Evansville	Sunnyside	

VERMILLION COUNTY.

Brouillet's Creek Coal Co	Clinton	Mine No. 3	See Note 13.
Brouillet's Creek Coal Co	Clinton	Mine No. 4	
Keller Coal Co	Clinton	Prince	
McClellan, Sons & Co	Clinton	Buckeye	
Torrey Coal Co	Voorhees	Torrey No. 4	
Cayuga Press Brick Co	Cayuga	Cayuga	

VIGO COUNTY.

Miller, A. F.	Macksville	Miller	Local.
Broadhurst, J. N. and G	Macksville	Broadhurst	Local.
Coal Bluff Mining Co	Terre Haute	Union	Small mine.
Davis, Edward	Ehrmandale	Vigo	
Ehrlich, Julius	Seeleyville	Ehrlich	
Grant Coal Mining Co	Burnett	Grant	Local.
Lankford, William	Macksville	Harmer	
Loughner Coal Co	Seeleyville	Hector	
Macksville Coal Co	Macksville	Murray	Local.
Nevins Coal Co	Fontana	Klondike	
Parke County Coal Co	Rosedale	Parke No. 10	
Terre Haute Brick and Pipe Co	Terre Haute	Brick Works	Local.
Vigo County Coal Co	Seeleyville	Ray	
Basil Mining Co	Chicago, Ill.	Nickel Plate	
Grant Coal Mining Co	Burnett	Grant No. 2	New mine.

LIST OF MINES—Continued.

WARRICK COUNTY.

NAMES.	ADDRESSES.	MINES.	REMARKS.
Archbold, John.....	Evansville.....	Star Nos. 1 and 2.....	See Note 14.
Bartley, Patrick.....	Evansville.....	Chandler.....	
Caledonia Coal Co.....	Boonville.....	Caledonia.....	
DeForrest Coal Co.....	Evansville.....	DeForrest.....	Small mine.
Hall & Lawrence.....	Chandler.....	Air Line.....	
Kelley & Nester.....	Boonville.....	Gough.....	Small mine.
J. Woolley Coal Co.....	Evansville.....	Big Vein.....	

NOTES.

1. All work in the Goucher, McAdoo & Co. Mine is paid for by the day. The entire product of this mine is consumed at the Monarch Clay Works, located near the mine and owned by this company. Fire-clay is mined with the coal, and, for this reason, it is impossible to ascertain the cost of mining the coal. This will explain why the wages are not reported for this mine.

2. The Louise Mine in Clay County, formerly owned by the Weaver Coal Company, was sold in the month of May to the Crawford Coal Company.

3. The Daviess County Coal Company retired from business in March, and their mines, Montgomery No. 1 and No. 2, were leased by the Washington Coal Company in the month of April.

4. The Edwardsport Mine in Knox County was shut down on March 15 and remained idle until November 1. When operations were resumed at this time there had been several changes in the stockholders of the company, and the mine is now under the management of Mr. George Moore, of Indianapolis, one of the original stockholders of the company.

5. The Lyford No. 2 Mine was leased in the month of September by the Torrey Coal Company. The lease, however, extends only until April 1, 1900, when it is understood that a new company will take charge of the property.

6. The top vein in Superior No. 1 Mine, owned by Zeller, McClellan & Co., was abandoned in the month of May and the shaft sunk to the bottom vein.

7. The Carbon Mine in Pike County was sold in the early part of the year to the Johnson & Potter Company.

8. The Petersburg, owned by the J. Woolley Coal Company, was abandoned in the month of May, but was re-equipped and operations resumed in November by the same company.

9. The Bunker Hill Mine, in Sullivan County, formerly operated by Ladson, Carty & Smith, changed hands in October, and William Crowder, the owner of the mine, and W. H. Sexton, who was formerly connected with the Summit Coal Company, have assumed the management of the mine, and are equipping it with electricity.

10. The Hymera Mine was sunk to the lower vein in September, and the top vein was then abandoned.

11. Briar Hill Mine, in Sullivan County, which was operated during the early part of the year by the Lyontoni Coal Company, changed hands in November, and the Dugger Co-operative Coal Company, the original owners, are now operating it.

12. The Bush Creek Mine, operated by Donald & Fogg, was leased in August by the Rainbow Coal Company, and its name was changed to the Caledonia Mine.

13. The shaft at Brouillet's Creek No. 3 Mine was sunk, in the early part of the year, to the bottom vein, and the top vein abandoned.

14. The Brizius Mine, in Warrick County, was leased in June by the John Archbold Coal Company and is now being operated by them as Star No. 2 Mine.

EXAMINATIONS.

Examinations of applicants for certificates of competency for mine and fire bosses and hoisting engineers at coal mines have been held at the following times and places and with the following results during the year, to wit:

DATES AND PLACES.	APPLICANTS.			PASSED.			FAILED.		
	M. B.	F. B.	H. E.	M. B.	F. B.	H. E.	M. B.	F. B.	H. E.
Terre Haute, May 23	13	.....	7	9	.....	5	4	.....	2
Evansville, September 6	7	1	3	6	.....	2	1	1	1
Terre Haute, December 8	18	.....	25	16	.....	19	2	.....	6
Brazil, February. (No record, see note.)									
Totals	38	1	33	31	.....	26	7	1	9

NOTE.

The Brazil examination, in February, was held by Mr. Fisher, before the expiration of his term. Upon examining the files in my office in the preparation of this report, I found that the record of the examina-

tion had never been turned over to me. I made diligent search among Mr. Fisher's papers, but was unable to find any record, or any notes from which I could give the result of this examination. It will be remembered that Mr. Fisher died very suddenly and unexpectedly. It is probable that those who took charge of his effects destroyed the papers relating to this examination, believing they were of no value.

CERTIFICATES OF COMPETENCY ISSUED DURING THE YEAR 1899.

MINE BOSSES.

	<i>Per cent.</i>
1. O. S. Stokesberry, Clinton.....	85
2. William Urwin, Knightsville.....	75
3. G. S. Patterson, Terre Haute.....	93
4. C. S. Roland, Hartwell.....	77
5. John W. Rees, Evansville.....	86
6. James Marsh, Ehrmandale.....	86
7. Nap. Harris, Asherville.....	76
8. Robert Fisher, Brazil.....	94
9. Michael H. King, Linton.....	96
10. J. S. Johnson, Oakland City.....	89
11. David Ingle, Oakland City.....	91
12. M. C. Randall, Linton.....	84
13. William T. James, Clay City.....	85
14. Alexander Ferguson, Clay City.....	77
15. Edward Dant, Montgomery.....	76
16. Johnson Peel, Cardonia.....	84
17. Reese Griffiths, Dugger.....	83
18. Edward Alias, Montgomery.....	81
19. William Rittenbery, Cloverland.....	78
20. W. H. Crawford, Dugger.....	91
21. Orion Long, Coal Bluff.....	81
22. Anthony Smith, Littles.....	78
23. W. B. Davis, Augusta.....	85
24. C. H. Marshall, Lyonton.....	77
25. Geo. Wm. Bird, Francisco.....	84
26. James Donald, Sullivan.....	89
27. Evan Price, Dugger.....	87
28. George Lindsay, Seelyville.....	77
29. E. H. Dugger, Dugger.....	88
30. John J. Eddy, Linton.....	80
31. Lander Blackburn, Francisco.....	86

HOISTING ENGINEERS.

1. E. W. Jackson, Clinton.....	95
2. William M. Exline, Sullivan.....	77
3. H. O. Cahill, Rosedale.....	86
4. John S. Brooks, Asherville.....	86

	<i>Per cent.</i>
5. Oliver F. Stephens, Sewall.....	75
6. William J. Bond, Farnsworth.....	75
7. Noah Hutchison, Lyonton.....	78
8. George R. Moore, Seelyville.....	75
9. Thomas J. Marsh, Linton.....	75
10. Wesley Morrison, Dugger.....	78
11. John Bledsoe, Eagle.....	79
12. Benjamine James, Cardonia.....	76
13. Arthur Dickenson, Linton.....	80
14. Lawrence Burgan, Mecca.....	78
15. E. F. McGranahan, Cloverland.....	85
16. Ferd B. Cochram, Farnsworth.....	76
17. Geo. O. F. Bryant, Seelyville.....	85
18. Ollie West, Linton.....	85
19. John Baird, Cardonia.....	78
20. William Redenbarger, Prairie City.....	81
21. Samuel J. Wilton, Carbon.....	78
22. Henry C. Bean, Linton.....	79
23. Braxton Walters, Farnsworth.....	81
24. William M. Taylor, Brazil.....	88
25. George W. Drain, Francisco.....	77
26. Ruthford B. Squire, Linton.....	88

My predecessor, speaking of the effect of examinations for certificates of competency for fire and mine bosses and hoisting engineers at coal mines, predicted that the interest aroused therein would raise the members of the craft in the estimation of the public, and also save from waste and loss a large percentage of our coal seams. I am glad to bear testimony to the truth of this prediction. In every part of the coal fields of this State may be seen evidence of their influence. They have acted as a powerful stimulus to investigation and study in this great branch of industry. It has aroused discussion, and caused the interchange of ideas and thought, while in nearly every mining community may be found a half dozen young men who are pursuing courses of study in some one of the numerous good mining schools through correspondence, which will result, no doubt, not only in good to themselves, but will be reflected in the mining industry of the future.

The result of this new awakening is not so perceptible, as yet, in the mines, for the reason that most of those now in operation were planned and developed before so much thought was given to the subject of mining; but considerable improvement has been made, even in the old mines. It is in the new mines recently opened, however, where the most progress may be seen.

In preparing the questions for examination, I have endeavored to make them as practical as possible, and, at the same time, to empha-

size those points most conducive to good mining. I herewith submit the lists of the questions used at the examination held at Terre Haute, May 23, 1899, together with some lists of answers to the same, which will give an idea of the character of the work done. There were no applicants for certificates of competency for fire bosses at this examination, and, therefore, no list of questions was prepared on that subject.

QUESTIONS FOR MINE BOSSES.

Questions for the examinations of applicants for certificates of competency to act as mine bosses at coal mines in the State of Indiana, held at Terre Haute, Ind., May 23, 1899:

1. What duties are imposed upon mine bosses by laws of Indiana?
2. A shaft sunk 150 feet to a vein of medium hard bituminous coal, with four feet of slate overlying it and two feet of fire-clay below it; describe plan of opening the mine; give width and length of bottom and thickness of shaft pillar, room and entry pillars; arrangement and construction of tracks; timbering; distance to cross entries and location of second opening?
3. In a certain mine the main air course and return are each 2,000 feet long. The air course is badly choked with fallen slate and the air is poor in all entries and working places, and the fan is being run to its full capacity. Name three ways in which the amount of air may be increased without putting in a larger fan.
4. What instruments are necessary to measure the amount of air circulation in a mine? Describe the use of each.
5. How would you discover the presence of fire damp in mines? Of white damp? Of black damp? What are the dangers to life and health from each kind?
6. Copy the sketch shown on the blackboard and show where you would place the doors and air bridges to ventilate the mine represented, as required by the laws of the State of Indiana. Use the signs as indicated on the board. (This may be answered in pencil.)
7. The main entry in a mine is driven in such a way that cross entries must be turned off an angle of 45 degrees. We wish to have 100 yards between the cross entries on a straight line. How far apart must the entries be turned on the main entry?
8. If you were in charge of a mine in which a number of rooms and entries were generating considerable quantities of explosive gas, how would you keep the faces of the working places clear while driving from one break-through to another?
9. What is a squeeze in a coal mine? How are squeezes produced or brought on? How may they be stopped after they have started?
10. What conditions bring about fires in mines? How would you prevent fires in mines? How would you extinguish fires in either coal or gob?

