

## THE PRINCETON PETROLEUM FIELD OF INDIANA.

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*Topography.*—Gibson County, of which Princeton is the county seat, lies in the southwestern point or "pocket" of Indiana, adjoining Illinois on the west and separated from that state by the Wabash River. On the north, with White River between, is Knox County; on the east Pike, and on the south, Posey, Vanderburgh and Warrick counties. It comprises an area of 490 square miles, with 305,114 acres of farm land, the surface of which is, for the most part, rolling, with the exception of the flat bottom lands of the Wabash River valley.

The county is divided topographically into three sections, viz.: the river flats, upland plains or terraces and rolling uplands. The soils of these are of drift origin, and are for the most part very fertile. The land west of Patoka, between the Patoka and White rivers, is of the lower flood plain deposits, and is subject to an annual overflow. Its soil is composed of alluvial silts and sands, except in one place in the southwestern point of White River township, where are a few compact and isolated knobs, called the Gordon Hills. They cover an area of one and a half square miles and rise to an elevation of 500 feet above sea level. In the lower flood plain to the east of the Gordon Hills heavy deposits of gravel occur, ranging from 20 to 114 feet in thickness.

South of the Patoka River and adjoining the Wabash River, lie the terraces or second bottoms, which are rarely overflowed. Along the Wabash River are several abandoned channels, and in these are found the low swamp land and river flats, which are drained by ditches.

Bordering the upper plain or terrace deposits, on a line drawn from the village of Patoka to the southeastern corner of Wabash township are the first sand hills or dunes, composed of coarse sands resting on the upper flood plain deposits. These range from one-half mile to two miles in width. Back of the sand hills and covering an area to the eastern border of the county, are the drift ridges of the rolling uplands. This is all tillable land underlain with stratified gravels and sands. The only loess of any consequence lies through the center of Montgomery township between townships 2 and 4 south and bordering the southern edge of Princeton in a strip covering two square miles.

The county is thus one of the richest farming districts in southern Indiana, the most stable crops being corn, wheat and hay on the ridges and lowlands, and watermelons on the sand ridges.

In the drilling of oil wells many clays and shales are encountered which form a part of the Coal Measure rocks. They are first found east of the Wabash three or four miles, and are heaviest in the vicinity of Princeton and the present oil field. Near the surface they are brown and almost black in color, but at a depth of 200 feet become gray. The shales are found in greater abundance, and their thicker layers are often separated by thin layers of limestone shell. At a depth of 100 to 125 feet, about 200 feet of a tough, soft shale gradually merging into a hard shale and limestone is encountered. At a depth of about 420 feet occurs a heavy vein (6 to 7 feet) of coal. This is mined just north of the corporate limits of Princeton. This vein is found over all the territory in the vicinity of Princeton and is everywhere a workable deposit. Just beneath this coal vein in the present oil field, alternate strata of shale and sandstone are gotten.

A record of the coal veins which occur in and about Princeton is given in the Patoka Folio of the United States Geological Survey as follows:

## COAL VEINS IN VICINITY OF PRINCETON.

Nearest Town.	Location.	Source of Information.	Depth. Feet.	Thick- ness, Feet.	Coal.
Patoka.....	Bluff South of river.....	Outerop.....	.....	1	Parker.
Princeton.....	Indian Creek, N. E. of town.....	Outerop.....	.....	2	
Princeton.....	N. E. $\frac{1}{4}$ Sec. 5, T. 2 S., R. 10 W.....	Kurtz deep bore.....	146	1	
Princeton.....	Sec. 5, T. 2 S., R. 10 W.....	Kurtz shallow bore.....	258	2 $\frac{1}{2}$	Millersburg.
			90	4 $\frac{1}{2}$	
Princeton.....	Sec. 33, T. 1 S., R. 10 W.....	Shannon well.....	76	1 $\frac{1}{2}$	
Princeton.....	S. E. $\frac{1}{4}$ Sec. 12, T. 2 S., R. 11 W.....	Oswald shaft.....	430	6	Petersburg.
Princeton.....	North edge of town.....	Interstate Gas & Oil Co.....	380	7	Petersburg.
			460	4	
			615	5	
Princeton.....	N. W. $\frac{1}{4}$ Sec. 8, T. 2 S., R. 10 W.....	Evans well.....	62	1 $\frac{1}{2}$	
			281	$\frac{1}{2}$	Millersburg
			402	6	Petersburg.
			514	6	
Princeton.....	Near preceding.....	Deep well.....	80	1 $\frac{1}{2}$	
			283	3	Millersburg.
			422	7	Petersburg.
			471	7	
			593	4	
			628	3 $\frac{1}{2}$	
Princeton.....	S. W. $\frac{1}{4}$ Sec. 7, T. 2 S., R. 10 W.....	Hall well.....	670	4	Petersburg.
			355	6	
			470	6	
			670	6	
			130	7	
			1,020	3	
Princeton.....	S. E. $\frac{1}{4}$ Sec. 7, T. 2 S., R. 10 W.....	Thompson well.....	82	1	
			281	2	Millersburg.
			396	6	Petersburg
			462	5	
			604	6	
			723	6	
Princeton.....	N. E. $\frac{1}{4}$ Sec. 18, T. 2 S., R. 10 W.....	Southern R. R. shops well	199	2	Millersburg.
			346	7	
			451	2	
Fort Branch..	Peter Hoffman place.....	Well.....	56	1	
			178	5	
			250	3 $\frac{1}{2}$	Millersburg.
			301	5	Millersburg.

*Drainage.*—The Patoka River enters the county at the north-eastern corner of Columbia township and has its mouth at the southwestern corner of White River township, cutting the country in a zig-zag fashion. The Patoka valley, before it merges into the more extensive Wabash valley, averages two miles in width, and many hills, of which Yeagers Hill is the highest, border the river throughout its course.

Above the Wabash bottoms the county is drained principally by the Patoka River, Pigeon Creek and Indian Creek. The Wabash, White and Patoka rivers are the only streams maintaining any notable flow throughout the seasons, while in the wet months the Indian, Pigeon and Indian Camp creeks flow merely enough to drain. The lesser streams have their sources in numerous springs found on the upland ridges.

In the lowlands a ditching system has converted the low marsh lands and bayous into rich black soil. The Blair, Summers, Stunkle and McCarty ditches are the largest, and the latter affords practically the only drainage for the southwestern end of the present oil field.

*Transportation, population and elevations.*—The transportation facilities of the county are fair, the Evansville & Terre Haute Division of the Frisco System, and the St. Louis & Louisville Division of the Southern Railroad pass entirely through the county and have their junction at Princeton. The latter railroad has its central shops at Princeton, and gives extensive employment to many people.

Besides these, the Evansville & Indianapolis Railroad passes north and south through Columbia and Barton townships on the east; the Evansville, Princeton & Vincennes Traction Company operates between Evansville and Princeton; and the Evansville & Terre Haute Railway has a branch road running from Ft. Branch through Owensville in Montgomery township and thence to Mt. Vernon, Posey County.

Within the last two or three years the improvement of roads has received much attention in the county, with the result that all the main roads are being converted into macadamized pikes. This has been of especial advantage to the region west of Princeton through the oil fields, where previously the only roads leading into the bottom lands of the Wabash River were of sand.

The population of the county in 1900 was 30,099, and at the present time is about 34,500, while that of Princeton was 6,041 as

against 8,500 now. Owensville has a population of about 1,250 and Patoka about 900.

The elevations in feet above sea level of the towns and principal points in the county are: Yeagers Hill, 642; Bald Hill, 634; Francisco, 430; Fort Branch, 440; Gordon Hills, 500; Haubstadt, 473; Hazelton, 422; Kings Station, 463; Lyles, 400; Owensville, 507; Patoka, 429; Princeton, E. & T. H. Ry. Station, 478; Southern Ry. Station, 461; Crossing of E. & T. H. and Southern railways, 429; Court House, 501; Mt. Carmel, Ill., Southern Ry., 390, Court House, 424.

#### THE PRINCETON OIL FIELD.

Since May, 1903, petroleum has been found in Gibson County in commercial quantities in a sandstone which varies from 820 to 920 feet below the surface. From the record of the bores and the appearance and structure of the oil bearing sand, which changes from a coarse gray on top to a finer grayish-yellow sand in the pay stratum, the latter is probably one of the sandstones of the Huron Group. This formation or group comprises the uppermost or latest rocks laid down during the Lower (Sub) Carboniferous period. The Huron comprises the surface rock over a strip two to 15 miles in width, which covers a part of eight counties in southwestern Indiana as follows: Western Crawford, eastern Perry, central and northwestern Orange, eastern Martin, western Lawrence, eastern Greene, western Monroe and central Owen. Immediately overlying the Huron to the west is the Mansfield sandstone or "Millstone grit," a massive sandstone ranging up to 150 feet in thickness, which is the basal formation of the Carboniferous rocks of the State.

