Since the publication of the second volume of my Report on the Geology of Indiana there has been a very great increase in mining operations over the entire area of the coal field, especially along the lines of railroads.

The reputation of the "block coal" for smelting iron ores continues to be fully sustained by its excellent behavior in the blast furnaces that are using it. By making changes at the Brazil Furnace, such as replacing the circle and belly pipes with others of much greater capacity, and putting up gas flues fifty inches in diameter, lined up with fire brick, the yield of this furnace has been increased by four hundred tons per month. She went into blast in October, and during the first thirty days has made one thousand and eight tons of foundry iron especially suited for the manufacture of Bessemer steel. These important improvements were brought about by E. C. Garlick, one of the managers of the furnace.

Mr. Hicks, the intelligent founder, assures me that the furnace now runs with the utmost regularity and he finds no difficulty in making a uniform grade of grey pig.

The Brazil Furnace is sixty-one feet high, fourteen feet across the boshes and is closed at the top. I take pleasure in calling attention to the immense success of this furnace from the fact that it has had a reputation of behaving very badly, and it is to be hoped that it will now not only win an enviable name, but lead the way to still further improvements in furnaces using block coal for fuel. The want of
water which has been experienced at this furnace during the last two seasons of unusual drouth has now been completely obviated by conveying it in cast iron pipes buried beneath the frost line from Otter creek to the furnace.

An account of the new furnace which has just been completed by the Southern Indiana Coal and Iron Manufacturing Company, on the Ohio & Mississippi Railroad near Shoals, in Martin county, Indiana, B. F. Devol, President, and Salem P. Town, Secretary, is given in the following letter received from Cyrus Mendenhall, late of the Kenton Furnace, Newport, Kentucky, and now a member of this new company:

Shoals, Ind., Nov. 12, 1872.

E. T. Cox, State Geologist:

Sir—Yours of 31st ult. has been referred to me for a reply. I regret that it has been out of my power to do so earlier.

Our blast furnace is, in size, thirteen feet across the boshes, fifty feet high, with close top like the Kenton Furnace of Newport, and has complete arrangements for heating the boilers and hot blast with the waste gases. The shaft is supported on pillars and has an iron casing lined with fire brick. The furnace is blown with six tuyeres. We have two hot-air stoves of most approved construction. The machinery is all horizontal; steam cylinders twenty-eight inches in diameter and eight feet stroke, with a heavy fly-wheel twenty-two feet in diameter. Blowing cylinder sixty inches diameter with the same stroke as steam cylinder, which works it by direct action. The engine is regarded as a very good one and has a bit of history connected with it. It was captured by the United States authorities from a blockade runner in the Gulf of Mexico, during the late war.

The engine house is of frame, twenty-five by seventy-five feet, and contains, besides the blowing machinery, a separate engine which draws our supply of water from Beaver creek.
and distributes the same over the works, including the filling of a tank on top of the elevator that supplies a water-balance for hoisting stock to the top of the tunnel of the furnace. Frame stock house, seventy-two by seventy-five feet, calculated to accommodate a second furnace.

Our furnace is now finished, except attachments of pipes to and about tuyeres, etc., and we have fire in it to-day to warm up, and expect to "blow in" next week. We are receiving iron ores from Iron Mountain and Iron Ridge, Missouri, and from our own mine on Webster's Hill, on the east side of the township, with which we are connected by a side-track from the Ohio & Mississippi Railroad. This bank of ore is over forty-two feet in thickness where it has been opened or uncovered, and the deposit seems to extend around the hill. You are acquainted with the character of the ore and we think it rather improves as we blast into it.

The Sampson Hill coal seam is forty inches thick; we have penetrated it with two entries, about one hundred and twenty yards each, and find the coal of remarkable purity. We are also driving an entry on seam A, at the foot of the hill near the county road, on southeast quarter of section 32, same township; this seam is not so thick as the Sampson Hill, but of very similar character.

A visit from you would be most welcome, and we would take pleasure in giving you such additional information as obtained by recent work in this vicinity.

Yours truly,

CYRUS MENDENHALL.

The rapid increase in the demand for Indiana block coal in Chicago, St. Louis, Cincinnati, Louisville and Indianapolis, without mentioning the numerous cities of less population but large consumers of the fossil fuel, and the consumption on the various railroad lines already constructed, points very clearly to a necessity for more roads from the large manufacturing centers to the coal field, which will not only give additional facilities for opening mines, but, by increasing competition in freights, have the two-fold ten-
dency to lessen its cost as well as to secure a more steady supply. With a view to accomplishing this end, a number of railroad lines have been proposed. On some of them work has been commenced, and others are in part completed.

Of the projected roads that will traverse the coal field, I desire to make brief mention and note their progress toward completion:

The Indiana North & South Railway, E. B. Thomas, President.—The northern division of this road is designed to run from Bloomfield, in Greene county, through Brazil and Carbon, in Clay county, Rockville, in Parke county, and Attica, in Fountain county, to Oxford, in Benton county, on the road running from Lafayette to Chicago via Kankakee, where connection will, for the present, be made with Chicago. This road has been graded from Brazil to within a few miles of Rockville, and is completed and running from Veedersburg, at the crossing of the Indianapolis, Bloomington & Western Railway, to Attica, on the Toledo, Wabash & Western Railway.

Along this completed line, in Fountain county, several shafts have been sunk and adits run to the block coal seam I, and mining operations have been commenced, and villages have sprung into existence like magic. The mines at Kirkland station are new, but the work of driving entries has proceeded so far that they are enabled to deliver four to five car loads of coal per day. Two miles above Veedersburg, a side-track is being laid to Lucas & Co.'s mine, and one and a half miles south of the crossing, Spears & Co. have opened a mine by running an adit on the seam, and are hauling considerable coal to the railroad.

The existence of this seam has also been proved by a bore at Veedersburg.

Joseph E. Young, of the Chicago, Danville & Vincennes Railroad, has organized a branch road from Young's station, on the main line, to run through Covington, in Fountain county, thence south down the valleys of Coal creek and Wabash river to Montezuma, in Parke county, thence up the Raccoon valley and across the table land to Brazil. The
rails have been laid on the division south of Covington to Snoddy's Mill on Coal creek, and, keeping pace with the progress of the road, extensive mining operations have been instituted at that point by Messrs. Phelps & Co. and Messrs. McClelland & Co., and the business of mining is already one of great importance to the community.

At Silver Island, a few miles south of Snoddy's mill, on property owned by Norbourn Thomas, is the Silver Island Mine. This coal is a semi-block, and now finds its way to market by the Wabash & Erie Canal. When it is reached by the railroad it will, on account of its excellence, prove a valuable acquisition to the trade.

The Evansville, Terre Haute & Chicago Railway, running from Terre Haute, Indiana, to Danville, Illinois, has been completed, ballasted and equipped, as predicted in my last report. During the month of March, 1872, they transported fourteen hundred and ten car loads of coal, and have averaged twelve hundred and eleven car loads, of twelve tons each, every month since the completion of the road. This company have arranged for an extension of their road north, from Danville to Gilman, on the Illinois Central Railroad, a distance of forty-eight miles. This extension will be built with easy grades, and laid with steel rails, with an especial view to carrying coals at the lowest possible rates from the Indiana coal field to Chicago. This route, with its connections, will be a short and direct one, and in co-operation with the Illinois Central Railroad, will have excellent facilities for the transportation of freight and passengers from the Wabash Valley to the great Northwest. Coal mines have been opened along the line of this railroad in the southern part of Vermillion county, Indiana, and at the Horse-shoe, on Little Vermillion creek, southwest of Eugene, on the line of the proposed Toledo & St. Louis Railway.

Hough & Co., at Clinton, work their mine by an adit, and elevate the coal to the dump-house by horse power. The seam ranges from four feet eight inches to five feet two inches, and will average five feet in thickness. It burns to
a white ash, without clinker, and makes a satisfactory steam and locomotive fuel.

J. W. Walker, near Clinton, has about one hundred and twenty acres of coal land. His mine is worked by an adit, and the coal elevated to the dump-house by steam power. The present product of this mine is seventy-five tons a day, with a present capacity of one hundred and eighty tons a day; average thickness of seam, five feet six inches. The whole product proves acceptable in the Chicago market for locomotive, steam and household purposes.

Aquilla Nebeker has opened the same seam, one and three quarter miles north of the above named mines, by an adit, but wagons the coal two-thirds of a mile. The seam here is five feet thick; and he is mining thirty-six tons per day. The upper part of the seam is caking coal, while the lower part is laminated, and contains from two to four inches of block coal, as noted by Professor F. H. Bradley, in his Report on Vermillion County, 1869, page 164. It is worthy of note, here, that this seam, which is referable to L in the general section of Indiana coals, is divided into two members by a parting of fire clay. While the upper part is caking, the lower part contains more or less block coal. At the Leatherman, Mill Bank and Firman mines, the entire lower member, twenty to thirty inches thick, is a true block coal, and at the Leatherman mine in particular, where it has been well opened, the walls exhibit the zigzag notches peculiar to block coal mines in Indiana.

At Clinton Locks, Fitch & Co. are putting down a switch to the old mines, once worked on an extensive scale, for shipment by canal. The seam is from five feet six inches to six feet thick. The mine will be in operation by the 1st of January, 1873. They expect to raise fifty tons per day, and have plans for the enlargement of their works this coming summer, which will greatly increase the capacity of the mine.

On the line of the Evansville, Terre Haute & Chicago Railroad, at Hillsdale, in Vermillion county, Burns, Porter, & Co. have made a test of the fire clay underlying the coal
which outcrops at that place. Bricks manufactured by hand were placed in the bridge-wall of a puddling furnace along with the justly celebrated Mt. Savage fire brick, and withstood this trying test during a period of more than seven weeks, in a state of perfect preservation; after which time they were no longer noticed, as the wall appeared to be sound. It may be well to say that the average duration of time which the best known fire brick stand in a similar situation, is nine weeks, and consequently we may fairly expect from this deposit, an article of fire brick, which will successfully compete with the best brands in the market. This clay has the rare and desirable quality of drying without cracking or warping, and with but little shrinkage. A crucial test was made in the hottest fire possible with a common furnace, to glaze or melt it, but without success, which appears to indicate that it is nearly free from alkali and other objectionable substances. These tests, with brick rudely made by hand, are deemed so satisfactory that the proprietors felt justified in beginning operations for manufacturing fire brick, etc., on a large scale. They have visited fire brick factories in the Eastern States and purchased machinery of the latest and best models to be found including a fire clay grinding mill, which has a roller that weighs four thousand pounds, and is capable of reducing a quantity of clay sufficient to make four thousand bricks per day. This mill and other machinery is driven by a twenty-four horse power engine. The company have just fairly commenced manufacturing, and hope to be able to supply a moderate demand during the coming autumn and winter. By next spring they expect to be able to meet the wants of the market.