11. If your fan was running at a speed of fifty revolutions per minute and giving 20,000 cubic feet per minute, and you wish to increase your quantity to 34,000 cubic feet, at what speed would the fan have to be run?

12. How many tons of mine-run coal can be taken out of a six-foot vein of coal before a second outlet must be provided as required by law?

13. In sinking a shaft 9x14 and 150 feet deep we have 20 feet of clay and hard-pan, 25 feet of quicksand and 105 of sand, shale and gray slate. Describe your method of sinking the shaft, the different sizes and amount of timber required to timber it, you to select your own sizes of timber.

14. Name the results of bad drainage under different circumstances and conditions found in the mines of Indiana.

15. What particular points should receive the mine boss's attention when visiting men at their working places and making rounds of the mine?

16. Each applicant will be required to show by a practical demonstration the use of the anemometer, etc., in the measurement of air currents. (These will be taken at intervals during the day.)

17. Name the different safety appliances in and about coal mines that should be under the general supervision of the mine boss.

18. In a mine with a gray shale roof that cuts badly on the entries describe your method of timbering an eight-foot entry, size of timber to be used, method of framing and setting the same.

19. In entering a mine after an explosion, to rescue persons, what course would you pursue to repair the mine and reach the working places to recover dead bodies, with the greatest safety to the rescuing party?

20. What accidents occurring in the mine from shot firing may be lessened by proper precautions, and what precautions would you suggest in this line?

QUESTIONS FOR ENGINEERS.

Questions for the examination of hoisting engineers at Terre Haute, Indiana, May 23, 1899:

1. What experience have you had in handling steam and machinery? Where have you been employed in this line?

2. What is the law of Indiana in regard to persons who may have charge of hoisting engines at coal mines?

3. What precautions are required by law, in Indiana, to be taken about the hoisting machinery and shafts to add to the safety of persons entering or leaving mines?

4. What changes would be necessary in the arrangement of a boiler furnace built to burn lump coal, to fit it to burn slack under the boilers?

5. What causes boiler walls to crack? How is this provided against in setting boilers?

6. Name three classes of boilers that are used at coal mines in Indiana. Which one of these do you prefer? Give reasons for your preference?

7. The shell of a plain cylinder boiler is 42 inches in diameter and 23 feet long, and is made of single-riveted steel plates one-fourth inch thick; what pressure can it carry safely?

8. What pressure would a two-flue boiler of the same dimensions and construction carry?

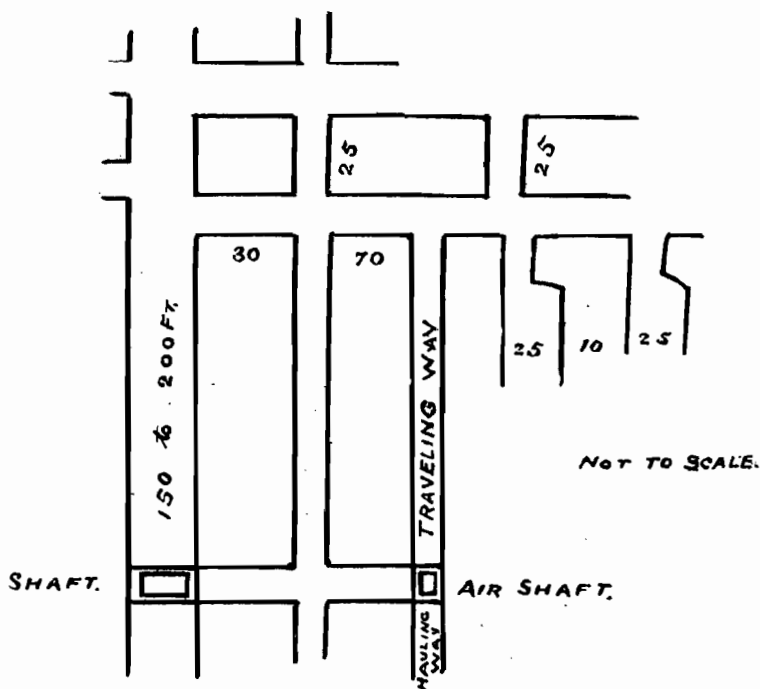
9. Describe a brake to be used on a hoisting rig. (If you can make your description plainer by a sketch, do so.)
10. What are the effects of too little water in a boiler? Of too much?
11. Why is cast iron used in some parts of an engine, wrought iron in other parts, and steel in other parts?
12. Name the different openings, pipes and valves through which steam passes from the boiler until it is finally exhausted, and give the effect produced by it at each step of its course.
13. How does the reverse link change the direction in which an engine runs?
14. How is the horizontal motion of the piston made to raise the cages perpendicularly? (Give all the mechanism that is used to produce the changes of direction of the motion.)
15. What parts of the hoisting machinery at a coal mine need lubricating? What kind of oil should be used for this purpose?
16. How is water forced into a boiler against the same pressure as is on the steam piston of the pump?
17. What are the usual effects of mine water on pumps and pipes? On boilers when used to make steam in them?
18. What is the weight per square inch on the bottom of a column of water 269 feet high?
19. What pressure of steam would be necessary at the boiler to raise and discharge water to this height, making due allowance for loss of pressure and friction of the water in the pipes? (Give the reasoning by which you arrive at your conclusion.)
20. How would you test your safety valve to learn whether it is reliable?

ANSWERS OF G. S. PATTERSON OF TERRE HAUTE, TO QUESTIONS FOR MINE BOSSES.

1. The mine boss shall examine all places where men are at work, or should be, at least every alternate day, and see that such places are safe, and, if they are not safe, have them put so. He shall measure the air every week at inlet and outlet and face, and report measurements at first of month to the Mine Inspector, with which report shall be given number of men and mules working and number of days worked. He shall see that the men are supplied with props and that all traveling ways are safe. When he shall be notified of an unsafe place, he shall give the informer a receipt for same and permit no one to enter the place until it is made safe. He shall look after the general safety of the men and see that safety appliances, under his jurisdiction, are in good order.

2. The bottom should be so arranged that the cars can be easily handled, and the dip of the seam and thickness of coal would determine the amount of bottom to be taken up or top brought down. In this case, especially if the bottom of the shaft is wet, it would be advisable to remove the clay. The main entries are to be driven straight from the bottom of shaft, and should be at least 16 feet wide for the turn-outs, which should extend to first cross entries. This turn-out and bottom of shaft should be securely timbered by cross bars let into the ribs, or, preferably, by means of steel eye beams, if the top is at all likely to break. The tracks

should be so managed that the loaded cars will run readily to the shaft and the empty ones be easily taken in the opposite direction. This can be best accomplished by having the tracks grade as shown in the sketch. There should be six feet in clear on turn-out. The following sketch shows general plan to first cross entry. The size of room, pillars and width of rooms, might vary from this according to top.



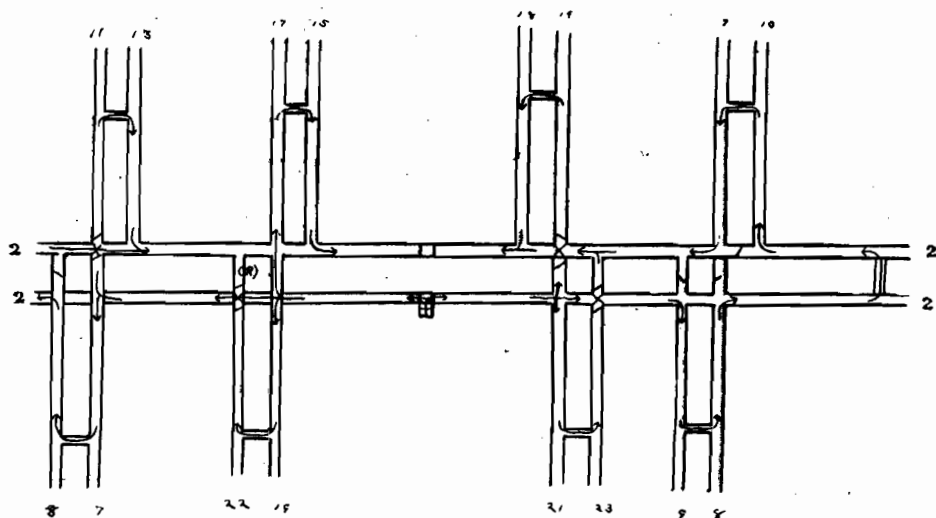
3. First, clean up the fallen slate; second, divide the air in splits; third, close up all leakages.

4. An anemometer, a watch and a tape. A section of the entries is measured to get the area. The anemometer registers the velocity of the air in feet, the time being taken by the watch. The anemometer is held in the current for several minutes, a portion of the time in different parts of the cross section, the time being accurately taken by the watch; if possible, the observer standing out of the current. The registration of the anemometer divided by the time number of minutes gives the velocity in feet per minute, which multiplied by the area of cross section in feet gives the number of feet per minute.

5. The presence of fire damp is indicated, frequently, by the hissing noise made in issuing from the coal. Its presence is shown on the naked light by elongation of the flame. It is only safely tested for by means of a safety lamp. White damp is indicated on a naked light by a peculiar brilliancy of the flame and a blue tip. Black damp is shown by the fact

that it does not support combustion, and lights grow dim and finally go out. Fire damp is dangerous on account of its violent explosive properties. White damp is also violently explosive and is also dangerous if inhaled. Black damp will not support combustion nor life, and a person subject to it in breathing is smothered. All of these, even in minute quantities, are detrimental to health, inasmuch as they take the place of so much pure air needed.

6. Brattices may be used where some doors are depending on haulage



roads. A cross-cut between entries would do away with doors at overcasts.

7. The distance on the main entry will be the hypotenuse of a right-angled triangle of 45 degrees. The hypotenuse equals the square root of sum of squares of the two sides and the two sides of a 45-degree triangle are equal; hence, distance equals the square root of the square of 100 plus the square of 100 equals 1,414 yards.

8. I should keep a brattice up as near as need be to the face from the last break-through, so as to turn the air directly to the face.

9. A squeeze is a general subsidence of the overlying strata crushing the pillars, and at times causing the bottom to heave. They are brought on usually by leaving insufficient pillars and failing to break the top. They are stopped by heavy timbering on the margin of the squeeze, and by getting a break in the roof to relieve the pressure.

10. Gob fires are started by spontaneous combustion, caused, largely, by decomposition of iron pyrites, assisted by oxidation of fine coal. The fire will be found where the ventilation is sluggish or none at all.

Fires are also started by explosions, ignition of a gas feeder, or by carelessness in handling naked lights about dry timber, feed, etc. Fires

can be avoided by great care in handling lights where fire is liable, and by keeping the ventilation current strong, and, in dusty mines, by periodically wetting down the roads.

To extinguish a fire, if it is small and easily approached, it can be wet and loaded out in cars. If too great for this, hose should be conducted to it and the fire extinguished with water. And if this be not successful, flooding that part of the mine may be necessary, or the fire can be isolated by building air-tight dams about it. In fighting any fire, care should be taken to keep the fresh air up with the working force. In all cases, also, the fresh air should be kept from the fire.