A typical section of the Huron Group, exposed near Footes Spring, Orange County, southwest quarter of section 11 (1 N. 2 W.) obtained by Mr. Kindle for the Twentieth report of this Department was as follows:

#### *Section near Footes Spring, Orange County.*

	<i>Feet.</i>
Slope with Mansfield fragments.....	18
Upper Huron limestone.....	15
Upper Huron sandstone.....	35
Middle Huron limestone .....	16
Lower Huron sandstone.....	30
Lower Huron limestone.....	6



Of the sandstones of this group, which comprise the formation yielding the oil, Mr. Kindle says: "These beds, which are separated by the Middle Huron limestones, vary widely in thickness and in lithological characters. They are composed of strata of sandstone of medium coarseness, buff to light gray or white in color. In many places iron in the form of limonite concretions occurs in the massive sandstone. Thin seams of coal, three to six inches in thickness, are found in them at some localities. Beds of shale sometimes in part replace the sandstones."

The Princeton field at present covers an area of twelve square miles, and lies in sections 35 (1 S., 11 W.) and 2, 3, 10 and 11 (2 S., 11 W.) of Patoka township. The eastern limit of the field is about one and a half miles from the northwestern corner of the corporate limits of Princeton. The field is easy of access and is cut by the old Sand and Mt. Carmel roads and by the Southern Railway.

*Early History of the Field.*—The early history of the Princeton oil field dates back to 1891, at the time when a subsidy was voted by Patoka township to the Southern Railway Company, inducing that company to locate their central shops at Princeton. A little previous to this time Wm. R. Wright of Princeton, while in search of coal and gas, had completed a well known as the Evans well, on the eastern edge of the city. A considerable pressure of gas was found, which induced him to pipe it to the courthouse yard and burn it, so attracting public interest to his well. This event, along with the voting of the subsidy, created some excitement and in a short time afterward four more wells were completed. However, they were unsuccessful in producing any quantity of gas, although the presence of heavy strata of coal and shale was shown.

Three of these wells were near the Evans well, while the fourth was located in the Southern shops yard. The latter well was notable as indicating the presence of workable coal strata. At a depth of 199 feet two feet of Millersburg coal was found, and at 346 feet a heavy vein of seven feet was located. At 451 feet a small vein of two feet was gone through, and in the neighborhood of 600 feet a small quantity of gas was encountered.

A sixth well was located on the J. B. Hall tract on the western edge of Princeton, west half of the southwest quarter of section 7, directly south of the E. & T. H. depot. A distinctive feature of this well was the depth and number of coal strata passed through. It was carried to a depth of 1,274 feet, and at 355 feet

a vein six feet in thickness was passed through. At 470 feet another vein of six feet was located and another of the same thickness at 670 feet. The largest vein was struck at 730 feet, being seven feet through, and finally, at a depth of 1,020 feet, three feet of coal was encountered, showing five strata of coal in this one location. This location has not, as yet, been operated for coal and the opening has been standing as a water well. Recently a small quantity of gas was found issuing from the hole, but merely enough to make a temporary blaze.

Gas has not been found in sufficient quantity to be of any commercial value in any of the wells located in 1891, but all were comparatively rich in coal strata. A full record of the wells as they were drilled is shown on the opposite page, the data being secured from E. Criswell, of Princeton.

Some time elapsed before prospecting for gas and coal was again begun. During the following ten years small deposits of jet-black asphaltum were from time to time encountered in several entries in the deep coal mine operated north of Princeton, near West Junction, the crossing of the E. & T. H. and Southern railways. This discovery led to the belief that petroleum would eventually be found, and finally, on January 16, 1902, a company composed of business men of Princeton was organized, and incorporated as the "Interstate Oil and Gas Company." These men were the pioneers of the Princeton oil field and were, namely: Seth Ward, Sr., S. T. Heston, Eugene Criswell, G. E. Bryant, Harry Kurtz and J. W. Archer. The capital stock was \$500,000, in \$1.00 shares. They leased 3,000 acres of land in the vicinity of Princeton, and early in the spring of 1902, let a contract to drill 2,000 feet, with the understanding that Trenton rock was to be reached. A bore was put down on the Chas. Brownlee farm, south half of the southwest quarter of section 6 (2 S., 11 W.), one-half mile north of the corporate limits of Princeton. The drill passed through alternating strata of shale, coal, fire-clay, limestone, sandstone, etc., and, after reaching a depth of 1,453 feet, the bore was abandoned on account of frequent cavings of the shale passed through. A deposit of asphaltum, estimated to be six feet in thickness was struck at a depth of 450 feet. At a depth of 869 feet a showing of oil was found, but the quantity was so small as not to warrant the shooting of the well. At a depth of 1,026 feet another showing of oil was encountered, but like the first, was passed in the hope of reaching Trenton rock. The abandonment of the well in February, 1903, after the expenditure of \$5,000, discouraged the operators, so that some time

Princeton Wells Drilled in 1891. Fig 1.

Scale 100 ft. in	No 1 Evans well E Broadway	No 2. Jerauld well L Broadway	No 3 Thompkins L Chestnut	No 4. Southern R.R. Shop yards	No. 5. Halls. West End.
50	Soil 1' 11'	Soil & Clay 20'	Soil & Clay 20'	Soil 14'	Soil & clay 6'
	Quick Sand 22'	Quick sand 20'	Quick sand 2'	Quick sand 14'	Clay Gravel water 28'
50	Blue Clay 21'	Blue mud 25'	Clay & Gravel 36'	Fire clay 25'	Shale 102'
	Soapstone 13'	Blue mud 25'		Black Slate 12'	
	Fire Clay 20'	Fire Clay 14'	Slate 24'	Red Slate 16'	
100	Limestone 4'	Limestone 12'	Soft Limestone 24'	Soapstone 16'	
	Soapstone 18'			Fire Clay 44'	
150	Fire Clay 45'	Soft Limestone 29'	Soapstone & Slate 92'	Soapstone 20'	Limestone 15'
	Soapstone & slate 70'	Sandy Shale 45'		Black Shale 60'	Shale 96'
200		Fire Clay & Shale 60'	Sandstone 12'	coal 2'	
			Slate 40'	White slate 36'	
250	Black Shale 60'	White sand 17'	Sandstone 8'	Limestone 9'	lime Shells 10'
	Coal 5'	Shale 20'	Slate 16'	Fire clay 19'	
300	Slate 30'	Fire Clay 8'	coal 2'	Slate 47'	Shale 106'
	lime shale 8'	Slate 22'	Sandy shale 20'		
350	Fire Clay 20'	Lime Stone 28'	Shale 10'		
	Slate 50'		Limestone 16'	Black Shale 40'	Coal 6'
400		Slate 78'	Slate 44'	Fire Clay 28'	Shale 49'
	Hard Shale 3'		lime shale 4'	Sandy Slate 10'	
450	Fire Clay 20'	Coal 17'	Fire clay 20'	Gas sand 60'	Limestone 35'
	Sandy Shale 40'	Slate 27'	Slate & Shale 29'		Shale 15'
		Coal 7'	Coal 5'	coal 2'	Coal 6'
500	Slate 40'	Fire Clay 32'	Soapstone 13'	Brown Slate 20'	
	Coal 6'		White Sandstone 4'		Shale 124'
550	Sandy Shale 35'	Slate 48'	Soapstone & Slate 35'	Limestone 35'	
	Soapstone 25'	Shale 35'	Shale 30'	Slate 16'	
600	Slate 28'	Shale 4'	Soapstone 20'	Limestone 20'	
	Coal 4'	Fire Clay 13'	Shale 20'	Shale 9'	Limestone 15'
	Coal 4'	Slate 15'	Coal 6'	Sand 15'	
650	Coal 4'	Coal 3'	Slate 10'	Fire Clay 18'	Shale 55'
	Coal 4'	Sandy Shale 14'	Sandy Shale 10'		Coal 6'
	Coal 4'	Slate 23'	Sandy Shale 10'		Shale 10'
	Coal 4'	Shale 19'	Sandy Shale 10'		Limestone 12'
700		Fire Clay 17'	Sandy Shale 30'		Shale 32'
			S.S. & Salt water 5'		Coal 7'
750			Slate 15'		
			Coal 6'		Limestone
			Fire Clay 10'		112'
800			Gray Limestone 14'		
			S. Shale 30'		Shale 41'
850			Clay & Shale 72'		Limestone 30'
900					Sandstone 40'
950					Shale 18'
1000					Sandstone 40'
1050					Coal 3'
1100					
1150					White Sandstone 221'
1200					
1250					Blue Limestone 30'
1300				1274	

elapsed before another entry was made in the field. The following is the record made of the drillings of the Interstate well, No. 1, as accurately as it could be kept under the circumstances:

*Record of Bore No. 1 Sunk by Interstate Oil and Gas Co.*

	<i>Feet.</i>	<i>Feet.</i>
Drift .....	40	
Soapstone .....	75	
Coal .....	3	118
Fire-clay .....	4	
Limestone .....	10	
Soapstone .....	148	280
Limestone .....	35	
Shale and mud.....	35	
Slate .....	20	
Limestone shale .....	1	
Slate .....	14	
Coal .....	7	392
Blue mud .....	43	
Slate .....	15	
Asphalt (?) .....	6	456
Limestone .....	30	
White sand .....	6	
Limestone .....	35	
Shale .....	45	
Slate .....	15	
Coal .....	5	592
Fire-clay .....	5	
Sand .....	15	
Slate .....	6	
Shale .....	5	
Gray sand .....	20	
Shale .....	36	
Limestone .....	13	
Coal .....	7	699
Shale .....	40	
Gas sand .....	12	
Shale .....	18	769
Sandstone .....	100 (oil)	869
Shale .....	25	
Sandstone .....	100	
Shale .....	5	
Gray sand .....	30 (oil)	1029
Asphalt base .....	25	
Shale .....	125	
Gray sand .....	20	1199
Salt water sand.....	15	
Shale .....	45	
Sand .....	40	
Limestone and shale.....	20	1319
Hard stone .....	84	1403

After the abandonment of the Interstate well a new company, known as the Hoosier Prospecting Company, was organized and, being stimulated by the reports of asphaltum in the vicinity, incorporated April 20, 1903, and recorded June 11, 1903, with \$5,000 stock in shares of \$10 each. They secured leases upon 700 acres of land northwest of Princeton and started a bore on the L. M. Miller farm, north half of the west half of the southeast quarter of section 2 (2 S., 11 W.), which was finished May 25, 1903, and developed into the first productive oil well in the Princeton field. The strata passed through were alternating layers of sandstone, limestone, shale and coal, varying in thickness from one to 134 feet. All belonged to the upper Carboniferous series of rocks. Five veins of coal were pierced, one of which, nine feet in thickness, was struck at a depth of 785 feet. The field record of the well was:

	<i>Feet.</i>
Drive pipe .....	60
Casing .....	802
Top of oil sand.....	871
Bottom of sand.....	893
Total depth .....	907

When finished the oil rose nearly to the top of the bore, but was not pumped for several months. On July 15, 1906, it was producing about three barrels per day.

A second well, 100 feet south, was drilled soon after the completion of the first and was finished in August, 1903. Its record showed:

	<i>Feet.</i>
Drive pipe (10 in.).....	60
Casing (8 in.).....	60
Casing (6¼ in.).....	384
Casing (4⅞ in.).....	800
Top of sand .....	871
Bottom of sand.....	895

The shale immediately overlying the oil pay in No. 1 on the Miller lease was continuous, and 62 feet in thickness, but in No. 2 there were two strata of non-productive sandstone intercalated with this shale before the oil pay was reached. This sandstone yielded slight quantities of gas. In several wells in the field these two strata of sand produced considerable pressure of gas, and in one instance, on the Kendle lease, the driller was badly burned by the rush of gas which ignited from the fire of a blacksmith's forge.



In the Hoosier Oil well No. 2, one of these gas veins ten feet in thickness was found 20 feet in the shale. The second, five feet thick, was 35 feet below the top of the shale. The third layer of sandstone, or oil sand, had the upper 12 feet barren, but the lower six feet proved to be rich in oil. The gas present was of sufficient pressure to spray the oil above the top of the derrick. A shot of 80 quarts of nitroglycerine was used and the initial production was 25 barrels per day. The well was put to pumping steadily September 15th, and on October 13th the two wells on the lease were producing about nine barrels of oil per day, and on July 15, 1906, averaged four barrels each.

The advent of a second successful well was reported far and wide and soon caused an influx of oil operators from every direction. A rush for leases took place and by the middle of October, 1903, sixteen companies had organized and half a dozen derricks were up. The new turn of affairs renewed the interest of the Interstate Company and, in September, 1903, they started their second bore. It was located on the S. Warnock tract, southwest quarter of the southwest quarter of the northwest quarter of section 6 (2 S., 10 W.), Patoka township, and was drilled to a depth of 950 feet, but proved to be dry with only a small showing of gas.

From this time the drilling of wells went steadily on and the field branched out to the southwest and northwest of Princeton, with considerable wild-cattling on the outskirts of the present field. A number of these wild-cat bores resulted in dry holes, which restricted this territory to the area of 12 square miles of the present field.

*The Outer Field.*—The wild-cat wells of the Princeton field cover an area of about 120 square miles, with Princeton as a central point. The wells placed in the outskirts of the present field were put down rapidly and, in many cases, with but little knowledge as to the nature of the oil bearing stratum. As a result, practically all of the wells came in as dry holes; but this does not necessarily mean that the outer field is barren territory. In fact, the present advance is moving directly into the wild-cat country. Records of these wells were kept only in a few cases, and only in the terms used by the drillers.

Near Owensville in Montgomery township two wells were put down by the "Eagle Oil & Gas Company." Of these well No. 1 was placed on the C. W. Jones tract of 20 acres, southwest quarter of section 30 (2 S., 11 W.). A contract was let to drill 1,000 feet

and the driller carried it to 1,030 feet. Through the drift, a large amount of water was met, necessitating 100 feet of 10-inch drive pipe. At a depth of about 150 feet, three feet of coal was found, and at a depth of 230 feet a vein of three and a half feet was met. The largest vein of coal was struck at 425 feet and was eight and one-half feet in thickness. At a depth of 500 feet a trace of gas was encountered. The bore was carried 40 feet into the sand and proved to be barren. After the drift was passed and the water cased off, the remaining depth was found to be entirely free from water, which marked it as one of the driest holes in the field.

No. 2 of this company was located on the W. Garret tract of 80 acres in the east half of the southeast quarter of section 4 (3 S., 12 W.). There was hardly any evidence of coal in this bore but a strong flow of gas was secured. A large volume of fresh water interfered with utilizing the gas, with the result that the bore was abandoned. The well was completed in October, 1904, and was reported barren.

A third well in the vicinity of Owensville was sunk by the Indian Camp Oil Company, on the H. A. Mauck lease of 15 acres in the southwest quarter of section 19 (2 S., 11 W.). At a depth of 430 feet, eight feet of coal was struck, and at 360 feet four feet was passed through. The field record of the well shows:

	<i>Feet.</i>
Drive pipe, 10 in.....	95
Casing, 8 in.....	130
Casing, 6¼ in.....	785
Top of sand.....	918
Depth into sand.....	28
Total depth .....	946

This well was drilled in eight days and came in without a showing of either oil or gas.

The fourth well in this vicinity was on the J. Meaders lease, southwest quarter of the northeast quarter of section 28 (3 S., 12 W.), Montgomery township. It was drilled by the Posey, Vanderburgh and Gibson County Gas and Oil Company, and was reported a dry hole.

South of Fort Branch, in Johnson township, a well was drilled on the H. Solloman tract, west half of the west half of section 5. It was drilled to a depth of 1,550 feet without a showing of oil. A large volume of salt water was, however, encountered.

The second well in the vicinity of Ft. Branch was drilled on

the J. E. Toops farm. It was put down over 1,000 feet without showing of oil or gas, but coming in contact with another large volume of salt water. An interesting fact concerning this well was the thickness of coal strata passed through. At a depth of 260 feet, five feet of coal was met and at 366 feet eight feet of coal was encountered. The thickest vein recorded in the county was struck at 591 feet, it being said to be twelve feet through, though part of it was doubtless black shale. Several smaller veins were also drilled through. In all, 25 feet of coal was passed through. This well was completed July 25, 1906, and was drilled to 925 feet before sand was gotten. At 935 feet a strong vein of salt water was encountered, and at 1,020 feet the drilling stopped.

A dry hole on the John S. Brown tract of 160 acres, southeast quarter of the northeast quarter of section 28 (2 S., 11 W.), Montgomery township, had the following record:

	<i>Feet.</i>
Drive pipe, 10 in.....	120
Casing, 8 in.....	210
Casing, 6¼ in.....	850
Top of sand.....	750
Total depth .....	1200

Northeast of Princeton a dry hole was drilled on the James Carithers tract of 100 acres, southwest quarter of the southeast quarter of section 27 (1 S., 10 W.), Patoka township. As there was no record kept of this well, but little is known about it, except that it had a showing of gas and was over 900 feet in depth.

About a mile west of the Carithers well, on the J. Glaze tract, south half of the northwest quarter of section 28 (1 S., 10 W.), White River township, the Ohio Oil Company drilled a dry hole in September, 1903. The well was plugged immediately after it was drilled, and doubt has been expressed as to whether it was barren or not. The record as given by the company is:

	<i>Feet.</i>
Top of sand.....	790
Water .....	853
Total depth .....	863

The same company drilled a test well on the R. Smiley tract, south half of the southeast quarter of section 21 (1 S., 11 W.), White River township. The intention of the company was to drill 2,500 feet into Trenton rock, but they only reached a depth of 1,735 feet when they had to abandon the well on account of cavings in the shale strata. This well is notable in that 14 feet from

the surface a heavy stratum of water gravel was struck which was 114 feet in thickness. At a depth of 1,400 feet a pool of salt water was struck which has been running out of the top of the bore for a year and a half. A mere showing of Huron sandstone was found. The record of the well showed:

	<i>Feet.</i>
Drive pipe, 15 in.....	106
Drive pipe, 12 in.....	166
Drive pipe, 10 in.....	741
Casing, 8 in.....	1060
Casing, 6¼ in.....	1735
Total depth .....	1735

The well came in dry and without a showing of gas.