At the same point, Montgomery & Co., formerly connected with a similar enterprise at Brazil, have erected first class buildings, which are admirably adapted to this branch of manufacture, together with a kiln that has a capacity to burn twenty-five thousand bricks. They have also purchased a set of roller-grinders for the reduction of the clay, to be
driven by steam, and expect soon to be in successful operation. Thorough tests of the clay, which proved eminently satisfactory, have also been made.

H. B. Hammond, President of the Indiana & Illinois Central Railroad, assures me that he will have the Illinois division of this road, from Decatur to Montezuma, on the Wabash river, completed and the cars running by the 1st of January, 1873, and that the Indiana division, through Parke, Hendricks and Marion counties to Indianopolis, will be speedily placed under contract, and completed some time during the coming year.

If the subsidies heretofore pledged to this road in Indiana, are made good, he expects to build it on the surveyed line; but otherwise, the most desirable and least expensive route will be selected; taking, of course, special care to cross the coal field in such a manner as will secure the best locations for coal mining operations. A direct road from the valuable coal field of Vermillion and Parke counties to Indianopolis and the important cities of Illinois, reached by the western division and its connections, must add very greatly to the commercial prosperity of the country. The enterprise has been so long on hand that faith in its completion has been almost lost; yet it is to be hoped, that with the cheering prospect now before us, one more effort will be made by the citizens along the line to have the road located where it will subserve the best interests of the counties through which it is to pass.

The Loganport, Crawfordsville & Southwestern Railway, under the management of John Lee, has been completed since the publication of the last Report, and reaches the coal along the valley of Sand creek, in Parke county. The changes wrought by this railroad through the hitherto quiet and beautiful agricultural district of Sand creek is indeed marvelous. Numerous mines have been opened and are in active operation. The village of Nyesville, four miles from Rockville and filled with a large mining population, usurps the site of a recent field of corn, and the plow has been exchanged for the miner's pick.
A branch road, one and three-quarter miles in length, reaches the Sand Creek Company's mines. Two seams, K and I, are workable on the property of this company, which comprises an area of six hundred acres. These two seams are separated by fifteen to twenty feet of shale and sandstone. The lower seam, 3 ft. 9 in. thick, is good block coal. The upper seam, K, four and a half feet thick, is an excellent quality of caking coal, and is the principal seam mined at this time, as it can be worked by adits at a convenient height above the railroad track to give room for "dump-houses," where the coal is screened and delivered into the cars. The following section exhibits the position of the seams of coal at these mines:

<table>
<thead>
<tr>
<th>Section at Sand Creek Coal Mines.</th>
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This company commenced operations last winter and have now two mines with separate "Head works" arranged in the most approved manner for economizing labor in screening, loading and weighing. The entries and rooms in the mine first opened are now sufficiently extended to permit them to
take out two hundred and forty tons of coal a day, but the delivery, at the time of my visit, only reached one hundred and forty-four tons, on account of a scarcity of miners. The new mine will soon be ready for delivering coal. The demand for this coal for locomotive and general uses is far in advance of the supply, and it has a high reputation in the market. It is a bituminous coal that may be classed as semi-caking from the fact that it agglutinates in burning less than the fatty caking coal of seam L. The color varies from dull black to glossy jet, and the fracture, from cubical to conchoidal, according to the part of the seam from which the specimen is taken.

A proximate analysis of an average specimen from the new mine shows it to be remarkably rich in hydro-carbon.

<table>
<thead>
<tr>
<th>SAND CREEK COAL.</th>
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<tr>
<td>Specific gravity, 1.296; a cubic foot weighs 81.00 lbs.</td>
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<tr>
<td>Coke, 50.00</td>
<td>Ash, light brown, 4.50</td>
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<tr>
<td>Fixed Carbon, 45.50</td>
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<tr>
<td>Volatile matter, 50.00</td>
<td>Hygroscopic Water, 4.50</td>
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<tr>
<td>Gas, 45.50</td>
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<tr>
<td>100.00</td>
<td>100.00</td>
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</tbody>
</table>

Products obtained by ultimate analysis from 100 parts of coal:

| Carbon, 76.38 |        |
| Ash, 4.71 |        |
| Hydrogen, 4.71 |        |
| Oxygen, 12.32 |        |
| Nitrogen, 1.88 |        |
| 100.00 |        |

Taking 8080 as the heat unit for the combustion of one part of pure carbon to carbonic acid; and 34,462 as the heat unit for the combustion of one part of hydrogen, which is according to the very accurate determinations of Faver and Silberman, we are enabled, by the aid of the above analysis
of the Sand Creek coal, to calculate its calorific power as compared with the combustion of an equal weight of carbon. These heat units refer to no particular weight, but simply indicate that a grain, or a pound, or a ton will raise the temperature of as many grains, pounds or tons of water from 4° to 5° of Centigrade.

And since the calorific power of hydrogen (34,462) is to the calorific power of carbon (8080), as 1 to 4.265, we have merely to multiply the percentage of available hydrogen by 4.265 and add the product to the percentage of carbon in order to determine its relative calorific power. The total amount of hydrogen found in the coal from the Sand Creek Company's new mine is 4.71 per cent.; of this amount 1.54 per cent. is required to saturate the oxygen (12.32 per cent.), giving 13.86 per cent. of combined water. We have then 3.17 per cent. of available hydrogen, which, multiplied by 4.265, gives 8990 as its relative calorific power compared to the combustion of pure carbon to carbonic acid. The heat unit is found by multiplying the carbon of the fuel by 8080 and the available hydrogen by 34,462. For example: In 100 parts of the sample of coal analyzed from the Sand Creek Company's new mine there are .7638 parts of carbon and .0317 parts of available hydrogen, then .7638 C. × 8080 + .0317 H. × 34,462 = 7208 heat units of the coal.

By dividing the heat units (7208) by 100 (the number of degrees, Centigrade, between the freezing and boiling points), we will have 72.08 as the number of pounds of water one pound of the coal will raise from the freezing to the boiling point; and since it requires 5.5 times more heat to convert water into steam than to raise its temperature from 0° to 100° Centigrade, we will find by dividing 72.08 by 5.5 that it will convert 13.10 pounds of water into steam.

Mr. I. Lowthian Bell* considers 11,000 to be the heat unit of the volatile hydrocarbons given off in the combustion of coal. This number I find to be as nearly correct as possible when tested in calculating the calorific power of the Sand

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*Chemical phenomena of iron smelting, page 306.
creek from the proximate analysis given above; provided the combined water, 13.86 per cent., is deducted from the total amount of volatile matter as well as the hygroscopic water determined by proximate analysis.

The percentage of solid carbon is .455, which, multiplied by 8080, gives 3676.4 heat units. The total volatile matter is .500, from this must be deducted .045 of hygroscopic water and .138 of combined water, which will leave .317 of hydrocarbons, this multiplied by 11,000 gives 3487 hydrocarbon calories.

The .3487 heat units of hydrocarbon added to the 3676 heat units of the solid carbon, gives 7163 as the heat units of the coal.

The ultimate analysis of an average specimen of coal taken from the old mine belonging to the Sand Creek Coal Company indicates for this coal a still higher calorific power; the elementary constituents in 100 parts are:

- **Ash, white**, - - - - - - 3.19
- **Carbon**, - - - - - - 77.03
- **Hydrogen**, - - - - - - 5.60
- **Oxygen**, - - - - - - 12.64
- **Nitrogen**, - - - - - - 1.54

100.00

It gave less ash and a larger percentage of carbon and hydrogen.

Calculated as before:

- **Carbon**, - - - - .7703×8080=6224
- **Available hydrogen**, - - .0402×34462=1385

Gives heat units=7609

A pound of coal will raise 76.09 pounds of water from the freezing to the boiling point.

The proximate analysis of this coal was not made, consequently no comparison can be given of the two modes of calculation.
OF INDIANA.

At the end of this Report a table will be found showing the calorific power of all the coals which the time allotted to chemical work has enabled us to make.

The Sand creek coal has a deservedly high reputation for steam and household use, and commands in the Chicago and Indianapolis markets as good a price as the block coal.

The other mines on Sand creek which are working this seam are: Parke Coal Company, Campbell’s mine, and Kyle’s mine.

Coal K is found over a large area of Parke county; it is the coal mined by Beard on section 25, town 15, range 6 and by Nevin on section 31, town 15, range 6 in the south part of the county.

The proximate analysis of Beard’s coal, given below, shows it to be fully equal to the Sand Creek coal:

BEARD’S COAL.

Specific gravity, 1.191; one cubic foot weighs 74.43.

Coke, - - 49.50  \(\frac{\text{Ash, white}}{-} = 1.00\)

\(\frac{\text{Fixed carbon}}{\text{ }} = 48.50\)

\(\frac{\text{Water}}{\text{ }} = 8.00\)

\(\frac{\text{Gas}}{\text{ }} = 42.50\)

Coke lamellar, brilliant, not swollen.

The details of the geology of this county will be found in the able report of Prof. Barnabas C. Hobbs.

The Indianapolis & St. Louis Railroad Company have surveyed a route for a branch road, which leaves the main line a short distance east of Carbon, in Clay county, and passing half a mile north of that town, continues westward and returns to the main track at Lodi, about eight miles from the starting point.

A shaft has been sunk and quite a number of mining enterprises have already been started along this proposed road which traverses a good district for coal.

The enterprising managers of the St. Louis, Vandalia, Terre Haute & Indianapolis Railroad are pushing their branches still farther south, and some of the heaviest mining
operations in the county are now carried on in this part of the block coal field. This road, with its fine equipment of cars and numerous branches that traverse the block coal field, is hauling nearly all the coal that is at present mined in this county for market.

A portion of the western division of the proposed railroad from Cincinnati to Terre Haute has been finished, and trains are running from Terre Haute to Middlebury, in Clay county. Mines have been commenced along the road to work the seams of caking coal over which it passes. The present terminus does not reach quite far enough east to strike the zone of block coal.

An organization has been recently formed, which comprises some of the leading business men of Indianapolis, to build a railroad to the block coal field in the southeastern part of Clay and western part of Owen counties, to be known as the Indianapolis Block Coal & Western Railway. The termini are Indianapolis and a point at or near Merom, on the Wabash river, in Sullivan county, Indiana.