11. Assuming the increase of speed will increase the velocity we have:

$$20,000 : 24,000 :: 50 : X$$

$$\frac{34,000 \times 50}{2,000} \text{ equals } 85 \text{ rev.}$$

12. The law requires a second opening after 5,000 square yards have been excavated. In a six-foot seam this would be $5,000 \times 6 = 30,000$ cubic feet; at 77 pounds per cubic foot $= 2,310,000$ pounds $= 1,155$ tons.

13. Put on ground at proper level for the top heavy sills extending on all four sides for a front bearing. These should be as large as can reasonably be obtained and not less than 12x12 inches; they will act as the top of shaft and support the head frame.

Sinking can be started from this with curbing of $2\frac{1}{2}$ inches or 3x6 inches, laid flat and spiked, breaking joint at the corners by alternate lapping. These should be followed down with the buntons being put in every four feet. The buntons to be 6x8 inches. To go through the quicksand, poling or piling should be used all around the shaft and kept ahead of the excavation, the curbing following closely and being suspended from that above.

If the sand, shale and slate are sufficiently hard after getting away from the quicksand and casing the water, the shaft can be timbered by square sills four or five feet apart with corner posts at the four corners. These timbers should be 6x8 inches, except corner posts, which may be 6x6 inches. Care should be taken to keep the shaft plumb by means of plumb lines and the four corners.

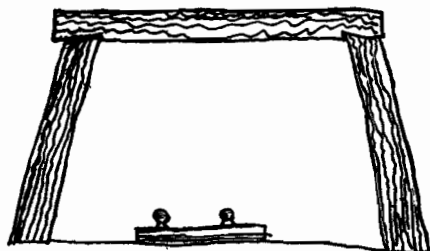
14. Bad drainage causes roads to become muddy and wet, softens the bottom, washes oil from wheels and makes hauling difficult. In case of a hard bottom, the roads will not be as bad as with fire clay, but they will become more or less muddy and cause trouble to the roads. Working places are also affected by failure to drain the main roads, and the tonnage thus affected.

15. He should see if the place is properly timbered, that they are driven in proper direction; that the air is sufficient; that they are throwing refuse into gob and not loading it; also that shots are properly placed. He should know all the features of the room so as to call the attention of the men to any dangerous condition.

16. (Anemometer test.)

17. Safety catches on cages, gates at top of shaft and at upper seams when two are working, covers on cages, lamps within ten feet of shaft at upper seam. If he has charge of the machinery, he should look after the brake or drum and indicator to engine.

18. This should be timbered with not less than 10-inch timber in sets three to four feet apart. They should be set and framed, as in sketch, with a slight spread. When the coal is hard and will stand it, the cross timbers can be let into ribs. This should be close lagged before the air has much chance at it.



19. After an explosion, restore the circulation as soon as possible. The rescuing party should proceed with caution, keeping the fresh air with them, repairing brattices and doors as they advance, and putting in brattices when necessary.

20. An accident from a shot supposed to miss fire can be prevented by the miner remaining away longer from the shot after it seemingly fails. Accidents from shots going off while men are passing can be largely avoided by the plan of rotation of shots, all men being past the point where the fire occurs. Blown out shots may be avoided largely by not putting in such a heavy charge, and seeing that the line of least resistance is not too great for the shot. Practically all of the precautions against these accidents in blasting are in the hands of the miners themselves, and they should be urged to use them.

ANSWERS OF WILLIAM E. JACKSON OF CLINTON, IND., TO QUESTIONS FOR
HOISTING ENGINEERS.

1. I have had quite a varied experience—three years as fireman, 19 months as hoisting engineer. I have been employed at Tracey City, Tenn., as fireman; Central City, Ky., as engineer; Island, Ky., as engineer and fireman; Clinton, Ind., as fireman; Linton, Ind., as fireman, at Island City Shaft.

3. (1) That the engineer shall be competent. (2) That safety catches shall be applied to the cages to hold the cages or check the force of their fall in case of breakage of rope or engine. (3) That there shall be in effect a fixed code of signals with signal bells, one at the bottom of the shaft and one in the engine room. (4) That no more than six men shall be on a cage at any one time; also, that no man shall come up or go down the shaft except when both cages are empty. (5) That the drum shall have a brake attached, with sufficient power over the drum to hold the cages in case of breakage or slip of machinery.

4. If the furnace was built with sufficient draught, as it should be, it would require little change, except in the grate bars, the area of which

ought to be enlarged to allow more draught to pass through, and the bridge walls ought to be lowered a little to allow the increased volume caused by the enlargement of the grate bar area. The grate bars of the single straight screen bar type are preferable to the sectional bar when burning slack.

5. The cause of boiler walls cracking is the expansion and contraction of the walls and the boiler's shell. I think the best method of setting boilers to prevent the walls from cracking is to leave an air passage in the walls, when building, to keep the walls as cool as possible, and, when complete, brace the sides of the wall and tie the braces at the top and bottom with iron rods, and to relieve the pressure on the walls by the expansion of the boiler shell sidewise. Hang the boiler to cross beams above, by means of wrought iron rods so that when the boiler is heated and expands, the rods will expand a little, allowing the shell to lower a little, saving the walls from strain. When the temperature is lowered, the hangers contract, thus raising the shell, which contracts proportionately, thus resuming its normal condition and former position.

6. The plain cylinder boiler, the cylinder flue boiler and the return flue boiler. I prefer the return flue boiler, because of the greater amount of heating surface contained in the return flue boiler over the other kind, thus making it easier to generate steam.

7. A plain cylinder boiler, 42 inches in diameter, made of one-quarter-inch steel plates, single riveted, 23 feet long, will safely carry 107 pounds. [Should have given the formula.—Inspector.]

8. A two-flue boiler of the same construction will carry 107, for the flues do not increase or diminish the strength of the shell. The above boilers would carry, while in perfect condition, 120 pounds, which is one-sixth of bursting strain.

9. A brake to be used on a hoisting rig should be composed of a circular band around the drum, with both ends hinged to a lever, so when the engineer presses down on the lever, it will draw one end of the strap or band up and the opposite end down, thus causing the strap or band to close tightly upon the drum. It should be so arranged that the engineer can use the brake with his foot.

10. The effects of too little water in a boiler are, to cause an explosion if any more cold water is pumped into the boiler while hot, or to burn the boiler and cause it to collapse. The effects of too much water in the boiler are, to cause the water to run from the boiler to the cylinder, thus causing the exhaust to choke. Sometimes it bursts the cylinder head out, and is liable to do a great amount of damage to the machinery by jerking it or stopping it suddenly. It also takes up the steam room in the boiler, thus decreasing the normal supply of steam.

11. Cast iron is used in some parts of an engine because it is not flexible. Wrought iron is used in other parts because it is tough and will bend before it will break. Steel is used because of its strength and durability and smoothness of surface.

12. Steam first passes through the main steam pipe to the cutoff valve, thence to the throttle valve, thence to the steam chest, thence through the slide valve openings to the cylinder. The effect, when it enters the cylinder, is to force the piston head back to the opposite end

of the cylinder from which it entered. This causes one-half revolution of the driving crank and shaft. Then the slide valve opening, through which the steam entered the cylinder, is closed to the line steam and opened so the dead or exhaust steam can return through it and enter the exhaust pipe, thence to the open air.

13. When the reverse link is raised or lowered, as the case may be, it forces the slide valve back or forward, thus closing the openings that were closed before the link was moved, thus forcing the piston in the opposite direction to that which it would have moved had the link remained where it was. This produces reversed motion to all the machinery.

14. The piston is attached to what is known as a connecting rod, and the connecting rod is attached to the crank pin on the crank, which is attached to the driving shaft. By the back and forward motion of the piston, the connecting rod being hinged to the piston crosshead, and also to the crank, by means of the crank pin, one end of the rod raises and lowers with the rotary motion. The drum is attached to the driving shaft, from which it gets its motion. Around the drum is coiled a rope, which runs in a grooved pulley at the top of the head frame. Then, by the rotary motion of the drum, the rope is coiled around it, and thus draws up the other end, which is attached to the cage, and thus hoists the cage. Then, to lower the cage again, the engine must be reversed. To the driving shaft is attached two small cranks, called eccentrics. To these are attached a rod to each crank or eccentric, called cam rods, and are attached at the other end to the reversing link, one rod to each end of the link. The link is moved back and forward by the motion of the cam rods, which, in turn, are propelled by the throw of the eccentrics. The method of reversing the motion of the engine is explained in answer to question No. 13.

15. The parts of a hoisting engine that need lubricating are, the steam chest and cylinder, the crosshead guides, the wrist pin, the crank pin, all the shaft and journal bearings, the reversing link, the eccentrics, the steam cutoff valve crosshead. Engine oil should be used on all parts of machinery except in the chest and cylinder; cylinder oil only should be used in them.

16. Water is forced in a boiler against the same pressure as the steam pressure on the steam piston by the steam piston head being larger than the water piston head.

17. Mine water rusts the pumps; that is, where it touches the iron, it completely eats up the pipes. When used in boilers to make steam it corrodes the shell and generally causes the shell to blister and burn just over the fire.

18. If the column is 269 feet the pressure would be 154 pounds, nearly. [Should have given formula.—Inspector.]

19. It will require 154 pounds, or the same force, to cover the resistance.

20. I would test my safety valve by the steam gauge, if it was a spring valve; but if it was the lever safety valve, I would weigh the weight and then figure its position.

The following certificates of service have been issued during the year:

MINE BOSSES.

- | | |
|--------------------------------|--------------------------------|
| 1. William Shepard, Boonville. | 6. John Ingle, Evansville. |
| 2. Louis Stock, Boonville. | 7. James Cuthbertson, Brazil. |
| 3. John Summers, Carbon. | 8. William Willson, Sullivan. |
| 4. Newton Braun, Brazil. | 9. William Schank, Ehrmandale. |
| 5. Richard Moore, Clinton. | 10. Clemens Haffey, Carbon. |

HOISTING ENGINEERS.

- | | |
|----------------------------------|---------------------------------|
| 1. G. A. McWelly, Turner. | 8. Clarence M. Rogers, Burnett. |
| 2. Frank Wilkerson, Evansville. | 9. Arthur Shelburn, Delcarbo. |
| 3. James T. Allen, Terre Haute. | 10. Edward Sherkie, Clinton. |
| 4. Charles F. Somers, Staunton. | 11. Fred Hoff, Brazil. |
| 5. John Crosby, Brazil. | 12. M. D. West, Staunton. |
| 6. Carlos D. Wilson, Evansville. | 13. Daniel Grimm, Brazil. |
| 7. B. F. Taylor, Burnett. | 14. Daniel Webster, Coal Bluff. |

FIRE BOSSES.

- | | |
|----------------------------------|-----------------------------|
| 1. John Crosby, Shelburn. | 2. John D. Price, Shelburn. |
| 3. Andrew Winterbottom, Clinton. | |

INDIANA MINES.

I give below a list of mines which were in active operation on January 1, 1900, the person in charge of each mine, as shown by the December (1899) reports of the mine bosses:

CLAY COUNTY.