A bore on the J. Kelch lease, southeast quarter of the southwest quarter of section 26 (1 S., 12 W.), White River township, was put down by W. J. Rogers of Mt. Carmel, Illinois, as a private enterprise. It was carried to a depth of 1,010 feet into salt water and came in as a dry hole, with a showing of gas. At a depth of 320 feet, four feet of coal was passed through; at 360 feet, 14 inches was found; at 400 feet, eight inches, and at 420 feet, six feet was struck. The field record of the well shows:

	<i>Feet.</i>
Drive pipe, 10 in.....	60
Casing, 8 in.....	110
Casing, 6¼ in.....	700
Top of sand.....	960
Thickness of sand.....	8
Total depth .....	1010

A well reported as dry was drilled on the Emma D. Pickeral tract, east half of the northwest quarter of section 19 (1 S., 11 W.), White River township.

A well located on the C. and E. Hitch tract, northwest quarter of the southeast quarter of section 33 (1 S., 11 W.), White River township, was put down by the Butler Oil Company and was also reported as a dry hole. The well was drilled over 1,000 feet and the Huron sandstone was gotten close to 900 feet.

In the southwest quarter of section 26, White River township, a bore was sunk by a private company which proved barren. It was immediately south of the southern wing of the field and placed a check on the movement toward the town of Patoka.

The Princeton Oil & Gas Company, of Princeton, sunk two bores in the outskirts of the present field. The first was on the E. D. Miller tract, west half of the southeast quarter of the south-

east quarter of section 5 (2 S., 11 W.), Patoka township. It came in a dry hole, but immediately under a six-foot vein of coal, at 460 feet, a small volume of gas was encountered, and just above the top of Huron sandstone, which was found at 935 feet, a heavy volume of gas was gotten, which flowed for a long period. A large quantity of water filled the bore and restricted the flow of gas which, at present, escapes from the bore only in sufficient quantity to make a small blaze when lighted. The drill was sunk 40 feet into the sand, making the total depth 975 feet. The well when completed was held to condemn the territory on the west of the present field, but in September, 1906, the active field was making progress in this direction.

A second bore by this company was completed in May, 1904, on the W. L. Watkins lease, northeast quarter of the southeast quarter of section 9 (2 S., 11 W.), Patoka township. It came in as a dry hole, and was drilled to a depth of 955 feet, the sand being found at 910 feet. This well placed a permanent check on the movement southwest of the active field.

In the southwest quarter of the southwest quarter of section 36 (1 S., 11 W.), Patoka township, on the Robert Mitchell tract, the Hoosier Oil Company drilled a dry hole. It was carried to a depth of 856 feet and had the following record:

	<i>Feet.</i>
Casing, 6¼ in.....	680
Top of sand.....	816
Depth into sand.....	40
Total depth .....	856

The Ohio Oil Company drilled a well on the Robert Howe tract, southeast quarter of the northwest quarter section 1 (2 S., 11 W.), Patoka township, close to the E. & T. H. Railroad, which showed a quantity of oil at 892 feet, but the well was never shot and is reported as a dry hole. It has since been plugged and abandoned. Its field record shows:

	<i>Feet.</i>
Drive pipe, 10 in.....	63
Casing, 6¼ in.....	165
Casing, 4⅞ in.....	705
Top of sand .....	871
Oil at .....	892
Total depth .....	912

The Gibson County Oil & Gas Company drilled one well, which proved to be dry. It was located in the northwest quarter of the northeast quarter of section 13 (2 S., 11 W.), Patoka township, on the J. McCarty tract.



In the northwest quarter of the southeast quarter of section 11 (2 S., 11 W.), Patoka township, on the R. H. McCurdy lease, the Interstate Oil and Gas Company drilled their third and last well. It was finished in January, 1904, and proved to be a dry hole.

The Crawford & Trenton Rock Oil Company drilled a dry hole on the Westfall tract, northeast quarter of the southwest quarter of section 14 (2 S., 11 W.), Patoka township. The same company drilled four wells on the W. W. Blair tract, southeast quarter of the northwest quarter of section 4 (2 S., 11 W.), Patoka township, of which two were dry holes and two were light pay wells, averaging about one and a half barrels per day. This was so light that they were abandoned. Several large veins of coal were passed through in these wells. At a depth of 430 feet the first vein was found, which measured seven feet through. At 555 feet a second vein, six feet in thickness, was struck. Also one of the same depth was found at 665 feet. The largest vein was encountered at 789 feet, and was nine feet through, making four thick strata in this territory. The four wells were about 350 feet apart, forming a square. The record of well No. 1 shows:

	<i>Feet.</i>
Drive pipe, 10 in.....	100
Casing, 8 in.....	120
Casing, 6¼ in.....	690
Top of sand.....	826
Total depth .....	850

A well on the L. Binkley farm, southwest quarter of the southeast quarter of section 10 (2 S., 11 W.), Patoka township, was drilled by the Ohio Oil Company and was carried to a depth of 1,040 feet. In it the Huron sand was gotten at 1,035 feet. This is due to an elevation in the surface of the land, one-half a mile from the active field. This well borders the present pay wells and came in as barren, which, along with the Interstate Oil Company's well No. 3 on the McCarty lease, placed a check on the field south and southeast of the old Sand road. Its record shows:

	<i>Feet.</i>
Casing, 8 in.....	69
Casing, 6¼ in.....	691
Top of sand.....	1035
Total depth .....	1040

The Ohio Oil Company also drilled two wells on the J. A. Mauck tract, of which No. 2, offsetting No. 2 on the W. W. Blair farm,

came in with a fair showing of oil, but not of sufficient quantity to justify shooting. It was located in the southwest quarter of the northeast quarter of section 4.

About one mile northeast of No. 2, just south of the Patoka River in the southeast quarter of the northeast quarter of section 33 (1 S., 11 W.), Patoka township, was located No. 1, which was completely barren of gas or oil. The field records of the two wells show:

	No. 1.	No. 2.
	<i>Feet.</i>	<i>Feet.</i>
Drive pipe, 10 in.....	103	93
Casing, 8 in.....	147	128
Casing, 6¼ in.....	748	700
Top of sand .....	875	864
Total depth .....	936	920

On the P. F. Mauck lease, the same company drilled a dry hole in the southeast quarter of the northwest quarter of section 3, the record of which showed:

	<i>Feet.</i>
Drive pipe, 10 in.....	36
Casing, 8 in.....	106
Casing, 6¼ in.....	759
Top of sand.....	878
Total depth .....	930

Northeast of this well, on the McConaha lease, the Ohio Oil Company drilled a dry hole, which showed:

	<i>Feet.</i>
Drive pipe, 10 in.....	84
Top of sand.....	827
Total depth .....	898

An important wildecat well in the northeast quarter of the southeast quarter of section 9, Patoka township, was put down on the W. L. Watkins' heirs farm. It was 1,000 feet southwest of No. 11 on the Kendle lease and 600 feet northwest of another dry hole on the Watkins' lease. This No. 2 Watkins showed a trace of oil, and was drilled to a depth of 877 feet. It practically placed the limit of the Princeton pool at that point, changing the direction from southwest to northwest. A cross section of the well is given, showing depth and thickness of strata passed through.

*The Active Princeton Field (Section 35).*—The north wing of the active field terminates in section 35 of Patoka township. It continues south to the middle of section 11 and from thence veers in a southwest direction to the lower half of section 10. Section 35 is controlled by the Ohio Oil Company and the wells are all constant in their production of oil, averaging for the section eight barrels

each per day in August, 1906. There is a total of 20 producing wells on the two leases operated on the section.

In the northeast quarter of the northeast quarter of this section, on the M. E. Hull tract, a dry hole was put down. This checked the movement of the field in the extreme northwestern direction.