If this road is built, it will afford facilities for extensive mining and manufacturing operations along the line, and prove of incalculable benefit to the country through which it passes, as well as to the city of Indianapolis.

A number of railroads are projected to run across the coal field in the southern part of the State.

The New Albany & St. Louis Air Line Railway has a portion of the track completed and the cars running over it.

I am also informed that the greater part of the road-bed in this State is finished ready for the iron, and that through the untiring energy of the President, Mr. Bradley, and the Secretary, Mr. Lyman, work is pushed forward with great rapidity all along the line.

Coal mines are already opened, and their numbers will rapidly increase along the road when it is completed to the great coal markets that it is designed to reach.

The Cincinnati & Rockport Railroad, which is to run from Rockport, on the Ohio river, in Spencer county, to Mitchell, in Lawrence county, Ind., and from thence, by connections
OF INDIANA.

with the Ohio & Mississippi Railroad, to Cincinnati, Ohio, is being built. The greater part of the grading has been finished in Spencer county, and it is expected that the road-bed will soon be ready for the iron as far north as Jasper, in Dubois county.

This road runs through the block coal field in the north part of Spencer and in Dubois counties, and will open up facilities for the establishment of blast furnaces in this part of the measures, as iron ores may be brought to Rockport by boats on the Ohio river.

A branch of the Cincinnati & Rockport Railroad is projected to run from Mitchell across the coal fields in Dubois, Pike, Gibson and Posey counties, and terminate at Mt. Vernon on the Ohio river, in the latter county.

The Evansville & Sandusky Railroad is projected to run from Evansville, in Vanderburg county, through the coal field in Warrick county, and a portion of Spencer and Dubois counties; thence to Seymour, at the crossing of the Jeffersonville, Madison & Indianapolis Railroad and the Ohio & Mississippi Railroad. The road-bed, I am informed, has been completed on this line from Evansville to Booneville, in Warrick county, and there is reason to believe that the road will be speedily finished to Seymour. It connects Evansville with the block coal field by the most direct route, and will insure to her flourishing manufacturers a supply of excellent fuel.

Evansville is favorably situated for obtaining iron ore by water transportation, at very low rates, from Missouri and the large deposits in the region bordering the Cumberland river in Kentucky. This, together with the ready access which the above road will secure to the block coal, gives them facilities for manufacturing iron that are not surpassed by any location in the State. The large rail rolling mill which is being built this year will prove but the beginning of her success in that direction, and open the road for the erection of blast furnaces.

The Indiana Mineral Railway is projected to run from a point on the Ohio river at or near the mouth of Anderson
creek, northward through Jasper, in Dubois county, to Black Oak Station, on the Ohio & Mississippi Railroad, in Daviess county, thence continuing north to Bloomfield, in Greene county, where it will connect with the proposed Indiana North & South Railway.

Mr. John Alexander, of Philadelphia, the President of this road, is making every possible exertion to have it built. It is the intention of the officers of this road to locate it near the center of the block coal zone, with a view of making the coal available for iron manufactures that are to be established at the terminus on the Ohio river. I am not aware that any grading has yet been done on this road.

Before dismissing the subject of railroads, which so materially aid in the development of the country, it may be well in this connection to make a few remarks in reference to the Wabash & Erie Canal. The lower part of this canal, from Montezuma, in Parke county, to Evansville, on the Ohio river, which is now without water and abandoned, runs through the very heart of the coal measures as well as one of the finest agricultural districts in the State. There is also in places along this portion of the canal large quantities of excellent timber.

If, in view of these facts, the owners of the canal would go to work and put it into good order it would eventually be one of the best investments in the State. When first made, the country through which it passed was for a great part of the distance almost a wilderness with but little commerce. It now teems with an agricultural, manufacturing and mining population that will furnish all the commerce that can be desired. Blast furnaces will be erected along its banks and the supply of ores to feed their rapacious stomachs can be brought by water transit from the large deposits of Missouri and the Cumberland river districts; as also the Lake Superior ores by its northern division. The valuable coal which may be mined along its banks and loaded direct from the shafts into boats will find its way to ready markets both north and south. Indeed, there is not a more favorable location to be found for a canal, and why the very part
which is sure to be remunerative has been abandoned and let go to ruin is difficult to understand. The fact of railroads running by its side for a part of the way is not a good and sufficient excuse for its abandonment. There is now, and will be, business enough for all, and the policy which has been pursued must be placed to the account of bad management and want of foresight on the part of the directors.

Since the publication of my Report on Daviess county, the Buckeye Cannel Coal Company have sunk a shaft at Black Oak Station, on the Ohio & Mississippi Railroad, which, at a depth of eighty feet, reached a seam of coal I, four feet six inches thick. The upper part of this seam, two feet six inches, is a hard, compact cannel coal, and the lower part of the same, two feet, is a rich caking coal. The two qualities of coal are not separated, as is usual, by shale or fire clay, but are so firmly united that fragments of the under part are often found attached to the cannel coal.
The following is a section of the strata passed through by their shaft:

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<th>Space.</th>
<th>Ft.</th>
<th>In.</th>
<th>Description</th>
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<tbody>
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<td></td>
<td>18</td>
<td></td>
<td>Soil and Clay.</td>
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<tr>
<td>29.</td>
<td>15</td>
<td></td>
<td>Quick Sand.</td>
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<td></td>
<td>6</td>
<td></td>
<td>Gray Shale.</td>
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<td>3.</td>
<td>3</td>
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<td>BLOCK COAL K.</td>
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<td>5</td>
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<td>Hard Fire Clay.</td>
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<td>16.</td>
<td>4</td>
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<td>Sandstone.</td>
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<td>Gray Shale.</td>
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<td>1.4</td>
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<td>BLOCK COAL.</td>
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<td>Fire Clay.</td>
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<td>Sandstone.</td>
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<td>15.</td>
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<td>Black Slate.</td>
</tr>
<tr>
<td>4.6</td>
<td>4</td>
<td>6</td>
<td>CANNEL, 2 ft. 6 in.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Caking, 2 ft. 0 in.</td>
</tr>
<tr>
<td>2.</td>
<td>2</td>
<td></td>
<td>Fire Clay.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total.</strong> 80 10</td>
</tr>
</tbody>
</table>

*A stream of water was encountered in this sand, which gave them great trouble, and materially increased the cost of sinking the shaft. The flow of water was estimated at 1,000 barrels in 24 hours.*

The Buckeye Cannel Coal Company have their mine in full operation and the coal meets with general favor. While the lower part brings the usual price of caking coal, the upper part, which is cannel, commands two to three cents
more per bushel and has a ready sale. The top seam of coal K, of this shaft is block, but here the roof is not strong enough to admit of its being worked, though on an adjoining property it has a good roof and is worked by an adit.

An exhaustive chemical analysis has been made of both the cannel and caking coal mined by the Buckeye Cannel Coal Company and the results are here given:

Cannel coal, proximate analysis:
Specific gravity, 1.229; one cubic foot weighs 76.87 lbs.
Coke, - - 48.00
  Ash, white, - - 6.00
  Fixed carbon, - - 42.00
Volatile matter, 52.00
  Hygroscopic Water, - - 3.50
  Gas, - - 48.50

Coke laminated, not swollen, lustreless.

Ultimate analysis of the same:
Carbon, - - - - - - 71.10
Ash - - - - - - 7.65
Hydrogen, - - - - - - 6.06
Nitrogen, - - - - - - 1.45
Oxygen, - - - - - - 12.74
Sulphur, - - - - - - 1.00

100.00

The relative calorific power is 9029; carbon being 8080, thus:

Available hydrogen, - .045 × 4.265 = 1919
Carbon, - - .7110 + 1919 = 9029

The heat units of the coal are 7294, thus:
.7110 carbon × 8080 heat units = 5744 carbon heat units.
.045 available hydrogen × 34462 = 1550 hydrogen heat units.
1550 hydrogen heat units + 5744 carbon heat units = 7294 coal heat units.

Expressed in a manner that will be more generally understood, it may be stated that the calculated or theoretical calorific power of this coal indicates that one pound of coal will raise the temperature of 72.94 pounds of water from the
freezing to the boiling point, or one pound of coal will convert into vapor 13.26 pounds of boiling water.

The heat units calculated from the proximate analyses are in this instance somewhat greater than is shown by the ultimate analyses, which may, in part, be owing to the fact that the analyses were made from different specimens, and that while one shows only six per cent. of ash, the sample taken for ultimate analysis gave 7.65 per cent.

Tested for gas, one pound of this cannel coal gave 4.86 cubic feet which had an illuminating power equal to 25.2 sperm candles. In practice the yield will be much greater.

For the purpose of comparison, a sample of Youghiogheny coal obtained from the Indianapolis Gas Works, and here considered the best gas coal to be had in the Pennsylvania field, was tested in the same manner, and the yield of illuminating gas was 4.05 cubic feet to the pound of coal, with an illuminating power of seventeen candles. In practice, at the Gas Works, the Youghiogheny coal yields 4.34 cubic feet per pound. The difference between the laboratory result, 4.5 cubic feet, and the practical yield of gas in the gas works, 4.34 cubic feet, furnishes a data by which to calculate the quantity of gas which may be obtained from the Daviess county cannel coal by distillation under similar conditions.

The ratio of the two quantities is as 1. to 1.07; therefore we have merely to multiply the number of cubic feet, 4.68, obtained in the laboratory, by 1.07 to find the number of cubic feet which the cannel coal will yield at the gas works, thus:

\[4.68 \times 1.07 = 5.2 \text{ cubic feet.}\]

In practice then the cannel coal will furnish 5.2 cubic feet of gas to the pound of coal, or 10400 cubic feet to the ton of 2000 pounds, and the Pittsburg coal 4.34 cubic feet to the pound, or 8680 cubic feet to the ton. The ratio of the two quantities is as 1 to 1.2.

It is not only the increased quantity of gas which the cannel coal yields that recommends it to the favorable con-
consideration of the gas companies, but it likewise gives a gas of very high illuminating power.

The illuminating power of a gas is ascertained by comparing the light which it will give in burning five cubic feet per hour in a standard argand burner, with the light given by a standard sperm candle, six to the pound and burning one hundred and twenty grains of sperm per hour. Tested in this manner the gas from Pittsburg coal has an illuminating power of seventeen standard sperm candles, and that from the Daviess county cannel coal 25.2 candles or as 1 to 1.5.

The value of gas in grains of sperm consumed is found by multiplying the candle power by 120, the number of grains of sperm consumed, and dividing the product by five, the number of feet of gas burned.

\[
\frac{25.2 \times 120}{5} = 605.
\]

The value, then, of one cubic foot of gas from the cannel coal is equal to the value of 605 grains of sperm.