MINE.	MINE BOSS.	ADDRESS.
Brazil Block No. 1	John Bolin	Brazil.
Monarch	James King	Brazil.
Diamond No. 3	Jas. Cuthbertson	Brazil.
Gladstone	W. P. McQuade	Brazil.
Brazil Block No. 11	Martin Navin	Diamond.
Brazil Block No. 8	Henry Payne	Brazil.
Pratt	H. W. Jenkins	Perth.
Eureka No. 2	W. T. Hopkins	Carbon.
Eureka No. 3	John Quigley	Carbon.
Rob Roy	Allen Walker	Brazil.
Dewey	John Cox, Sr.	Brazil.
Gart No. 5	A. Gilmour	Cardonia.
Gart No. 3	Geo. Doidge	Brazil.
Crawford No. 4	Samuel Lindsey	Hoosierville.
Columbia No. 5	M. Hoffman	Asherville.
Columbia No. 4	T. Thompson	Hoosierville.

INDIANA MINES—Continued.

CLAY COUNTY—Continued.

MINE.	MINE BOSS.	ADDRESS.
Louise.....	Grif. Howell.....	Center Point.
Crawford No. 5.....	Walter Knox.....	Asherville.
Briar Hill.....	Robert Bennie.....	Clay City.
Markland.....	Peter Andrew.....	Clay City.
Harrison No. 2.....	Chas. Nash.....	Clay City.
Harrison No. 3.....	Chas. Nash.....	Clay City.
Klondyke.....	J. Ehrlich.....	Staunton.
Silverwood.....	William Myers.....	Turner.
San Pedro.....	Ed. Somers.....	Staunton.
Crawford No. 3.....	Wm. Printz.....	Brazil.
Diamond No. 5.....	James Cuthbertson.....	Brazil.
Brazil Block No. 10.....	Wm. McBeth.....	Perth.
Cloverland Mine.....	Geo. Donie.....	Brazil.
Pearl.....	Robt. Jenkins.....	Brazil.

DAVISS COUNTY.

Cabel No. 4.....	A. Kocher.....	Washington.
Cabel No. 9.....	A. Kocher.....	Washington.
Wilson's No. 4.....	J. Teverbaugh.....	Washington.
Mutual.....	D. W. Davis.....	Cannelburg.
Hoosier.....	A. W. Stuckey.....	Raglesville.
Union.....	A. W. Stuckey.....	Raglesville.
Stuffles No. 3.....	W. A. Jacobs.....	Raglesville.
Hawkins.....	Thomas Harris.....	Washington.
Montgomery No. 2.....	Ed. Dant.....	Montgomery.
Montgomery No. 3.....	Thos. Small.....	Washington.

FOUNTAIN COUNTY.

Sturm.....	J. S. Tiley.....	Silverwood.
------------	------------------	-------------

GIBSON COUNTY.

Oswald.....	J. C. Anderson.....	Princeton.
-------------	---------------------	------------

GREENE COUNTY.

Island No. 1.....	S. C. Risher.....	Linton.
Island No. 2.....	J. S. Newport.....	Linton.
Island Valley.....	Joseph Fennel.....	Linton.
Flubart.....	Thomas McQuade.....	Linton.
South Linton.....	N. C. Randall.....	Linton.
Summit No. 2.....	Earnest Dugger.....	Linton.
Templeton.....	John A. Templeton.....	Linton.
Summit.....	Frank Lockhart.....	Linton.

INDIANA MINES—Continued.

KNOX COUNTY.

MINE.	MINE BOSS.	ADDRESS.
Prospect Hill	W. R. Scott.....	Vincennes.
Bicknell	R. M. Freeman	Bicknell.
Edwardsport	Charles Harding	Edwardsport.

MARTIN COUNTY.

Tunnel	F. M. Wampler	Indian Springs.
--------------	---------------------	-----------------

PARKE COUNTY.

Parke No. 8	George Mitch	Rosedale.
Cox No. 3	James Burt	Coxville.
Mecca No. 1	James Skene.....	Mecca.
Lucia	F. J. Urbain.....	Mecca.
Lyford No. 2.....	Wm. Wilson.....	Lyford.
Brazil Block No. 12	Robert J. Wallace.....	Diamond.
Standard	James Baxter	Brazil.
Superior No. 2	Jno. Chesterfield, Sr.....	Brazil.
Superior No. 1	Geo. Myers	Brazil.
McIntosh No. 1	Samuel Holden	Brazil.
McIntosh No. 3	Jno. Chesterfield, Jr.....	Brazil.
Otter Creek	John Bolin	Carbon.
Crawford No. 1.....	Henry Schlatter.....	Carbon.

PERRY COUNTY.

Cannelton	Geo. W. Briggs	Cannelton.
Troy	H. L. Williams	Troy.

PIKE COUNTY.

Woolley	H. T. Brewis.....	Petersburg.
Blackburn	John R. Willey.....	Petersburg.
Little's	Anthony Smith.....	Littles.
Carbon	C. C. Potter	Sophia.
Ayrshire	Dave Ingle, Jr.....	Ayrshire.
Hartwell	C. C. Roland.....	Cable.

SULLIVAN COUNTY.

Jumbo	G. H. Sargent	Eagle.
Hymera	Sam Campbell.....	Hymera.
Phoenix.....	Joseph Peters	Alum Cave.
Star	S. Woolley	Del Carbo.
Shelburn.....	C. C. Hall.....	Shelburn.
Sullivan.....	David Harrison.....	Sullivan.
Caledonia.....	Thomas Thomas.....	Farnsworth.
Bunker Hill.....	H. W. Sexton	Farnsworth.
Briar Hill	James James	Dugger.
Ingleside.....	Wm. McCloud	Dugger.
Dugger.....	John G. Griffith.....	Dugger.
White Ash.....	Wm. Britton	Hymera.
Green Hill.....	John Beck	Sullivan.

INDIANA MINES—Continued.

VANDERBURGH COUNTY.

MINE.	MINE BOSS.	ADDRESS.
Union.....	P. Schultheis.....	Evansville.
Diamond	G. Bonenberger.....	Evansville.
First Avenue.....	Frank Guenther.....	Evansville.
Sunnyside.....	C. H. Baetz	Evansville.
Ingleside.....	Alex Maule.....	Evansville.

VERMILLION COUNTY.

Buckeye	Wm. Chesterfield.....	Clinton.
Brouillet's Creek No. 3.....	Thos. Clements	Clinton.
Brouillet's Creek No. 4.....	Stewart Shirkie	Clinton.
Prince	John Mushett, Jr.....	Clinton.
Torrey No. 4.....	Geo. Davis.....	Voorhees.
Cayuga	R. M. Irving.....	Cayuga.

VIGO COUNTY.

Peerless	G. R. Anthony.....	Fontanet.
Union	James Johnson.....	Fontanet.
Diamond No. 2.....	Thomas Gregory.....	Fontanet.
Grant Nos. 1 and 2	James Devonald.....	Burnett.
Nickel Plate	Claude Peck	Ehrmandale.
Klondyke.....	John Bland, Jr.....	Ehrmandale.
Ray	George West	Seelyville.
Ehrlich.....	H. B. Ehrlich.....	Seelyville.
Hector	William Grey	Seelyville.
Parke No. 10.....	Jeff. Ladson.....	Heckland.
Brick Works	Robert B. Bieler.....	Macksville.
Murray .....	.....	Macksville.
Broadhurst.....	John F. Erwin.....	Macksville.
Larimer .....	.....	Macksville.
Vigo	John Barker	Ehrmandale.

WARRICK COUNTY.

Star No. 1	Geo. F. Archbold.....	Newburg.
Air Line	T. B. Hall	Chandler.
Chandler	Patrick Bartley	Chandler.
Big Vein	William Woolley.....	Boonville.
Caledonia.....	E. P. Hargrooves.....	Boonville.
Gough.....	Wm. Kelly	Boonville.
Star No. 2	Geo. Archbold	Newburg.

A NEW ELECTRIC MOTOR.

A Terre Haute, Ind., firm has recently introduced a motor for hauling coal and other material, designed to work on a new traction principle.

The motor complete weighs two tons, and can be made any size, larger or smaller. It receives the tractive power from friction wheels clamped against and rotated along the sides of a center or third rail. These wheels are rotated through suitable gearing by an armature which is supplied with the current by a trolley which runs along a trolley wire inserted in a groove in the sides of the center rail. The current is returned through the track rails, laid with fish-plates and bonded.

This motor is in successful operation in the Brazil Block Coal Company's No. 1 and Cox No. 3 mines, Brazil, Ind., and Cabel & Co.'s No. 9 Mine, Washington, Ind.; also in the Kellyville Coal Company's No. 3 Mine, Grape Creek, Ill.; and also the Catlin Coal Company's mine, Catlin, Ill.

The grades in these mines are variable. In the Cabel & Co.'s mine the motor moves a large trip of empties up a long hill with a six per cent. grade and down a slight grade farther in; it then brings out the same number of loaded cars and loads them back coming down the hill to the shaft.

In the Brazil Block Coal Company's No. 1 Mine it brings a large trip of loaded cars up grades from two to eight per cent. and holds back the empties going in. At Cox No. 3 trips of 15 to 25 cars are handled on grades from one to four per cent. some places against the loads and sometimes against the empties. In the Kellyville and Catlin mines the grades are from one to four per cent.

TABLE OF FATALITIES BY YEARS.

YEAR.	Em- ployes.	Tons of Coal.	Fatalities.
1879	3,459	1,196,490	.....
1880 .....	.....	1,550,375	.....
1881	4,567	1,771,536	10
1882 .....	.....	1,990,000	.....
1883	5,403	2,560,000	11
1884	5,716	2,260,000	9
1885	6,502	2,375,000	7
1886	6,406	3,000,000	7
1887 .....	.....	3,217,711	.....
1888	6,685	3,140,979	17
1889 .....	.....	.....	.....
1890	6,550	3,791,211	5
1891	6,975	3,819,600	5
1892	7,600	4,408,417	19
1893	7,431	4,358,897	22
1894 .....	.....	.....	.....
1895	7,885	4,202,084	23
1896	7,112	4,068,124	28
1897	7,984	4,088,100	16
1898 .....	.....	5,146,920	19
1899	7,366	5,864,975	15

NOTE.—Where blanks occur there was no report.

LEGISLATION.

The following laws have been enacted for the special benefit of mine workers since the last report of the Inspector of Mines:

IMPURE MINERS' OIL.

Act approved March 3, 1899, p. 246.

Section 1. Be it enacted by the General Assembly of the State of Indiana, that only a pure animal or vegetable oil, or other oils that shall be as free from smoke as a pure animal or vegetable oil, and not the product or by-product of rosin, and which shall, on inspection, comply with the following list, shall be used for illuminating purposes in the mines of this State: All such oil must be tested by the State Supervisor of Oil Inspection or his deputies at 60 degrees Fahrenheit. The specific gravity of the oil must not exceed 24 degrees Tagliabue. The test of the oil must be made in a glass jar one and five-tenths (1 5-10) inches in diameter by seven (7) inches in depth. If the oil to be tested is below 45 degrees Fahrenheit, and should the oil be above 45 degrees and below 60 degrees Fahrenheit, it must be raised to a temperature of about 70 degrees Fahrenheit, when, after being well shaken, it shall be allowed to cool gradually to a temperature of 60 degrees Fahrenheit before finally being tested. In testing the gravity of the oil the Tagliabue hydrometer must be, when possible, read from below, and the last line which appears under the surface of the oil shall be regarded as the true reading. In case the oil under test should be opaque or turbid, one-half of the capillary attraction shall be deemed and taken to be the true reading. When the oil is tested under difficult circumstances an allowance of one-half degree may be made for possible error in parallax before condemning the oil for use in the mine. All oil sold to be used for illuminating purposes in the mines of the State shall be contained in barrels or packages, branded conspicuously with the name of the dealer, the specific gravity of the oil, and the date of shipment.