The west 300 acres of the section is owned by R. Stormont. Fif-

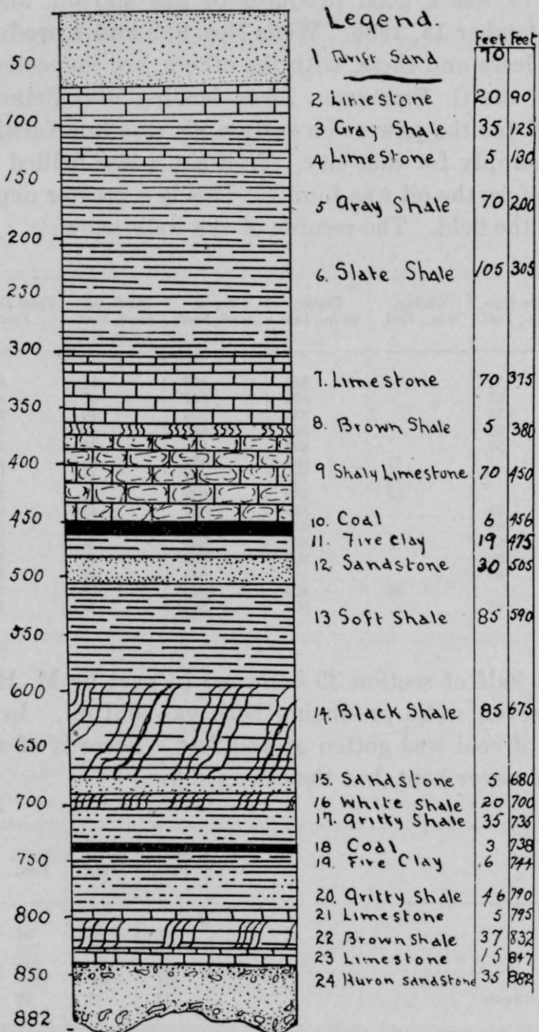


Fig 2

Farmers Oil Co  
(Watkins) No 1

teen wells have been drilled on his land, all of which, with the exception of Nos. 11, 13 and 15 are good producers both of gas and oil. No. 11 was drilled on July 15, 1906, and only produced a small quantity of oil until salt water broke into the well, causing it to be abandoned temporarily. Wells Nos. 13 and 15 were dry holes, and were finished on September 17 and November 26, 1906, respectively, while No. 14 was a good producer of gas and oil, and was completed September 14, 1906. Wells Nos. 8, 9 and 4 produce the most gas on the lease and these, with the others, are connected to a main gas line on the G. Emerson farm, leading into Princeton. Outside of fuel for the powers on section 35, this line furnishes a part of the gas supply for that city. Well No. 4 was drilled 35 feet into the sand before the oil was found. This is a greater depth than the average in the field. The records of the wells show:

Number of Well.	Drive Pipe, 10-in., Feet.	Casing, 8-in., Feet.	Casing, 6½-in., Feet.	Top of Sand, Feet.	Depth into Sand, Feet.	Total Depth, Feet.	Initial Production, Bbls.
1. ....	54	.....	840	840	52	892	15 bbls.
2. ....	67	.....	830	847	47	894	12 "
3. ....	53	.....	832	852	46	898	40 "
4. ....	70	.....	685	869	48	917	42 "
5. ....	54	.....	692	861	46	907	55 "
6. ....	.....	51	680	853	46	899	40 "
7. ....	.....	75	730	903	42	945	20 "
8. ....	.....	87	700	822	43	865	12 "
9. ....	95	.....	895	897	44	941	20 "
10. ....	88	.....	822	825	47	872	12 "
11. ....	85	.....	800	839	39	878	6 "
12. ....	82	.....	806	829	42	871	12 "
13. ....	60	.....	.....	848	44	892	Dry. "
14. ....	.....	88	620	845	31	876	18 "
15. ....	65	.....	800	865	40	935	Dry.

The east half of section 35 is owned in part by M. Howard, and on it are seven wells producing both gas and oil. In well No. 6 eight feet of coal was gotten at 460 feet. Records of wells Nos. 1 and 2 were never kept, but the others show:

	No. 3, Feet.	No. 4, Feet.	No. 5, Feet.	No. 6, Feet.	No. 7, Feet.
Drive pipe. ....	66	42	55	44	59
Casing, 6½-in. ....	870	830	795	800	798
Top of sand. ....	830	860	840	834	840
Total Depth. ....	871	901	878	875	881
Initial production, barrels. ....	12	10	20	15	40

No. 7 on this lease came in as one of the best wells in the field, producing a heavy flow of both oil and gas. It was shot August 4, 1906.

*Section 2.*—Section 2 has three companies operating on it, with a total of 44 bores drilled. Of these 38 are active pay wells, three have been abandoned and three were dry holes. The northeast quarter was leased by the Ohio Oil Company in two leases, the R. M. Mumford and the Mumford Heirs tracts. The R. M. Mumford tract occupies the east half of the northeast quarter, and has three pay wells upon it. Records of these wells show :

	No. 1, Feet.	No. 2, Feet.	No. 3, Feet.
Drive pipe, 8 in.....	70	62	40
Casing, 6¼ in.....	715	700	700
Top of sand.....	904	904	918
Depth into sand.....	78	38	34
Total depth .....	982	942	952

The west half of the northeast quarter of this section is owned by the Mumford Heirs and was the first lease operated by the Ohio Oil Company in the Princeton field. There are eight wells on the lease, seven of which are productive of both gas and oil. No. 1 started at a production of 25 barrels per day but settled to eight in about ten days. In it the top of the oil producing sand was found at 913 feet, and the oil between 918 and 930 feet. There was 47 feet of this first sand stratum, the lower portion of which was barren. Then followed a layer of shale, eight feet in thickness, below which was another layer of sandstone 48 feet thick. At a depth of 1,088 feet a strong vein of salt water was encountered and the drilling was stopped. No. 2, a quarter of a mile west, was a light producer of about eight barrels. Oil was gotten at 881 feet and gas at 875 feet. In No. 7 only a showing of oil was found. As a consequence the well was never shot and is left as a dry hole. In well No. 5 but little water was found, while in No. 7, 500 feet distant, 335 feet of water stood in the bore. In No. 5 the pay was the deepest in the field, being found at a depth of 903 feet. The records of the wells show :

	No. 1, Feet.	No. 2, Feet.	No. 3, Feet.	No. 4, Feet.	No. 5, Feet.	No. 6, Feet.	No. 7, Feet.	No. 8, Feet.
Drive pipe, 10-inch.....		67	58	42	33	42	40	42
Casing, 8-inch.....			154			145	140	150
Casing, 6½-inch.....		725	702	715	715	700	733	714
Top of sand.....	913	869	862	895	903	858	854	870
Depth into sand.....	48	68	62	72	67	59	53	41
Total Depth.....	1,088	928	924	967	965	917	909	911
Initial production, barrels.....	25	10	10	20	22	5	showing	5



The east half of the southwest quarter and the southeast quarter of section 2 are leased by the Hoosier Prospecting Oil Company. This pioneer company, which has been previously mentioned, holds leases on two tracts; the L. M. Miller tract, east half of the southwest quarter and the west half of the southeast quarter, and the G. Woods tract, east half of the southeast quarter. The Miller tract has eight wells on it, all of which are pay wells, and four of them only producing gas enough for use in the power. The Woods tract has one well upon it connected to the power on the Miller tract. The wells average a total of 20 barrels of oil per day.

In most of the Hoosier wells on the Miller lease five veins of coal were struck, the depths being approximately the same for all the wells. The first vein was gotten at 120 feet, and was two and a half feet thick, while the second vein was about six feet through and was 450 feet deep. Two other veins of six feet each were gotten at depths of 560 feet and 670 feet respectively. The largest vein was gotten at 789 feet. Between lines drawn west of Princeton along the old Sand road and northeast to the Patoka River there occur these five thick strata of coal at approximately the same depths, the variation not exceeding eight feet at the most. The field records of part of the Hoosier wells show:

## MILLER LEASE.

	No. 1, Feet.	No. 2, Feet.	No. 3, Feet.	No. 4, Feet.	No. 5, Feet.
Drive pipe, 10-inch. ....		60	100	78	98
Casing, 8-inch. ....	60			160	140
Casing, 6½-inch. ....	802		715	708	690
Casing, 4½-inch. ....		800	220	210	855
Top of sand. ....	871	871	864	864	843
Depth into sand. ....	22	24	64	40	12
Total Depth. ....	893	895	928	904	855

## WOODS LEASE.

	No. 1, Feet.
Drive pipe, 10-inch. ....	
Casing, 8-inch. ....	73
Casing, 6½-inch. ....	720
Casing, 4½-inch. ....	853
Top of sand. ....	903
Depth into sand. ....	62
Total Depth. ....	965

Of the northwest quarter of section 2, all but the northwest 40 acres is leased by the Patoka Valley Oil Company. This com-

pany was previously controlled by the Hoosier Prospecting Oil Company, which at the time of the transfer, in March, 1905, was operating wells Nos. 1 and 2. The Patoka Company has seven wells on the E. P. Downey lease, of which six are producing. No. 1 was plugged and abandoned in the fall of 1904, on account of fresh water breaking into the well. Wells Nos. 5, 6 and 7 are gas wells and yield the fuel for the power on the lease. All six wells average a total of 30 barrels of oil per day. The records show:

	No. 1, Feet.	No. 2, Feet.	No. 3, Feet.	No. 4, Feet.	No. 5, Feet.	No. 6, Feet.
Drive pipe, 10-inch.....	100	80	83	80	80	80
Casing, 8-inch.....	120					130
Casing, 6½-inch.....	710	695	685	700	690	730
Casing, 4½-inch.....	846	229	250			
Top of sand.....	846	868	860	858	853	850
Depth into sand.....	41	39	33	41	39	45
Total depth.....	887	907	893	899	892	895
Initial production, barrels.....	4	6	12	10	2	10
Production, August, 1906, barrels.....		3	8	7	3	6

The R. Conant lease, on the southwest quarter of the northwest quarter of section 2, was absorbed in October, 1904, by the Patoka Oil Company from the Crescent Oil Company. The latter company, at the time of the transfer, was operating three wells, two of which have since been plugged while No. 1 is yet being operated by the Patoka Company. The records of the wells show in part:

	No. 1, Feet.	No. 2, Feet.	No. 3, Feet.
Drive pipe, 10 in.....	60	70	...
Casing, 6¼ in.....	760	175	...
Tubing .....	900	...	...
Top of sand.....	867	860	872
Depth into sand.....	47	40	42
Total depth .....	914	900	914

The northwest quarter of the northwest quarter of section 2 has two bores upon it one of which is dry, though at one time it produced considerable gas. The other is a pay well operated by the power on the R. Stormont lease in section 35. The field records show:

	No. 1.	No. 2.
	Feet.	Feet.
Casing, 8 in.....	65	65
Casing, 6¼ in.....	730	...
Top of sand.....	861	864
Total depth .....	904	916
Initial production, barrels.....	15	dry

The west half of the southwest quarter of section 2 comprises the Dixon lease, west half of the north half; Geiser lease, east half of the north half; and the Knight lease, south half of the above location. The Dixon lease has four wells upon it, producing both gas and oil, and the Geiser lease two, which have been constant pay wells since January 1, 1904, at which time they yielded 75 barrels per day, but settled later to 20 barrels. Well No. 2 on the lease was drilled 35 feet into the sand before pay oil was struck. Well No. 3 on the Dixon lease pumps a large quantity of water and makes but two barrels of oil per day.