Calculated for the Pittsburg coal we have:

\[
\frac{17 \times 120}{5} = 408 \text{ grains.}
\]

One cubic foot of this gas is equal in value to 408 grains of sperm. The relative value of the two gases in sperm, the Pittsburgh taken as one, is 1 to 1.5.

To offset the deficiency in quantity and illuminating power of the gas from the Pittsburg coal as compared with that from the Daviess county cannel coal, we must bear in mind that while the coke from the former coal is abundant and of excellent quality, and the large surplus over what is required for heating the retorts finds a ready sale in the market as a fuel, the coke from the cannel coal is small in quantity and comparatively inefficient for fuel.

The comparisons given below of the relative values of the two cokes are made from the laboratory experiments;
as the results obtained at the gas works are variable from
the fact that coke gains from twenty to twenty-five per cent.
in weight by being wet.

One hundred parts of Pittsburg coal distilled for gas,
gave:

Coke, 70
Ash, 3 = 67 per cent. of solid carbon.

One hundred parts of canal coal gave:

Coke, 52.8
Ash, 13.5 = 39.3 per cent. of solid carbon.

Rating Pittsburg coal as 1, the value of the respective
cokes is as 1. to 0.587. We may consider, therefore, that
the coke from the former is worth twice as much as that
from the latter, for heating purposes.

A table will be given, further along, showing the relative
value of all the coals which have been tested for gas, but I
desire, in this place, to make special note of the analyses
which have been made to determine the value of the coal
from seam L for gas purposes.

The coal from Washington, in Daviess county, has not
been tested in the laboratory; but a practical test was made
at the Indianapolis Gas Works, and the yield was 4.16
cubic feet per pound. Being absent from the city at the
time this test was made, I had no opportunity of determin­
ing its illuminating power; but Mr. Stacy, the intelligent
and obliging superintendent of the works, to whom I am
indebted for a multitude of favors,* informs me that it was

---

*The Indianapolis Gas Light & Coke Company, having remodeled
and greatly enlarged their buildings, have now the most complete gas
works in the West. Everything is being made new, and no expense has
been spared to procure machinery and apparatus of the most approved
character. They are also putting up and have nearly completed a mini­
ture gas works for testing coals for gas. Twenty pounds, or the one hun­
dredth part of a ton, is the capacity of the retort, and this quantity will
be ample to enable them to determine the amount and illuminating power
of the gas, and, in fact, the value of all the constituents of the coal. Such
an apparatus should be purchased by the State for the use of the survey,
as I do not feel at liberty to trespass upon the uniform courtesy which the
Gas Company and their agents have always shown to me when seeking
information which, in some instances, it might not be prudent to give if
governed by pecuniary interest.
nearly equal to the Pittsburg, and the yield of coke was very fair as to quantity and quality.

In the Pioneer shaft at Curryville in Sullivan county, Indiana, which is owned by Smith, Beswick & Co., there are two seams of caking coal, L and K, as given in the section of this shaft by Prof. John Collett.*

The space between the two is forty-seven feet. The upper seam, L, is 4 ft. 6 in. thick and the lower seam, K, is 5 ft. 2 in. thick.

Tested for illuminating gas, this lower seam gave, calculated for one pound of coal, first trial:

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>- - - -</td>
<td>3.68</td>
<td>cubic feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coke</td>
<td>- - - -</td>
<td>.575</td>
<td>pounds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbonic acid and Sulphur</td>
<td>-</td>
<td>.015 &quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>- - - -</td>
<td>.025 &quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tar and ammoniacal liquor</td>
<td>-</td>
<td>.070 &quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Second trial of same coal gave:

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>- - - -</td>
<td>3.61</td>
<td>cubic feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coke</td>
<td>- - - -</td>
<td>.625 lbs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tar and ammoniacal liquor</td>
<td>-</td>
<td>.075 lbs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>- - - -</td>
<td>.025 &quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbonic acid and Sulphur</td>
<td>-</td>
<td>.010 &quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The average yield of gas by the above analysis is 3.65 cubic feet per pound of coal, which, multiplied by 1.07, the ratio between the laboratory yield and the quantity obtained by distillation at the gas-works gives:

\[ 3.65 \times 1.07 = 3.90. \]

The gas value of this coal may then be fairly stated at 3.90 cubic feet to the pound. Mr. Stacy, Superintendent of the Indianapolis Gas-works, made a trial of the same coal from Sullivan county, probably from this seam, and he thought the yield of gas was about four cubic feet to the pound of coal.

The illuminating power is equal to fifteen candles, which

is two less than that of the Yougothegheny coal. The average yield of coke is sixty-five per cent. Ash in the coke 4.46 per cent., leaving 60.54 per cent. of solid carbon.

The value of the Standard shaft coal, for gas, compared with the Yougothegheny, is:

\[
\begin{array}{c|c|c}
\text{Yougothegheny} & 100 & \text{Ratio of quantity.} \\
\text{Standard} & 90 & \\
\end{array}
\]

As compared for illuminating power:

\[
\begin{array}{c|c|c}
\text{Yougothegheny} & 100 & \text{Ratio of quality.} \\
\text{Standard} & 88 & \\
\end{array}
\]

Value of coke:

\[
\begin{array}{c|c|c}
\text{Yougothegheny} & & 100 \\
\text{Standard} & & 90 \\
\end{array}
\]

An exhaustive analysis has been made of another coal from Sullivan county, belonging to Henry K. Wilson:

Specific gravity, 1.228; weight of one cubic foot, 76.75 lbs.

\[
\begin{array}{c|c|c|c}
\text{Coke} & 52.40 & \text{Ash, white} & 0.80 \\
& & \text{Solid carbon} & 51.60 \\
\text{Volatile Matter} & 47.60 & \text{Water} & 2.35 \\
& & \text{Gas} & 45.25 \\
\end{array}
\]

Coke puffed, brilliant and porous.

Ultimate Analysis:*

\[
\begin{array}{c|c|c}
\text{Ash, red} & 1.66 \\
\text{Carbon} & 4.09 \\
\text{Nitrogen} & 1.80 \\
\text{Oxygen} & 11.45 \\
\text{Sulphur} & 1.00 \\
\end{array}
\]

100.00

Calculated for calorific power:

Carbon $0.8409\times0.8080=6794.4$ carbon heat units.

Available hydrogen \( \frac{0.0351\times34462}{\frac{1}{2}}=1209.6 \) hydrogen heat units.

\[
6794.4+1209.6=8004. \text{ total heat units.}
\]

The calorific power is 8004 heat units.

*Made from another specimen of the coal.
One pound of coal will raise 80 pounds of water from the freezing to the boiling point, or convert 14.54 pounds of boiling water into vapour.

The calorific power calculated from the results obtained by the proximate analysis is a little less:

- Solid carbon $0.516 \times 8080 = 4169$ carbon heat units.
- Hydrocarbons after deducting hygroscopic and combined water $3237 \times 11000 = 3560$ heat units.

$$4169 + 3560 = 7729$$ total heat units.

Tested by either mode of calculation the calorific power of this coal is very high.

**Distilled for gas, one pound of coal gave:**

- Pure illuminating gas, $- - 3.95$ cubic feet.
- Coke, $- - - - 0.675$ pounds.
- Ash, $- - - - 0.012$ “
- Ammoniacal liquor, $- - 0.05$ “
- Candle power, $- - - - 15$.

**Comparative yield of gas:**

- Youghiogheny, $- - - - 100$.
- Wilson, $- - - - 98$.

**Illuminating power:**

- Youghiogheny, $- - - - 100$.
- Wilson, $- - - - 88$.

**Value of coke:**

- Youghiogheny, $- - - - 100$.
- Wilson, $- - - - 97$.

It will be apparent from the above that the Wilson coal, for gas, approaches very closely to the best Youghiogheny gas coal.

In order that our Western coals may be more fully appreciated and their true value for gas understood by the gas companies, I will give a few examples in the way of drawing a comparison between the value of the English.
the Indiana and the Yougbiogheny gas coals, estimating the latter at 100.

The English coal here cited is the average of forty-eight samples of caking coals used at various gas works.

<table>
<thead>
<tr>
<th></th>
<th>YOUIGHENNY</th>
<th>ENGLISH</th>
<th>WILSON'S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield of gas,</td>
<td>100</td>
<td>106</td>
<td>98</td>
</tr>
<tr>
<td>Illuminating power,</td>
<td>100</td>
<td>74</td>
<td>88</td>
</tr>
<tr>
<td>Value of coke,</td>
<td>100</td>
<td>95</td>
<td>97</td>
</tr>
</tbody>
</table>

Specimens of peat from St. Joseph county, Indiana, cut from the bog in cubes, pressed and thoroughly air dried, were obtained from Rev. W. Corby, of Notre Dame College, where it is largely used as fuel, have also been tested to determine its commercial value as fuel, compared with wood; and for gas, compared with Yougbiogheny coal.

The proximate analysis gave:

Coke, 36.00

\[\begin{align*}
\text{Ash, dirty yellow,} & \quad - \quad - \quad 9.50 \\
\text{Solid carbon,} & \quad - \quad - \quad 26.50
\end{align*}\]

Volatile Matter, 64.00

\[\begin{align*}
\text{Water,} & \quad - \quad - \quad 8.50 \\
\text{Gas,} & \quad - \quad - \quad 55.50
\end{align*}\]

Calculated for calorific power:

Solid carbon 2650×8080=2141 carbon heat units.

Hydrocarbon 5550—combined water 3646=hydrocarbon 1905×11000=2095 heat units.

2141+2095=4236 total heat units for the peat. This, in calorific effect, will raise 42.36 pounds of water from the freezing to the boiling point, or convert 7.7 pounds of boiling water into vapor.

Air dried beech wood, as used for fuel, contains in 100 parts∗:

\[\begin{align*}
\text{Carbon,} & \quad - \quad - \quad - \quad - \quad - \quad 39.10 \\
\text{Hydrogen,} & \quad - \quad - \quad - \quad - \quad - \quad 4.90 \\
\text{Oxygen,} & \quad - \quad - \quad - \quad - \quad - \quad 36.00 \\
\text{Water and Ash,} & \quad - \quad - \quad - \quad - \quad - \quad 20.00
\end{align*}\]

∗See Wagner's Chemical Technology, page 704.
Calculated for calorific power:

Carbon, \[0.3910 \times 8080 = 3159\] carbon heat units.

Available hydrogen, \[0.004 \times 11000 = 44\] hydrogen heat units.

\[3159 + 44 = 3203\] total heat units.

This will raise 32.03 pounds of water from the freezing to the boiling point and convert 5.8 pounds of boiling water into vapor.

The relative evaporating value of the St. Joseph county peat, well dried, and air-dried beech wood may be stated thus:

100 pounds beech wood will evaporate 5.8 pounds water.

100 pounds peat will evaporate 7.7 pounds water.

Ratio of value:

<table>
<thead>
<tr>
<th></th>
<th>Wood</th>
<th>Peat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
<td>133</td>
</tr>
</tbody>
</table>

That is, the peat has, theoretically, about one-third more evaporating power than the wood.

An example of peat given by Wagner* has 4033 heat units. The evaporative power is 7.3 pounds of water, which is nearly the same as obtained from the St. Joseph peat.

A numbers of examples from the same authority—Wagner—are here given for the sake of comparison. They are according to Brix’s investigations.

<table>
<thead>
<tr>
<th></th>
<th>Water, Per cent.</th>
<th>Undried, Per cent.</th>
<th>Dried, Per cent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fir wood</td>
<td>16.1</td>
<td>4.13</td>
<td>5.11</td>
</tr>
<tr>
<td>Elm</td>
<td>14.7</td>
<td>3.84</td>
<td>4.67</td>
</tr>
<tr>
<td>Birch</td>
<td>12.3</td>
<td>3.72</td>
<td>4.39</td>
</tr>
<tr>
<td>Oak</td>
<td>18.7</td>
<td>3.54</td>
<td>4.60</td>
</tr>
<tr>
<td>Red beech</td>
<td>22.2</td>
<td>3.39</td>
<td>4.63</td>
</tr>
<tr>
<td>White beech</td>
<td>12.5</td>
<td>3.62</td>
<td>4.28</td>
</tr>
</tbody>
</table>

That is to say, one pound of fir wood, containing 16.1 per cent. of water will evaporate 4.13 pounds of water.

The evaporating power of wood is only half that of caking coal, and according to the above results, it is also less effective than the Notre Dame compressed peat.

*Wagner's Chemical Technology, page 701.
Peat is the carbonaceous product resulting from the decomposition of plants which grow in shallow stagnant water. The plants from which it is chiefly derived belong to the family of mosses. The most abundant peat-forming plant is the sphagnum, which sends out new shoots and continues to grow at the surface of the water, while the older parts are undergoing the transformation into peat.

The cost of cutting and preparing peat for market, in this country where labor commands such high wages, is very great; but when the better kinds are properly pressed and dried, it makes a very desirable fuel, and the time is not far distant when it will be brought into more general use in the northern part of the State, where there is no stone coal, and wood is becoming scarce.

The results obtained, and given above, for the calorific power of fuel, are based upon the complete conversion of its combustible constituents into carbonic acid and water. As this, however, is seldom, if ever, accomplished in practice, and there is besides, a very great loss by radiation and from the formation of soot, cinder, etc., the calorific power obtained from fuel, in its practical application, is seldom more, and in many instances very much less than one-half of its theoretical value. The heat generated by the combustion of carbon to carbonic acid is 8080, while the heat generated by the combustion of twice the weight of carbon to carbonic oxide is 4946, showing a loss of 3134 heat units.*

The value of fuel depends very much on the amount of volatilizable substances which it contains, and coals which have a large amount of hydro-carbons burn with a large flame, and are considered the best for generating steam, while the less gaseous coals are preferred for iron smelting.

The examples given by I. Lowthian Bell,† to show the relative value of coke and raw coal for smelting iron in blast furnaces, are defective. The estimate for the heat units for the volatile matter of the coal, is too great. A deduc-

†Chemical Phenomena of the Blast Furnace, pp. 305, 306.
tion of at least four-tenths should be made for the hygroscopic and combined water of the coal.

On the other hand, either the raw coal, of the Scotch furnaces cited, was of a character unsuited for the business, or the furnaces and the blast were not arranged to secure a favorable combustion of the coal.

A much better result is obtained from the use of raw block-coal in Clay county, where only 4250 pounds of coal are required to make a ton of iron, and I am fully of the opinion that with properly constructed furnaces this quantity may be materially reduced.

The elementary analyses of five block-coals, used for smelting iron, are here subjoined:

<table>
<thead>
<tr>
<th></th>
<th>Ash</th>
<th>Carbon</th>
<th>Hydrogen</th>
<th>Nitrogen</th>
<th>Oxygen</th>
<th>Sulphur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garlick &amp; Collins' Brazil Furnace, No. 1</td>
<td>3.88</td>
<td>76.81</td>
<td>4.13</td>
<td>1.78</td>
<td>12.90</td>
<td>.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.07</td>
<td>82.70</td>
<td>4.77</td>
<td>1.62</td>
<td>9.39</td>
</tr>
<tr>
<td>Star Mine, Planet Furnace, No. 1</td>
<td>2.74</td>
<td>80.74</td>
<td>5.61</td>
<td>1.67</td>
<td>8.60</td>
<td>.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.74</td>
<td>81.60</td>
<td>4.39</td>
<td>1.67</td>
<td>8.87</td>
</tr>
<tr>
<td>Clay Coal Company's Mine</td>
<td>1.68</td>
<td>84.68</td>
<td>4.10</td>
<td>1.35</td>
<td>7.69</td>
<td>.50</td>
</tr>
</tbody>
</table>

The average of the two specimens analyzed from Garlick & Collin's mine will give:

Carbon, \(0.7975 \times 8080 = 6444\) carbon heat units.
Hydrogen, \(0.0306 \times 34462 = 1054\) hydrogen heat units.

\(6444 + 1054 = 6498\) total coal heat units.

The average of the two specimens analyzed from the Star Mine will give:

Carbon, \(0.8120 \times 8080 = 6560\) carbon heat units.
Hydrogen, \(0.05 \times 34462 = 1723\) hydrogen heat units.

\(6560 + 1723 = 8283\) total coal heat units.

The practical evaporative effect of a coal may be taken as equal to two-thirds of that which has been calculated from its chemical composition.
The following coals collected by Prof. John Collett, from Dubois and Pike counties, have been proximately analyzed and the results are given below, for an account of these coal seams the reader is referred to Prof. Collett's report in this volume:

Northeast part of Dubois county, on Davidson creek, near Ludlow, is Burnham's coal A, one foot thick; color, bright; fracture, conchoidal and splintery; composition in 100 parts:

**BURNHAM'S COAL A.**

Specific gravity, 1.306; one cubic foot will weigh 81.62 pounds.

Coke,

<table>
<thead>
<tr>
<th>Ash, white</th>
<th>Fixed carbon</th>
<th>Coal</th>
<th>Water</th>
<th>Gas</th>
<th>100.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.50</td>
<td>53.50</td>
<td>56.50</td>
<td>4.50</td>
<td>39.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Coke lamellar, brilliant, not puffed.

**ELKIN'S COAL A.**

Section 21, township 1 north, range 3; seam 11 inches thick. Same seam as Burnham's, in the same vicinity, and is similar in appearance.

Specific gravity, 1.295; one cubic foot will weigh 80.93 pounds.

Coke,

<table>
<thead>
<tr>
<th>Ash, brown</th>
<th>Fixed carbon</th>
<th>Coal</th>
<th>Water</th>
<th>Gas</th>
<th>100.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.00</td>
<td>50.50</td>
<td>54.50</td>
<td>6.50</td>
<td>39.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Coke laminate, dull, not puffed.

**HARBISON'S COAL A.**

Is situated on the bank of White river, in section 26, township 1 north, range 5, about three miles east of Portersville;
the seam is 18 inches thick, the upper four inches of which is cannel, and the lower part semi-block. The analysis given below is of the cannel part of the seam:

Specific gravity, 1.198; one cubic foot will weigh 74.87 pounds.

<table>
<thead>
<tr>
<th></th>
<th>Ash, pink</th>
<th>Fixed carbon</th>
<th>Water</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>33.50</td>
<td>10.00</td>
<td>23.50</td>
<td>6.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>66.50</td>
<td>60.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100.00 100.00

Coke unchanged in shape, lustreless, compact.

This coal is remarkably rich in gas, showing almost as much as is contained in the celebrated Boghead coal of Scotland, and although only four inches thick when seen at the outcrop, may become of great value for gas works, as small quantities can be used to enrich the gas of poorer coals. The proposed Indiana Mineral Railway is to run near this property.

HAY'S COAL A.

Near Bretzville, on the line of the New Albany and St. Louis Air Line Railway, on section 33, township 2 south, range 3; the seam is three feet thick, a compact, splinty cannel, color brilliant black, fracture conchoidal and splinty. It is mined in large cubical blocks. This seam is not of uniform quality, consequently analyses have been made of portions of the top, middle and bottom of the seam.

Upper part, slaty cannel, three inches thick.

Specific gravity, 1.289; one cubic foot will weigh 80.56 pounds.

<table>
<thead>
<tr>
<th></th>
<th>Ash, white</th>
<th>Fixed carbon</th>
<th>Water</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>55.00</td>
<td>3.50</td>
<td>51.50</td>
<td>4.50</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>45.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100.00 100.00

Coke much puffed, amorphous, vitreous.
Middle part, bright, slaty cannel, 2 ft. 4 in. thick. Specific gravity, 1.264; one cubic foot will weigh 79 lbs.

Coke, - - 52.50 \{ Ash, white, - - 3.00
 Fixed carbon, - - 49.50
Volatile matter, 47.50 \{ Water, - - 7.00
 Gas, - - 40.50

---

100.00

Coke, puffed, vitreous, lamellar.

Bottom part, laminated block coal, eight inches thick. Specific gravity, 1.271; one cubic foot will weigh 79.43 lbs.

Coke, - - 53.50 \{ Ash, white, - - 2.00
 Fixed carbon, - - 51.50
Volatile matter, 46.50 \{ Water, - - 6.50
 Gas, - - 40.00

---

100.00

Coke slightly puffed, vitreous, laminate.

This coal is well adapted for general use, and may be used in the manufacture of iron.

KESLER'S COAL A.

Near St. Anthony, section 34, township 2 south, range 4, on the New Albany & St. Louis Air Line Railway, 3 ft. 6 in. to 4 ft. thick where opened. The general character of the seam at this place is a semi-block; analyses were made from the upper, middle, and lower parts of the seam.

Upper part, slaty coal, 3 inches. Specific gravity, 1.333; one cubic foot will weigh 83.31 lbs.

Coke, - - 51.50 \{ Ash, blue, - - 11.50
 Fixed carbon, - - 40.00
Volatile matter, 48.50 \{ Water, - - 7.00
 Gas, - - 41.50

---

100.00

Coke puffed, amorphous, vitreous.
OF INDIANA.

Middle part, block, approaching cannel, 2 feet; specific gravity, 1.268; one cubic foot will weigh 79.25 lbs.

<table>
<thead>
<tr>
<th></th>
<th>Ash, gray</th>
<th>-</th>
<th>-</th>
<th>8.50</th>
<th>Fixed carbon,</th>
<th>-</th>
<th>-</th>
<th>40.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>49.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Volatile matter, 51.00

<table>
<thead>
<tr>
<th></th>
<th>Water,</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>Gas,</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.00</td>
<td></td>
<td></td>
<td></td>
<td>45.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100.00

Coke puffed, vitreous, amorphous.

Lower part, caking and rash coal, 1 ft. 6 in. Specific gravity, 1.260; one cubic foot will weigh 78.75 lbs.

<table>
<thead>
<tr>
<th></th>
<th>Ash, brown</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>Fixed carbon,</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>49.50</td>
<td></td>
<td></td>
<td></td>
<td>40.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Volatile matter, 50.50

<table>
<thead>
<tr>
<th></th>
<th>Water,</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>Gas,</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.50</td>
<td></td>
<td></td>
<td></td>
<td>44.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100.00

Coke puffed, lustreless, amorphous.

H. B. KITTAEN'S COAL A.

Three miles southeast of Ferdinand, in the edge of Spencer county, one foot ten inches thick; worked by stripping; caking coal.

Specific gravity, 1.244; one cubic foot will weigh 77.75 pounds.

<table>
<thead>
<tr>
<th></th>
<th>Ash, white</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>Fixed carbon,</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>48.50</td>
<td></td>
<td></td>
<td></td>
<td>46.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Volatile matter, 51.50

<table>
<thead>
<tr>
<th></th>
<th>Water,</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>Gas,</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.50</td>
<td></td>
<td></td>
<td></td>
<td>47.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100.00

Coke much puffed, lustreless, laminate.

JOHN FEST'S COAL A.

One mile northeast of Henryville, on section 25, township 3 south, range 5, where seen, the seam is two feet six inches to three feet thick; caking coal; color, dull black; fracture cubical.
Specific gravity, 1.305; one cubic foot will weigh 81.56 pounds.

Coke, \( - \) \( - \) 53.50 \( \{ \) Ash, fawn, - - - 5.50
Fixed carbon, - - 48.00

Volatile matter, 46.50 \( \{ \) Water, - - - 5.50
Gas, - - - 41.00

100.00

Coke much puffed, vitreous, amorphous.
This coal is near the line of the Rockport and Cincinnati Railway.

H. B. KATHMAN’S COAL A.

Two miles southeast of Ferdinand, on section 3, township 4 south, range 4, in the edge of Spencer county; one foot ten inches thick; worked by stripping; caking coal.

Upper part, laminate emi-block.
Specific gravity, 1.250; one cubic foot weighs 78.12 lbs.

Coke, \( - \) \( - \) 47.50 \( \{ \) Ash, white, - - - 2.00
Fixed carbon, - - 45.50

Volatile matter, 52.50 \( \{ \) Water, - - - 4.00
Gas, - - - 48.50

100.00

Coke slightly swollen, lustreless, laminate.
Lower part, cubical caking coal.

Specific gravity, 1.251; one cubic foot weighs 78.19 lbs.

Coke, \( - \) \( - \) 50.00 \( \{ \) Ash, white, - - - 2.50
Fixed carbon, - - 47.50

Volatile matter, 50.00 \( \{ \) Water, - - - 5.00
Gas, - - - 45.00

100.00

Coke swollen, vitreous, laminate.

BRIDENBAUGH’S COAL K.

On section 27, township 1 north, range 5, two feet eight inches thick; semi-caking coal; upper part laminated; lower part cubical with calcite in the cleavage partings.
OF INDIANA.

Upper part:
Specific gravity, 1.273; one cubic foot weighs 79.56 lbs.

<table>
<thead>
<tr>
<th></th>
<th>Ash, red</th>
<th>Fixed carbon</th>
<th>Water</th>
<th>Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke,</td>
<td>56.50</td>
<td></td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
<tr>
<td>Coke laminate,</td>
<td>dull,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>not</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>puffed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Middle part:
Specific gravity, 1.265; one cubic foot weighs 79.06 lbs.

<table>
<thead>
<tr>
<th></th>
<th>Ash, light red</th>
<th>Fixed carbon</th>
<th>Water</th>
<th>Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke,</td>
<td>55.00</td>
<td></td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
<tr>
<td>Coke dull,</td>
<td>laminate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lower part:
Specific gravity, 1.246; one cubic foot weighs 77.87 lbs.

<table>
<thead>
<tr>
<th></th>
<th>Ash, red</th>
<th>Fixed carbon</th>
<th>Water</th>
<th>Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke,</td>
<td>56.00</td>
<td></td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
<tr>
<td>Coke laminate,</td>
<td>dull,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>slightly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>puffed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RUDOLPH'S COAL K.

On section 20, township 1 north, range 5, one mile west of Portersville, seam three feet thick. Specific gravity, 1.361; one cubic foot weighs 78.81 lbs.

<table>
<thead>
<tr>
<th></th>
<th>Ash, red</th>
<th>Fixed carbon</th>
<th>Water</th>
<th>Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke,</td>
<td>52.50</td>
<td></td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
<tr>
<td>Coke laminate,</td>
<td>lustreless,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>not</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>swollen.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Only the upper part of this seam has been analysed, for want of time. It is a bright, black caking coal, excellent for steam and blacksmiths' use.

**JOE STEIN'S COAL.**

On section 53, township 1 south, range 4, one and a half miles south of the line of the Evansville & Sandusky Railway; seam reported two feet thick.

Specific gravity, 1.260; one cubic foot weighs 78.75 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>-</th>
<th>52.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash, brown</td>
<td>-</td>
<td>3.50</td>
</tr>
<tr>
<td>Fixed carbon</td>
<td>-</td>
<td>48.50</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>48.00</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>-</td>
<td>4.50</td>
</tr>
<tr>
<td>Gas</td>
<td>-</td>
<td>43.50</td>
</tr>
</tbody>
</table>

100.00

Coke swollen, laminate, lustreless.

**MICHAEL WILSON'S COAL K.**

One quarter of a mile north of Jasper; semi-block and block; three feet thick; color, dull black. The middle part of the seam is excellent coal.

Specific gravity, 1.416; one cubic foot weighs 88.50 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>-</th>
<th>55.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash, white</td>
<td>-</td>
<td>2.50</td>
</tr>
<tr>
<td>Fixed carbon</td>
<td>-</td>
<td>53.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>44.50</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>-</td>
<td>4.00</td>
</tr>
<tr>
<td>Gas</td>
<td>-</td>
<td>40.50</td>
</tr>
</tbody>
</table>

100.00

Coke laminate, not swollen, vitreous.

The following analysis was made of another specimen from the same mine:

Specific gravity, 1.286; one cubic foot will weigh 80.37 pounds.

<table>
<thead>
<tr>
<th>Coke</th>
<th>-</th>
<th>49.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash, red</td>
<td>-</td>
<td>5.00</td>
</tr>
<tr>
<td>Fixed carbon</td>
<td>-</td>
<td>44.50</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>50.50</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>-</td>
<td>6.00</td>
</tr>
<tr>
<td>Gas</td>
<td>-</td>
<td>44.50</td>
</tr>
</tbody>
</table>

100.00

Coke brilliant, laminate, slightly swollen.
OF INDIANA.

ADAM SMITH'S COAL K?

Three and a half miles south of Jasper, on section 11, township 2 south, range 5; the seam is from 3 ft. 6 in. to 4 feet thick.

Upper part, bright caking coal:
Specific gravity, 1.256; one cubic foot weighs 78.50 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>Water</th>
<th>Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>47.00</td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
</tbody>
</table>

Ash, white, 3.50
Fixed carbon, 43.50

Volat ile matter
53.00

Coke swollen, amorphous, vitreous.

Middle part, block coal:
Specific gravity, 1.335; one cubic foot weighs 83.43 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>Water</th>
<th>Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.50</td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
</tbody>
</table>

Ash, white, 2.50
Fixed carbon, 49.00

Volat ile matter
48.50

Coke not swollen, laminate, lustreless.

Lower part, semi-block coal:
Specific gravity, 1.261; one cubic foot weighs 78.81 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>Water</th>
<th>Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>49.00</td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
</tbody>
</table>

Ash, gray, 4.50
Fixed carbon, 44.50

Volat ile matter
51.00

Coke swollen, laminate, brilliant.

Taken altogether this is an excellent coal for manufacturing and general use.

It is on the line of the proposed railways through this county.

BRETZVILLE COAL A?

In the cut of the New Albany & St. Louis Air Line Railway; said to be three and a half feet thick:
Specific gravity, 1.275; one cubic foot weighs 79.68 lbs.

Coke, - 52.50 
| Ash, white, - - 3.50 |
| Fixed carbon, - - 49.00 |

Volatile matter, 47.50 
| Water, - - - 4.50 |
| Gas, - - - 43.00 |

100.00

Coke laminated, vitreous, not swollen.

The cut where this coal shows was partly filled with water, so that a good view could not be had of the seam, to determine its actual thickness. It is a very good block coal.

Analyses of coals from Pike county, collected by Prof. John Collett, and referred to in his report:

THOS. CASE’S COAL L?

On section 19, township 1 north, range 6, near White river, and one mile east of High Bank; color, bright; fracture cubical; contains seams of calcite in the cleavage partings; seam two feet thick.

Specific gravity, 1.280; one cubic foot weighs 80. lbs.

Coke, - 49.50 
| Ash, fawn, - - - 4.00 |
| Fixed Carbon, - - 45.50 |

Volatile matter, 50.50 
| Water, - - - 3.50 |
| Gas, - - - 47.00 |

Coke swollen, lustreless, amorphous.

BENNETT’S COAL K.

On section 7, township 1 north, range 7, on Mud creek, near White river, in the northern part of the county; the seam is six feet thick; dull black color; laminated, and breaks into small cubes; it is a caking coal.

Specific gravity, 1.268; one cubic foot weighs 79.25 lbs.

Coke, - 49.00 
| Ash, brown, - - - 3.50 |
| Fixed carbon, - - 45.50 |

Volatile matter, 51.00 
| Water, - - - 6.00 |
| Gas, - - - 45.00 |

Coke swollen, laminate and vitreous.
ALEXANDER'S COAL N.

On section 33, township 1 north, range 8, one and a half miles southwest of Petersburg; is a semi-caking coal; the seam is from 3 ft. 6 in. to 6 ft. thick, will average 4 feet.

Specific gravity, 1.284; one cubic foot weighs 80.25 lbs.

Coke, - - 52.50 { Ash, white, - - - 3.00
  { Fixed carbon, - - 49.50
  
Volatile matter, 47.50 { Water, - - - 6.00
  { Gas, - - - 41.50

100.00 100.00

No record was made of the appearance of the coke.

The following analysis was made of another specimen from the same seam:

Specific gravity, 1.259; one cubic foot weighs 78.69 lbs.

Coke, - - 56.00 { Ash, white, - - - 4.00
  { Fixed carbon, - - 62.00
  
Volatile matter, 44.00 { Water, - - - 8.00
  { Gas, - - - 36.00

100.00 100.00

Coke much puffed, vitreous, amorphous.

This is an excellent steam and grate fuel; burns without clinker, and will probably prove to be a good gas coal.

OWNER UNKNOWN, COAL K.

On section 2, township 2 south, range 8, at the mouth of Barren creek, two and a quarter miles west of Winslow; caking coal; color, dull black; is four feet eight inches thick, and contains some iron pyrites in the seams.

Specific gravity, 1.268; one cubic foot weighs 79.25 lbs.

Coke, - - 51.00 { Ash, white, - - - 3.00
  { Fixed carbon, - - 48.00
  
Volatile matter, 49.00 { Water, - - - 4.50
  { Gas, - - - 44.50

100.00 100.00

Coke much puffed, vitreous, amorphous.
DR. POSEY’S COAL K.

Four miles northeast of Petersburg, on sections 12 and 13, township 1 north, range 8; it is ten feet thick and will average about six feet; is a caking coal.

**Upper part:**

Specific gravity, 1.288; one cubic foot weighs 80.50 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>53.50</th>
<th>Ash, lead color,</th>
<th>48.50</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon,</td>
<td>48.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>46.50</td>
<td>Water,</td>
<td>6.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas,</td>
<td>40.00</td>
</tr>
</tbody>
</table>

100.00 100.00

Coke slightly puffed, vitreous, amorphous.

**Middle part:**

Specific gravity, 1.275; one cubic foot weighs 79.68 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>52.00</th>
<th>Ash, fawn,</th>
<th>4.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon,</td>
<td>48.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>48.00</td>
<td>Water,</td>
<td>7.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas,</td>
<td>41.00</td>
</tr>
</tbody>
</table>

100.00 100.00

Coke puffed, brilliant, amorphous.

**Bottom part:**

Specific gravity, 1.244; one cubic foot weighs 77.75 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>56.50</th>
<th>Ash, brown,</th>
<th>6.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon,</td>
<td>50.50</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>43.50</td>
<td>Water,</td>
<td>5.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas,</td>
<td>38.00</td>
</tr>
</tbody>
</table>

100.00 100.00

Coke lamellar, brilliant, not puffed.

This is a good coal for steam and blacksmithing. It contains a large per centage of gas, and it is reported that it was used at the Gas Works in Evansville, when the Wabash and Erie Canal, which ran close by the mine, was in operation.
SHANDY'S COAL K.

Upper part:
On section 13, township 1 north, range 8, near Dr. Posey's; the seam is from 5 to 8 feet thick.
Specific gravity, 1.279; one cubic foot weighs 79.94 lbs.
Coke, - - 56.50
\[ \text{Ash, white, - - 5.00} \]
\[ \text{Fixed carbon, - - 51.50} \]
Volatile matter, 43.50
\[ \text{Water, - - 6.50} \]
\[ \text{Gas, - - 37.00} \]
\[ \text{100.00} \]

Coke brilliant, lamellar, slightly swollen.
Lower part:
Specific gravity, 1.270; one cubic foot weighs 79.37 lbs.
Coke, - - 52.50
\[ \text{Ash, white, - - 3.50} \]
\[ \text{Fixed carbon, - - 49.00} \]
Volatile matter, 47.50
\[ \text{Water, - - 6.00} \]
\[ \text{Gas, - - 41.50} \]
\[ \text{100.00} \]

Coke lustreless, amorphous, puffed.
This coal is similar in character and quality to Dr. Posey's.

DE BRULER'S COAL K.

On section 8, township 1 north, range 7, two miles northeast of Dr. Posey's, and five miles northeast of Petersburg; this is a caking coal and the seam is from five to seven feet thick.
Top part of the seam:
Specific gravity, 1.294; one cubic foot weighs 80.87 lbs.
Coke, - - 47.00
\[ \text{Ash, blue, - - 5.00} \]
\[ \text{Fixed carbon, - - 42.00} \]
Volatile matter, 53.00
\[ \text{Water, - - 8.00} \]
\[ \text{Gas, - - 45.00} \]
\[ \text{100.00} \]

Coke very much puffed, lustreless.
G. R.—4
Middle part of seam:

Specific gravity, 1.271; one cubic foot weighs 79.43 lbs.

Coke, - - 50.00  
\[\begin{align*}
\text{Ash, brown,} & \quad - \quad - \quad 5.50 \\
\text{Fixed carbon,} & \quad - \quad - \quad 44.50
\end{align*}\]

Volatile matter, 50.00  
\[\begin{align*}
\text{Water,} & \quad - \quad - \quad 6.00 \\
\text{Gas,} & \quad - \quad - \quad 44.00
\end{align*}\]

100.00  100.00

Coke puffed, lustreless.

Lower part of seam:

Specific gravity, 1.268; one cubic foot will weigh 79.25 pounds.

Coke, - - 53.50  
\[\begin{align*}
\text{Ash, blue,} & \quad - \quad - \quad 3.50 \\
\text{Fixed carbon,} & \quad - \quad - \quad 50.00
\end{align*}\]

Volatile matter, 46.50  
\[\begin{align*}
\text{Water,} & \quad - \quad - \quad 6.50 \\
\text{Gas,} & \quad - \quad - \quad 40.00
\end{align*}\]

100.00  100.00

Coke puffed and lustreless.

Good steam and blacksmith's coal.

CROWE'S COAL L.

On section 10, township 1 north, range 7, three miles north of Algiers; color, dull black; seam three and a half to four feet; caking coal with a cubical fracture.

Upper part of seam:

Specific gravity, 1.274; one cubic foot weighs 79.62 lbs.

Coke, - - 56.00  
\[\begin{align*}
\text{Ash, fawn,} & \quad - \quad - \quad 3.50 \\
\text{Fixed carbon,} & \quad - \quad - \quad 52.50
\end{align*}\]

Volatile matter, 44.00  
\[\begin{align*}
\text{Water,} & \quad - \quad - \quad 8.50 \\
\text{Gas,} & \quad - \quad - \quad 35.50
\end{align*}\]

100.00  100.00

Coke puffed, vitreous, amorphous.

Lower part of seam:

Specific gravity, 1.262; one cubic foot weighs 78.87 lbs.
Coke,  -  -  56.40 \{ Ash, gray,  -  -  -  8.50
\} Fixed carbon,  -  -  47.90
Volatile matter,  43.60 \{ Water,  -  -  -  8.50
\} Gas,  -  -  35.10

100.00  100.00

Coke vitreous, swollen, puffed.
This is a good coal, has an excellent reputation wherever known, stands exposure to the weather, and large quantities have been shipped to southern points, by the river, from this mine.

TURNER SMITH'S COAL N.

On section 4, township 1 south, range 8, two miles southwest of Petersburg. The seam is 4 feet thick; is a caking coal with cubical fracture and contains seams of calcite in the partings:
Specific gravity, 1.279; one cubic foot weighs 79.93 lbs.

Coke,  -  -  56.00 \{ Ash, white,  -  -  -  2.50
\} Fixed carbon,  -  -  53.50
Volatile matter,  44.00 \{ Water,  -  -  -  5.50
\} Gas,  -  -  38.50

100.00  100.00

Coke much puffed, vitreous, amorphous.

HAWTHORN & GLEASON'S COAL L.

In an old shaft sunk below the bed of White river at High Bank, one and a half miles north of Petersburg, on section 15, township 1 north, range 8; reported to be 8 feet 6 inches thick. The shaft has been abandoned and is now full of water. The specimen analyzed was taken from a hill where it had been exposed for several years; it is a caking coal, and this specimen contains a large percentage of ash.
Specific gravity, 1.269; one cubic foot weighs 79.31 lbs.
Coke, - - 59.50 \{ Ash, gray, - - 14.00
\{ Fixed carbon, - - 45.50
Volatile matter, 40.50 \{ Water, - - 8.50
\{ Gas, - - 32.00
---
100.00 100.00

Coke unchanged, dull, laminate.

**BARR'S COAL M.**

On the bank of the Wabash and Erie Canal, four miles south of Petersburg, on section 15, township 1 south, range 8; is a caking coal and the seam is 2 feet 6 inches thick.

Specific gravity, 1.260; one cubic foot weighs 78.75 lbs.

Coke, - - 60.50 \{ Ash, white, - - 3.50
\{ Fixed carbon, - - 57.00
Volatile matter, 39.50 \{ Water, - - 7.00
\{ Gas, - - 32.50
---
100.00 100.00

Coke puffed, vitreous.
This is a good strong coal for heating purposes.

**FALL'S COAL N?**

Near Centerville, on section 24, township 1, range 9; the seam is 3 feet 10 inches thick; the upper part, semi-block; while the lower part is a choice caking coal.

Upper part of seam:

Specific gravity, 1.274; one cubic foot weighs 79.62 lbs.

Coke, - - 52.00 \{ Ash, fawn, - - 5.00
\{ Fixed carbon, - - 47.00
Volatile matter, 48.00 \{ Water, - - 5.50
\{ Gas, - - 42.50
---
100.00 100.00

Coke dull, laminate, slightly puffed.

Lower part of seam:

Specific gravity, 1.268; one cubic foot weighs 79.25 lbs.
### OF INDIANA.

<table>
<thead>
<tr>
<th>Coke</th>
<th>55.50</th>
<th>Ash, white</th>
<th>4.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon</td>
<td>51.50</td>
</tr>
<tr>
<td><strong>Volatile matter</strong></td>
<td>44.50</td>
<td>Water</td>
<td>7.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>37.00</td>
</tr>
<tr>
<td></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Coke vitreous, puffed, amorphous.**

### DETAR'S COAL A.

Two miles east of Pikesville, on section 28, township 2 south, range 6; the seam is from 2 to 3 feet thick, the upper part of which is cannel, and the lower part a good article of caking coal.

**Upper part of seam:**

- Specific gravity, 1.444; one cubic foot weighs 90.25 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>55.50</th>
<th>Ash, red</th>
<th>14.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon</td>
<td>41.50</td>
</tr>
<tr>
<td><strong>Volatile matter</strong></td>
<td>44.50</td>
<td>Water</td>
<td>7.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>37.00</td>
</tr>
<tr>
<td></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Coke laminate, brilliant, not puffed.**

**Lower part of seam:**

- Specific gravity, 1.288; one cubic foot weighs 80.50 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>54.50</th>
<th>Ash, dark red</th>
<th>5.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon</td>
<td>49.50</td>
</tr>
<tr>
<td><strong>Volatile matter</strong></td>
<td>45.50</td>
<td>Water</td>
<td>5.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>40.00</td>
</tr>
<tr>
<td></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Coke much puffed, glossy, laminate.**

### BEE'S COAL K.

Two miles east of the new town of Arthur, on the New Albany and St. Louis Air Line Railway, on section 17, township 2 south, range 7; the seam is eighteen inches thick and is a non-caking coal.
Specific gravity, 1.269; one cubic foot weighs 79.31 lbs.

Coke, \[58.50\] \{ Ash, dark brown, \[14.00\] \} Fixed carbon, \[44.50\]
Volatile matter, \[41.50\] \{ Water, \[4.50\] \} Gas, \[37.00\]

100.00

Coke compact, vitreous, laminate.

**MOULTON’S COAL K.**

One and a half miles northeast of Winslow, on section 28, township 1 south, range 7; this is a caking coal, and the seam is about 5 feet thick.

The upper part has a laminate structure, is rich in gas, and burns with a large flame.

The middle part is more compact and glossy, and contains some pyrites.

The lower part has a cubical fracture.

**Upper part of seam:**

Specific gravity, 1.244; one cubic foot weighs 77.80 lbs.

Coke, \[51.50\] \{ Ash, lead color, \[3.50\] \} Fixed carbon, \[48.00\]
Volatile matter, \[48.50\] \{ Water, \[5.50\] \} Gas, \[43.00\]

100.00

Coke much puffed, amorphous, lustreless.

**Middle part of seam:**

Specific gravity, 1.257; one cubic foot weighs 78.56 lbs.

Coke, \[59.00\] \{ Ash, dark red, \[8.50\] \} Fixed carbon, \[50.50\]
Volatile matter, \[41.00\] \{ Water, \[4.50\] \} Gas, \[36.50\]

100.00

Coke laminate, slightly swollen, lustrous.
OF INDIANA.

Lower part of seam:
 Specific gravity, 1.257; one cubic foot weighs 78.56 lbs.

Coke, 52.50  
| Ash, white,  | -  | -  | 3.00 |
| Fixed carbon, | -  | -  | 49.50 |

Volatile matter, 47.50  
| Water,  | -  | -  | 6.00 |
| Gas,  | -  | -  | 41.50 |

100.00  

Coke puffed, amorphous, lustreless.

THOMAS’ COAL K.

Half a mile north of Winslow, on section 32, township 1 south, range 7; the seam is five feet thick, and is a caking coal similar in quality to the above.

Specific gravity, 1.280; one cubic foot weighs 80.00 lbs.

Coke, 52.50  
| Ash, white,  | -  | -  | 4.00 |
| Fixed carbon, | -  | -  | 48.50 |

Volatile matter, 47.50  
| Water,  | -  | -  | 7.00 |
| Gas,  | -  | -  | 40.50 |

100.00  

Coke amorphous, puffed and lustreless.

WELLS & WHITMAN’S COAL L.

One and a half miles west of Winslow, on section 36, township 1 south, range 8, and on the south side of Patoka river; the seam is five feet thick, and is a caking coal.

Upper part of seam:
 Specific gravity, 1.294; one cubic foot weighs 80.87 lbs.

Coke, 55.00  
| Ash, white,  | -  | -  | 2.50 |
| Fixed carbon, | -  | -  | 52.50 |

Volatile matter, 45.00  
| Water,  | -  | -  | 8.00 |
| Gas,  | -  | -  | 37.00 |

100.00  

Coke slightly puffed, laminate, vitreous.

Middle part of seam:
 Specific gravity, 1.278; one cubic foot weighs 79.87 lbs.
Coke, \( - - 52.50 \) \{ \begin{align*} & \text{Ash, white,} \quad - - 2.00 \\
& \text{Fixed carbon,} \quad - - 50.50 \\
& \text{Volatile matter,} \quad 47.50 \} \begin{align*} & \text{Water,} \quad - - 6.00 \\
& \text{Gas,} \quad - - 41.50 \\
\end{align*}
\}

\begin{align*}
\text{Coke puffed, vitreous, laminate.} \\
\text{Lower part of seam:} \\
\text{Specific gravity, 1.275; one cubic foot weighs 79.68 lbs.}
\end{align*}

Coke, \( - - 53.00 \) \{ \begin{align*} & \text{Ash, white,} \quad - - 2.50 \\
& \text{Fixed carbon,} \quad - - 50.50 \\
& \text{Volatile matter,} \quad 47.00 \} \begin{align*} & \text{Water,} \quad - - 5.00 \\
& \text{Gas,} \quad - - 42.00 \\
\end{align*}
\}

\begin{align*}
\text{Coke puffed, vitreous, laminate.} \\
\text{This is altogether a most excellent coal and well adapted for steam, manufacturing and household uses.}
\end{align*}

G. W. MASSEY'S COAL L.

On the south bank of Patoka river, two miles north of the New Albany and St. Louis Air Line Railway, on section 4, township 2 south, range 8; this is a caking coal and the seam ranges from 6 to 10 feet in thickness.

Upper part of seam:

Specific gravity, 1.268; one cubic foot weighs 79.25 lbs.

Coke, \( - - 57.00 \) \{ \begin{align*} & \text{Ash, light gray,} \quad - - 3.50 \\
& \text{Fixed carbon,} \quad - - 53.50 \\
& \text{Volatile matter,} \quad 43.00 \} \begin{align*} & \text{Water,} \quad - - 8.50 \\
& \text{Gas,} \quad - - 34.50 \\
\end{align*}
\}

\begin{align*}
\text{Coke brilliant, compact, laminate.} \\
\text{Lower part of seam:} \\
\text{Specific gravity, 1.279; one cubic foot weighs 79.93 lbs.}
\end{align*}
**OF INDIANA.**

<table>
<thead>
<tr>
<th>Coke</th>
<th>56.50</th>
<th>Ash, white</th>
<th>1.50</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon</td>
<td>55.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>43.50</td>
<td>Water</td>
<td>7.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>36.50</td>
</tr>
</tbody>
</table>

100.00

Coke brilliant, slightly puffed, laminate.

This is a good coal for general fuel and steam purposes.

**THOMAS MARTIN’S COAL L.**

One and a half miles north of the N. A. & St. L. A. L. Ry., on section 9, township 2 south, range 8; the seam is from 7 to 9 feet 6 inches thick, and is a caking coal.

Upper part of seam:
Specific gravity, 1.258; one cubic foot weighs 78.62 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>55.50</th>
<th>Ash, gray</th>
<th>3.50</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon</td>
<td>52.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>44.50</td>
<td>Water</td>
<td>7.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>37.00</td>
</tr>
</tbody>
</table>

100.00

Coke, much puffed, vitreous, amorphous.

Middle part of seam:
Specific gravity, 1.269; one cubic foot weighs 79.31 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>60.00</th>
<th>Ash, light gray</th>
<th>3.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon</td>
<td>57.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>40.00</td>
<td>Water</td>
<td>6.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>33.50</td>
</tr>
</tbody>
</table>

100.00

Coke puffed, vitreous, amorphous.

Lower part of seam:
Specific gravity, 1.275; one cubic foot weighs 79.68 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>57.50</th>
<th>Ash, white</th>
<th>2.50</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon</td>
<td>55.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>42.50</td>
<td>Water</td>
<td>7.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>35.00</td>
</tr>
</tbody>
</table>

100.00

Coke puffed, vitreous, slightly laminate.
This is a splendid, mammoth seam of coal, well adapted for steam and household uses.

**P. S. TEVAULT’S COAL K.**

Three miles east of Pleasantville, on section 16, township 3 south, range 7; the seam is about 5 feet thick caking coal and a very good fuel.

Specific gravity, 1.245; one cubic foot weighs 77.81 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>52.50</th>
<th>Ash, white,</th>
<th>3.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon,</td>
<td>49.50</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>47.50</td>
<td>Water,</td>
<td>7.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas,</td>
<td>40.50</td>
</tr>
</tbody>
</table>

100.00

Coke much puffed, amorphous, lustreless.

The analyses of the following coals from Warrick county will serve to show their relation to the coals of Dubois and Pike counties.

**WOOD’S COAL K.**

Two miles southeast of Holland, on section 19, township 4 south, range 5; this is a caking coal, and the seam is three feet thick. It is a good coal, contains a large percentage of gas, burns with a large flame, and is considered excellent for blacksmithing.

Specific gravity, 1.272; one cubic foot weighs 79.50 lbs.

<table>
<thead>
<tr>
<th>Coke</th>
<th>48.00</th>
<th>Ash, white,</th>
<th>3.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed carbon,</td>
<td>45.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>52.00</td>
<td>Water,</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas,</td>
<td>47.50</td>
</tr>
</tbody>
</table>

100.00

Coke much puffed, lustreless, amorphous.

**INGHAM’S COAL K?**

Two miles north of Taylorsville, on section 5, township
3 south, range 6; this is a block coal, and the seam is two feet six inches thick.

Upper part of seam:
Specific gravity, 1.280; one cubic foot weighs 80. lbs.

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>51.00</td>
<td>Ash, white</td>
<td>2.00</td>
<td>Fixed carbon</td>
<td>49.00</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>49.00</td>
<td>Water</td>
<td>7.50</td>
<td>Gas</td>
<td>41.50</td>
</tr>
<tr>
<td></td>
<td>100.00</td>
<td></td>
<td>100.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Coke slightly puffed, laminate, vitreous.

Lower part of seam:
Specific gravity, 1.311; one cubic foot weighs 81.93 lbs.

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<td>Gas</td>
<td>41.00</td>
</tr>
<tr>
<td></td>
<td>100.00</td>
<td></td>
<td>100.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Coke laminate, vitreous, not puffed.