Sec. 2. Any individual, firm, corporation or company that sells or offers for sale any other oil other than provided in section 1 to be used for illuminating purposes in coal or other mines of the State, or the individual, firm, corporation, company or person having in charge the operation or running of any mine, who permits the use in his or their mine any oil for illuminating purposes other than that provided for in section 1, or any employe in any mine of this State, who uses, with a knowledge of its character, a quality of oil other than is pro-

vided for in section 1, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than five (5) dollars nor more than twenty-five (25) dollars.

SANITARY.

Act approved March 4, 1899, p. 382.

Section 1. Be it enacted by the General Assembly of the State of Indiana, That there be no shooting, or blasting of any kind allowed in the mines of the State in working hours: Provided, In cases of opening up a new mine, which contains not over twenty (20) employes, and not over one hundred (100) yards in any direction from the bottom of said shaft, the said mine operator, superintendent, agent, boss and miners shall be permitted to allow shooting or blasting twice in working hours only.

Sec. 2. That where powder, or other explosives, is used in mining or loosing coal, in any mine of this State, it shall be unlawful for any miner or other persons to fire any shot in any working place, on any entry, before all shots in places beyond such working place have been fired, and all miners and other persons have passed such working place on their way to the outlet of such mine.

Sec. 3. That in any mine in this State where coal is mined by "blasting off the solid" it shall be unlawful for any miner or other person to drill any hole, for the purpose of blasting, more than one foot past the end of the cutting or "loose end," or to prepare a "shot" in such a way that the distance from the hole to the loose end shall be more than five feet, measured at right angles to the direction of the hole.

Sec. 4. That it shall be unlawful for any miner, or other person, to place in any hole, for the purpose of blasting coal or other material, in any coal mine in this State, more than eight pounds of blasting powder, or to light a squib, fuse or other device with a purpose to discharge any shot which he knows to contain more than eight pounds of blasting powder, or to discharge any such shot by the use of an electric battery or any other device which may be used for such purpose.

Sec. 5. It shall be the duty of the mine operator or superintendent or agent or mine boss to see that section one (1) of this act be enforced or carried out.

Sec. 6. And for violation of any section of this act the same parties, the mine operator, superintendent, agent, boss and miners, shall be guilty of a misdemeanor, and for such offense shall be fined not over (\$100) one hundred dollars, nor less than (\$5) five dollars, or

imprisoned in the county jail not over (6) six months, nor less than (30) thirty days for each offense.

Both of the above acts have been generally complied with, and it is believed have resulted in much good. Last year, three fatal accidents occurred by reason of heavy shot firing; this year, no fatal accident from this cause is reported. There is no doubt that the provision of the law relative to rotation in shot firing will result in avoiding many accidents. Formerly such accidents were frequent, but if the present law on that subject is observed no such accidents are likely to occur.

Much has been done by legislation for those connected with the mining industry; but the laws on this subject are still weak and defective in many respects, oftentimes rendering them unenforceable. It many times occurs that the Inspector is thought lax in diligence, when in fact the difficulty lies in the defectiveness of the law itself—sometimes by reason of an inadequacy of power, at other times for want of a proper and efficient remedy.

It requires time, careful thought and persistent and patient effort to bring a system of mining laws to anything like a state of perfection. In the meantime, the more ignorant and easily prejudiced of the craft are prone to attribute all the fault to those charged with the execution of the laws, to misjudge their actions and motive, and to question their ability and good faith.

NEEDED LEGISLATION.

On the subject of future legislation, the following acts and amendments of present laws (a number of which were also recommended by my predecessor) are recommended:

1. In all cases where the Inspector is authorized to order the men out of a mine, he should be permitted to bring an injunction suit in the name of the State and to prosecute it without filing a bond, and have the services of the law officers of the State, as he now has in criminal cases.

2. Whenever the Mine Inspector shall find men working without sufficient air or under any unsafe condition, he should be authorized to bring suit immediately without giving the notice now required. As the law now stands, it permits mine operators to allow their mines to get into a bad condition between the visits of the Inspector, knowing that a reasonable time must be given to make repairs before they are subjected to a fine. With the best work that can be done by the Mine Inspector and the law officers of the State, a mine may run in an unfit condition for ten months of the year.

3. When a new mine is opened, or one resumes work after a shut-down, notice should be given to the Inspector so that he may know of the fact. In several instances mines have been reopened after a long stoppage, and operated, usually under very bad conditions, for six weeks before the knowledge of the fact comes to this office by the reports now required by law.

4. The Inspector should be given some supervision over small mines. There are numerous mines in the State which, during some part of the year, employ a sufficient number of men to bring them within the operation of the law, and for the rest of the year employ but a few men. If the Inspector visits them at a time when less than ten men are employed, he has no power to order improvements made, and the visit is wasted. When the number of men is increased, the mine is run without complying with the law, and, as this is usually at the busy season of the year, visits of inspection can not be made without neglecting more important work. In addition to this, employes of small mines are denied the protection and benefits of the law at all times.

5. It frequently occurs that when a surveyor has been appointed to make a map of a mine, as provided by law, in case where the operator has failed or refused to do so, he is compelled to resort to the courts to secure the pay for his work; and that, in such litigation, it requires a large part of the money thus earned by him to pay his attorney fees and other expenses. We recommend the law be so amended that, in case such surveyor is compelled to employ an attorney to recover pay for the services rendered in such work, he be entitled to recover a reasonable attorney fee, in addition to his compensation and costs.

7. The provision in the above act relative to shooting has been construed by the Attorney-General as not prohibiting shooting during the noon hour in certain cases. His decision on this subject is as follows:

INDIANAPOLIS, IND., June 23, 1899.

Hon. James Epperson, State Mine Inspector, Linton, Indiana:

Dear Sir—Replying to yours of the 21st, in which you ask what is meant by the term "working hours," in section 1, of the act approved March 4, 1899 (Acts of 1899, p. 382):

There is nothing in the law to aid me in interpreting this phrase. Taking it as it stands, it is my opinion that it would naturally mean hours established by rules of work in the mines. If it is the known and established rule for the miners to quit work at 12 o'clock in a certain mine and not to resume their work until 1 o'clock, then the interim from 12 to 1

would not be a working hour for that mine, but the application of this interpretation should be made in accordance with the fixed rules of each individual case.

Very truly yours,

W. L. TAYLOR,

Attorney-General.

The above act ought to be amended so as to prohibit shot firing from starting time in the morning until quitting time in the evening.

8. In many places in nearly all the mines there are long stretches of entry so narrow that a person can not stand at the side of the track and let a trip of cars pass him. These narrow places frequently occur on grades, where the cars run at a high rate of speed. Quite a number of accidents have occurred by men meeting trips of cars in such narrow places and being unable to get out of the way. Many accidents have been narrowly averted by such meetings. Niches in the coal, or manways at the side of the track, could be provided in such narrow places, at a comparatively small cost, giving immunity from danger to all persons passing along such entries; and I recommend that such legislation be enacted by the next legislature.

9. The present law relative to hoisting engineers and mine and fire bosses provided for a service certificate for all who had served three years, as well as certificate of competency procured by examination. We presume this provision of the law is based upon the theory that such service was conclusive evidence of competency. Experience leads me to believe that this provision of the law ought to be changed, and that all persons engaged in these positions ought to be required to pass periodical examinations. The benefit of this change will readily suggest itself to all thoughtful persons who give the matter serious consideration.

The State of Illinois has had such a law for some years, resulting in much good to all concerned.

We would further recommend that the examinations for certificates of competency be placed in the hands of a board of examiners, composed of one operator, one miner, one mechanical engineer and the Inspector of Mines and Deputy Inspector of Mines. This might add to the efficiency and thoroughness of this work, and would probably prove more satisfactory to those who are required to submit to these examinations. At least it would free such examinations from any suspicion of favoritism.

MINOR ACCIDENTS REPORTED AT INDIANA MINES, 1899.

NAMES.	DATE.	OCCUPATION.	INJURY.	CAUSE.	MINE.	COUNTY.
John Powers	Jan. 20.		Foot mashed		Eureka No. 2	Clay.
J. P. Riggs	Jan. 28.		Knee injured	Falling coal	Pratt	Clay.
Andrew Linsey	Jan.		Finger mashed	Falling coal	Gart No. 3	Clay.
William Pence	Jan.		Foot mashed	Falling coal	Crawford No. 4	Clay.
William Rockey	Jan.		Head cut		Rob Roy	Clay.
C. Bodypenny	Jan.		Body bruised	Caught by cage	Briar Hill	Clay.
Van Sugas	Jan. 7.	Miner	Burned	Heavy shot firing	Torrey No. 4	Vermillion.
William Phipps	Jan. 7.	Miner	Burned	Heavy shot firing	Torrey No. 4	Vermillion.
George Vanderver	Feb.	Driver	Toes broken	Loaded car	Brazil B. C. Co. No. 1	Clay.
Samuel Cummock	Feb.	Miner	Finger mashed	Falling coal	Gart No. 5	Clay.
Samuel Smith	Feb. 24.	Laborer	Foot mashed	Caught by coal chute	Crawford No. 5	Clay.
Wesley Brooks	Feb.	Miner	Leg sprained		South Linton	Greene.
E. Holden	Feb. 4.	Driver	Face bruised	Kicked by mule	Brazil B. C. Co. No. 1	Clay.
Lay L. Sharp	Feb.				Eureka No. 2	Clay.
Frank Cramer	Feb.	Miner	Foot mashed	Falling coal	Shelburn	Sullivan.
Wayne Bennie	Feb.	Miner	Knee hurt	Falling coal	Broadhurst	Vigo.
John Mahaut	Feb.	Miner	Hand mashed		Star	Warrick.
Edward McCann	March 22.	Miner	Arm bruised	Falling slate	Brazil B. C. Co. No. 11	Clay.
Alex. Gilmour	March 22.	Miner	Hand mashed	Falling coal	Eureka No. 2	Clay.
C. F. Dowell	March	Miner	Leg bruised	Falling coal	Eureka No. 2	Clay.
Alex. Gray	March	Car trimmer	Finger mashed	Struck by coal	Eureka No. 2	Clay.
Wm. Props	March 18.	Miner	Back bruised	Falling slate,	Harrison No. 2	Clay.
Thomas Ellis	March 14.	Driver	Shoulder hurt	Between cars	Summit	Greene.
Thomas Kinney	March	Driver	Leg injured	Coal falling off car	Templeton	Greene.
Henry White	March	Driver	Body bruised	By mine car	Otter Creek No. 1	Parke.
John McCann	March 17.	Driver	Body bruised	By mine car	Brazil B. C. Co. No. 12	Parke.
Samuel Welsh	March 25.	Miner	Body bruised	Falling coal	Brazil B. C. Co. No. 12	Parke.
Joe Clark	March	Miner	Finger mashed off	Falling coal	Phoenix	Sullivan.
Joe Garvo	March 8.	Miner	Sprained ankle	Falling slate	Brazil	Clay.
Jarvis Willis	March 20.	Miner	Body bruised	Caught between cars	Cox No. 3	Parke.
William Spence	April	Miner	Back hurt	Falling slate	Gart No. 5	Clay.
Bonis James	April 4.	Miner	Wrist dislocated	Mine car	Crawford No. 5	Clay.
Arthur Elston	April	Miner	Hip injured	Falling slate	Summit	Greene.
Chester McKinsey	April	Miner	Hip injured	Falling slate	Otter Creek	Parke.
F. McCrocklin	April	Miner	Body bruised	Mine car	Star City	Sullivan.
Roscoe Hassie	April	Car trimmer	Three fingers cut off	Coupling cars	Diamond	Vigo.
John Hill	May 9	Miner	Ankle bruised	Falling slate	Peerless	Vigo.
Voorhees Harpold	May 9	Miner	Ankle dislocated	Falling slate	Peerless	Vigo.
Frank Ruballa	May 9	Miner	Back hurt	Falling slate	Brazil B. C. Co. No. 8	Clay.
William Swaddy	May 22	Driver	Leg hurt	Mine car	Klondyke	Clay.
William Robison	May 23	Miner	Foot hurt	Falling slate	Silverwood	Fountain.
William Benson	May 25	Miner	Foot hurt	Falling coal	Summit	Greene.
Dock Cruden	May 25	Miner	Foot hurt	Falling slate	Summit	Greene.