On the W. F. Knight lease there are four wells, No. 1 being a dry hole, while the other three are pay wells and make a total of nine barrels of oil per day. The C. E. Knight tract, included in the W. F. Knight lease, has one pay well averaging three barrels of oil per day. The L. E. Knight lease, adjoining the W. F. Knight tract in section 3, southeast quarter, has two pay wells making six barrels per day. The twelve pay wells are run on one power, operated on the W. F. Knight lease, and all of the wells make gas which is piped to the leading main on the G. Emmerson farm and from thence to Princeton. The records of the wells show:

Number of Well.	Drive Pipe, 10-in., Feet.	Casing, 8-in., Feet.	Casing, 6¼-in., Feet.	Top of Sand, Feet.	Depth into Sand, Feet.	Total Depth, Feet.	Initial Production, Barrels.	Production in August, 1906, Barrels.	Lease.
1.....	92	165	700	860	50	910	20	3	Dickson.
2.....	104	136	715	887	42	931	30	3	Dickson.
3.....	80	160	700	868	41	909	25	2	Dickson.
4.....	92	147	.....	862	55	917	10	3	Dickson.
1.....	86	138	691	856	56	912	25	3	C. Knight.
1.....	60	80	600	900	60	978	75	20	Geiser.
2.....	75	67	772	868	45	913	40	12	Geiser.
1.....	90	.....	690	840	62	902	Gas.	Dry.	W. Knight.
2.....	94	161	710	864	38	902	15	3	W. Knight.
3.....	.....	116	690	863	40	930	15	3	W. Knight.
4.....	.....	105	682	844	58	902	12	3	W. Knight.
1.....	95	135	685	858	32	890	5	3	L. E. Knight.
2.....	90	.....	650	869	35	904	3	3	L. E. Knight.

*Section 3.*—The northeast quarter of section 3 has but two wells upon it in addition to those already mentioned. On the Mum-

ford Heirs' tract the Ohio Oil Company put down a dry hole which had the following record:

	<i>Feet.</i>
Drive pipe, 10 in.....	55
Casing, 8 in.....	160
Casing, 6 in.....	712
Top of sand.....	884
Total depth .....	914

On the Bradley lease in the southeast quarter of the northeast quarter the Hoosier Oil Company sunk a bore which had an initial production of seven barrels per day. Later the pay declined and the well was plugged and abandoned.

In the northeast quarter of the southeast quarter of section 3 there are three wells, one on the Smith lease, west half, and the other two on the McCurdy lease, east half, one of which was finished April 1, 1904, but has since been abandoned, and the other was brought in October 9, 1906, producing both gas and oil. The records of the three wells show:

	<i>McCurdy No. 1. Feet.</i>	<i>McCurdy No. 2. Feet.</i>	<i>Smith. Feet.</i>
Drive pipe, 10 in.....	90	102	106
Casing, 8 in.....	165	...	167
Casing, 6¼ in.....	600	820	707
Top of sand.....	874	864	874
Total depth .....	925	926	933
Initial production, barrels.....	10	30	24
Present production .....	Not operated	20	4

The north half of the southeast quarter of the southeast quarter of section 3 is owned by F. Jones. On it the Ohio Oil Company drilled a well 700 feet east from the power on the W. F. Knight lease and brought in a dry hole, with a heavy showing of gas. The record shows:

	<i>Feet.</i>
Drive pipe, 10 in.....	74
Casing, 8 in.....	160
Casing, 6¼ in.....	715
Top of sand.....	854
Total depth .....	888

The other well, 800 feet west, gave only a showing of oil, and a third one 600 feet away produced a good flow of oil, with the following record:

	<i>Feet.</i>
Drive pipe .....	112
Casing, 6¼ in.....	680
Depth to sand.....	856
Total depth .....	904
Initial production, barrels.....	40

In the northwest quarter of the southeast quarter the Ohio Oil Company sunk two bores, one on the Sam. Embree lease, which proved to be a dry hole with a very light showing of oil, and one on the N. E. Embree lease, which is a light well. The records show:

	<i>S. Embree.</i> <i>Feet.</i>	<i>N. Embree.</i> <i>Feet.</i>
Drive pipe, 10 in.....	74	62
Casing, 8 in.....	142	150
Casing, 6¼ in.....	720	...
Top of sand.....	896	888
Total depth .....	933	919
Initial production, barrels.....	dry	5

On the H. E. Sweppy tract, north half of the southwest quarter, are two wells, completed in February and April, 1904, which gave merely a showing of oil and were later abandoned and plugged. The records show:

	<i>No. 1.</i> <i>Feet.</i>	<i>No. 2.</i> <i>Feet.</i>
Drive pipe, 10 in.....	36	40
Casing, 8 in.....	85	100
Casing, 6¼ in.....	706	710
Top of sand.....	865	875
Into sand .....	31	30
Total depth .....	896	905

*Section 11.*—There are in this section a total of 18 bores, 15 of which are pay wells, while two are dry holes. One, after a good showing of oil was gotten, was abandoned because of lost tools.

The west half of the northeast quarter is owned by J. Woodburn, and on it three light wells were put down, which produce a total of about six barrels of oil per day. The records show:

	<i>No. 1,</i> <i>Feet.</i>	<i>No. 2,</i> <i>Feet.</i>	<i>No. 3,</i> <i>Feet.</i>
Drive pipe, 10 in.....	77	73	72
Casing .....	135	154	122
Casing, 6¼ in.....	...	705	692
Top of sand.....	842	853	841
Total depth .....	936	910	883
Initial production, barrels.....	light	30	20

On the east half of the northwest quarter of section 11, owned by H. and A. M. Embree, there are eight bores, all of which are pay wells making 500 barrels of oil per month. Five of the wells produce gas for power use only. The partial records of five of the wells show:



	No. 1.	No. 5.	No. 6.	No. 7.	No. 8.
	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Top of sand.....	841	839	845	842	839
Depth into sand...	30	39	48	46	40
Total depth .....	901	878	893	888	879

The west half of the northwest quarter of section 11 is owned by G. Emmerson. The first well on the lease, finished September 15, 1905, produced an excellent show of oil, but unfortunately the drilling tools were lost in the well, which caused it to be abandoned. Four pay wells were afterwards gotten in Nos. 2, 5, 6 and 7, while Nos. 3 and 4 came in as dry holes. The records of four of these wells show:

	No. 1.	No. 3.	No. 5.	No. 7.
	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Drive pipe, 10 in.....	96	18	84	20
Casing, 8 in.....	140	110	135	...
Casing, 6¼ in.....	700	640	680	624
Casing, 4¾ in.....	210	700	...	...
Top of sand .....	838	832	835	820
Total depth .....	890	870	885	864.5
Initial production, barrels...	10	dry	8	10

*Section 10.*—The most productive area in the active field lies in this section, in which four companies are operating. There are on the section 39 wells, 36 of which produce oil and gas, while two came in as dry holes. The gas pressure has been quite high and afforded the greater part of the supply for Princeton.