William Goodman	May	Driver	Body bruised	Mine car	Dugger	Sullivan
John Hill	May 22	Miner	Ankle hurt	Draw slate	Peerless	Vigo
James Bell	May 23	Miner	Burned	Gas explosion	Lyford No. 2	Parke
H. Evans	May 23	Miner	Burned	Gas explosion	Lyford No. 2	Parke
Mathew Phipps	May 4	Miner	Bruised	Premature blast	Crawford No. 5	Clay
William Allsman	May	Pumper	Crushed	Caught by cage	Bush Creek	Sullivan
Frank Wetzel	June 4	Miner	Hand hurt	Falling coal	Crawford No. 5	Clay
Samuel Buffy	June 25	Sinker	Body bruised	Falling tub	Silverwood	Mountain
George Anderson	June 12	Miner	Body injured	Falling slate	Lyford No. 2	Parke
Daniel Walton	June	Miner	Back injured	Falling slate	Crawford No. 1	Clay
George Williams	June 3	Driver	Foot hurt	Mine car	Peerless	Vigo
David Leach	June 15	Miner	Body bruised	Falling slate	Peerless	Vigo
James Smith	June 14	Driver	Ribs fractured	Kicked by mule	Briar Hill	Clay
Daniel Lembaugh	July	Driver	Foot mashed	Moving machine	Dugger	Sullivan
W. P. Wood	July	Miner	Leg bruised		Phoenix No. 1	Sullivan
Sylvester Gorey	July	Miner	Foot mashed		Phoenix No. 1	Sullivan
Hud Watson	July	Driver	Rib fractured	Falling slate	Troy	Perry
Wm. Schunck	July		Back hurt	Falling slate	Crawford No. 1	Clay
Wm. Roberts	July 7	Miner	Footsprained	Falling slate	Mecca No. 1	Parke
Wm. Johnson	July 20	Miner	Body bruised	Draw slate	Mecca No. 1	Parke
Ed. Don	July 14	Driver	Bruised slightly	Falling slate	Templeton	Greene
John Pieker	July 7			Mine car	Klondyke	Clay
West Poland	July 17	Driver	Foot mashed		Brazil B. C. Co. No. 12	Parke
James Dunnichy	July 28	Miner	Arm and ankle hurt	Falling slate	Crawford No. 5	Clay
Ed. Tolson	July 21	Miner	Leg hurt	Went back on shot	Pratt	Clay
Mat Reynolds	July 25	Driver	Foot hurt	Mine car	Gladstone	Clay
Robert Maunkhouse	Aug. 3	Miner	Neck and sh'lder bruised	Falling slate	Phoenix No. 1	Sullivan
A. A. Tucker	Sept.	Miner	Foot mashed		Phoenix No. 1	Sullivan
Charles Phipps	Sept.	Day man	Arm mashed	Falling slate	Mecca No. 1	Parke
Wm. Edwards	Sept. 28	Timberman	Foot mashed	Slate	Summit No. 2	Greene
Elmir Thomas	Sept.	Loader	Leg hurt	Kicked by mule	Summit No. 2	Greene
Millard	Sept.	Driver	Nose and mouth mashed	Falling slate	Standard	Parke
Wm. Havercamp	Sept.	Miner	Body bruised	Falling slate	Standard	Parke
John Havercamp	Sept.	Miner	Body bruised	Kicked by mule	Lyford No. 2	Parke
Clarence Roush	Oct. 20	Driver	Body bruised	Falling coal	Eureka No. 2	Clay
Morgan Clements	Oct. 28	Miner	Hand mashed	Mine car	Klondyke	Clay
Ross Williams	Oct. 27	Driver	Hand hurt	Draw slate	Summit No. 1	Greene
Columbus Bowers	Oct. 26	Miner	Back and leg bruised	Kicked by mule	Lyford No. 2	Parke
Cad Rush	Oct.	Driver	Slightly bruised	Machine bit	Brazil B. C. Co. No. 12	Parke
Mike Grabin	Oct. 7	Machine runner	Foot cut	Draw slate	Seelyville	Vigo
Albert Jones	Oct. 19	Miner	Body bruised	Caught between car and door	Oswald	Gibson
James Charles	Nov. 1	Driver	Body bruised	Falling slate	Green Hill	Sullivan
T. J. House	Nov. 8	Miner	Fractured rib	Mine car	Evansville	Vanderburgh
Fred Hartweck	Nov. 14	Driver	Body bruised	Caught between car and slate	Dugger	Sullivan
John Hammock	Nov.	Driver	Body bruised	Caught between car and post	Oswald	Gibson
Luther Daniels	Nov.	Driver	Body bruised	Coal falling off car	Crawford No. 5	Clay
William Gardner	Nov. 14	Driver	Foot hurt	Draw slate	Gladstone	Clay
Thomas Darby	Nov. 9	Miner	Slightly bruised	Explosion of powder charging hole	Brazil B. C. Co. No. 12	Parke
Joe Myrick	Dec. 6	Miner	Burned			

MINOR ACCIDENTS REPORTED AT INDIANA MINES, 1899—Continued.

NAMES.	DATE.	OCCUPATION.	INJURY.	CAUSE.	MINE.	COUNTY.
John Gilpin	Dec.	Driver	Leg hurt	Caught between car and door..	Cox No. 3	Parke.
William Morris	Dec. 18 .....	.....	Body bruised	Draw slate	Eureka No. 2	Clay.
John Kirkland	Dec. 5	Loader	Leg and shoulder bruised	Draw slate	Brazil B. C. Co. No. 11	Clay.
Sylvester Newman	Dec. 12	Driver	Foot mashed	Mine car	Summit No. 1	Greene.
Alfred Burr	Dec.	Miner	Leg bruised	Falling slate	Rob Roy	Clay.
John Elliot	Dec.	Driver	Bruised	Between cars	Gart No. 3	Clay.
Anthony Lonx	Dec. 16	Driver	Foot hurt	Mine car	Klondyke	Vigo.
.....	Dec. 17	Miner	Body bruised	Shot	Star No. 1	Warrick.
.....	Dec. 17	Miner	Body bruised	Shot	Star No. 2	Warrick.

SERIOUS ACCIDENTS REPORTED AT INDIANA MINES, 1899.

NAMES.	DATE.	OCCUPATION.	INJURY.	CAUSE.	MINE.	COUNTY.
C. Bridgewater	Jan. ....	.....	Leg broken .....	.....	Fairview Mine	Clay.
Robert Steele	Jan. 28 .....	.....	Back injured	Falling slate	Gart No. 5	Clay.
Curt Marsh	Jan. 20	Trapper	Leg broken	Mine car	Island City No. 1	Greene.
Edward Engiert	Jan. 31	Miner	Back and body hurt	Falling slate	McIntosh No. 1	Parke.
John Englert	Jan. 31	Miner	Body badly bruised	Falling slate	McIntosh No. 1	Parke.
Charles Reed	Jan. 31	Driver	Foot crushed	Caught by car	Buckeye	Vermillion.
Memson Stevenson	Feb.	Miner	Body burned	Powder explosion	Eureka No. 3	Clay.
John Thomas	Feb. 10	Driver	Arm broken	Caught by car	Eureka No. 2	Clay.
Larness White	Feb.	Miner	Rib broken	Falling slate	Briar Hill	Clay.
George Shafe	Feb. 8 .....	.....	Bruised	Falling of cage	Harrison No. 3	Clay.
John Howe	Feb.	Driver	Leg broken	Falling of mine car	Star City	Sullivan.
Frank Gray	Feb. 7	Driver	Collar bone broken	Caught between roof and car	Ingleside	Vanderburgh.
Henry Mucher	Feb. ....	.....	Back hurt	Falling slate	Union	Vigo.
Henry Keller	Feb.	Cager	Leg mashed	Caught by cage	Star	Warrick.
John Davidson	March 30 .....	.....	Leg broken	Caught betw'n hopper & screen	Cox No. 3	Parke.
Samuel Hurst	May 15	Miner	Leg broken .....	.....	Shirkey No. 4	Vermillion.
Steve Thomas	May 23	Miner	Burned and bruised	Gas explosion	Lyford No. 2	Parke.
Charles Harmon	May 23	Miner	Burned and bruised	Gas explosion	Lyford No. 2	Parke.
John Bonar	May 23	Miner	Burned and bruised	Gas explosion	Lyford No. 2	Parke.
John Low	June 26	Miner	Leg broken	Falling coal	Parke No. 3	Parke.
Luke Beading	July 13	Miner	Back broken	Draw slate	Columbia No. 4	Clay.
M. Sobra	August 21	Miner	Collar bone broken	Falling slate	I. McInt'h & Co. No. 1	Parke.

SERIOUS ACCIDENTS REPORTED AT INDIANA MINES, 1899—Continued.

NAMES.	DATE.	OCCUPATION.	INJURY.	CAUSE.	MINE.	COUNTY.
Harris			Body burned	Shot through pillar	Oswald.	Gibson.
Louis Race.	Sept.	Miner	Face & hands bdly b'rnd	Explosion charging shot	Columbia No. 2	Parke.
Felice Timberman	Oct. 17	Miner	Leg broken	Falling slate	Cox No. 3	Parke.
Walter Knox	Oct. 26	Miner boss	Ribs, 1 b'k'n, 2 fract'd	Falling slate	Crawford No. 5	Clay.
J. B. Small	Oct. 9	Miner	Shoulder broken	Falling coal	Island Valley	Greene.
Joseph Alenbaugh	Oct. 31	Miner	Leg broken	Draw slate	Summit No. 1	Greene.
Bana Cava	Oct.		Leg broken	Caught by cage	Superior No. 1	Parke.
Al. Smith	Oct. 3	Driver	Jaw broke twice	Falling slate	Dugger	Sullivan.
P. Kolskinern	Oct.	Driver	Leg broken	Mine car.	Eureka	Vermillion.
John Shocktaw	Nov. 20	Miner	Eyes burned	Went back on squibbed shot	Summit No. 1	Greene.
Carl Shocktaw	Nov. 20	Miner	Body bruised	Went back on squibbed shot	Summit No. 1	Greene.
Roy Hawkins	Nov. 24	Miner	Spine injured	Draw slate	Ingleside	Sullivan.
Henry Thomas	Dec. 15	Miner	Face and hands burned	Windy shot	Eureka	Vermillion.
Wm. McDowald	Dec. 5	Driver	Broken leg	Mine car.	Brazil B.C. Co. No. 11	Clay.