The northeast quarter of the northeast quarter of section 10 is owned by F. M. Smith and has on it five active wells, producing 150 barrels per week. Four hundred feet southwest from No. 4 on the Smith lease, is a sixth well on the Drake tract of one acre. This well was brought in June 10, 1904, and offsets No. 1 on the Farmers lease 400 feet north. Both are large gas producers. The pressure in No. 1, on the Smith lease, was so great that it blew out pieces of slate a pound or more in weight, and prevented the immediate shooting of the well. It was capped and furnished a gas supply for one year; and in March, 1905, was drilled deeper and shot for oil. A heavy flow was secured and at the present time it produces eight barrels per day. A record of the bore shows:

	<i>Feet.</i>
Drive pipe, 10 in.....	104
Casing, 8 in.....	...
Casing, 6¼ in.....	725
Top of sand .....	873
Depth into sand.....	61
Total depth .....	934
Initial production, barrels.....	10

On the quarter section directly south of the Smith lease is the J. Woods tract of 20 acres on which are two wells, and there are also two wells on the M. Woods lease of 20 acres. These four wells make a total of 15 barrels of oil per day, and have the following records:

	<i>J. B. Woods.</i>		<i>M. K. Woods.</i>	
	<i>No. 1.</i>	<i>No. 2.</i>	<i>No. 1.</i>	<i>No. 2.</i>
	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Drive pipe, 10 in.....	92	80	70	50
Casing, 8 in.....	157	190	160	...
Casing, 6¼ in.....	750	700	718	810
Casing, 4⅞ in.....	157	156	144	...
Top of sand.....	815	818	835	814
Total depth.....	872	867	883	872
Initial production.....	...	...	...	27

The west half of the northwest quarter and the east half of the northeast quarter of section 10 contains 12 pay wells which average 2,700 barrels per month. This is the best producing lease in the field, both in gas and oil and is owned by C. Emmerson. The field records of the wells show:

Number of Well.	Drive Pipe, 10-in., Feet.	Casing, 8-in., Feet.	Casing, 6¼-in., Feet.	Casing, 4⅞-in., Feet.	Top of Sand, Feet.	Total Depth, Feet.	Initial Production, Bbls.
1.....	88	.....	680	230	840	895	50
2.....	.....	86	675	225	838	855	6
3.....	.....	89	680	225	837	875	12
4.....	.....	90	675	230	835	868	10
5.....	.....	88	680	215	840	875	12
6.....	.....	96	689	210	870	890	75
7.....	.....	97	685	225	839	886	15
8.....	85	110	680	220	860	895	15
9.....	70	106	675	225	845	880	10
10.....	68	115	670	230	843	884	15
11.....	70	108	680	225	846	880	15
12.....	70	96	650	235	849	885	15

The west half of the northwest quarter and the northwest quarter of the southwest quarter of section 10, and the west half of the northeast quarter of section 9, are owned by the J. W. Kendle heirs, and the wells on them are also good producers of both oil and gas, the surplus supply of the latter being sent to Princeton by a direct pipe line along the old Sand road. The Kendle lease lies in the head of the lowlands, the surface being flat. The lease has 16 wells upon it, of which 14 produce oil and 10 gas, while two, Nos. 4 and 5, are dry holes. The records of 15 of the wells show:

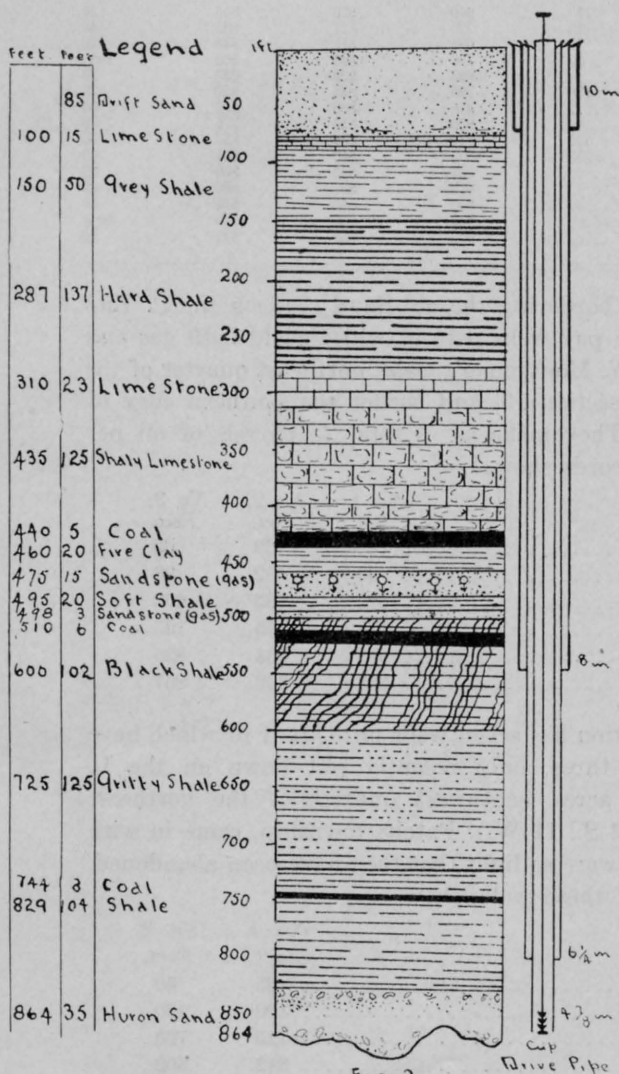


Fig 3.  
Ohio Oil Co.  
(Kendle) No 10

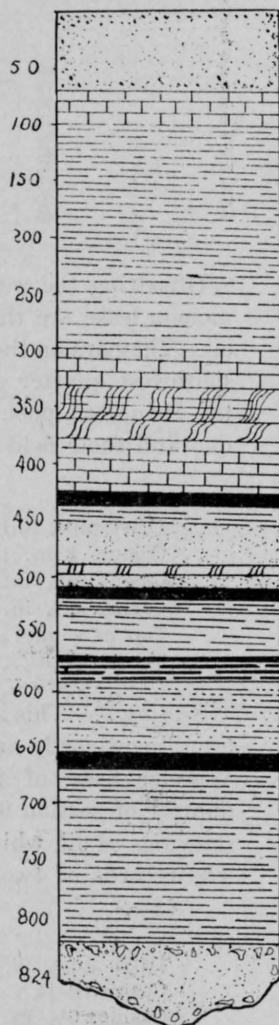


Fig 4  
OHIO Oil Co  
(Kendle) No 9

From the above records, which are practically the only ones kept in the fields, it will be seen that operations in the Princeton oil field to the close of the year 1906, resulted in 122 producing wells, 44 dry holes, 11 abandoned pay wells and one well drilling, making a total of 176 wells, 82 of which yield gas. The field is gradually extending north in section 35 and west of the southwest wing into sections 9 and 4.

#### THE PRODUCTION OF OIL IN THE PRINCETON FIELD.

The oil of the Princeton field is found in a bluish-gray, sharp and coarse-grained sandstone. This formation, which is the Huron sandstone, immediately underlying the Mansfield sandstone or Millstone Grit, is the same as that in which the Loogootee oil occurred, 45 miles to the northeast, and somewhat similar to the Casey and Robinson sands 60 miles to the northwest. The latter sands, however, belong to the Upper Carboniferous rocks.

The records of the wells in the vicinity of Princeton show a change in the depth from the surface to the top of the Huron sandstone of a little over 30 feet to the mile and a local dip in the sand from the J. Glaze farm in section 28, White River township, to the Kendle tract in the southwest quarter of section 10, Patoka township, of a little more than three feet to the mile. The elevations of the two locations are the same and the difference in the depths running in a southwesterly direction, is 20 feet in six miles. From the Kendle tract in section 10 to the R. Stormont tract in section 35, the dip in the oil bearing sand is a little over five feet to the mile. The average depth to the oil sandstone in the north wing of the field is 856 feet; that of the central portion, 861 feet; and in the south wing, 836 feet, while the pay oil is gotten at the respective average depths of 25, 20 and 15 feet below the top of the sand.

Much trouble is experienced with numerous shales passed through, as all of them are comparatively soft and friable, and are very likely to cave. For this reason most of the wells have to be cased nearly to the top of the productive sand. The drift in the field varies from 100 to 70 feet in thickness, and a ten-inch drive pipe is driven through this. Eight-inch casing is driven to an average depth of 150 feet and in several cases to 500 feet. This is to protect the bore from the cavings of the upper shale deposits, and the vast amounts of fresh water found in them. Six and a quarter inch casing is driven to the gritty shales lying above the

productive sand to insure free drilling. The above sizes of pipe and casing are used in nearly all the Princeton wells, and the number of feet used varies but little.

The drilling of a well, including the building of a derrick and setting up of the machinery; also the necessary delays in drilling, etc., occupies about ten or twelve days. After pay oil has been struck the wells are immediately shot, a nitro-glycerine plant operated by the Hercules Torpedo Company, being located on the McConaha farm near the north wing of the field. The average shot for a Princeton well is 100 quarts, used in 20-quart torpedoes. The cost of the shot is \$1.00 per quart.

Difficulty in pumping often arises in a new well on account of trouble with the suction cups, due to the grinding of the loose sand torn from its compact state by the shot. The sand grains are sharp and rather coarse and cut away the packing in the cups, which necessitates their being taken up and replaced. After a well has been in use some time the sand is cleaned away and the wearing is lessened. The cups are made of leather or canvas, the latter being best adapted to this field. Companies often have so much trouble in this respect that they employ men constantly to keep the rods clean. A portable derrick is used by the Ohio Oil Company, while the others use a block and pulley.

The oil of the Princeton field seems to be in a pool or body of porous sandstone at a level of about 850 feet below the surface. The formation of a deep cavity in the oil producing sand by shooting with nitro-glycerine causes a flow of oil to it, the oil coming from a common level in the field. The inflow of the oil through seepage from the surrounding sandstone fills up the hole and part of the casing. This is pumped down until the seepage, after two or three weeks, assumes a constant flow, producing in the average well seven and a half barrels of oil per day. For example, in the northern wing of the field on the Mumford Heirs' lease, the periods of pumping off the wells are shown in the fact that No. 6 and No. 1 are pumped off in three and a half hours, Nos. 2, 3, 7 and 8 in two hours and No. 5 in three hours. This is generally done in the forenoon and the wells are then left to stand and collect oil until the following morning. If pumped over the above time, the cups are likely to become sanded, causing an additional expense; and also the oil will roil and turn yellow. This is no doubt due to the sulphur compounds in the oil, as the higher the per cent. of sulphur, the more it seems to roil. In most places in this field the oil is steamed to reduce the impurities and sediment to a mini-



mum. This is done by connecting pipes from the boiler of the engine with the bottom of the tank and forcing steam through the oil, which precipitates the sulphur and impurities. After standing quite a while the sediment is drawn off from the bottom of the tank, along with any water that is present. For a year and a half about 70 wells in the field have been constant and steady producers and have added wealth to the pockets of the operators.

The oil found in the Princeton field is darker and thicker than that yielded by the Trenton rock. It registers 31° Beaumé and its percentage of illuminants is low; the quality being such that for a long time the Indiana Pipe Line Company paid 35 cents less per barrel for it than for the Trenton limestone product. On August 16, 1904, the price was advanced to the same figure as the Trenton rock oil, and until April 27, 1906, it sold for the same. On that date the price was lowered to 83 cents, or ten cents lower than Trenton rock oil. On July 25th it again fell to 81 cents, and on August 1st to 79 cents. From that figure it was lowered to 74 cents on August 9th; to 69 cents on August 15th and to 64 cents on August 25th, which price it held to the close of the year. This was 21 cents less than was being paid for the Trenton rock product. Taking both the amount received and time into consideration, the average price for the year was 77½ cents per barrel, as against 88 3-5 cents for the Trenton rock oil. The Indiana Pipe Line Company, operated by the Standard Oil Company, controls the output of the field, and bought all the oil produced in 1906 except 6,036 barrels. They have constructed a loading rack for tank cars on the Miller lease in section 2, and from this point lead lines are connected to all lease tanks, which, in turn, are connected to the producing wells as fast as they are finished.

The output of the field by months for the years 1904, 1905 and 1906 is shown in the following table;

*Number of Barrels of Huron Sandstone Oil Piped or Shipped from the Princeton Field in 1904, 1905 and 1906, by Months.*

	1904.	1905.	1906.
January .....	1,412	4,043	8,026
February .....	1,399	3,637	6,127
March .....	2,920	5,400	7,322
April .....	1,319	5,262	9,033
May .....	2,047	5,559	8,463
June .....	2,315	4,523	10,201
July .....	2,971	5,569	9,498
August .....	2,991	6,296	9,429
September .....	3,345	6,141	9,469
October .....	3,093	6,865	9,312
November .....	4,554	6,116	8,294
December .....	3,841	5,395	8,382
Totals .....	32,207	64,806	103,843

By subtraction the gain in the field for the year 1905 is shown to be 32,599 barrels, or a little over 100 per cent.; while the gain in 1906 was 39,037 barrels or 60.2 per cent.

*Cost of a Producing Well in the Princeton Field.*

An estimate of the average cost of drilling and fitting up a new well in the Princeton field, based on the cost of No. 12 well of the Farmers' Oil Company on the C. Emmerson lease, is as follows:

Rig or derrick.....	\$300
Drilling at 65c. per foot.....	575
70 feet drive pipe (10 in.) at \$1.10.....	77
96 feet casing (8 in.) at 73c.....	73
650 feet casing (6¼ in.) at 41c.....	266
235 feet casing (4⅞ in.) at 30c.....	60
1,500 feet pull rod.....	43
850 feet tubing at 12½c.....	106
860 feet sucker rod at 3½c.....	30
1,500 feet lead pipe at 8¼c.....	124
Pumping outfit .....	12
Power .....	210
Engine .....	600
Two 200-barrel tanks.....	224
Incidentals .....	100
Total .....	\$2,800

The incidentals include the cost of necessary teaming and minor supplies. The second well on the lease will cost about \$1,300 less, as the tanks, power house and power are in place, and in many cases the casing is pulled and re-used.

The same rig or derrick can also be used, though there will be a loss of \$125 in tearing it down and rebuilding. It is not customary to build a power house until three or four producing wells have been finished on the lease, but if not built, an engine and boiler for pumping must be purchased for each productive well, which will cost about \$350.00. In one case in the Princeton field the Monarch Company have in use an eccentric power (the Mascot) designed for the pumping of 47 wells. The cost of such a power is about \$2,500. At the present time the average well on a 12-well lease in this field costs about \$1,500 which is very near the cost of an oil well in the Indiana Trenton rock field.

#### *The Cost of Operating a Lease.*

The cost of operating an oil lease in the Princeton field after the production has been established need not be more than \$110 per month, the salary of the pumper being \$60; the cost of the fuel, where gas is lacking, about \$30 and the cleaning and repairing the suction cups, \$20. On most leases in the field one or more wells at the least have been found to yield sufficient gas to run the power. A dozen wells or more can be operated almost as cheaply as one, after they have been connected with the power.

Where the plant has been established, it will pay to pump as low as two or three wells, even if the yield is only three barrels each day, provided the price of oil remains as constant as it has the past year.

An estimate of expense and income from three three-barrel wells, after deducting the royalty of one-sixth, is as follows:

##### Income per month:

225 barrels of oil at 79c. (price in 1906).....	\$177 75
Salary of pumper.....	\$60 00
Cost of cleaning cups.....	20 00
	<hr/> 80 00

Profit ..... \$97 75

With six three-barrel wells on the lease the income would be \$355.50 and the expense \$80.00, a net gain of \$275.50 per month.

From the above statements it will be seen that the cost of

drilling and operating a lease in the Huron sandstone field is as low as that of the Indiana Trenton rock field.

According to the statements of several of the operators in the field, it cost 45 cents per barrel to produce oil on the average lease in the Princeton field. Whatever is received above that sum is net profit. If the lease is small, the cost is greater in proportion.

After the well has been pumped off, to use the terms of the operator, the pumping on that well should cease, as it would be an economic loss to the machinery to continue. One should be on the lookout for overflow of oil, and also guard against the waste of the volatile part of the petroleum, the natural gas. This has in the past ten years been wasted to such an enormous extent that the supply is very nearly exhausted in the Indiana fields. Its loss as a fuel both in the field and home is greatly felt, and a willful waste of it is deplored. The Princeton field produces a constant flow of gas and on six of the leases the supply beyond the need of fuel for the power, is of sufficient quantity to furnish Princeton with an abundance. The remaining leases have only enough to pump their wells. A State law insists upon the capping and plugging of the casing in a well, whether it produces gas or not, and any negligence of this should be avoided.

#### *Relations of the Princeton Field to the Trenton Rock and Other Producing Fields.*

In another part of this volume it is shown that while so-called pools exist in the Trenton rock formations, they are not necessarily connected. The same fact may be noted in the Huron sandstone and neighboring formations. The Princeton, Robinson and Casey fields are not in any way connected. The Robinson oil is found in a sandstone of the Lower Coal Measures, while the Casey oil is found in a still higher formation. Neither does the oil at Princeton have anything to do with the Trenton rock oil. The top of Trenton in Gibson County will be found at approximately 1,600 feet below sea level, which will make it about 2,100 feet below the surface. The oil at Princeton does not come from the Trenton rock but from a shale or limestone either above or below the sandstone in which it is found. The Huron sandstone forms a porous bed or reservoir for the oil from the nearby producing strata, and this field, like those of Robinson and Casey, is merely a pool with limits yet to be found.

*The Oil Map.*

The accompanying map of the Princeton oil field embraces 72 square miles of portions of Patoka, White River, Montgomery and Washington townships. It is made on a large scale in order that leases and tracts may be located in the vicinity of the active field.

*Future Drilling.*

Several attempts have been made to drill to Trenton rock, but all have been failures, due to the expense attached and the caving of the strata passed through. This fact, along with the narrow limits of the field indicate its infancy, and a great deal may be brought to light by a more thorough and systematic search for oil in this territory. The fact that wells reach a depth of 1,000 feet and more in this territory does not indicate a lack of oil. While there is nothing to indicate oil in Trenton rock, there is nothing to show that it is absent, and it is not impossible that oil in commercial quantities may be found present in pockets in that formation.

Attempts north and south of the present field have resulted in a failure to locate oil, while east and west the territory is practically untried. The trend of the field would indicate a north-western course from Princeton and but two bores oppose a south-easterly course, both of which were put down at a time when but little was known of the nature of the oil bearing strata. This, along with the territory east of Princeton, is unproven, and there exists a chance of development that may prove a valuable addition to the present narrow limits of the field.

*Acknowledgments.*

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