FATAL ACCIDENTS REPORTED AT INDIANA MINES, 1899.

NAMES.	DATE.	OCCUPATION.	INJURY.	CAUSE.	MINE.	COUNTY.
Frank Vanhook	Jan.	Miner	Found dead in room	Unknown	Union	Vigo.
Morris James	Feb. 1	Cager	Body crushed	Caught by cage	Prince	Vermillion.
D. B. Hall	March 15	Miner boss	Found in sump	Unknown	DeForest	Warrick.
James Osborn	May 12	Driver	Crushed	Mine car.	Lyford No. 2	Parke.
Gillum Mankins	June 2	Driver	Crushed	Mine cars on grade	Lyford No. 2	Parke.
George Lawton	July 14	Driver	Head and chest crushed	Falling slate	Brazil B.C. Co. No. 1	Clay.
Thomas Davis	July 6			Falling slate	Torrey No. 4	Vermillion.
Jacob Niedlinger	Aug. 22	Miner	Killed	Falling slate	Columbia No. 4	Clay.
Wiley Buck	Sept. 29	Miner	Killed instantly	Falling slate	Bicknell	Knox.
Herman Minnis	Sept. 29	Miner	Killed instantly	Shot blowing through pillar	Seeleyville	Vigo.
George Thomas	Sept. 29	Miner	Fatally hurt	Shot blowing through pillar	Seeleyville	Vigo.
Joe Sieva	Oct. 14	Miner	Killed instantly	Falling slate	Superior No. 2	Parke.
John Williams	Nov. 23	Miner	Killed instantly	Draw slate	Peerless	Vigo.
Jackson Nevins	Dec. 9	Non-employee	Killed instantly	Falling in shaft at night	Mecca No. 1	Parke.
William Adamson	Dec. 11	Miner	Killed instantly	Fell in shaft at night	Torrey No. 4	Vermillion.

NOTE.—Man killed at Hawkins Mine, Daviess County. No record of name or date.

ABANDONED MINES.

The following is a list of mines, by counties, abandoned during the year, together with the names of the companies operating the same and the date of abandonment:

CLAY COUNTY.

Otter Creek Coal Company, Fairview Mine, block coal, during the month of October.

Jackson Coal and Mining Company, Brazil Mine, block coal, during the month of June.

Brazil Block Coal Company, No. 7 Mine, block coal, during the month of April.

Samuel Pyrah, Pyrah No. 3 Mine, block coal, during the month of February.

D. H. Davis Coal Company, World's Fair Mine, block coal, during the month of December.

Crawford Coal Company, No. 2 Mine, block coal, during the month of March.

Crawford Coal Company, No. 3 Mine, block coal, during the month of February.

DAVISS COUNTY.

Daviess County Coal Company, Montgomery No. 1 Mine, bituminous coal, during the month of January.

FOUNTAIN COUNTY.

Indiana Bituminous Coal Company, Silverwood No. 2 Mine, bituminous coal, during the month of September.

OWEN COUNTY.

Lancaster Block Coal Company, No. 2 Mine, block coal, during the month of March.

PARKE COUNTY.

I. McIntosh & Co., No. 1 Mine, block coal, during the month of August.

SULLIVAN COUNTY.

The New Curryville Coal Company, Curryville Mine, bituminous coal.

The force in this mine was reduced last year to less than ten men, to evade the law. The company continued to operate it in a desultory manner until May or June of the present year, when the mine was dismantled and abandoned and the hoisting machinery sold to the Green Hill Coal Company.

DESCRIPTION OF MINES.

My predecessor, in his report for 1898 (see Report of State Geologist for 1898, pages 1609 to 1697, inclusive), gave a full description of all mines, subject to the mining laws of Indiana; and, therefore, we deem it inadvisable to repeat these descriptions in this report, but refer those who may desire such information to the above mentioned report. I give herewith, however, a description of all new mines not contained in the report referred to.

MARY MINE.

This mine is located one and one-half miles northeast of Diamond, in Parke County, on the Brazil Block Coal Company's No. 12 Mine switch, which leads from a branch of the C. & I. C. R. R. The shaft is 8 by 18 feet in size and 105 feet deep. The coal seam is four feet and ten inches thick and is an excellent quality of block coal. In sinking the shaft two strata of quicksand were struck, which gave considerable trouble, the first of which was 18 feet thick and the second 35 feet thick, between which was 22 feet of hard-pan. At the point where the shaft struck the coal, its roof is a sand slate or shale, making a bad top; and, at present, only 12 men are employed in the mine, working three shifts of four men to a shift, doing little but driving entries prospecting in search of better roof.

ZELLER, McCLELLAN AND COMPANY'S No. 1 MINE.

This mine is located about one mile east of Diamond, in Parke County, on a branch of the C. & I. C. R. R. The top vein was abandoned about May 1, and sinking to the bottom vein, which lies 40 feet below the upper one, was commenced and the sinking completed in 10 days. At this time, 150 men are employed in the mine, and it has a capacity of 500 tons per day. The shaft is 8 by 21 feet in size

and is located in the southeast corner of a block of 200 acres of coal, owned by this company, averaging three feet and seven inches in thickness, which rises to the east and north, thus affording good and inexpensive drainage and also facilitating the haulage of coal. The roof is a sand slate of good quality, requiring much less timber than is usually required in the block coal veins.

SILVERWOOD MINE.

This mine is located near Silverwood in Fountain County, on the T., St. L. & K. C. R. R., and is owned and operated by the Indiana Bituminous Coal Company. The shaft is located in a basin of coal of fine quality about three miles long and one mile wide, averaging six feet and six inches in height. The shaft is 8 by 18 feet in the clear and 86 feet deep, and was commenced on June 19, and reached the coal a short time later. It is equipped with self-dumping cages of Prox & Brinkman make.

WHITE ASH MINE.

This mine is located one-half mile east of Hymera, on the Farmersburg branch of the E. & T. H. R. R., and is operated by the White Ash Coal Company. The shaft is 7 by 20 feet in size and 53 feet deep. The vein is "Coal V" and is very irregular in this mine. On the west side of the shaft the vein has an average thickness of six feet and four inches, while on the east side it gradually thins, until, at the head of the main east entry, the coal is but little over four feet in thickness. The roof is usually of very excellent character. Immediately above the coal is a stratum of hard black slate, ranging from three to five feet in thickness, which in turn is overlaid with about three feet of limestone. This mine was opened in 1893 by Marshall Zenor, who continued to operate it until 1894, when, for some reason, he closed it down and it stood idle until December, 1898, when the present company leased it. They, however, only operated it on a small scale until about March of the present year. My first inspection was made on June 26, and several defects were observed. The company was given ten days in which to remedy the defects noted and to report the same to me, which they did in the time given them. On October 26, I again visited this mine, and found considerable improvement had been made in the way of equipment since my last inspection, and also found the mine in good condition. At this time they were working 27 miners and four day men, with an output of 150 tons per day.

SUMMIT No. 2.

This mine is located one and one-half miles northwest of Linton, is owned and operated by the Summit Coal Company, and has access to both the Illinois Central and Pennsylvania systems of railroads. The shaft is 8 by 15 feet in size and 150 feet deep. The vein will average about five and one-half feet in thickness and is known as "Coal VI" in Professor Ashley's report for 1898, being the same vein as is worked at nearly all the mines in Greene County. The shaft is very favorably located, being sunk in the basin of a block of coal about one mile square in area and having excellent roof and bottom. Ground was broken in July, 1898, and the shaft was completed and ready to furnish coal in the market January 12, 1899. The mining is done solely by electric chain machines of link belt machine pattern. The mine is furnished throughout with the most modern and latest improved equipment, and, when fully developed, will have a mining capacity not exceeded by any mine in the State. At the time of my inspection, made October 23, I found the mine in good condition and about 25 men employed therein; but, since that time, the working force has been nearly doubled and the mine now has a capacity of about 400 tons per day. Among other improvements added to this mine during the present year is an escape shaft, or second outlet, 8 by 10 feet in size, one-half which is bratticed off for a manway, and the other half for a fan shaft. On the fan shaft is placed a 12-foot steel fan of the Crawford & McCrimmon make, which furnishes excellent ventilation in all parts of the mine.

INGLESIDE MINE.

This mine is located in Sullivan County, about one mile south of Dugger, on the I. & V. Branch R. R., and is owned and operated by George Ingle, of Evansville, Indiana. This shaft is 8 by 18 feet in size, 50 feet deep, and was commenced July 7, and completed ready for shipping coal on October 1, of the present year. The vein is "Coal VI," has an average of about four feet, eight inches, and is being mined by electric chain machines of the "link belt" make. The power is furnished by a Jenney dynamo 30 K. W., and the mine is also equipped with Prox & Brinkman self-dumping cages. When the shaft was first sunk considerable trouble was had with faults and bad roof, the slate overlying the coal at the point where the shaft was sunk being very thin and falling to the sand rock; but after the entries had been driven for some distance from the shaft to the east, the slate

was found to be much thicker, and, from the present indications, it looks as though the roof would get good in that direction.

HYMERA MINE.

This mine is located in Hymera, on the Farmersburg Branch of the E. & T. H. R. R., and is operated by the Harder-Hafer Coal Company. The shaft has been sunk during the summer to the lower vein, or "Coal V," the top vein having been worked out and abandoned about May 14 last. The coal at the point where the shaft struck the lower vein is seven feet, six inches thick, of excellent quality, and the roof is very good, being a hard black slate. The coal is mined by electricity, the same as formerly used in the upper vein. I made three inspections of this mine during the past year. On the first inspection, April 23, I found some minor defects, which were promptly remedied on my request. Upon the second inspection, June 26, because of the defective condition at that time, I served upon the company the following notice:

LINTON, INDIANA, June 27, 1899.

Mr. Thomas Sutton, Mine Boss, Hymera Mine, Hymera, Indiana:

Dear Sir—On inspection of your mine yesterday, I find that part of the hoisting shaft, extending from the top vein to the surface, in what I considered a very dangerous condition. You will, perhaps, remember I called your attention to this at my last inspection, made April 23, and that we examined the shaft carefully that day. While we found that there was considerable squeeze on the curbing, which had bulged out in many places, yet we did not deem it unusually dangerous, as all of your men were working in the top vein at that time, and even had there been a break they could have got out of the mine easily without risk of life.

I think the condition of the shaft is much worse to-day than it was at that time, and nearly all of your men are working in the lower vein now, with no means of escape except by the main shaft.

I presume you are aware there is a large space around the shaft from the top vein to the surface, in which the curbing had been burned out, and, when recurbed, was filled in with loose dirt, logs, etc. You are undoubtedly also aware that should the curbing give way in that part of the shaft, which has been filled with loose dirt, that men working in the lower vein would have but little chance to escape.

I do not think it wise or prudent that men should be allowed to work in the mine while the shaft is in its present condition, and mentioned that fact to your superintendent yesterday. He informs me that he has ordered the timber to recurb the shaft and could be ready to commence on it within one week. This should give you ample time to make preparation for the work. And I hereby give you notice that no miner, or other persons, shall be allowed to work in the mine, only such as will be required

to do the timbering and repairing of the shaft. This notice is to take effect July 6, and continue until the shaft has been properly timbered and made safe and same reported to me. This notice does not apply to your pumper, who can go in and out of the mine to the top vein by means of the pump shaft.

JAMES EPPERSON,

Inspector of Mines.

The above notice was complied with, and at my next inspection I found the mine in good condition. At this last inspection, this mine was working about 35 men, the work being done mostly in the entries.

GREEN HILL MINE.

This mine is located about one and one-half miles east of the town of Sullivan, on the I. C. R. R. The shaft is 7 by 14 feet in size and 70 feet deep. The mine was opened in the summer of 1896, but stood idle most of the time until January 1 of the present year, when a joint stock company, composed mostly of miners, was organized and leased the mine. This company purchased the machinery, cars and equipment formerly used at the Curryville Mine, and moved it to this mine. The coal averages about four and one-half feet in thickness, is "Coal VI," and is sold exclusively to local trade at present. It is the intention of the company to lay a switch from the railroad to their mine next summer. The advisability of mining the coal with electric machinery is being seriously considered by the company. This mine became subject to the mining laws of the State in April of this year, and the first inspection was made by me April 4, the mine then having 13 men employed therein. I found the mine in good condition at that time, except a few minor defects, which the company agreed to remedy at once. I made another inspection in the October following and found the mine in good condition and 16 men employed in it.

ZELLER, McCLELLAN & COMPANY'S BITUMINOUS MINE.

This mine is located near Cloverland, Clay County, on the T. H. & I. Division of the Vandalia Line. The shaft was commenced August 7 (the sinking was completed within thirty days), and is 8 by 20 feet in size and 100 feet deep. The vein averages about six feet and six inches in height, the roof is gray shale, overlaid with a sand slate, and is "Coal VI." This is a pick or hand mine, and employs 60 miners, has a capacity of 350 tons of mine run daily, and is equipped with the ordinary Prox & Brinkman self-dumping cages. The company is constructing a slope, to be used as a manway, or second outlet, at the present time.

THE INDIANA MINING INSTITUTE.

The organization of the Institute was noted in the report of the Inspector of Mines for last year, and its objects fully stated. We have only its report on its progress during the year. The meetings are held quarterly, and no omissions were made in 1899. All of the meetings were well attended, with the exception of the one at Sullivan. The papers submitted during the year were not as many as the year previous, but the discussions were probably more general and interesting. In addition to a discussion of papers read, several subjects connected with coal mining were considered, and many interesting features brought out. The membership now numbers 75, and each meeting shows an increase; yet there are many eligible men who should belong, but who do not seem to see the advantage of the interchange of thoughts and experience which this association renders. I have yet to meet a man who attended a meeting that did not feel he had made some addition to his knowledge from its deliberations. There are some men who object to it as a labor organization, having obtained this false idea of its objects and methods. It is strictly an educational institution, and its objects so stated in the constitution, the idea being not to object to labor organizations, or organizations of other kinds, but to have an association for scientific and practical advancement.

In addition to papers and discussions mentioned, the Institute made visits to the Brazil Block Coal Company's mine to inspect a new electric motor, to Crawford & McCrimmon's machine shop to see Mr. Spears's pump, and to Prox & Brinkman Manufacturing Company to examine some new mining machinery.

At the annual meeting, July 29, 1899, the old officers were re-elected, as follows:

M. McMorrow, President.

Wm. Spears, Vice-President.

G. S. Patterson, Secretary.

A. D. Scott, Treasurer.

The above officers, with the following, constitute the executive committee: P. J. Mooney, H. C. Payne, Robert Fisher.

This meeting was terminated in the evening by a banquet at the Terre Haute House.

Since the end of the year we have to record the death of Mr. Robert Fisher, ex-Mine Inspector, to whose efforts the organization of the Institute is due.

Mr. Fisher was very active in the affairs of the Institute while he was the Inspector of Mines, and continued his interest after retiring from office at the end of his term. To him is largely due the improvement in mining conditions in the State, and his mark will be left in the history of the industry in Indiana.

The headquarters are at the office of the Secretary, Room 400, Opera House Building, Terre Haute, Ind., where all members are welcome.

We add also a paper on "Mine Water and Pumps," by Wm. Spears, of Brazil.

MINE PUMPS AND PIPES AND ACID WATER.

BY WM. SPEARS.

(Sullivan Meeting, October 29, 1898.)

This is a very vexatious subject to think of and a difficult one to write about, as so little appears to be understood about the composition of the acid water.

However, in every mining district, where old coal mines are found, the coal companies, hoisting engineers and mine bosses think they know all about the effects of the water on pumps and pipes, and we are at a loss to know just what to do to overcome the difficulties that are in the way, and yet all coal operators will agree that the destruction of mine pumps and pipes by the action of mine water, containing sulphur, is among the most aggravating circumstances connected with the mining of coal. The constant wear and tear of pumps and pipes, caused by the action of acid water is placed among the heaviest expenses in the operation of a mine.

We think this is due to what is called sulphur of iron pyrites contained in the coal, and, of course, the more sulphur contained in the coal, the more acid will be found in the water.

Iron pyrites are composed of iron and sulphur in direct chemical combination. These substances have a strong affinity for each other; hence, anything containing sulphur is injurious to iron. These substances are more or less soluble in water, and the contamination of the water comes from the soaking and leaching of the "gob" piles. It is well known that the water in newly opened mines is not sulphury, where there are no old works close by, and is not injurious to pumps and pipes, and is generally good drinking water. This can only be explained by the supposition that the currents of water passing through the coal within their reach and the passages have become free from contamination, but the mining of coal disturbs these conditions, and fresh surfaces of sulphur coming in contact with the water in rooms, entries and gob piles, more or less of it becoming dissolved, renders the water corrosive.

And when we compare what we have seen and think, we know by observation that the older the mines become the worse will be the quality

of the water. No doubt some of this contamination of the water is known to come from the fire-clay under the coal, and also from some of the soft blue slate found around "faults."

It may be supposed that the clay and blue slate have become charged with the sulphur from the drainage through the coal in the ages gone by, or that comes from the rider veins.

Some believe that the clay contains some of the pyrites in itself, as we find it sometimes contains large quantities of iron.

Let me say here that a number of close observing mine experts believe that the contamination of the water comes from that source.

Whichever way it comes about, it comes, and has a very destructive influence upon everything made of iron, with which it comes in contact.

It is well known that dirt piles, which contain large quantities of fire-clay, coal and other refuse substances taken out of the mine, will affect the surface drainage for years, perhaps centuries, and any surface water coming from such source is utterly unfit for use in boilers. These circumstances, it seems to me, does prove the deleterious quality of the clay, coal and other refuse materials put in the dirt piles. These conditions seem to be universal in all coal mining districts.

Many ways are resorted to to discharge this corrosive water from the mines. In the olden times they balled it out with buckets, near the "crop;" then pulled it with ropes and buckets; then the water box; then pumps of various kinds; but to-day we depend chiefly on steam pumps made of iron. This is all right when the water is not copperous, but when we find acid in the water, we are calling for something more durable.

These conditions have forced many of the coal companies and mine bosses to put on their thinking caps and consult with each other to see if something could be done to get a cheap pump, and your humble servant has thought of a plan; i. e., to make a pump much heavier than any now made of iron, and it would take longer to eat it up than the smaller ones, and to make the valve seats larger, and the perforations in the seats larger, so that the water would rush through more freely, and the discharge to be larger also. Then thought of something better, namely, to make a pump in sections, so that the parts that would wear out could be more easily replaced, as all pieces according to that number, and make the pump high enough so it could be cut off, and the top of the working barrel and the lower valve seats be made in a plate by themselves, just the same as the top valve plate has been made formerly, and have lugs cast on the pump by which to bolt it all together, of course using two gaskets instead of one, and then to cover all parts of the pump inside with a lining of bronze composition, so that the mine water would not touch the iron if possible; and then a brass plate five-eighths of an inch thick at the back of the stuffing box between the cradle and the water end of the pump, for, in bad water, the part that holds the packing always eats away. Also there are two small air chambers, one over each valve, and a crane to raise the top off and swing it to one side. There is also a lubricator on the piston-rod stuffing box.

I should have said that I do not claim the manufacturers charged too much for their pumps, as I understand the bronze costs from 16 to 20 cents per pound, so you see a big pump runs into money rapidly.

Mr. Albert Hixon, of Carbon, Ind., and myself have tried babbitt metal and lead to repair the parts which have become eaten away and to fill holes which have become eaten into the pump seats and bridges, and it was all O. K., and also find that some grades of this resist the acid water very well. I find, in talking with Mr. C. W. Crawford, of the Brazil Machine Shops, that to make a good bronze composition, lead and tin are the only metals available that are invulnerable, but of these tin is too expensive. Babbitt metal is too brittle and is also too expensive.

Therefore, lead, mixed with other material, is the only metal to be had at a low price that will answer the purpose.

The fact that lead chambers are used in the distillation of sulphuric acid from iron pyrites is sufficient proof that it will stand the action of mine water.

Now let me say that Llewellyn Evans, an experienced man with mine pumps in Clay and Parke counties, thinks that the construction of this kind of a pump the best he ever saw.

Mr. James W. McClelland, Superintendent of the Brazil Block Coal Co., and Mr. William Zeller, General Manager of the Zeller & McClelland Co., both say it is just the pump we need for acid water.

Mr. W. W. Risher, Superintendent of the Crawford Coal Co., had a No. 10 pump made of this construction, and it is now on experimental trial in their No. 4 Mine, at Hoosiersville, Clay County, Indiana, pumping water from old works that have been standing for eighteen years, and has been running continuously for seventy days at sixty strokes per minute.

With your permission I will have present a photograph of this pump. The price of this pump will be about half the cost of a bronze composition pump, and should it wear out in time, the lining may be removed, and by adding more of the composition, it can be run over again. But I have digressed from my experience with the new idea pump.

Now a word or two on the subject of pipes. The water must be brought out of the interior of the mine. We must sink pump shafts, supply the steam to a pump in the woods or field, as they may happen, or put in pipes and have them eaten into holes by the acid water in from three to six months, or may be a longer time. We could use wooden pipes in some places, and I will here say that this acid water appears to preserve the wooden pipes.

But the objection to wooden pipe is that it takes up so much room. You can not lay it along the side of the entry, and you can not hang it to the roof (it is so bunglesome), and when the roof is bad the entries have to be driven as narrow as possible in order to get the cross-bars as short as possible. Just imagine a mine with four or five piles of pipe in it, all eaten up. I have tried to turn some of them half over when the bottom began to go in holes, and the top side appeared to be good, and where the entry is straight, this was all right. But where the water runs along the outside of the pipe as well as the inside it is like the candle burning at both ends—it does not last long. When pipe is laying in the mud, with the water running over it at the side of the hauling road, I have tried to decide in my own mind whether the action of the water on the inside or the mud and water on the outside would eat the faster.

I believe the best way is to place the pipe as high and dry as possible. Put in a goodly number of unions, so the pipe can be taken apart without cutting it.

We often find a pipe so thin that we can not cut a new thread on it, and a part so poor we can not put a clamp on it; then we make what we call a cork joint. We slip a short three-inch pipe over a two-inch pipe and cork both ends tight with hemp packing or cloth covered with grease, and tightly wrap it with lamp wick or twine. I have seen the outside of the pipe painted, but am unable to say what was the result.

The only thing I can say is, to get a pipe made of soft material, such as will bend and not eat very rapidly. I have an idea in my mind of the material from which such pipe should be made, and will only add that steel pipe appears to crystallize and become brittle, and is not as good as iron pipe in bad acid water. And I think the day is not far distant when we will have a pipe that will answer the purpose.

The following is a photograph of the pump described by Mr. Spears in the above article:

