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STATE GEOLOGICAL SURVEY *of* KANSAS

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DEVELOPMENT OF THE OIL AND GAS RESOURCES OF KANSAS

By
ANTHONY FOLGER
ROY H. HALL

MINERAL RESOURCES CIRCULAR 2

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PART I

Development of the Oil and Gas Resources of Kansas in 1928 and 1929

ANTHONY FOLGER

PART II

Development of the Oil and Gas Resources of Kansas in 1930

ROY H. HALL

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PART I.

Development of the Oil and Gas Resources of Kansas in 1928 and 1929.[1]

ANTHONY FOLGER.[2]

INTRODUCTION.

This discussion of the oil and gas resources of Kansas in 1928 and 1929 is the second of a series of reports, started in 1927, by the Kansas Geological Society and published by the State Geological Survey of Kansas, which undertakes to present information on the oil and gas development of this state.

The first report of this series was prepared by L. W. Kesler, and issued by the State Geological Survey of Kansas as Mineral Resources Circular 1, Volume 29, Number 11, June 1, 1928. In addition to data relative to the oil and gas resources of Kansas during 1927, it contains a semidetailed history of the development in western Kansas (all ranges west) from 1922 to 1927 inclusive.

The present paper continues to stress the importance of the development in western Kansas, and includes a brief account of eastern Kansas activity. Possibly the chapter of chief interest is an exhaustive summary of the oil and gas development in Sumner county for the period from June, 1915, to December, 1929.

For convenience in further consideration, the state is divided into three parts: (1) eastern Kansas, (2) meridian counties, and (3) western Kansas. The meridian counties are Harvey, Sedgwick and Sumner, which are cut by the sixth principal meridian into two ranges east and four ranges west. Western Kansas, as here treated, comprises two-thirds of the state and includes all ranges west.

It is desired to stress the fact that all of the statements and conclusions presented in this paper are made as of the date of December 31, 1929. It is unfortunate that the transmittal of the manuscript of this paper for publication has been so long delayed, and it is hoped that this unavoidable delay will not detract seriously from the value of its contents. Since our subsurface information is ever changing, any corrections of the text resulting from additional data derived from exploitation subsequent to 1929 have been made in the form of footnotes, rather than an alteration of the text itself.

1. Prepared at the request of the Kansas Geological Society. Original manuscript completed March 1, 1930. Manuscript enlarged during 1930 and 1931.

2. Geologist, Gypsy Oil Company, Wichita, Kan.

ACKNOWLEDGMENTS.

This review is an enlargement of a joint paper by Charles E. Straub and Anthony Folger, on "Petroleum Production and Development in Kansas During 1928 and 1929,"[3] in which the chapter on eastern Kansas was prepared by Straub and that on western Kansas by Folger. After the appearance of this joint paper Mr. Straub was unable to assist further in preparation of the manuscript for the State Survey, and he, therefore, kindly turned over all of his material to the present author.

Those chapters which relate to western Kansas, and to Sumner, Sedgwick, Harvey, Marion, Chase and Morris counties, have been prepared wholly by the present author. The general statement, together with the majority of the eastern Kansas manuscript, has been contributed by Mr. Straub.

The review of development for eastern Kansas for the year 1928 is a compilation resulting from contributions by J. R. Reeves, Empire Oil and Refining Company; J. S. Barwick, Skelly Oil Company; Homer Charles, Oklahoma Natural Gas Corporation; R. B. Rutledge, Barnsdall Oil Corporation; B. S. Ridgeway, Roth and Faurot; and J. L. Garlough, consulting geologist; and for the year 1929 from contributions by R. L. Kidd, Empire Oil and Refining Company; John L. Rich, William L. Stryker, Lee and Garlough, and William Ainsworth, consulting geologists. To all of these gentlemen grateful acknowledgment is tendered for their assistance.

The accuracy and completeness of the production figures appearing in this report are due primarily to unusual assistance received from Frank Leach and Lewis Lieberman, production engineers, Shell Petroleum Corporation; Thomas H. Allan, Midwest Refining Company; and James I. Daniels, Continental Oil Company. Much of the accuracy of this report would have been impossible without their assistance, and the author wishes to extend to each his sincere thanks.

Grateful acknowledgment and thanks are due the following parties for assistance in compiling production statistics on Sumner county; James I. Daniels, Continental Oil Company; Frank Leach and Lewis Leiberman, Shell Petroleum Corporation; R. L. Kidd, Empire Oil and Refining Company; R. L. Clifton, Champlin Refining Company; R. J. Cullen, The Twin State Oil Company; Hart-

3. Petroleum Development and Technology, 1930: Trans. Amer. Inst. & Met. Engrs., Petroleum Division, pp. 437-465, 1930.

man and Skaer Oil Company; E. B. Shawver, Shawver and Sutter; Dollie Radler, Amerada Petroleum Corporation; W. E. Feist, Phillips Petroleum Company; R. J. Riggs, Indian Territory Illuminating Oil Company; L. W. Kesler, Sinclair Oil and Gas Company; W. R. Thawley, Gypsy Oil Company; Richard Foley and R. A. Whortan, Prairie Oil and Gas Company; E. K. Sheller, Harris and Haun, Inc.; and C. B. Day, Consolidated Gas Utilities Company.

And finally the author desires to express his gratitude to L. W. Kesler, Sinclair Oil and Gas Company; Roy H. Hall, Gypsy Oil Company; Leo R. Fortier, Shell Petroleum Corporation; and Edward A. Koester, Stearns-Streeter Company; for their careful reading of the manuscript and for their many helpful criticisms and suggestions pertaining to its contents.

GENERAL STATEMENT.

Kansas produced 38,420,069 barrels of oil in 1928 and 40,756,082 barrels in 1929, thereby retaining its rank as fourth among the oil-producing states of this country.

Production for 1928 was less than that for 1927 (Fig. 1) because of a decrease in the number of completions, but the average initial production per well (Table 1) shows an increase due to the completion of wells of comparatively large capacity in the new Valley Center field of Sedgwick county.

TABLE 1.—*Kansas completions and initial production, 1920 to 1929, inclusive.*

YEAR.	Total completions.	Oil wells.	Gas wells.	Dry holes.	Dry holes, per cent.	Total initial production, bbls.	Av. initial production per well, bbls.
1920.....	3,164	2,327	147	690	21.8	181,845	78.1
1921.....	1,380	909	118	353	25.6	95,789	105.3
1922.....	1,640	1,057	86	497	30.3	74,391	70.4
1923.....	1,405	807	63	535	38.1	61,372	76.0
1924.....	1,125	650	79	396	35.2	92,668	142.5
1925.....	2,003	1,281	86	636	31.7	207,880	162.2
1926.....	2,338	1,458	96	784	33.5	173,664	119.1
1927.....	1,333	685	79	569	42.8	98,253	143.4
1928.....	1,157	587	115	455	39.3	101,043	172.1
1929.....	1,058	553	52	453	42.8	165,611	299.4

This increase in average initial production per well was further augmented during 1929 by completion of additional wells of comparatively large capacity in the Valley Center field and the new Greenwich field of Sedgwick county.

Production for 1929 exceeded that for 1928 and threatened to ex-

ceed all records, except that of 1918. However, production was prorated in October, 1929, to 50 per cent of the gross potential by operators in the Valley Center pool, resulting in a curtailment of approximately 10,000 barrels per day. This proration continued through the balance of the year and was applied as well to new discoveries in McPherson county and to production in the Greenwich field.

Competitive drilling for flush production in the Valley Center field by the use of rotary equipment, an innovation for Kansas operators, hastened development and no doubt accounts for part of

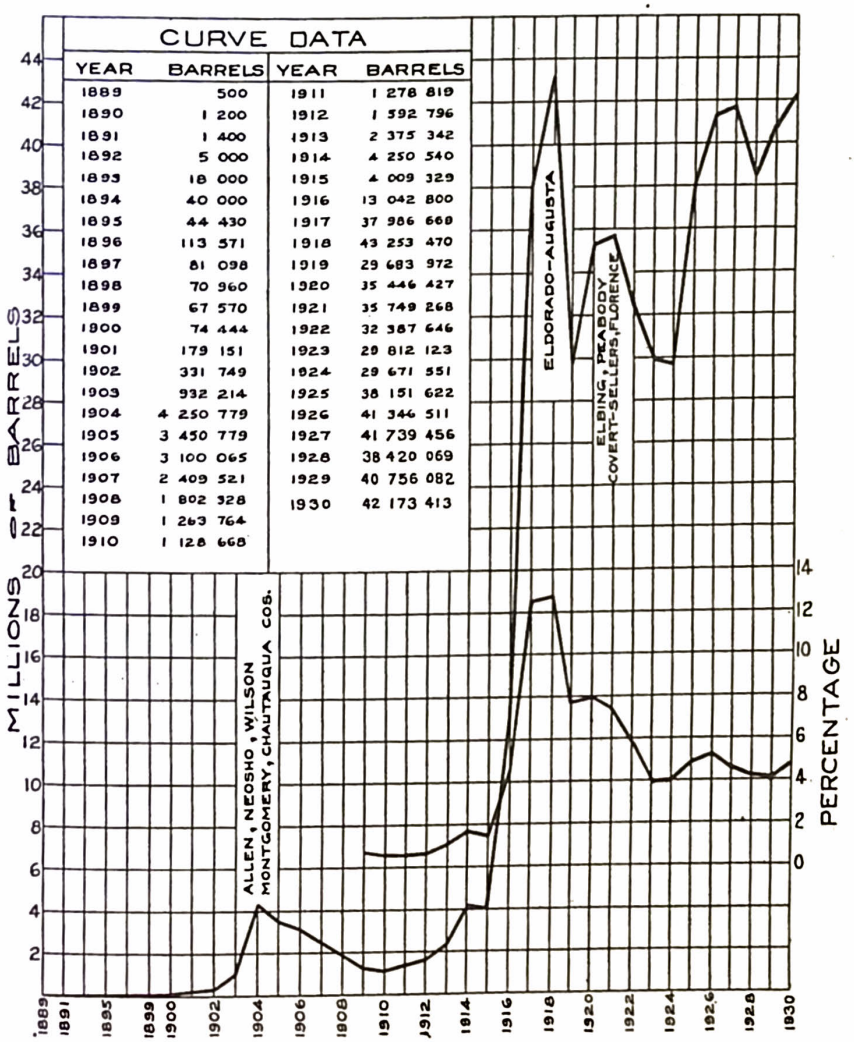

FIG. 1.—Petroleum production in Kansas, 1889 to 1930, inclusive, and percentage of annual production of the United States.

the large flush production in the new pools of Sedgwick county. Rotary equipment is also being used in the Voshell field of McPherson county and the Caldwell field of Sumner county.

It is significant of the type of oil encountered that the average weighted gravity of Kansas crude was higher than that of any other state in the Mid-Continent field during 1929. This fact, together with the relatively lesser drilling depths at which production is found, better operating conditions than elsewhere existent, reasonable recoveries per acre versus costs, and the large potential areas as yet undeveloped, has caused the major companies to become extremely active in the state, practically all of those of the north Mid-Continent area and some from the south having offices at Wichita, Kan.

Wildcatting was at its height for Kansas about the middle of the year 1929. There were approximately 50 counties active, 40 of which are in central and western Kansas. Sedgwick county led in drilling operations, Greenwood ranked second and Butler third.

Figure 2 shows the rank of the producing counties for 1929. Greenwood led in production for 1927 and 1928, with Butler ranking second and Sumner third. Sedgwick county, which ranked second for 1929, would have been first had it not been for proration in the Valley Center field.

The principal producing localities were the Churchill-Oxford field of eastern Sumner county for 1928, and the Valley Center field of Sedgwick county for 1929. Approximately one-fifth of the total production of the state came from the latter during 1929.

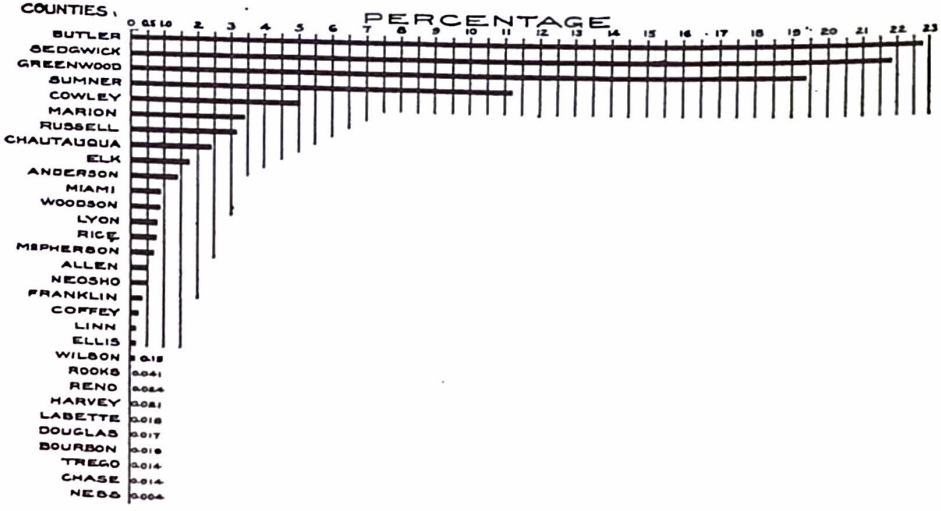

FIG. 2.—Percentage of Kansas oil production in 1929 by counties.

EASTERN KANSAS.

Shoestring Area.

The most important development in the Shoestring area during 1928 was the continued development of the Big Lake pool of Miami county in T. 16 S., R. 24 E.; the discovery of a new upper Bartlesville sand pool centered about sec. 4, T. 21 S., R. 21 E., of Anderson county; the "drilling up" of the Blue Mound gas field located in the northeastern part of T. 22 S., R. 22 E., and the western part of T. 22 S., R. 23 E., Linn county; and the development of shale gas in Miami and Johnson counties.

During 1929 Bartlesville sand and gas pools similar to those developed in 1927 were again opened in T. 22 S., R. 21 E., and in T. 21 S., R. 21 E., Anderson county; a new pool was developed in T. 17 S., R. 25 E., Miami county; a new Bartlesville sand gas pool opened in T. 17 S., R. 20 E., Franklin county; and a gas pool was developed in the Bush City sand in T. 21 S., R. 21 E., of Anderson and Linn counties.

Shale gas was further developed during 1929 in Miami and Johnson counties and adjacent parts of Missouri; that on the Fairfax airport, of Kansas City, being of considerable importance, the wells having an open flow capacity up to 1½ million cubic feet at depths ranging from 340 to 370 feet.

Table 2 gives such details as are available concerning these developments.

Anderson County

A most important field was discovered in Anderson county in 1928 and extended in 1929. Situated in secs. 4, 10 and 15, T. 21 S., R. 21 E., about 65 wells have been completed with an initial yield of 10 to 200 barrels of oil. The sand varies up to 50 feet in thickness and ranges in depth from 650 to 750 feet. The production is significant, in that it is the most northern field in eastern Kansas producing light oil from the upper Bartlesville sand. Heretofore bodies of this sand have been found to be only gas bearing in this part of the state.

During 1929 a second Bartlesville sand field was opened up in secs. 9, 16 and 21, T. 22 S., R. 21 E. The producing sand lies at a depth of 715 to 750 feet, and some 12 wells have been completed for an initial production of 120 barrels of oil.

TABLE 2.—*Development and New Discoveries in Northeastern Kansas Shoestring Area.*

County.	Locations.	Development period.	Producing sand.	Depth range, feet.	Sand thickness, feet.	Initial production, cu. ft. or bbls.	Gravity.	Wells producing.
Wyandotte	Fairfax Airport	1929		340 to 370		1,000,000 to 1,500,000	Gas	14
Miami	29 to 14-16-24	1927-'28	Big Lake	325 to 400		20 to 250		
Miami	6-17-25	1929	Big Lake	375 to 400				15
Miami	1-17-23	1929		418	25	Gas and oil	34°	3
Linn	14, 23, 26-21-21	1929	Bush City	570 to 620	50	1,000,000	Gas	35
Anderson	15, 22-21-21		Oil sand					
Linn	NE 22-22, W 22-23	1927-'28	Lower Cherokee	650 to 700		250,000 to 4,500,000	Gas	75
Anderson	About 4-21-21	1928	Upper Bartlesville	700	0 to 50	10 to 75	34°	35
Anderson	9, 16, 21-22-21	1929	Bartlesville	715 to 750	25	120		12
Anderson	10, 15-21-21	1929	Bartlesville	650 to 750	40	100 to 200	33°	30
Anderson	6-17-20	1929	Bartlesville	720 to 760		1,000,000	Gas	12

Franklin County.

This old territory was credited with less than a dozen scattered completions during 1928. Two gas wells were drilled as offsets to two producers in a Bartlesville sand pool discovered in 1924, but were never connected to a pipe line. The four gassers now completed are probably all the small dome on which they are located will accommodate. Dry holes surround the producers. More gas pools should be expected in western Franklin county. As a whole it is practically untested.

A new Bartlesville sand gas pool was added to the producing fields of Franklin county during 1929. Located in sec. 6, T. 17 S., R. 20 E., twelve gas wells have been completed to date. Their initial yield of gas is 1,000,000 cubic feet from a depth of 720 to 760 feet.

Linn County.

The major producing area in Linn county, the Blue Mound gas field, was developed during 1928. The field is in the northeastern part of T. 22 S., R. 22 E., and the western part of T. 22 S., R. 23 E. The producing sand is in the lower part of the Cherokee shale. The wells are 650 to 700 feet deep and came in at 250,000 to 4,250,000 cubic feet open flow and 210 pounds rock pressure. Approximately 15 wells were drilled during the year, making a total of 75 in the field.

In 1929 an important gas area was opened in secs. 14, 23 and 26, T. 21 S., R. 21 E. About 35 gas wells, each with an initial yield of 1,000,000 cubic feet, are producing from a 50-foot sand body at a depth of 570 to 620 feet. The producing horizon is the Bush City sand.

Miami County.

The search for shallow oil in this county during 1927, brought about by the discovery of the Big Lake field, continued into the early part of 1928, but was gradually abandoned, owing to the lack of success in finding more oil and the shift of interest to drilling for shale gas. The Big Lake field as now defined curves from sec. 29 to sec. 14, T. 16 S., R. 24 E. It is a shoestring pool a quarter to a half-mile in width that has furnished wells of from 20 to 250 barrels. A calcareous sand, ranging up to 40 feet in thickness and which is 325 to 400 feet deep, serves as the reservoir rock. Some inside locations

yet remain undrilled, but dry holes have lessened the hope for additional extensions.

During 1929 two additional producing areas were found. In sec. 6, T. 17 S., R. 25 E., some 15 wells are producing from a depth of 375 to 400 feet in a horizon equivalent to that of the Big Lake field. Farther west, in sec. 1, T. 17 S., R. 23 E., three wells derive oil and gas from a 25-foot sand body at a depth of 418 feet.

The shale gas of Miami county occurs under the same conditions as that in the Chanute-Coffeyville district of the southeastern part of the state. The wells are 450 to 550 feet deep and have an open flow of 15,000 to 500,000 cubic feet daily. The rock pressure is 100 to 140 pounds. The common producing zones are highly carbonaceous shales 3 to 10 feet thick that occur within and just below the Fort Scott limestone. Salt water is almost invariably associated with the gas, and the two come to the surface together and are separated in a drip tank. Pipe lines which make connection with Kansas City markets instigated much drilling. The shale gas area occupies parts of Johnson county, Kansas, and Jackson and Cass counties, Missouri.

Southeastern Kansas.

The principal developments for 1928 and 1929 in southeastern Kansas were: (1) *Labette county,* the Oswego shale, Bartlesville sand, and Mississippi lime gas pools in T. 32 S., R. 19 E., Ts. 33 and 34 S., Rs. 18 and 19 E.; T. 32 S., Rs. 17 and 18 E.; (2) *Bourbon county,* the extension of an old Bartlesville oil pool in T. 23 S., R. 21 E.; (3) *Chautauqua county,* the continued development of the Peru sand oil pool in T. 33 S., R. 12 E.; and (4) *Elk county,* the discovery and development of the "Mississippi lime" pool of the Moline townsite.

Table 3 gives such details as are available relative to these developments and others of minor importance.

Allen County.

A 1,000,000-foot gas well in Bartlesville sand was drilled in the NW¼ of sec. 18, T. 26 S., R. 20 E., in the early part of 1928. Additional drilling in the vicinity brought about no extensions and the discovery well was soon drowned out by water.

Allen county has been so thoroughly developed that wildcat wells are seldom drilled. This was especially true during 1928 and 1929.

TABLE 3.—*Development and new discoveries in southeastern Kansas.*

COUNTY.	Locations.	Development period.	Producing sand.	Depth range, feet.	Sand thickness, feet.	Initial production, bbls. or cu. ft.	Gravity.	Wells producing.
Woodson	8-24S-17E	1928	"Big lime"	325	.....	.....	Gas	.....
Woodson	31-23S-16E	1928	"Mississippi lime"	1,500	.....	25	.....	.....
Bourbon	23, 26-23S-21E	1929	Bartlesville	600 to 650	.....	50 to 100	27°	.....
Labette	32S-19E	1928	"Oswego" shale	150 to 750	.....	500,000 to 1,000,000	Gas	100 to 150
Labette	33S-18 and 19E	.....	Bartlesville	.....	.....	100,000 to 1,000,000	Gas	.....
Labette	34S-18 and 19E	.....	"Mississippi lime"	.....	.....	100,000 to 3,000,000	Gas	.....
Labette	32S-17 and 18E	1928	"Oswego," Bartlesville and "Mississippi lime"	Deeper	.....	100,000 to 3,000,000	Gas	.....
Montgomery	5, 6, 8-34S-15E	1928	Bartlesville	.....	.....	250,000	Gas	10 to 12
Montgomery	17, 18, 19, 20-34S-15E	1928	Wayside	500	.....	5	.....	15 to 20
Montgomery	32-33S-15E and 5-34S-15E	1928	Bartlesville	1,000	.....	?	?	.....
Montgomery	34S-13E	1928	Redd oil, "Mississippi" gas	.....	.....	.....	.....	.....
Chautauqua	33S-12E	1927-'29	Peru	900	.....	30	34-35°	23
Elk	Moline townsite	1928-'29	"Mississippi" oil	1,980	35 to 40	100	36-37°	33
	9, 10, 15, 16-31S-10E	1927-'28	Encill	1,150	.....	.....	Gas	3
Elk	3-31S-8E	1928	Kansas City	1,920 to 1,975	.....	600 to 700	36°	Oil 3
Elk	12-31S-8E	1929	Encill	1,505 to 1,515	.....	14,000,000	Gas	.....
Elk	35, 36-31S-10E	1928	"Oswego" oil	1,550	.....	130	.....	1
			"Mississippi" gas	2,000	.....	600,000 to 1,000,000	Gas	.....
Elk	34-29S-12E	1928	Top Kansas City	800	.....	.....	.....	.....
Elk	12,13-29S-8E	1928	"Wilcox"	.....	.....	Small	.....	2
Elk	9-29S-9E	1929	"Wilcox"	2,640	.....	80	33°	1

Chautauqua County.

The only development of importance which has taken place in Chautaqua county has been the extension of a new field one mile west of Monett, in T. 33 S., R. 12 E., discovered in October, 1927. To date 23 oil wells and 5 dry holes have been drilled. The producing horizon is the Peru sand found at a depth of 900 feet. The average initial production is 30 barrels, and the gravity of the oil is 34°-35° Bé.

Drilling has taken place in a few other areas over the county, but no new production of importance has resulted.

Elk County.

The greatest activity during 1928 in Elk county took place in the Moline field, located in secs. 10, 15 and 16, T. 31 S., R. 10 E., in the west edge of the town of Moline. The discovery was made in November, 1927, but practically all drilling occurred during 1928. To date the field includes 33 oil wells, three gas wells, and five dry holes. The oil-producing horizon is the top of the "Mississippi lime" found at an average depth of 1,980 feet. Penetration of the lime averaged 35 to 40 feet. The initial production is approximately 100 barrels, and the gravity of the oil 36°-37° Bé. The gas horizon is the Encill sand at the top of the Kansas City group, at an approximate depth of 1,150 feet. The surface structure is a "nose" projecting westward from the Webb dome in sec. 14, T. 31 S., R. 10 E.

The Ferguson oil field, located in sec. 3, T. 31 S., R. 8 E., was discovered in July, 1928, though a 6-million-foot gas well was drilled as early as August, 1926. To date three oil wells and three dry holes have been drilled. The gas comes from the Encill sand at a depth of 1,865 feet, and the oil is found in the Kansas City group at a horizon 110 feet below its top. The wells flow with an initial production of 600 to 700 barrels per day of 36 gravity oil, at a depth from 1,920 to 1,975 feet. The surface structure is a small closed dome.

In November, 1928, a new gas area was opened in the SW¼ of sec. 12, T. 31 S., R. 8 E., at a depth of 1,505 to 1,515 feet. This is again the Encill sand, which has produced large quantities of gas in western Elk county. Initial production was reported as 14 million cubic feet.

A number of wells were drilled during 1928 in a field first dis-

covered in 1926 in secs. 35 and 36, T. 31 S., R. 10 E., and secs. 1 and 2, T. 32 S., R. 10 E. Eight gas wells, one oil well and one dry hole were drilled during 1928. The oil well was completed for 130 barrels in the "Oswego lime" at 1,556 to 1,575 feet, testing 37° Bé. The gas horizon is in the top of the "Mississippi lime" found at an approximate depth of 2,000 feet and has a yield of from 600,000 to 1,000,000 cubic feet.

In sec. 34, T. 29 S., R. 12 E., a number of small wells have been completed in the top of the Kansas City group at an 800-foot depth.

In the Porter field, secs. 12 and 13, T. 29 S., R. 8 E., three wells were drilled to the "Wilcox" sand; two of them small producers, and the third a dry hole.

What may prove to be a new "Wilcox" sand producing area was discovered in 1929 through the completion of a well in sec. 9, T. 29 S., R. 9 E., at a depth of 2,640 feet. The test yielded, initially, 80 barrels of 33° Bé. oil daily.

Labette County.

An active drilling campaign for gas has been in progress in parts of Labette county during the past two years.

The Gas Development Company, of Independence, laid an 8-inch line into Parsons in the early part of 1928. From the Oklahoma boundary this gas line runs north between ranges 18 and 19 until it meets the Missouri-Kansas-Texas railroad right of way, thence northeast along this right of way into Parsons. This line has furnished a market for low-pressure gas and has encouraged drilling in this vicinity.

The most active play has been in T. 32 S., R. 19 E.; T. 33 S., Rs. 18 and 19 E.; and T. 34 S., Rs. 18 and 19 E. There have been 100 to 150 wells drilled in these five townships. They range in depth from 150 to 750 feet. The gas is produced from three principal horizons: (1) Shale breaks in the Fort Scott limestone; (2) Bartlesville sand; and (3) the top of the "Mississippi lime." Gas is found, also, in the so-called Squirrel sand, stratigraphically between the Fort Scott limestone and the Bartlesville sand, and also in coal seams above the Bartlesville. The initial production ranges from 10,000 to 500,000 cubic feet in the Fort Scott, 100,000 to 1,000,000 in the Bartlesville, and 100,000 to 3 million in the "Mississippi lime."

These three horizons also produce gas in T. 32 S., Rs. 17 and 18 E., and a large number of wells have been drilled. The depths are

slightly greater, due to normal west dip. From this area the Edgar Zinc Company, of Cherryvale, furnishes that town with gas.

Montgomery County.

No new pools of any consequence have been discovered in Montgomery county during the 1928-1929 period.

The Consolidated Oil and Manufacturing Company, of Independence, has drilled 10 to 12 new wells in secs. 5, 8 and 9, T. 34 S., R. 15 E., which produce gas from the Bartlesville sand. Their initial volume is about 250,000 cubic feet. These wells were drilled in an old gas field, and therefore cannot be considered a new pool.

The same company drilled between 15 and 20 shallow oil wells in secs. 17, 18, 19 and 20, T. 34 S., R. 15 E., which produce from a sand approximately 500 feet deep, probably corresponding to the old Wayside sand horizon. Their initial production is about five barrels per day.

Cavert *et al.*, of Independence, drilled several oil wells in sec. 32, T. 33 S., R. 15 E., and sec. 5, T. 34 S., R. 15 E., resulting in production from the Bartlesville sand at a depth of approximately 1,000 feet.

Brady, of Independence, is developing both oil and gas in T. 34 S., R. 13 E., about 2 miles north of Havana. The oil is being produced from the Redd sand and the gas from the top of the "Mississippi lime."

These localities represent the principal drilling in Montgomery county in 1928. The usual amount of scattered drilling has also taken place, most of it being for shale gas in the shale breaks of the Fort Scott limestone in the eastern part of the county.

Neosho County.

Shale gas was discovered in the vicinity of Kimball and St. Paul, in the eastern part of the county, during 1928. Wells with volumes of from 10,000 to 600,000 cubic feet were obtained in the same shales that furnish the shale gas of eastern Wilson county, but in this area at a depth of only 200 to 250 feet. Salt water occurs with the gas in the smaller wells, but not in the larger ones. These discoveries indicate that much more shale gas territory remains undrilled.

A sand-gas pool was discovered three miles southeast of St. Paul, in a sand on top of the "Mississippi lime," found at a depth of 600 feet. The volumes of the 5 wells completed to date are 100,000 to 1½ million cubic feet. The rock pressure is 240 pounds.

More shale-gas development took place along the western border of the county. Little wildcat work for shale gas or oil was carried on.

Wilson County.

Wilson county has been quite thoroughly tested for oil and gas by drilling which has extended over a period of forty years. The county has furnished more gas than oil. Some of the largest gas wells in the state have been drilled here. In later years the county has taken rank as the chief producer of shale gas.

Practically all of the sands are lenticular bodies within the Cherokee shale, but sandy zones near the top of the "Mississippi lime" furnished production locally, and the top of the Ordovician "Siliceous lime" is a possible reservoir.

Most of the oil in Wilson county is low in gravity, ranging between 22 and 30 degrees Bé. The main oil sand occurs as scattered lenses 10 to 25 feet below the Fort Scott limestone. Heavy, unmarketable oil is known to occur locally in considerable quantities in the upper Bartlesville sand about 80 feet below the Fort Scott. The only Ordovician pool in the county was discovered in the NW¼ of sec. 17, T. 27 S., R. 16 E., in November, 1924. The first well made 75 barrels of oil of about 22 degrees Bé. gravity. The pool was very small and its production was cut down rapidly by the encroachment of salt water. Other pools of heavy oil may be found in the "Siliceous lime" on well-defined closed structures.

Gas has been produced from most of the lenticular sands in the Cherokee shale. The largest wells were completed in sands in the Bartlesville zone, especially that 80 to 100 feet below the top of the Cherokee. A lower, rather persistent sand, 230 to 250 feet below the top of the Cherokee shale, sometimes referred to as the "salt sand," also produces gas, but the wells are not as large or long-lived as those in the upper horizon. The "first break" in the "Mississippi lime" is gas-bearing under favorable structural conditions.

The best-known gas field of the county is the old Vilas field, located about two miles east of that town. This pool, extending north-south, is five miles in length by three-quarters of a mile in width, and furnished wells of 5 million to 40 million cubic feet open flow. The lenticular sand body, in the upper Bartlesville zone, ranges in thickness up to a maximum of 140 feet. Some lenses were redrilled a second and a third time after the demand for gas increased with the dwindling of the eastern Kansas reserves. The original rock pressure of about 300 pounds is now only 2 pounds,

and the volumes of the wells from the last redrilling only 50,000 to 100,000 cubic feet.

The lenticular sands of Wilson county are reflected in its many small and irregularly arranged pools. Accumulation is controlled by the shape of the sand bodies and their position in respect to the regional dip, as well as by local structure. Many of the Wilson county domes are or were productive of gas.

In spite of the thorough exploration that has been made in the county, new sand-gas fields are occasionally brought in. One such was opened in secs. 5, 6, 7 and 8, T. 28 S., R. 16 E., during 1928. Production from the "salt sand" was encountered at 1,505 feet, and about 10 wells, the largest with an open flow of 1½ million cubic feet, were drilled, having a rock pressure of 315 pounds.

In 1928 and 1929 practically all the drilling in Wilson county was done for shale gas in the proven territory in the eastern part of the county.

Woodson County.

A number of gas wells only 325 feet deep were completed in sec. 8, T. 24 S., R. 18 E., in the Neosho Falls gas field which had its original development in the "first break" of the "Mississippi lime." The production occurred in a sandy zone in the Winterset limestone. The accumulation was apparently controlled by the dome-like structure of the field, but the local porosity of the limestone helped regulate the size of the wells. The largest well had an open flow of 1½ million cubic feet at a rock pressure of 90 pounds.

A discovery oil well, with 25 barrels initial production of 32-degree oil, producing from the "first break" in the Mississippi lime, was drilled in the northwest corner of the SE¼ of sec. 31, T. 23 S., R. 16 E.

No important discoveries were made by the few other tests put down during the 1928-'29 period.

Western Counties of Eastern Kansas.

Marion County.

The only development of importance in Marion county during this period took place in the Lost Springs and Hillsboro fields. Isolated producing wells throughout the county will not be discussed.

Lost Springs Field.[4] The Lost Springs field comprises a rec-

4. Now considered as one field, the Lost Springs field was carried formerly as two producing areas; the Reznicek pool and the Lost Springs townsite pool. (Kesler, L. W., Oil and Gas Resources of Kansas in 1927: Mineral Resources, Circ. 1, Kan. Geol. Survey, p. 30.)

tangular-shaped area, four miles north and south and two miles east and west, throughout which discontinuous production is obtained from 48 wells producing from the "Mississippi lime." The field includes parts of secs. 2, 3, 4, 10, 12, 13, 14, 15, 21, 22, 23, 26, 28, 33 and 34, T. 18 S., R. 4 E. Actual production at the present time is obtained only from secs. 2, 3, 13, 14, 15, 21, 22, 23 and 26.

The discovery well, Harwood and Winters No. 1 Reznicek, SW cor. NW¼ sec. 22, T. 17 S., R. 4 E., was completed in November, 1926, for an initial production of 75 barrels of 37.5 degrees Bé. oil. Later it was deepened 30 feet, resulting in a new initial production of 275 barrels. By June, 1927, three offset wells had been drilled, each of which had an initial yield of 850 barrels. For the remainder of the year these wells were prorated to 50 barrels a day each.

Extensive development of this field did not occur until late in December, 1927, and early in 1928, when Loriaux and Robinson completed an oil well on the Lost Springs townsite, in sec. 23, T. 17 S., R. 4 E., for an initial production of 200 barrels. Development of the field has been as follows:

Year.	Producing wells.	Dry holes.	Total completions.
1926	1	1	2
1927	3	3	6
1928	44	22	66
1929	0	2	2
Totals	48	28	76

All of the wells produce from the "Mississippi lime." The depths to the top of this formation range from 2,288 to 2,435 feet, averaging 2,365 feet. Thirteen tests have penetrated below the base of the "Mississippi lime," but all have been dry holes. Of this number, six stopped in Kinderhook shale, five in the Siluro-Devonian, and two penetrated into the "Siliceous lime."

Most of the wells in the Lost Springs field have a relatively low initial yield. The average initial production for the field is 135 barrels. Half of the total number of producing wells, however, record an initial yield of less than 100 barrels. The maximum initial production has been 1,000 barrels.

Lost Springs has produced a total of 909,044 barrels of oil. The actual producing area comprises 370 acres. Thus the recovery per acre to the end of 1929 has been 2,460 barrels to the acre. While there still remain a great number of locations to be drilled, it is doubtful if the field will ever be extended much beyond its present rectangular-shaped limits.

HILLSBORO FIELD. The Hillsboro field comprises 17 wells, producing from the Viola limestone (Ordovician), in the E½ E½ of sec. 12, T. 19 S., R 2 E., and the W½ W½ of sec. 7, T. 19 S., R. 3 E. In addition 3 dry holes have been completed; one in sec. 7, T. 19 S., R. 3 E., and one each in secs. 1 and 12, T. 19 S., R. 2 E.

The field was discovered on October 16, 1928, by Courtney Davis, who completed his No. 1A Weins, in the SW cor. NW¼ of sec. 7, T. 19 S., R. 3 E., with an oil showing in the "Mississippi lime." After some delay this well was tested and produced 124 barrels on December 4, 1928, and 208 barrels on December 28, 1928—a total of 332 barrels of oil. Later this test was deepened to the Viola limestone and completed March 18, 1929. Subsequently all of its oil has come from the Viola, and 332 barrels of oil is all this test ever produced from the "Mississippi lime."

The real discovery well for Viola production, however, was Empire Oil and Refining Company, No. 1 Suderman, in the SE cor. NE¼ of sec. 12, T. 19 S., R. 2 E., which was completed at a total depth of 2,843 feet on January 24, 1929, with an initial production of 400 barrels of oil.

The average depth to the top of the Viola limestone is 2,820 feet, with a range in depth of from 2,803 to 2,851 feet. Penetration of the Viola ranges from 9 to 38 feet, averaging 18 feet. Two of the producing wells completely penetrated the Viola (thickness 75 feet) and, after encountering a hole full of water in the "Wilcox" sand, were plugged back to produce from the Viola.

All of the production obtained from the Hillsboro field is derived from the Viola limestone. The producing acreage totals 170 acres. The recovery per acre to the end of 1929 has been 2,035 barrels. The average gravity of the oil is 37 degrees Bé.

CHASE COUNTY.

Chase county is credited with two important gas fields; one in T. 18 S., Rs. 6 and 7 E., the other in Ts. 19 and 20 S., R. 7 E. In addition, gas is produced from a few isolated wells throughout the county.

ELMDALE FIELD. The oldest gas field in Chase county is situated in the immediate vicinity of the town of Elmdale, from which the field derives its name. Very little definite information is available as to its development, and all production records prior to 1927 have been destroyed by fire. The gas is produced by the Twin City Gas

Company, which supplies gas to Cottonwood Falls, Strong City and Elmdale.

The gas wells are located in secs. 26, 34 and 35, T. 19 S., R. 7 E., and secs. 1 and 2, T. 20 S., R. 7 E. Approximately 15 gas wells have been completed, producing from the McKissick Grove shale of the Wabaunsee group, at a depth of about 500 feet, and with a rock pressure of 85 to 110 pounds.

The only available production records are as follows:

1927	30,252,000 cubic feet
1928	29,365,000 cubic feet
1929	34,512,000 cubic feet
Total	94,129,000 cubic feet

LIPPS FIELD. The principal gas field in Chase county is the Lipps field, situated in secs. 25 and 36, T. 18 S., R. 6 E., and secs. 29, 30, 31 and 32, T. 18 S., R. 7 E. The field was discovered by Preston and Pasewalk through the completion of their No. 1 Lipps in the NE cor. SW¼ of sec. 32, T. 18 S., R. 7 E., on April 7, 1926. Pipe-line connections were not made until 1927, but production thereafter has been continuous. All of the gas is taken by the Empire Oil and Refining Company.

A total of 29 tests have been drilled in the Lipps field, of which 11 have been dry holes and 18 have produced gas. The maximum number of gas wells producing at any one time totals 16. A detailed record of the development of this field follows:

YEAR.	Producing wells.	Dry holes.	Totals.
1926	3	3	6
1927	14	8	22
1928	1	0	1
1929	0	0	0
Totals	18	11	29

The top of the gas zone ranges in depth from 1,102 to 1,245 feet, with an average depth of 1,170 feet. The producing horizon is a true sand in the Lawrence shale of the Douglas group, and occupies a stratigraphic position about half way between the base of the Oread limestone and the top of the Iatan limestone.

Two tests in the Lipps field have penetrated to the pre-Cambrian. One of these is in sec. 25, T. 18 S., R. 6 E., the other in sec. 32, T. 18 S., R. 7 E. The axis of the "Granite Ridge" in this immediate locality extends through secs. 29 and 32, T. 18 S., R. 7 E. The field, therefore, is situated not only on the axis of the "Granite Ridge," but extends, as well, a distance of 2 miles down the west flank.

The gas wells have an initial production of 1½ million to 5 million cubic feet. The annual production record for the field has been:

Year.	Volume of gas produced (cubic feet).	Number producing wells.
1927	578,911,000	16
1928	163,906,000	15
1929	158,433,000	14
Total	901,250,000	...

Morris County.

The principal gas producing areas of Morris county are the Heigle field, in T. 16 S., R. 7 E., and the Wilde field, in T. 17 S., R. 7 E. Both fields were discovered by the General Utilities Company of Kansas City, Mo.

Heigle Field. The discovery well of this field, No. 1 Heigle, was completed in November, 1927, by the General Utilities Company, in the SW cor. SE¼ of sec. 11, T. 16 S., R. 7 E. The producing horizon, 1,437 to 1,441 feet, had an initial open flow of 1,550,000 cubic feet of gas at 490 pounds rock pressure.

The field is situated in secs. 10, 11, 14, 15 and 16, T. 16 S., R. 7 E. Two gas wells and 6 dry holes have been completed. The gas wells have an open flow ranging from 500,000 cubic feet to 3 million cubic feet, with an average rock pressure of 480 pounds.

Production is derived chiefly from the top of the Lansing group at an average depth of 1,450 feet. A few wells, however, produce from the McKissick Grove shale at a depth of 450 feet.

Pipe-line connections to the field were completed in 1928. During 1928 the total volume of gas produced was 110 million cubic feet, and in 1929, 130 million cubic feet.

Wilde Field. In October, 1929, the General Utilities Company contributed another gas field to Morris county through the completion of their No. 1 Carpenter, in sec. 21, T. 17 S., R. 7 E. This test had an initial open flow of 550,000 cubic feet of gas and a rock pressure of 120 pounds at a depth of approximately 600 feet. During the latter part of 1929 other tests penetrated deeper than the discovery horizon and contributed two additional producing zones yielding an open flow of one-half to four million cubic feet, at a rock pressure of 465 pounds.

The field is located in secs. 11, 14, 15, 21, 22 and 27, T. 17 S., R. 7 E. A total of 17 gas wells and 3 dry holes have been drilled.

Gas is produced from the following three horizons:

	Depth in feet.
Willard shale (Wabaunsee group)	600
Lawrence shale (Douglas group)	1,200-1,250
Lansing group	1,400

Pipe-line connections to the Wilde field have not been completed, so no production figures are available for 1929.

Greenwood County.[5]

Lamont Field. This pool, discovered in 1927, was developed rapidly during 1928 and 1929 and now extends in a northwest-southeast direction for three miles through secs. 23, 24, 25 and 26, T. 22 S., R. 12 E., secs. 29, 30 and 32, T. 22 S., R. 13 E., adjacent to and partly including the townsite of Lamont. Over 100 producing wells have been drilled, having an average initial production of 300 barrels of 40° Bé. gravity oil, found in Bartlesville sand at depths of approximately 1,650 feet. The pool has a daily average of 4,330 barrels, and produced 1,579,000 barrels during 1928. Expected recovery per acre is 7,000 barrels.

Norton Field. The Norton field, discovered in April, 1929, is located in secs. 15 and 22, T. 22 S., R. 12 E., and appears to be a connecting link in a sand trending between the producing Bartlesville area northeast of Madison and the Lamont pool. Nine producing wells, with an average initial production of 109 barrels of 41° Bé. gravity oil, have been completed in the Bartlesville sand which is found at depths slightly in excess of 1,700 feet. Water is present in the lower part of the sand body and is significant in that the ultimate recovery probably will be low.

Demalorie-Souder Field. During 1928 four additional Bartlesville sand wells were completed in the west extension of this important field, with initial yields of approximately 150 barrels each at depths of 2,150 feet. Explorations to further extend the pool have failed.

Edwards Field. Efforts to extend the Edwards field, located in T. 23 S., R. 11 E., were only partly successful in 1928. However, during 1929, 33 producing wells were completed in secs. 21, 22, 27 and 28, T. 23 S., R. 11 E., with an average initial production of 304 barrels of 42° Bé. gravity oil. As with most of the important pools of Greenwood county, production is from the Bartlesville sand, which

5. Manuscript for Greenwood, Butler and Cowley counties, by Charles E. Straub.

is found at a depth of about 1,900 feet in this area. This extension is of importance, due to the saturated condition of the sand which attains a thickness of 90 feet, the sustained nature of the production, and the possibility that it may connect with the Patterson field to the southeast. An ultimate yield of 7,000 barrels per acre may be expected.

PATTERSON FIELD. This pool was opened by the discovery of Bartlesville production at a depth of about 1,765 to 1,837 feet, in a well located in sec. 36, T. 23 S., R. 11 E., near Hamilton, and recently has been extended into sec. 1, T. 23 S., R. 11 E. Ten wells have been completed with an average initial production of 357 barrels of 41° Bé. gravity oil. A recovery of 7,000 barrels per acre may be expected.

QUINCY AND HOGGETT FIELDS. Bartlesville sand production was discovered in November, 1927, just east of the town of Quincy, in T. 25 S., R. 13 E. This area was thought to have excellent possibilities, but efforts during 1928 resulted in the completion of only seven producers and an equal number of dry holes. The sand was found at a depth of about 1,400 feet. The oil is of 38° Bé. gravity and recovery will not exceed 2,500 barrels per acre.

Near Quincy, in sec. 9, T. 26 S., R. 13 E., a Bartlesville sand well was completed in July, 1929, with an initial production of 50 barrels of 37° Bé. gravity oil at a depth of 1,535 feet. Ten wells have been completed with an average initial production of 102 barrels. The decline has been rapid.

MISCELLANEOUS. During 1928 several wells were completed in what is locally known as the "Cattlemen's sand," at about the Bartlesville horizon, at a depth of 2,200 feet, in sec. 6, T. 25 S., R. 9 E., Olsen area. A few wells were completed as producers from the "Mississippi lime" at depths of about 1,600 feet in the Virgil area of eastern Greenwood county during 1929.

BUTLER COUNTY.

HAVERHILL FIELD. This field was discovered in April, 1927, and continued to develop during 1928 and 1929. Twenty-four producing wells were completed in 1928, with an average initial production of 198 barrels, and 29 wells were completed in 1929, with an average initial production of 126 barrels, making a total of 53 new wells. The field is at present 3 miles long, trending through secs. 22, 27 and 34, T. 27 S., R. 5 E., and is one-fourth to one-half mile in width.

The oil is 40° Bé. gravity and is found in Bartlesville sand at a depth of approximately 2,700 feet. Recovery will be approximately 4,000 barrels per acre.

SLUSS FIELD. This narrow Bartlesville sand pool, located in secs. 5 and 6, T. 27 S., R. 6 E., was discovered in March, 1928. At the end of the year there were about 25 wells, which had initial productions of 200 to 500 barrels of 39° Bé. gravity oil. The Bartlesville sand occurs at a depth of about 2,700 feet. By the end of 1928 the pool had produced 490,000 barrels, but during 1929 declined rapidly, due to close drilling. Five other wells were completed during 1929. The recovery is expected to exceed 7,000 barrels per acre. Two wells have been completed in the Viola limestone of Ordovician age.

SHAFFER FIELD. Development of this pool, located in secs. 3, 4, 8, 9, and 10, T. 27 S., R. 6 E., was carried into secs. 8, 9 and 10 during 1928. Fifteen wells were completed in the Viola "lime" (Ordovician) at a depth of about 3,150 feet, with initial productions averaging 150 barrels. Five others were completed during 1929 in the Viola, averaging 67 barrels, and four in the top of the "Mississippi lime" at a depth of about 2,750 feet, averaging 54 barrels. Most of the Viola wells showed considerable oil in the top of the "Mississippi lime." The gravity is 36° Bé. and the recovery is expected to exceed 7,000 barrels per acre.

ELDORADO FIELD. Almost 100 wells were completed during 1928 in the 650-foot sand (Admire shale of the Wabaunsee group) of the Eldorado field, in secs. 19, 20 and 30, T. 25 S., R. 5 E., averaging 20 barrels initial production of 36° Bé. gravity oil. During 1929, in the above sections and in secs. 24, 25 and 36, T. 25 S., R. 4 E., about 75 other wells were completed, in the same horizon, with an average initial production of 25 barrels. Recovery is expected to be approximately 2,000 barrels per acre.

Development of the deep pay in the Eldorado field was carried on by the completion of 25 wells in secs. 18, 19 and 20, T. 26 S., R. 5 E., for an average initial production of 130 barrels of 35° Bé. gravity oil from the Ordovician Viola "lime" and "Wilcox" sand at approximately 2,600 feet on inside proven areas. Recovery of 7,000 barrels per acre is expected from these wells.

MISCELLANEOUS DISCOVERIES. During 1928 several "Mississippi-lime" wells were completed in the vicinity of the Pierce discovery well, located in sec. 28, T. 25 S., R. 4 E., with an average initial

production of about 50 barrels of 43° Bé. gravity oil at a depth of around 2,600 feet.

"Mississippi-lime" production was also encountered at a depth of 2,765 feet, near Benton, in sec. 10, T. 26 S., R. 3 E. The discovery well had an initial production of 450 barrels, but the offsets were practically dry, and two tested the subjacent Ordovician without securing production.

What was thought to be an important discovery well was completed during 1929 in sec. 24, T. 27 S., R. 4 E., as a 210-barrel producer of 41° Bé. gravity oil from the "Wilcox" sand, found at a depth of 3,012 to 3,022 feet. The offsets were smaller wells and efforts to extend the producing area beyond a quarter-mile have failed.

Cowley County.

The most important development in Cowley county in 1928 took place in the State field (discovered in 1926) adjoining Winfield on the north and located in secs. 9, 10, 15, 16 and 22, T. 32 S., R. 4 E. Ten wells were producing from two horizons in the Kansas City group during 1928, but four of these were deepened to the Bartlesville sand, found at a depth of about 3,000 feet. Development of the pool continued during 1929, and good wells were completed in the "Siliceous lime," which is the principal producing horizon of this field.

The Bartlesville sand production of the East Winfield pool, found at a depth of about 3,050 feet, was extended a quarter mile east in sec. 19, T. 32 S., R. 5 E., during 1929.

The Smith field, which is producing from the Bartlesville sand at about 3,000 feet in sec. 10, T. 31 S., R. 3 E., was extended into section 15 during 1929.

In the Burden area of T. 31 S., R. 6 E., several Bartlesville-sand wells were completed in section 30 during 1929 at a depth of about 3,000 feet, having initial yields of 25 to 200 barrels, and in section 20 a good well producing from the same sand was encountered at about 2,900 feet. A gas well estimated to have an open flow of 40 million cubic feet at 1,640 feet, and 68 million cubic feet at 2,215 feet, was encountered in the northeast corner of the same section, but has been mudded off to test lower sands for oil. Another well has since been drilled in the center of the same 40-acre tract. It missed the first gas, but about 16½ million cubic feet was encounter in the 2,200-foot sand with a rock pressure of about 800 pounds.

In sec. 18, T. 30 S., R. 5 E., a Bartlesville sand well was completed at a depth of 2,850 to 2,900 feet, with an initial production of 100 barrels. This well is northeast of the old Rock pool.

Development of the helium gas areas in the vicinity of Dexter continued during 1928 and 1929, the wells having open-flow capacities up to 500,000 cubic feet, containing two per cent helium.

Meridian Counties.

Harvey County.

At the close of 1929 a total of 58 wells had been completed in Harvey county, 50 in ranges east and 8 in ranges west. Only a few of these wells have penetrated to the "Siliceous lime."

Walton Field. The first commercial production obtained in Harvey county, and the discovery well of the Walton field, was found by Newton Oil Corporation at their No. 1 Wetschensky, located in the SW cor. NE¼ of sec. 4, T. 23 S., R. 2 E., which was completed in December, 1923, at a total depth of 2,435 feet.

The Walton oil field is located about 3 miles southeast of Walton. Actual production has been found only in sec. 4, T. 23 S., R. 2 E., but wells have been drilled in sec. 33, T. 22 S., R. 2 E., and secs. 3, 4, 8 and 9, T. 23 S., R. 2 E., in an attempt to extend the field. A total of 18 wells have been drilled, of which number some 10 wells have been productive.

Production is obtained at a depth of 2,440 feet in the Lansing-Kansas City beds, 240 feet below the top of the Lansing group and 140 feet above the base of the Kansas City group.

The oil is taken by Derby Oil Company. The first commercial production was run in March, 1924, and production has continued to the present time, but most of the wells have been abandoned. The gravity of the oil is 35 degrees Bé. The total production of the field to the end of December, 1928, was 103,850 barrels.

Halstead Field. The first commercial production encountered in ranges west of Harvey county was discovered by the Shell Petroleum Corporation in their No. 1 Haury, in the NE cor. SW¼ SE¼ of sec. 11, T. 23 S., R. 2 W., in August, 1928. This well reached the top of the "Mississippi lime" at 2,940 feet, and from 2,961 to 2,972 feet had an initial production of 8,400,000 cubic feet of gas. For the first seven months after completion the only gas taken from No. 1 Haury was used in the drilling of other wells on

this lease. On April 5, 1929, the well was deepened and yielded a small amount of 29-degree Bé. oil from the upper part of the "Mississippi lime" at 3,005 feet. Deepening was continued and the well was drilled to a total depth of 3,554 feet in "Siliceous lime," but failed to find oil in the Simpson formation. Subsequently, it was plugged back to the "Mississippi lime" and from October 8 to November 2, 1928, produced 1,301 barrels of oil. Believing its gas production of more value, the well was finally plugged back to 2,968 feet (present total depth), and on January 15, 1930, again started actual gas production.

Four additional wells have been drilled, three in section 11 and one in section 14. Only one of these was productive, Shell Petroleum Corporation No. 1-B Haury, in the SW cor. NE¼ SW¼ of sec. 11, T. 23 S., R. 2 W. Completed in April, 1929, it continued to produce gas for the rest of the year.

The total recovery from these two wells is as follows:

	Gas production, cubic feet.	Oil production, barrels.
1928.		
Shell, No. 1 Haury	9,826,000	....
1929.		
Shell, No. 1 Haury	9,222,000	1,301
Shell, No. 1-B Haury	78,620,000	....
Totals	97,668,000	1,301

Sedgwick County.

The most important discovery of oil in central Kansas during the latter part of 1928 was in Sedgwick county. Prior to this time 35 tests had been drilled in the county. Of these, 9 tests stopped above the "Mississippi lime," 11 tests stopped in the "Mississippi lime," and 15 tests penetrated the Simpson formation, or below. None of the 35 wells were productive, although showings of oil and gas were reported from a number of them.

On August 21, 1928, the Bu-Vi-Bar, Continental and Gypsy Oil companies completed their No. 1 Wright, in sec. 12, T. 26 S., R. 1 W., for an initial production of 1,700 barrels of oil from the Simpson dolomite. This discovery led immediately to an active drilling campaign. Its success is evidenced by the fact that in 16 months (August 21, 1928, to December 31, 1929) four major oil fields and eight additional areas of production, each represented by a single producing well, were discovered. The total recovery of oil from the 167 producing wells in Sedgwick county has been 9,139,428 barrels, distributed as shown in Table 4.

TABLE 4.—*Cumulative production in Sedgwick county from August, 1928, to December 31, 1929.*

FIELD.	Location.	Date of discovery.	Production, barrels.	Number producing wells.	Per acre recovery, barrels.	Number acres producing.	Producing horizon.
Valley Center	T. 26 S., R. 1 W., T. 26 S., R. 1 E.	Aug. 21, 1928	7,407,443	111	8,230	900	Chiefly Simpson dolomite.
Goodrich	T. 25 S., R. 1 E.	Dec. 4, 1928	440,390	4	11,000	40	"Mississippi lime," Simpson dolomite.
Robbins	T. 28 S., R. 1 E.	Apr. 15, 1929	158,221	8	1,975	80	"Mississippi lime."
Greenwich	T. 26 S., R. 2 E.	Apr. 27, 1929	1,046,431	36	5,235	200	Simpson dolomite, "Mississippi lime."
Miscellaneous	.....	.....	86,943	8	.....	80	———
Total	.....	.....	9,139,428	167	.....	1,300	———

A record of the monthly production in Sedgwick county for the last 17 months (1928-1929) is shown in Table 5. It is significant that in 1929 Sedgwick county produced 21.8 per cent of all the oil recovered in Kansas for the year, and ranked second in production among counties. Were it not for the fact that production was prorated in the Valley Center and Greenwich fields, this county would have ranked first in production during 1929.

Oil in Sedgwick county is produced from six horizons. Following is the gross amount of oil recovered from each horizon, together with the number of wells producing from each:

Oil production in Sedgwick county by geologic horizons.

Producing horizon.	Gross production, in barrels, to Dec. 31, 1929.	Number wells producing Dec. 31, 1929.
Kansas City group (Pennsylvanian).....	2,347	1
"Wilcox" sand (Ordovician).....	3,000	1
"Basal" sand (Pennsylvanian).....	47,095	2
Misener sand (Mississippian).....	50,711	1
"Mississippi lime" (Mississippian).....	1,390,184	40
Simpson dolomite (Ordovician).....	7,645,091	122
Totals	9,139,428	167

It is of unusual interest to observe the amount of water produced with the oil in the three principal "Mississippi lime" fields in Sedgwick county.

Production of oil and water in "Mississippi lime" fields of Sedgwick county.

Field.	Gross production of oil from "Mississippi lime."	Gross production of water in addition to the oil.	Per cent water.
Greenwich field	769,460	945,665	123
Goodrich field	436,033	310,000*	70
Robbins field	158,221	7,965	5

* Approximate.

VALLEY CENTER FIELD. On August 21, 1928, the Bu-Vi-Bar, Continental and Gypsy Oil companies completed their Wright No. 1 in the SE cor. NE¼ SE¼ of sec. 12, T. 26 S., R. 1 W., for an initial production of 1,700 barrels of oil at a depth of 3,367 feet. This discovery led immediately to an active drilling campaign, the rapidity of which was increased by the discovery of oil on December 27, 1928, in a well drilled by the Aladdin Oil Company No. 1 Smyser, in the NE cor. SW¼ SE¼ of sec. 36, T. 25 S., R. 1 W., 1¾ miles north of the discovery well. Early in January, 1929, drilling activity was further increased through the discovery of oil in the Mary Jane Oil Company No. 1 Fitch, in the SW cor. NW¼ SE¼ SW¼ of sec. 6, T. 26 S., R. 1 E., and by the completion of Reynolds and

TABLE 5.—*Monthly production of oil from Sedgwick county for 1928-1929, in barrels.*

MONTHS.	Valley Center field.	Greenwich field.	Goodrich field.	Robbins field.	Plains Co. Curry No. 1 2-27S-1W.	Connell Pet. Cross No. 1 27-25S-1W.	Patton-Wentz Swanson No. 1 6-26S-1E.	Producers-Refiners Kuske No. 1 24-25S-1E.	Barnsdall Samuels No. 1 24-25S-1E.	Mars Oil Miller No. 1 2-26S-2E.	East-borough field.	Totals.
PRODUCTION FOR 1928.												
Producing wells....	5	0	1	0	0	0	0	0	0	0	0	6
August.....	18,559	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,559
September.....	50,516	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50,516
October.....	50,472	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50,472
November.....	54,168	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	54,168
December.....	128,618	.....	25,828	.....	.....	.....	.....	.....	.....	.....	.....	154,446
Annual totals....	302,333	.....	25,828	.....	.....	.....	.....	.....	.....	.....	.....	328,161
PRODUCTION FOR 1929.												
Producing wells....	111	36	4	8	1	1	1	1	1	1	2	167
January.....	166,720	.....	44,846	.....	.....	.....	.....	.....	.....	.....	.....	211,566
February.....	165,409	.....	26,205	.....	.....	.....	.....	.....	3,500	.....	.....	197,114
March.....	300,827	.....	26,366	.....	.....	.....	.....	.....	3,166	.....	.....	330,359
April.....	565,100	4,179	66,204	5,324	.....	.....	.....	.....	1,140	.....	.....	641,947
May.....	591,730	46,078	53,390	15,866	.....	383	.....	.....	620	.....	.....	708,067
June.....	1,065,380	73,702	15,733	18,461	.....	389	3,450	600	Plugged	.....	.....	1,177,715
July.....	971,636	97,827	34,443	18,885	.....	200	2,945	8,122	.....	.....	.....	1,134,058
August.....	908,892	152,116	36,638	24,312	.....	381	2,976	4,588	.....	1,701	.....	1,131,604
September.....	858,650	212,971	33,690	21,087	.....	187	2,400	4,290	.....	1,057	2,310	1,136,642
October.....	465,127	162,128	29,014	20,064	1,264	400	2,201	4,464	.....	874	2,387	687,923
November.....	484,430	145,117	23,319	16,512	4,965	206	2,310	4,440	.....	1,110	2,400	684,809
December.....	561,209	152,313	22,714	17,710	4,802	201	124	4,185	.....	1,192	5,013	769,463
Annual totals....	7,105,110	1,046,431	414,562	158,221	11,031	2,347	16,406	30,689	8,426	5,934	12,110	8,811,267
Grand totals...	7,407,443	1,046,431	440,390	158,221	11,031	2,347	16,406	30,689	8,426	5,934	12,110	9,139,428

Hays No. 1 Roll, in the SW cor. NW¼ NE¼ of sec. 7, T. 26 S., R. 1 E. These four wells resulted in a town-lot drilling campaign, and very shortly there were over 100 active operations in this field.

This producing area is called the Valley Center field. It is situated in sec. 36, T. 25 S., R. 1 W.; secs. 1 and 12, T. 26 S., R. 1 W.; and secs. 6 and 7, T. 26 S., R. 1 E. The field has a length of 2¼ miles north and south and a width of 14 locations (1¾ miles) east and west. At the present time it is limited only to the north by nine dry holes in the Valley Center town site, and to the southeast by one well in the NE cor. of sec. 18, T. 26 S., R. 1 W.

The discovery of this field resulted from core drilling by the Continental Oil Company. The field is located in a subsurface anticline known as the Bluff City anticline which extends from T. 35 S., R. 5 W., through sec. 9, T. 30 S., R. 2 W., to sec. 12, T. 26 S., R. 1 W., and thence northeastward. The amount of closure increases with depth. The nearest dry hole which had been drilled previous to the discovery well is 2½ miles to the southwest in the NE cor. NW¼ NE¼ of sec. 24, T. 26 S., R. 1 W., and stopped in the "Mississippi lime."

By the close of 1929 a total of 125 wells had been completed in the Valley Center field. The principal producing zone includes two dolomite pays in the upper part of the Simpson formation of Ordovician age, and called locally the "First and Second Simpson dolomites." An analysis of these 125 completions follows:

Producing horizon of wells in the Valley Center field.

Number of wells producing from "Second Simpson dolomite"	97
Number of wells producing from "First Simpson dolomite"	13
Number of wells producing from Misener sand (Mississippian)	1
Number of dry holes	14
Totals	125

The average depth to the "Second Simpson dolomite" is 3,375 feet. In those wells which have been completed in the "First Simpson dolomite" the amount of penetration varies from 2 to 13 feet and averages 8 feet. For the "Second Simpson dolomite" the amount of penetration varies from 2 to 15 feet and averages 7 feet.

Six tests in the Valley Center field have been deepened to the "Siliceous lime." Five of these penetrated this formation for a distance varying from 12 to 120 feet. One test, however, the Cosden Oil Company No. 1 DeWees, in sec. 1, T. 26 S., R. 1 W., was abandoned early in January, 1930, at a depth of 4,006 feet, 540 feet below the top of the "Siliceous lime."

The stratigraphic information derived from these deep tests, together with data from the producing wells, permits the following table which shows the average thicknesses of the stratigraphic units encountered in the Valley Center field below the Pennsylvanian:

Average thickness of stratigraphic units in the Valley Center field.

Mississippian:		
"Mississippi lime"		245 feet
Chattanooga shale		85 feet
Misener sand *		7 feet
Ordovician:		
Simpson formation [6]		145 feet
"First Simpson dolomite" †	15 feet	
Gray shale	20 feet	
"Second Simpson dolomite"	50 feet	
Upper dolomite zone ‡	22 feet	
Sand zone	10 feet	
Lower dolomite zone	20 feet	
"Wilcox" sand and green shale	60 feet	
Siliceous lime		540 feet plus

* Number producing wells, 1. † Number producing wells, 13. ‡ Number producing wells, 97.

An unconformity exists at the base of the Chattanooga shale which permits it to rest on Misener sand, the "First Simpson dolomite," the Simpson gray-shale zone, or the "Second Simpson dolomite." In the majority of cases Chattanooga shale is in contact with the Simpson gray-shale zone or the "Second Simpson dolomite."

At the close of 1929 the Valley Center field had produced 7,407,443 barrels of oil from 111 wells. Its production was prorated in October, 1929, with a result that its yield was reduced by some 10,000 barrels per day. The amount of oil produced by the 110 Simpson-dolomite wells has been 7,356,732 barrels, and from the one Misener-sand well, 50,711 barrels. The recovery thus far has been 8,230 barrels to the acre. During December, 1929, the daily average prorated production was 180 barrels per well.

GREENWICH FIELD. The Greenwich field is the second most important oil pool in Sedgwick county. It was discovered on April 27, 1929, by the Shell Petroleum Corporation at their No. 1 Lygrisse, located in the SE cor. NE¼ of sec. 15, T. 26 S., R. 2 E., and was completed for an initial production of 2,118 barrels from 3,164 to 3,170 feet. Its producing horizon is a dolomite in the top of the

6. Subsequent study of samples from the Valley Center field suggests that all of the 145 feet of sediments here referred to the Simpson formation may not be of Simpson age. The following changes are indicated by this study. The "First Simpson dolomite" is of Misener (Mississippian) age. The underlying gray shale is equivalent to the Maquoketa shale but may be locally reworked, in which case it would be classified as Misener. If this new classification is accepted, and evidence is accumulating to indicate that it should be accepted, then the production from the "First Simpson dolomite" will of necessity be regarded as Misener production. The age of the producing horizons will be discussed in a forthcoming paper on the Valley Center field, by Roy H. Hall and Arthur S. Price.

Simpson formation. The discovery well made no water until June 23, 1929. Thereafter it made 5 barrels of water per day until October 13. Between then and the end of 1929 no water has appeared with the oil.

Additional interest in this field developed on June 22, 1929, when production was encountered in the top of the "Mississippi lime" by the Shell Petroleum Corporation No. 1 Community, situated in lot 17, block 7 of the Greenwich town site, in the SE¼ SW¼ of sec. 15, T. 26 S., R. 2 E. This well had an initial production of 1,555 barrels of 43° Bé. oil from 2,922 to 2,924 feet. At the close of the year 11 wells were producing from the Simpson formation and 27 wells from the "Mississippi lime."

The Greenwich field is located principally in secs. 14 and 15, T. 26 S., R. 2 E. However, there is one producing well in the SE cor. of sec. 10, one in the SW cor. of sec. 11, and one in the N½ NE¼ of sec. 22, all in T. 26 S., R. 2 E. The wells producing from the Simpson formation are located, chiefly, along the west line of section 14 and the east line of section 15. The "Mississippi lime" wells are situated in and around the Greenwich town site, in the S½ of sec. 15, and around the common corner of sections 10, 11, 14 and 15. The Greenwich town site, with an area of 40 acres, has 15 "Mississippi lime" wells, one Simpson well, and five dry holes.

The number of tests completed in the Greenwich field totals 53. Of this number 27 wells are producing from the "Mississippi lime," 11 wells are producing from the Simpson formation, 3 wells have been abandoned in the "Mississippi lime," 11 wells have been abandoned in the Simpson formation or below, and 1 well was abandoned above the "Mississippi lime." The average depth to the top of the "Mississippi lime" is 2,908 feet, and to the top of the Simpson dolomite, 3,210 feet. The average thickness of the "Mississippi lime" is 242 feet.

The most interesting factor relative to the Greenwich field is that it has produced 1,046,431 barrels of oil and 1,014,993 barrels of water, or only 31,438 barrels more of oil than water. The "Mississippi lime" wells produce 123 per cent more barrels of water than oil. In the Simpson wells the yield of water is 25 per cent in addition to the oil produced. Because of this interesting relationship of oil to water, Table 6 is inserted, showing the monthly production of oil and water from each of the two producing horizons:

TABLE 6.—*Monthly production of oil and water in the Greenwich field, 1929, in barrels.*

	Simpson oil.*	"Mississippi lime" oil.	Total oil.	Simpson water.	"Mississippi lime" water.	Total water.
April	4,179	None	4,179	None	.....	.....
May	46,078	None	46,078	None	.....	.....
June	69,749	3,953	73,702	85	.....	85
July	28,586	69,241	97,827	400	4,382	4,782
August	21,458	130,658	152,116	6,548	31,679	38,227
September	21,341	191,630	212,971	10,296	174,180	184,476
October	26,807	135,321	162,128	15,074	205,263	220,337
November	23,648	121,469	145,117	17,360	228,167	245,527
December	35,125	117,188	152,313	19,565	301,994	321,559
Totals	276,971	769,460	1,046,431	69,328	945,665	1,014,993

* Includes Borg No. 2, producing from "Wilcox" sand.

One of the wells of greatest interest in this field is the Shell Petroleum Corporation No. 2 Borg, in the NW cor. SW¼ SW¼ of sec. 14, T. 26 S., R. 2 E., completed in December, 1929. This well penetrated Simpson dolomite from 3,229 to 3,280 feet, in which a hole full of water was encountered. At 3,280 feet it reached the "Wilcox" sand series and had another hole full of water in the top of this horizon. Commercial production was found from 3,350 to 3,354 feet in "Wilcox" sand, 121 feet below the top of the Simpson formation, 70 feet below the top of the "Wilcox" sand series, and about 50 feet above the top of the "Siliceous lime." A quarter-mile offset to the east, No. 1 Borg, was then deepened to this horizon, and failing to find production continued drilling and penetrated the "Siliceous lime" at 3,361 feet. No. 2 Borg is the only well in Sedgwick county producing from the "Wilcox" sand, and to the writer's knowledge is the only well in Kansas that produces from a horizon as far below the top of the "Wilcox." During December, 1929, it produced 3,000 barrels of oil and no water.

The average gravity of the oil produced both from the "Mississippi lime" and the Simpson formation is 42° Bé. The initial production of the Simpson wells varies from 198 to 2,118 barrels and averages 500 barrels. For the "Mississippi-lime" wells the initial production varies from 60 to 2,142 barrels and averages 400 barrels.

To December 31, 1929, the per-acre recovery from the wells producing from the "Mississippi lime" has been 8,550 barrels, as compared with 2,520 barrels of oil to the acre for those wells producing from the Simpson formation. The average recovery for the entire

field has been 5,235 barrels of oil per acre. During December, 1929, the average daily production for the entire field was 140 barrels per well. The production from the Simpson wells is prorated.

The limits of the Greenwich field are but partially and unsatisfactorily defined. One well a quarter of a mile east of production, two wells a mile northwest of production, one well a mile south of production, and four wells offsetting production in the Greenwich townsite, have all been drilled with unsuccessful results into the Simpson formation or below. The field has a considerable potential acreage.

Goodrich Field. The second field to be discovered in Sedgwick county, and the third in importance, is the Goodrich field, located in sec. 16, T. 25 S., R. 1 E. The discovery well, the Continental Oil Company No. 1 Goodrich, in the SW cor. NE¼ SW¼ of sec. 16, T. 25 S., R. 1 E., was brought in on December 4, 1928, for an initial production of 4,139 barrels of 42.5° Bé. oil from 3,014 to 3,024 feet. Production at this depth was wholly unexpected and no preparations had been made to take care of the oil. The well flowed wild for some time before it was successfully shut in. When the well was opened up it yielded approximately 1,500 barrels of oil per day during its first month of production. According to the Continental Oil Company, the most authentic samples of the producing horizon were composed almost wholly of chert, and the age of the production was variously considered to range from Pennsylvania Burgess sand to Ordovician "Siliceous lime." However, the completion of its offsets has established definitely that the production is from the top of the "Mississippi lime."

Two additional "Mississippi lime" wells have been completed. No. 2 Goodrich, the north offset to the discovery well, had an initial production of 420 barrels, and No. 1 Black, the north offset of No. 2 Goodrich, had an initial production of 230 barrels. These three wells together have produced 436,033 barrels of oil.

The south offset of the discovery well, No. 1 Westerfield, in the NW cor. SE¼ SW¼ of sec. 16, T. 25 S., R. 1 E., failed to obtain production in the "Mississippi lime" and was deepened to the "Siliceous lime" and completed at a total depth of 3,511 feet. The top of the Simpson formation was reached at 3,326 feet. After completion the well was plugged back to 3,331-3,332 feet and had an initial production of 125 barrels of 39° Bé. oil from a dolomite in the

top of the Simpson formation.[7] Completed in April, 1929, it produced 1,865 barrels that month, dropped to 107 barrels for the month of May, and during December, 1929, yielded 506 barrels of oil. Its gross production has been 4,357 barrels of oil and approximately 48,800 barrels of water in nine months.

The recovery per acre for the Goodrich field has been 11,000 barrels. During December, 1929, its daily average production per well was 190 barrels of oil. So far it is limited only to the southeast by a dry hole in the NW cor. SW¼ NE¼ of sec. 21, T. 25 S., R. 1 E., which penetrated into the Simpson formation.

ROBBINS FIELD. The Robbins field is situated in secs. 20 and 21, T. 28 S., R. 1 E. It was discovered on April 15, 1929, by Shell Petroleum Corporation No. 1 Robbins, in the NW cor. SW¼ of sec. 21, T. 28 S., R. 1 E., and completed for an initial production of 218 barrels of 41° Bé. oil from 3,092 to 3,102 feet. This well reached a peak production of 775 barrels on May 11, 1929, and produced no water until June 23. At the present time the field has 8 producing wells and 2 dry holes. It has a length of 4 locations north and south, and 2 locations east and west.

The producing horizon is the top of the "Mississippi lime," found an average depth of 3,090 feet. One well in the field has been deepened to the Ordovician and was abandoned at 3,542 feet in "Wilcox" sand with a hole full of water. The field is limited on the immediate west by one well, and on the south by two wells; all unsuccessful in an attempt to extend production in those directions. A well one-half mile to the east has been abandoned in the Simpson at 3,540 feet.

A point of unusual interest is the small amount of water (5 per cent) produced with the oil, in contrast to the reverse condition in the Greenwich field. The present recovery per acre has been 1,975 barrels. During December, 1929, the field had an average daily production per well of 75 barrels of oil.

Miscellaneous Tests. Eight producing wells have been completed in Sedgwick county at localities isolated from the major producing areas. A record of the important facts relative to them has been summarized in Table 7.

In addition to the two wells in sec. 24, T. 25 S., R. 1 E., shown on Table 7, two other tests have been drilled in this same section. Producers and Refiners Corporation completed their No. 2 Kuske in the

7. Subsequent study has demonstrated that the producing horizon of No. 1 Westerfield is equivalent to the "First Simpson dolomite" pay of the Valley Center field, and is therefore of Misener age. (See Footnote 6.)

NE cor. NW¼ NE¼ of sec. 24, T. 25 S., R. 1 E., at a total depth of 3,053 feet with only a show of oil. It missed the producing horizon of its west offset, No. 1 Kuske. The second test, Barnsdall Oil Corporation No. 1 Kuske, in the NE cor. SE¼ of sec. 24, T. 25 S., R. 1 E., was also a failure. After encountering a hole full of water in the Producers and Refiners Corporation No. 1 Kuske horizon it penetrated the top of the "Mississippi lime" at 3,068 feet. Subsequently, it was deepened into the "Siliceous lime" and abandoned at 3,708 feet.

Another interesting failure was Barnsdall Oil Corporation No. 1 Rapp, in sec. 22, T. 26 S., R. 2 E. This test produced 1,353 barrels of oil and 615 barrels of water from the top of the "Mississippi lime" between August 1 and September 6, 1929. It was deepened to the Ordovician and abandoned at a total depth of 3,295 feet.

Sumner County.[8]

General Statement. The first commercial gas production in Sumner county was discovered on June 1, 1915, through the completion of the Empire Gas and Fuel Company No. 1 Horton, located in the center of the NE¼ NW¼ of sec. 15, T. 35 S., R. 2 E., in the North Vernon field. This well, producing from a sand lens in the Severy shale of the Shawnee group, was abandoned September 24, 1921.

The first commercial oil production was discovered on May 14, 1925, when Prairie Oil and Gas Company completed their No. 1 Thiessen, situated in the SW cor. SE¼ SE¼ of sec. 22, T. 34 S., R. 2 E., in the Padgett oil and gas field. Production was encountered in the "Mississippi lime" and the well is still producing oil.

Thirteen oil and gas fields have been developed in Sumner county; 8 in ranges east, and 5 in ranges west. For the names and locations of these fields see Table 8.

A total of 258 producing wells have been completed, of which number 234 are oil wells and 24 are gas wells. On December 31, 1929, there were 204 producing oil wells and 10 producing gas wells, making a total of 234 active producers.

Between June 1, 1915, and December 31, 1929, Sumner county produced 10,252,548,000 cubic feet of gas and 20,415,651 barrels of

8. Unusual care has been taken to procure a complete record of all of the oil and gas produced in Sumner county since the completion of its first commercial well. This attempt has been successful, except for the North Vernon field, and the following statements and production figures on Sumner county may be considered to be as accurate and complete as can be compiled.

TABLE 7.—*Miscellaneous producing wells completed in Sedgwick county during 1929.*

NAME.	Location.	Total depth, feet.	Top "Mississippi lime."	Depth of producing horizon, feet.	Production, barrels.	Gravity degrees, Baume.	Producing horizon.	Cumulative production, 1929, bbls.
Connell Petr. Co., No. 1 Cross	27-25S-1W	3,650	3,190	2,690-2,730	20	35	Middle Kansas City group (Penn.),	2,347
Producers & Refiners, No. 1 Kuske	24-25S-1E	3,017	Not reached	3,013-3,017	1,800	43	"Basal" sand (Pennsylvanian)	30,689
Barnsdall Oil Co., No. 1 Samuels[1]	24-25S-1E	3,662	3,064	3,064-3,067	140	40	"Mississippi lime"	8,426*
Mars Oil Company, No. 1 Miller[2]	2-26S-2E	2,894	2,857	2,893-2,894	460	45	"Mississippi lime"	5,934
Patton and Wentz, No. 1 Swanson	6-26S-2E	3,010	Not reached	3,001-3,010	197	38	"Basal" sand (Pennsylvanian)	16,406
Plains Oil Company, No. 1 Curry	2-27S-1W	3,401	3,078	3,389-3,391	170	41	Simpson dolomite (Ordovician)	11,031
Fisher and Laucke, No. 1 Trustee	19-27S-2E	2,938	2,927	2,937-2,938	122	44	"Mississippi lime"	2,033
E. W. Marland Co., Inc., No. 1 Mackey	30-27S-2E	2,970	2,955	2,958-2,970	67	41	"Mississippi lime"	8,957

1. Plugged and abandoned in June, 1929.
2. Produced 5,934 barrels of oil and 74,353 barrels of water from August to December, 1929.
* Abandoned.

oil. During 1929 the production of gas was 1,618,324,000 cubic feet, and oil 4,488,027 barrels. Cumulative production of gas and oil for each field will be found in Table 8.

The annual production of oil and gas has been as follows:

Production of oil and gas in Sumner county, by years.

Year.	Oil production, barrels.	Gas production, cubic feet.
1915	.....	200,000,000
1916	.....	400,000,000
1917	.....	400,000,000
1918	.....	280,000,000
1919	.....	200,000,000
1920	.....	357,571,000
1921	.....	101,099,000
1922	.....	19,146,000
1923	.....	None
1924	.....	None
1925	40,264	485,026,000
1926	1,307,409	2,094,530,000
1927	6,481,288	1,883,128,000
1928	8,098,663	2,070,447,000
1929	4,488,027	1,761,601,000
Total	20,415,651	10,252,548,000

The oil and gas is recovered from 12 producing horizons, of which 9 occur in the Pennsylvanian, 1 in the Mississippian, and 2 in the Ordovician. Most of the oil has been obtained from the Stalnaker sand, Pennsylvanian, which has produced 18,517,368 barrels, or 90 per cent of the oil recovered. The "Mississippi lime" is the largest gas-producing horizon. Gas statistics reveal that 60 per cent of the gas (6,224,050,000 cubic feet) has been produced from the "Mississippi lime," and that 2,468,782,000 cubic feet, or 24 per cent, has been recovered from the Severy shale (Pennsylvanian).

A complete record of the producing horizons in Sumner county, together with the amount of oil and gas produced from each horizon, is given in Table 9.

North Vernon Field. The first commercial production to be found in Sumner county dates back to June 1, 1915. On that date Empire Gas and Fuel Company completed their No. 1 Horton in the center NE¼ NW¼ of sec. 15, T. 35 S., R. 2 E., at a total depth of 1,508 feet, with an initial open flow of 5 million cubic feet of gas and a rock pressure of 500 pounds. This gas production was found in a sand lens in the Severy shale of the Shawnee group. Partial incentive for the drilling of this test was furnished through the previous completion of B. B. Jones No. 1 Stalnaker, in the NW cor. SE¼ of sec. 11, T. 35 S., R. 2 E., on April 20, 1914, at a total depth of 2,397

Name of Field.	Location.	Date of discovery.	
North Vernon	S. 15, 16, 17; T. 35S; R. 2E	Jun. 1, 1915	
Padgett	S. 14, 22, 23, 26, 27, 34, 35; T. 34S; R. 2E.. S. 3; T. 35S; R. 3E.	Oct. 6, 1924	
West Extension, Rainbow Bend	S. 24, 25; T. 33S; R. 2E..... S. 19; T. 33S; R. 3E.	Apr. 19, 1925	
Miller	S. 17; T. 32S; R. 2E	Jun. 10, 1926	
Rutter	S. 21; T. 33S; R. 2E	Jun. 19, 1926	
Churchill	S. 24, 25, 26, 36; T. 31S; R. 2E.... S. 19; T. 31S; R. 3E.	Jun. 23, 1926	
Hunnewell	S. 8, 17, 18; T. 35S; R. 1E	Apr. 3, 1927	...
Oxford	S. 11, 14, 22, 23; T. 32S; R. 2E	May 10, 1927	
Love & Latta	S. 9; T. 30S; R. 2W	Jun. 6, 1927	
Douglas	S. 23; T. 34S; R. 2W	Jul. 28, 1927	
Anson	S. 25, 26, 35; T. 30S; R. 2W	Apr., 1928	....
Caldwell	S. 16; T. 35S; R. 3W	Apr. 10, 1929	
Wellington	S. 33; T. 31S; R. 1W	Dec. 4, 1929	
Totals			23

1. Producing at present only from the "Mississippi lime." Date of last Severy shale production could not be obtained.
2. Date of last "Siliceous lime" production, January, 1929.
3. Date of last gas production, October 31, 1928.
4. Date of last Emporia "lime" production, February 3, 1928.
5. Date of last Topeka "lime" gas production, May 7, 1928.
6. Cumulative production does not include the oil produced from an offset well, across the state

TAB

	Group or formation.	Prod
	Wabaunsee.	Enpor
	Shawnee.	Howar
		Severy
		Topeka

feet. Its chief gas pay was encountered in a sandstone from 2,380 to 2,397 feet, with an estimated yield of 7 million cubic feet. Historical interest is attached to this test, since it was from this well that the now prolific oil-bearing Stalnaker sand was named. As far as can be ascertained, No. 1 Stalnaker never produced gas commercially.

Subsequent to the completion of No. 1 Horton, the Empire drilled two additional gas wells and one dry hole on its lease. The gas rights on their No. 1 and 2 Horton were sold to the Jones-Buell Company, who produced from this property until February 10, 1918, when the production was taken over by the Empire. All of the production on the Horton lease comes from the Severy shale. The dates of completion and abandonment of the wells on this lease follow:

The Empire-Horton lease, T. 35 S., R. 2 E.

Name.	Location.	Completed.	Last production.	Abandoned.
No. 1 Horton	C. NE, NW, sec. 15	6- 1-15	7-21	9-24-21
No. 2 Horton	NW cor. SE, NE, NW, sec. 15	8-12-15	4-18	4-23-18
No. 3 Horton	C. EL W½ SE, NW, sec. 15	1-21-20	10-31-22	3-21-23
No. 4 Horton	C. WL E½ SE, NW, sec. 15	5-15-23	None	5-15-23

Production in this immediate area has been confined to sec. 15, the SW¼ of sec 16, and the SE cor. of sec. 17, all in T. 35 S., R. 2 E. The producing area lies two miles south of the southern end of the Padgett oil and gas field, and is situated practically on the Kansas-Oklahoma state line. The field has never been referred to by any special name. Since the producing properties in this field are practically continuous with the Vernon field in Kay county, Oklahoma, immediately across the state line, it is suggested that the production on the Kansas side be referred to as the North Vernon field.

The second important lease in the North Vernon field is situated in the E½ of sec. 15. Here Winn and Perkins completed their first gas well in the center of the SW¼ NE¼ of sec. 15, in February, 1919, and their second well in the center N½ NW¼ NE¼ of sec. 15, in April, 1919. An outlet for this gas was not provided until some time in 1927, when Herman Boxer took over this property and completed a third well in the center of the NW¼ SE¼ NE¼ of sec. 15, in July, 1928. The Larutan Gas and Fuel Company purchased a part of the gas from these wells between September, 1927, and October 8, 1929. Boxer also held a franchise to supply the town of Geuda Springs (sec. 12, T. 34 S., R. 2 E.) and furnished gas to this

town for three years, to the extent of some 28 million cubic feet annually. The town is now supplied by the Home Natural Gas Company, of Winfield. Another project started by Boxer was to supply gas to the Chillocco Indian School in Kay county, Oklahoma, but gas was never run through this line. The last gas taken from the Boxer properties was on October 8, 1929. All of the wells produced from the Severy shale.

During 1927-1929, Fred Morgan, of Oklahoma City, exploited the SW¼ of sec. 16, T. 35 S., R. 2 E. His No. 1 White, in the NE cor. SW¼ sec. 16, was completed in May, 1927, as a dry hole in the "Wilcox" sand at 3,581 feet. No. 2 White, in the SW cor. SE¼ SW¼ of sec. 16, was completed in May, 1928, as a dry hole in the Stalnaker sand at 2,370 feet. More successful was No. 3 White, in the SE cor. SW¼ of sec. 16, which was completed in April, 1929, as a 6 million-cubic-foot gas well in the "Mississippi lime" at a total depth of 3,372 feet. In September, 1928, Morgan brought in his No. 1 Meyers, in the SW cor. sec. 16, for a 7½ million-cubic-foot gas well in the "Mississippi lime" at 3,385 feet.

As a result of this discovery Tidal Oil Company drilled a west offset, No. 1 Horton, in the SE cor. of sec. 17, T. 35 S., R. 2 E. On November 11, 1928, it reached the top of the Stalnaker sand at 2,217 feet, and encountered an oil showing estimated at 75 barrels per day in this sand between 2,331 and 2,336 feet. This showing was tested and oil was run from December 1, 1928, to February 5, 1929, during which time it produced 821 barrels of oil. After the oil was exhausted the test was deepened to the "Mississippi lime," which was topped at 3,281 feet. The first gas was found at 3,295 feet and the well was deepened to a total depth of 3,377 feet, with an initial production of 4,150,000 cubic feet of gas, on February 14, 1929.

Summarizing the discontinuous and rather erratic exploitation of the North Vernon field, we obtain the following:

Development of the North Vernon Field.

Probable number of tests drilled	16
Probable number of producing gas wells	9
Probable number of dry holes	7
Number of producing gas wells, 12/31/29	3
Date of last gas production from Horton lease	October 31, 1922
Date of last gas production from Boxer lease	October 8, 1929

One oil well produced from December 1, 1928, to February 5, 1929, and was subsequently deepened to produce gas.

The producing horizons in this field have been the Severy shale, Stalnaker sand, and "Mississippi lime," of which the last is the only producing zone at the present time. Production from the individual wells has been as follows:

Production of individual wells in the North Vernon field.

Name.	Location T. 35 S., R. 2 E.	Producing horizon.	Production.
Nos. 1, 2 and 3, Horton	Sec. 15.	Severy shale	Gas.
Nos. 1, 2 and 3, "Boxer"	Sec. 15.	Severy shale	Gas.
No. 3 White	Sec. 16.	"Mississippi lime"	Gas.
No. 1 Meyers	Sec. 16.	"Mississippi lime"	Gas.
No. 1 Horton	Sec. 17.	Stalnaker sand	Oil.*
No. 1 Horton	Sec. 17.	"Mississippi lime"	Gas.

* Exhausted.

Production statistics for the North Vernon field are essentially unsatisfactory, since much of the gross yield must be estimated.

J. Garfield Buell states that no production records were kept on the Empire-Horton lease during the period the Jones-Buell Company took the gas (June 1, 1915, to February 10, 1918). Even the Empire Company has no record of how much gas it produced from February 10, 1918, to January 1, 1920. Therefore, the amount of gas produced prior to 1920 has been approximated from recovery per acre figures furnished by the Empire.

The production figures of the Larutan are complete for the Boxer lease. The amount of gas Boxer sold Geuda Springs for three years is placed at 28 million cubic feet annually, which was the estimate in recent court proceedings.

The production record of the two gas wells in section 16, owned by Fred Morgan, must be estimated through comparison with the Tidal offset, since Morgan has persistently refused all information relative to his wells.

The actual and estimated gas production is summarized as follows:

Gas production of the North Vernon field, by leases.

		Cu. ft.
Horton lease (Sec. 15)	Estimated 6-1-15 to 1-1-20	1,480,000,000
	Actual 1-1-20 to 10-31-22	477,816,000
Boxer lease (Sec. 15)	Estimated	84,000,000
	Actual 9-27 to 10-8-29	426,966,000
Tidal production (Sec. 17)	Actual 2-14-29 to 12-31-29	208,991,000
Morgan production (Sec. 16)	Estimated 9-28 to 12-31-29	600,000,000
Total		3,277,773,000
Total estimated		2,164,000,000
Total actual		1,113,773,000

The amount of gas produced from the Severy shale has been 2,468,782,000 cubic feet, and from the "Mississippi lime" 808,991,000 cubic feet. The only oil production has been from one Stalnaker-sand well, for 2 months, amounting to 821 barrels.

A record of the annual production of gas from the North Vernon field follows:

Gas production of the North Vernon field, by years.

	Cu. ft.		Cu. ft.
1915	200,000,000	1924	None
1916	400,000,000	1925	None
1917	400,000,000	1926	None
1918	280,000,000	1927	153,689,000
1919	200,000,000	1928	289,000,000
1920	357,571,000	1929	877,268,000
1921	101,099,000		
1922	19,146,000	Total production	3,277,773,000
1923	None		

Padgett Oil and Gas Field. For a period of five years gas and oil have been recovered from a field in southeastern Sumner county, situated 3 miles southwest of Geuda Springs and known locally as the Padgett field. Discontinuous production is encountered in an area four miles long and one mile wide. To the end of 1929 the gross yield of oil has been 467,531 barrels, and of gas 5,415,059,000 cubic feet. The field consists of about 340 acres of proven gas and oil production.

Production of either gas or oil has been found in the following sections: 14, 22, 23, 26, 27, 34 and 35, T. 34 S., R. 2 E., and in sec. 3, T. 35 S., R. 2 E.

Attention was first directed to this area by the discovery of gas. On October 6, 1924, the Continental Oil Company completed their No. 1 Padgett in the NW cor. SW¼ sec. 23, T. 34 S., R. 2 E., at a total depth of 3,455 feet in the "Mississippi lime." Its initial production was 40 million cubic feet of gas at 1,200 pounds rock pressure. Gas was first run from this test on April 29, 1925, and thereafter it has been continuously produced.

Credit for the discovery of oil belongs also to Continental Oil Company through the completion of their No. 1 Thiessen on May 14, 1925. This test, situated in the SW cor. SE¼ SE¼ sec. 22, T. 34 S., R. 2 E., found production in the "Mississippi lime" from 3,491 to 3,497 feet and had an initial production of 315 barrels of oil. Subsequently it was deepened, unsuccessfully, to the "Wilcox" sand and plugged back to produce from the "Mississippi lime." Plugging was completed on September 18, 1925.

For a "chat" producer this discovery well has had a remarkable producing history. Between May, 1925, and December, 1929, it has yielded 84,073 barrels of oil. Its annual production record follows:

Production of Continental Oil Co., No. 1 Thiessen, by years.

	Barrels.
1925	9,943
1926	19,738
1927	22,590
1928	17,863
1929	13,939
Total	84,073

Peak production occurred from March to August, 1927. During no month (excepting in July and August, 1925, when it was deepened to the "Wilcox" sand) has its production fallen below 1,000 barrels a month.

On May 17, 1925, three days after the completion of No. 1 Thiessen, the Prairie Oil and Gas Company brought in their No. 1 McCutcheon. This test is located in the SE cor. NW¼ sec. 34, T. 34 S., R. 2 E., 1½ miles southwest of No. 1 Thiessen. Its production, likewise from the "Mississippi lime," has declined characteristically and its gross yield to December, 1929, has been 44,941 barrels.

Total completions in the Padgett field number 33. Of these 18 have produced oil, 4 are gas wells, and 11 tests have been dry. One oil well and one gas well have been plugged, so that at present there are but 20 producing wells. Exploitation has been slow, but persistent as illustrated below:

Number of completions in Padgett field, 1913 to 1929, by years.

Year.	Oil wells.	Gas wells.	Dry holes.	Totals.
1913	0	0	1	1
1918	0	0	1	1
1924	0	1	1	2
1925	3	2	2	7
1926	1	0	4	5
1927	0	0	0	0
1928	6	1	1	8
1929	8	0	1	9
Totals	18	4	11	33

The oil in the Padgett field has been derived from 16 "Mississippi-lime" wells producing from an average depth of 3,460 feet, and from 2 "Wilcox" sand wells which produce from a depth of 3,785 feet. All of the gas occurs in the "Mississippi lime"[9] at an average depth of 3,425 feet. Ten tests have been drilled into the Simpson formation, or below, of which number eight were unsuccessful.

The discovery of oil by a well drilled in the Ordovician "Wilcox" sand, in July, 1927, added a new producing horizon to the Padgett

9. During 1930 four gas wells were completed which produce from the Pennsylvanian.

field, with a possibility of greater recovery. Thus far, however, the results have been disappointing. This test, Harris and Haun No. 1 Hendrix, located in the center SW¼ SE¼ sec. 14, T. 34 S., R. 2 E., had an initial production of 130 barrels of oil. It was not produced, however, until August, 1928. A second "Wilcox" sand test, Harris and Haun No. 1 Warner, in the center NW¼ NE¼ sec. 23, T. 34 S., R. 2 E. (an offset one-half mile to the south), was completed in June, 1928. After an unprofitable trial of five months, it was plugged on October 25, 1928. These are the only "Wilcox" sand producers in the Padgett field. A record of their production follows:

"Wilcox" sand production in Padgett field.

	1928.	1929.	Totals.
Harris and Haun, No. 1 Hendrix	8,060	15,351	23,411
Harris and Haun, No. 1 Warner	2,959	.....	2,959
Totals	11,019	15,351	26,370

Between May, 1925, and December, 1929, the recovery of oil from the Padgett field has been 467,531 barrels. Of this amount, 441,161 barrels of oil have been produced from the "Mississippi lime." The amount of oil produced annually is shown in Table 9a:

TABLE 9A—*Monthly production Padgett oil and gas field, Sumner county, Kansas, in barrels.*

MONTH.	1925.	1926.	1927.	1928.	1929.
January	.....	3,634	4,474	4,355	10,144
February	.....	3,078	3,766	4,175	10,581
March	.....	3,279	5,027	4,534	13,101
April	.....	3,311	5,146	8,430	15,978
May	1,332	3,481	4,139	5,305	16,387
June	2,265	4,161	5,969	7,117	37,224
July	1,257	4,859	5,549	7,595	31,169
August	1,245	5,188	5,106	9,432	24,075
September	3,727	5,624	4,500	9,722	22,100
October	4,075	5,111	4,583	10,621	23,824
November	3,465	5,077	4,182	8,729	22,690
December	3,322	4,854	4,483	8,467	22,507
Totals	20,688	51,657	56,924	88,482	249,780
Grand total..... 467,531	.....	.....	.....	.....	.....

The producing wells have a range in gravity of 34° to 41° Bé. The average gravity is 38° Bé. Their initial production varies from 15 to 1,540 barrels of oil and averages 125 barrels. But four wells have recorded an initial production as great as from 200 to 600 barrels.

The only phenomenal test in the Padgett field has been Prairie Oil and Gas Company No. 4 Olson, located in the NW cor. NE¼ NW¼ sec. 3, T. 35 S., R. 2 E. This well, completed on June 3, 1929, had an initial production of 1,540 barrels of 40° Bé. oil and 500 barrels of water. It produced in excess of 15,000 barrels during the first month and declined rapidly thereafter.

The 16 wells producing from the "Mississippi lime" show a recovery of 2,755 barrels per acre to the end of December, 1929.

The four "Mississippi lime" gas wells have yielded a considerable volume of gas. Two of these wells were completed for an initial production of 40 million cubic feet, a third for 9 million and the fourth for 4 million. Their rock pressure is 1,200 pounds. The gross annual gas production appears in Table 10.

TABLE 10.—*Annual cubic feet of gas produced from the Padgett field.*

YEARS.	Continental Padgett No. 1 23-34S-2E.	Gypsy Mircau No. 1 23-34S-2E.	Continental Warner No. 1 23-34S-2E.	Harris & Haun Temsk No. 1 14-34S-2E.	Totals.
1925.....	268,328,000	216,698,000	.....	.....	485,026,000
1926.....	1,381,030,000	507,840,000	205,660,000	.....	2,094,530,000
1927.....	525,804,000	561,198,000	141,107,000	.....	1,228,109,000
1928.....	453,465,000	312,699,000	a55,984,000	206,652,000	1,028,800,000
1929.....	407,152,000	146,035,000	.....	25,407,000	578,594,000
Totals.....	3,035,779,000	1,744,470,000	402,751,000	232,059,000	5,415,950,000

a. Plugged October 22, 1928.

WEST EXTENSION, RAINBOW BEND FIELD. In April, 1925, the Rainbow Bend field was extended one mile westward. This new producing area straddles the Sumner-Cowley county line. Although the discovery well was drilled in Cowley county, one-quarter mile east of the county line, it is included in this paper with the Sumner county fields. The producing wells are separated from the Rainbow Bend field by a nonproductive syncline, and are situated upon a well-defined and separate area of subsurface folding. The field is one mile long and three-quarters of a mile wide. It differs from Rainbow Bend in that production is derived from "Siliceous lime" as well as from Burbank sand.

The discovery well, Continental Oil Company No. 1 E. A. Heskett, in the SE cor. NW¼ sec. 19, T. 33 S., R. 3 E., was completed on April 19, 1925, at a total depth of 3,207 feet. An initial production of 75 barrels of 38° Bé. oil was obtained from a sand extending

from 3,185 to 3,207 feet. The first well actually to produce from the Sumner county portion of this field was completed on December 24, 1925. This test, Phillips Petroleum Company No. 1 Holt, located in the NE cor. SE¼ sec. 24, T. 33 S., R. 2 E., extended production half a mile to the west and had an initial production of 185 barrels of 40° Bé. oil from 3,197 to 3,219 feet.

The producing sand in the discovery well occupies a stratigraphic position at the base of the Pennsylvanian, and at this locality is basal Cherokee in age. It is in contact with the "Mississippi lime," and is considered equivalent to the Burbank sand of Oklahoma. Eight wells in the field produce from this horizon. Some of them penetrate a few feet into the top of the "Mississippi lime," but all derive their production from the Burbank sand. Only one of these has been deepened to the Ordovician; namely, the Continental Oil Company No. 2 E. A. Heskett, in the SW cor. NW¼ sec. 19, T. 33 S., R. 3 E. This test was first completed on January 28, 1926, at a total depth of 3,227 feet in "Mississippi lime"; the Burbank sand extended from 3,197 to 3,225 feet. Deepening was started on September 1, 1926, and the test was drilled to a total depth of 3,560 feet in the Ordovician without further success. On September 27, 1926, it was plugged back to 3,217 feet and has continued production thereafter from the Burbank sand.

The average depth to the top of the Burbank sand is 3,195 feet. The wells producing from this sand have an average initial production of 87 barrels. The only large well has been Phillips Petroleum Company No. 2 Holt, which had an initial production of 430 barrels.

A feature of interest, and one which distinguishes this field from the Rainbow Bend field proper, has been the recovery of oil from the "Siliceous lime" over a period of 2½ years. Four wells have produced from this horizon. Credit for this discovery belongs to the Sinclair Oil and Gas Company, who, on July 2, 1926, completed their No. 1 Holt in the NE cor. SE¼ SE¼ sec. 24, T. 33 S., R. 2 E. This test had an initial production of 50 barrels of 41° Bé. oil from 3,574 to 3,581 feet.

The average depth to the top of the "Siliceous lime" in the four producing wells is 3,565 feet. Their initial production ranges from 50 to 500 barrels, and averages 255 barrels. The wells are located on the apex of a small subsurface dome.

The "Siliceous lime" wells were abandoned in January, 1929, after a disappointing attempt to produce them over a period of 2½ years. The dates of completion and plugging of these four wells follows:

Name.	Location.	Completed.	Last production.	Plugged.
Sinclair; No. 1 Holt	24-33S-2E	7-2-26	9-27	11-21-27
Sinclair; No. 2 Holt	24-33S-2E	8-6-26	9-27	11-4-27
Sinclair; No. 3 Holt	24-33S-2E	11-28-26	9-27	10-25-27
Continental; No. 1 Swain	25-33S-2E	2-20-27	1-29	8-12-29

The total number of tests completed in the West Extension Rainbow Bend field is 16. As will be seen from the data appearing below, no attempt has been made since 1927 to develop further this field. Indeed, it is doubtful if this could be done profitably.

Number of Annual Completions, West Extension Rainbow Bend Field.

Year.	Number producing wells.	Number dry holes.	Total.
1925	4	0	4
1926	7	2	9
1927	1	2	3
1928	0	0	0
1929	0	0	0
Totals	12	4	16

All of the dry holes have penetrated into the Ordovician "Siliceous lime." The number of producing wells at the end of 1929 is 8, and production now is entirely from the Burbank sand.

Between April 19, 1925, and December 31, 1929, the total amount of oil produced from this field has been 299,136 barrels. The yield from its two producing horizons has been:

	Barrels.
Total "Siliceous lime" production (abandoned Jan. 1929) (Ordovician),	55,227
Total Burbank sand production (Pennsylvanian)	243,909
Gross production for field	299,136

The daily average production during December, 1929, for the remaining 8 wells is 8 barrels of oil per well. The average recovery per acre for the field to the end of 1929 has been 2,500 barrels. The recovery for the separate horizons is:

Producing horizon.	Recovery per acre, in barrels.
"Siliceous lime"	1,380
Burbank sand	3,050
Average for field	2,500

Miller Field. A year before the discovery of the Oxford field, Shell Petroleum Corporation added a new producing area to eastern Sumner county, which is known locally as the Miller field. It is situated 3½ miles west of Oxford. While the field has never been of material importance from a standpoint of cumulative production, it nevertheless has had an interesting history in so far as its producing horizons are concerned.

TABLE 10A—*Monthly production West Extension Rainbow Bend field, Sumner and Cowley counties, Kansas, in barrels.*

MONTH.	1925.	1926.	1927.	1928.	1929.
January	.....	9,614	9,500	4,583	2,586
February	.....	8,167	8,005	3,981	2,535
March	.....	12,269	6,984	3,858	2,439
April	661	14,952	6,959	3,264	2,424
May	895	13,121	7,643	2,924	2,591
June	747	8,726	7,014	3,356	2,257
July	477	7,694	6,769	2,715	2,260
August	903	17,422	7,370	2,446	2,274
September	1,361	8,669	4,766	3,295	2,438
October	5,444	8,245	5,549	3,085	2,291
November	3,793	10,360	4,101	2,871	2,286
December	5,295	13,836	4,057	2,998	2,011
Totals	19,576	133,075	78,717	39,376	28,392
Grand total..... 299,136	.....	.....	.....	.....	.....

The discovery well, Shell Petroleum Corporation No. 1 Miller, located in the NE cor. SW¼ sec. 17, T. 32 S., R. 2 E., was completed on June 10, 1926. The Simpson formation was penetrated at 3,615 feet, and the top of the "Siliceous lime" at 3,662 feet. Production was derived from two horizons. The upper pay, lying between 3,637 and 3,642 feet in the "Wilcox" sand, had an initial production of 200 barrels of oil. The lower or "Siliceous lime" pay yielded 600 barrels of oil from 3,662 to 3,671 feet, the total depth, and the test was thus completed with an initial production of 800 barrels of 37° Bé. oil. From June to October, inclusive, it produced in excess of 10,000 barrels a month, and reached a peak in July, 1926, of 19,394 barrels.

Within five months of this discovery three productive offsets were brought in, and in July, 1927, an offset a quarter of a mile distant was completed. All produced from the "Siliceous lime," but the north offset to the discovery well (Shell Petroleum Corporation No. 1 Owens), in addition to 325 barrels from the "Siliceous lime" produced 75 barrels from the "Wilcox" sand.

The Ordovician production of two diagonal offsets declined so rapidly that they were plugged back to produce from beds in the Kansas City group. These wells (Shell Petroleum Corporation No. 1 Owens, in the SE cor. NW¼ sec. 17, and the Twin State Oil Company No. 1 Hartzell, in the NW cor. SE¼ sec. 17), concluded their Ordovician production in February and May of 1928, and began producing from the Kansas City beds in March and October of 1928,

respectively. No. 1 Owens was plugged back to 3,000 feet and produces from 2,955 to 2,965 feet. No. 1 Hartzell was plugged back to 2,982 feet and produces from 2,955 to 2,967 feet. The top of the pay in both wells occurs 185 feet below the top and 75 feet above the base of the Kansas City group. The production, therefore, is middle-lower Kansas City in age. The monthly yield from both wells is small.

But one attempt has been made to extend the original producing area of this field. On August 11, 1929, Shell Petroleum Corporation completed their No. 2 Miller, in the SW cor. SE¼ SW¼ sec. 17, T. 32 S., R. 2 E. This test was drilled to a total depth of 3,716 feet in "Siliceous lime," but failed to encounter Ordovician production. The top of the "Mississippi lime" was penetrated at 3,332 feet, and a showing of oil was present in this horizon. Accordingly the test was plugged back to 3,385 feet and produces from near the top of the "Mississippi lime" at 3,358 to 3,359 feet. Initial production was 75 barrels of 37° Bé. oil.

Thus the Miller field, insignificant in area, derives its oil from four horizons: Kansas City group, "Mississippi lime," "Wilcox" sand, and "Siliceous lime." Since the "Wilcox" sand oil proved of small consequence, its production will be classified with that from the "Siliceous lime." The cumulative production and per acre recovery for each horizon is as follows:

Production in the Miller field, June, 1926, to December, 1929, inclusive.

Producing Horizon.	Age.	Number of wells.	Total production since discovery, barrels.	Per acre recovery barrels.
Kansas City group	Pennsylvanian	2	22,803	1,140
"Mississippi lime"	Mississippian	1	2,251	225
"Siliceous lime"	Ordovician	5	252,049	6,300
Total			277,103	

The average recovery for the field to the end of 1929 has been 5,540 barrels to the acre. During December, 1929, the field had an average daily production of 18 barrels per day per well from its 5 producing wells.

No dry holes occur in this field, but one Ordovician producer has been plugged—the I. T. I. O. No. 2 Norris, in the SE cor. SW¼ NE¼ sec. 17. Completed on July 3, 1927, it produced 1,084 barrels the first month. After a rapid decline resulting in a production of 58 barrels in November, production ended on December 4, and the well was plugged on December 13, 1927. It is difficult to anticipate

the results of any further drilling. An offset half a mile to the south was dry in the Ordovician, and Ordovician production in an offset a quarter mile east has been exhausted. Probably much of the oil in the immediate area to the north and west has been drained, so there is little hope that the field will be extended.

Water records for the Miller field are available on two wells—Shell Petroleum Corporation No. 1 Miller and No. 1 Owens. The "Siliceous lime" has yielded an excessive amount of water—some 400 per cent in the cases on record—whereas the Kansas City furnishes comparatively little water—about 25 per cent.

For the week ending February 5, 1928, Shell Petroleum Corporation No. 1 Miller produced 170 barrels of oil and 645 barrels of water. During the week ending December 29, 1929, the proportion was 187 barrels of oil and 730 barrels of water. Of interest is the fact that between February, 1928, and December, 1929, it produced 20,180 barrels of oil to 73,091 barrels of water.

TABLE 10B—*Monthly production Miller field, Sumner county, Kansas, in barrels.*

MONTH.	1926 (a).	1927 (a).	1928 (b).	1929 (b).
January	.....	10,044	3,121	3,553 (1,049)
February	.....	8,500	2,945	2,854 (1,085)
March	.....	7,987	3,514 (658)	3,633 (1,049)
April	.....	7,405	4,139 (1,182)	2,898 (921)
May	.....	5,714	3,389 (1,104)	2,979 (942)
June	14,716	5,870	4,094 (1,369)	3,577 (1,037)
July	19,394	5,197	3,847 (1,053)	2,941 (780)
August	14,562	4,996	3,738 (1,023)	3,940 (1,131)
September	21,889	5,114	4,025 (1,475)	3,090 (779)
October	24,318	4,228	3,773 (1,285)	3,689 (839)
November	14,798	3,424	3,237 (919)	3,472 (995)
December	12,104	3,627	3,946 (1,311)	2,822 (817)
Totals	121,781	72,106	43,768 (11,379)	39,448 (11,424)
Grand total, 277,103	.....	.....	.....	.....

(a) All production from "Siliceous lime."

(b) Total production from "Siliceous lime" and "Kansas City lime." The amount of "Kansas City" production is indicated by figures in parenthesis. For 1929 the total monthly production includes also the following "Mississippi lime" production from the Shell Miller 2 well, in barrels: August, 460; September, 80; October, 824; November, 565; December, 322.

During its last week of Ordovician production, ending February 5, 1928, Shell Petroleum Corporation No. 1 Owens showed a recovery of 23 barrels of oil and 495 barrels of water. Subsequently it was plugged back to the Kansas City group and again began producing on March 17, 1928. Water appeared the following week in the proportion of 297 barrels of oil to 55 barrels of water. No appreciable

increase of water took place, and for the week ending December 29, 1929, it yielded 149 barrels of oil and 70 barrels of water. During its 22 months of Kansas City production (March, 1928, to December, 1929) it has produced 20,073 barrels of oil and 5,778 barrels of water.

RUTTER LEASE. Three and one-half miles west of the west extension of the Rainbow Bend field a single well has been producing from the "Mississippi lime" for 3½ years. This test, Shell Petroleum Corporation No. 1 Rutter, is located in the SW cor. SE¼ NW¼ sec. 21, T. 33 S., R. 2 E. Completed on June 19, 1926, a total depth of 3,621 feet in the "Siliceous lime," it was plugged back to 3,315 feet and started producing from the upper part of the "Mississippi lime" on June 19, 1926, with an initial production of 18 barrels of oil. During July, 1926, it reached its peak production of 763 barrels for the month, and its monthly production to the end of 1929 has averaged but 343 barrels.

Attempts to extend this production have been unsuccessful. A south offset was drilled by Imo Oil Company at their No. 1 Quinn, in the NW cor. NE¼ SW¼ sec. 21, T. 33 S., R. 2 E. A showing of oil, found in the "Mississippi lime," was soon exhausted, and the test was deepened into the "Siliceous lime" and abandoned June 27, 1928, at a total depth of 3,700 feet. Likewise unsuccessful were Helmerick and Payne, who drilled their No. 1 Melick in the NE cor. sec. 21, T. 33 S., R. 2 E. Rewarded by only a small show of oil in the "Mississippi lime," the test was deepened to the "Siliceous lime" and abandoned at 3,590 feet on June 17, 1928.

TABLE 10c—*Monthly production Shell Petroleum Corp., No. 1 Rutter, in barrels.*

MONTH.	1926.	1927.	1928.	1929.
January	.....	534	325	188
February	.....	465	307	188
March	.....	463	293	255
April	.....	506	259	190
May	.....	419	199	201
June	237	464	337	217
July	763	429	218	181
August	650	396	224	243
September	768	279	285	181
October	594	360	213	148
November	594	328	214	210
December	504	419	273	154
Totals	4,110	5,162	3,147	2,356
Grand total 14,775	... .	.....	.....	.....

Some water is produced with the oil derived from No. 1 Rutter. During the week ending February 5, 1928, it made 103 barrels of oil and 42 barrels of water. For the week ending December 29, 1929, the proportion was 47 barrels of oil and 7 barrels of water. Accurate water records are not available before February 1, 1928. However, between this time and December 31, 1929, the well produced 5,178 barrels of oil as against 1,487 barrels of water. This percentage of water, 29 per cent, is not relatively high in comparison to some "Mississippi-lime" fields in Kansas.

No. 1 Rutter has produced a total of 14,775 barrels of oil to the end of 1929. During December, 1929, its daily average production was 5 barrels per day. The recovery for this one well has been 1,475 barrels per acre.

CHURCHILL FIELD. The Churchill field of Sumner county is important in several ways. First, it constituted the most important discovery of oil in Kansas during 1926 and resulted in the first production of any consequence on the "Granite Ridge" of Kansas, south of the Augusta field. Second, it added a new producing horizon to this portion of Kansas, the Stalnaker sand of Pennsylvanian age. Third, it was discovered by means of core-drill exploration and is one of the signal examples of the benefits to be derived from such procedure. And fourth, it was the first field in Kansas in which gas-lifting apparatus has been installed successfully.

The field is situated along the axis of the "Granite Ridge," in secs. 24, 25, 26 and 36, T. 31 S., R. 2 E. Immediately across the line, in Cowley county, three dry holes, one producing well, and one producing well now plugged, have been completed in secs. 19 and 30, T. 31 S., R. 3 E. The field has a maximum length of two miles and an average width of one-half mile. Its productive area totals 775 acres.

The discovery well was drilled by Shell Petroleum Corporation on June 23, 1926. This test, No. 1 Churchill, is located in the NE cor. SW¼ sec. 25, T. 31 S., R. 2 E. The Stalnaker sand was encountered at 1,822 feet, and the pay horizon extended from 1,855 to 1,867 feet, total depth. Initial production was approximately 200 barrels.

Development of the Churchill field progressed with fair rapidity, owing to the fact that much of the Shell acreage was about to expire. By the end of 1926 a total of 14 producing wells had been completed. During 1927 the producing wells completed numbered 46. Ninety-seven tests have been drilled to the end of 1929, as follows:

Number producing wells	83
Number repressuring gas wells	1
Number dry holes	13
Total completions	97
Maximum number producing wells during any one month	76
Number producing wells plugged	5
Number producing wells, December 31, 1929	71

All the wells in the Churchill field produce from one horizon—the Stalnaker sand. Based upon the best available subsurface information extending westward from the outcrop, this sand appears to straddle the Douglas-Lansing contact. The Stalnaker sand has a maximum thickness in this field of 175 feet. Its top would extend some distance up into the lower part of the Douglas group, and its base probably an almost equal stratigraphic distance down into the upper part of the Lansing group.[10] The average depth to the top of the Stalnaker sand is 1,870 feet; the range in depth, from 1,790 to 1,955 feet. Penetration of producing wells into the sand varies from 38 to 170 feet, and averages 60 feet. The top of the Stalnaker generally is marked by a thin limestone "shell." The horizon is not a solid body of sandstone, but contains variable amounts of shale; in fact, it may be said, in general, that there are two sand bodies separated by a shale.

The Stalnaker sand is a subsurface stratigraphic unit and does not outcrop. The name was derived from the Stalnaker farm, where, on April 20, 1914, B. B. Jones completed a gas well in the NW cor. SE¼ sec. 11, T. 35 S., R. 2 E. The actual producing horizon, 2,380 to 2,397 feet, yielded 7 million cubic feet of gas. This gas was derived from a body of sand comparable in thickness and stratigraphic position to the oil-producing sand at Churchill and Oxford.

The occurrence of oil in the "Granite Ridge" structure at Churchill is unique. In the producing structures lying to the north along the "Granite Ridge" and associated folds, such as Augusta, Eldorado, Florence, Peabody and Elbing, the sediments normally intervening between lower Pennsylvanian and Viola have been removed, so that Pennsylvanian rocks are in contact with Ordovician. Most of the oil is derived from the Ordovician and the rocks in the zone of unconformity. At Churchill lower Pennsylvanian is likewise in contact with Ordovician, but no oil is derived from either the

10. As now interpreted (June, 1932), this sand represents the base of the Virgil series, which rests unconformably on Lansing or younger beds of the Missouri series.—R. C. Moore.

Ordovician or the unconformity. Instead, it is concentrated well up in the Pennsylvanian, some 865 feet above the contact.

The tests which afford stratigraphic information below the Stalnaker sand, and penetrate the Ordovician, are four in number. These are:

Deep wells in the Churchill field.

Name.	Location.	Depth top "Siliceous lime," feet.	Interval, top Stalnaker to top "Siliceous lime," feet.
Amerada, No. 1 Evers...	SW SE SW 24-31S-2E...	2,770	887
Vickers, No. 4 Shore....	NE SE 24-31S-2E.....	2,750	840
Wentz, No. 4 Herrick...	C SW SE 25-31S-2E.....	2,796	928
Theta, No. 1 Sleigh.....	NE SW NW 36-31S-2E..	2,820	805

In all of these tests Pennsylvanian rocks (probably upper Cherokee) are in immediate contact with "Siliceous lime," excepting Amerada No. 1 Evers, which has 30 feet of Viola and "Wilcox" sand. The normal interval in this general area between the top of the Stalnaker sand and the "Siliceous lime" is 1,400 feet. Thus the average interval at Churchill of 865 feet is far short of normal and is indicative of pre-Pennsylvanian uplift and erosion. Faulting accompanied this folding, and subsurface faults, with considerable throw, are present on both the east and northwest flanks of this field. In one case on the northwest flank the interval between Stalnaker and "Siliceous lime" increases, through faulting, from 865 feet to 1,365 feet in one-half mile.

The average initial production of the 76 producing wells in the Churchill field is 600 barrels, with a range of initial production from 10 barrels to 2,000 barrels. The initial yields group themselves readily into six classes, as follows:

8 wells had an initial production ranging from	10	to	100 barrels.
7 wells had an initial production ranging from	100	to	200 barrels.
16 wells had an initial production ranging from	200	to	500 barrels.
29 wells had an initial production ranging from	500	to	1,000 barrels.
11 wells had an initial production ranging from	1,000	to	1,500 barrels.
5 wells had an initial production ranging from	1,500	to	2,000 barrels.

The well having the largest initial yield is Shell Petroleum Corporation No. 2 Churchill, in sec. 25, T. 31 S., R. 2 E.

Great quantities of water are produced with the oil recovered from the Stalnaker sand. Complete water statistics are not available, but certain interesting facts may be presented. Between February 1, 1928, and December 31, 1929, the proportion of oil and

water produced (for which figures are available) was 5,059,477 barrels of oil and 3,356,892 barrels of water. Complete figures for this same period would show an even higher percentage of water. During the week ending February 5, 1928, 31 out of 55 wells (on which data are at hand) were producing water, and 75,997 barrels of oil were recovered from these wells together with 10,554 barrels of water. For the week ending December 29, 1929, 58 out of 65 wells (on which data are at hand) were producing water, and only 31,426 barrels of oil were recovered as against 51,790 barrels of water.

One of the interesting engineering features in the Churchill field is the fact that many of the wells are produced through the aid of gas-lift. No gas of consequence is present with the oil, and for this reason gas-lift apparatus was installed. The first well to be connected to this gas-lift process was Shell Petroleum Corporation No. 1 Rutter, on September 21, 1926. The success of this method of operation is evidenced by the fact that during August its production had been 4,084 barrels, whereas its September yield increased to 40,016 barrels. Ten wells had been connected to gas-lift by February 3, 1927, and in all a marked increase of production was manifest. This method of operation has proven very satisfactory and was continued, for any specific well, until production became so small that it was more profitable to produce it through pumping than by gas-lift. At the present time gas-lifting has been practically abandoned.

TABLE 10D—*Gross production of the Churchill field in barrels, by months*(a).

MONTH.	1926.	1927.	1928.	1929.
January	.....	399,960 (18)	300,656 (63)	198,018 (75)
February	.....	413,188 (25)	330,640 (65)	186,004 (76)
March	.....	495,410 (33)	400,759 (67)	225,537 (76)
April	.....	499,649 (39)	326,135 (67)	178,430 (76)
May	.....	561,838 (46)	327,759 (71)	179,098 (76)
June	3,368 (1)	505,567 (47)	312,509 (71)	210,365 (76)
July	16,993 (1)	471,242 (48)	342,222 (72)	165,097 (76)
August	55,860 (4)	400,115 (48)	313,980 (74)	196,814 (75)
September	99,697 (8)	408,012 (51)	248,071 (74)	152,502 (74)
October	193,233 (8)	425,934 (54)	233,511 (74)	146,330 (74)
November	269,997 (12)	396,477 (60)	264,390 (75)	172,579 (74)
December	357,638 (14)	416,959 (60)	212,051 (75)	132,550 (71)
Total	996,786	5,394,351	3,612,683	2,143,324
Grand total..12,147,144	.....	.....	.....	.....

(a) The total number of wells from which the reported production was obtained is indicated by figures in parenthesis.

When gas-lifting became unprofitable as a method of increasing production, attention was turned to injecting gas into the producing sand through the aid of repressuring gas wells. The wells are drilled into the Stalnaker sand and the casing cemented to prevent the escape of injected gas back up the hole around the outside of the casing. Gas is then forced down the hole and disseminated through the oil sand, gradually mixing with the oil and allowing its freer passage into producing wells. The first gas-repressuring well, Shell Petroleum Corporation No. 7 Wiles, in the center N½ NE¼ sec. 25, T. 31 S., R. 2 E., was completed in October, 1929.[11] The injection of gas into the oil sand appears to give highly satisfactory results, but it will be some time before there can be any final analysis of this method of operation.

Emphasis must be laid on the remarkable per-acre recovery of the Churchill field. Between June 23, 1926, and December 31, 1929, the cumulative production has been 12,147,144 barrels from a producing area of 775 acres. The recovery has been 15,675 barrels per acre. During December, 1929, the daily average production from the 71 producing wells was 60 barrels per day per well.

HUNNEWELL GAS FIELD. The Hunnewell gas field, situated 3 miles east of Hunnewell and practically on the Kansas-Oklahoma line, is located in secs. 8, 17 and 18, T. 35 S., R. 1 E.

In April, 1927, Amerada Petroleum Corporation completed their No. 1 Hamilton, in the SW cor. SE¼ NE¼ sec. 18, T. 35 S., R. 1 E., at a total depth of 3,890 feet in the Ordovician. A gas-showing higher in the hole, estimated at 8¼ million cubic feet, from 2,286 to 2,320 feet, had been passed up in anticipation of deeper production. The test was plugged back to this gas showing, and on April 3, 1927, had an initial production of 1,415,000 cubic feet of gas with a rock pressure of 150 pounds.

The property was taken over by the Hartman-Skaer Oil Company who completed, subsequently, three gas wells on this and adjacent acreage in sections 17 and 18. None had a higher initial production than the discovery well, and the volume of gas produced has been small. Within eighteen months all of the gas wells had been plugged, and the field was abandoned on October 31, 1928.

Besides the four producing gas wells, five dry holes have been drilled in this field; one in sec. 7, one in sec. 17 and three in sec. 18, all in T. 35 S., R. 1 E. Of these, one penetrated to the "Siliceous

11. A second gas-repressuring well was drilled in 1930, and a third in 1931.

lime," three stopped in the Pennsylvanian Stalnaker sand, and the fifth only reached the Oread limestone.

Two gas-producing horizons are present in the Hunnewell field. The first, at a depth of 2,148 feet, occurs as a sand in the Kanwaka shale of the Shawnee group and is probably the time equivalent of the Elgin and Lower Hoover sands. The second gas horizon, found at a depth of 2,275 feet, is from a sand in the uppermost part of the Lawrence shale of the Douglas group. This sand is thought by James I. Daniels, of the Continental Oil Company, to be correlative with the lower Endicott sand of the Tonkawa field in Oklahoma.

Three of the gas wells produce from this sand in the upper Lawrence shale, namely: Hartman-Skaer Nos. 1 and 2 Hamilton, and No. 1 Riley, in secs. 18 and 17, respectively. In No. 1 Hamilton the Oread "lime" extends from 2,220 to 2,270 feet. Since the top of the gas horizon occurs at 2,286 feet, with a shale intervening, the gas zone is but 17 feet below the base of the Oread. Southward, in Oklahoma, the top of this sandstone horizon lies at a much greater stratigraphic distance below the base of the Oread, because of the regional southward divergence which characterizes all Pennsylvanian formations in this area.

The one well producing from a sandstone in the Kanwaka shale is Hartman-Skaer No. 1 Bowers, in the SW cor. sec. 8, T. 35 S., R 1 E. It was completed on February 27, 1928, with an initial production of 1,095,000 cubic feet in a sand from 2,148 to 2,150 feet. The top of the pay is 15 feet below the base of the Lecompton limestone and occurs 120 feet above the Lawrence shale-gas horizon.

The total recovery of gas from the Hunnewell field has been 416,717,000 cubic feet. The yield from the Lawrence shale has been 374,994,000 cubic feet, and from the Kanwaka shale, 41,723,000 cubic feet. Production statistics for the field are shown in Table 11.

TABLE 11.—*Gas production in the Hunnewell field, April 3, 1927, to October 31, 1928, in cubic feet.*

YEAR.	Hamilton No. 1.	Hamilton No. 2.	Bowers No. 1.	Riley No. 1.	Annual total.
1927	222,185,000	16,800,000	.....	.....	238,985,000
1928	.....	120,990,000	41,723,000	15,019,000	177,732,000
Totals	*222,185,000	†137,790,000	‡41,723,000	*15,019,000	§16,717,000

* Completed April 3, 1927; plugged November 21, 1927.
† Completed October 15, 1927; first gas taken November 22, 1927; plugged October 8, 1928.
‡ Completed February 27, 1928; plugged August 31, 1928.
§ Completed September 12, 1928; plugged October 31, 1928.

OXFORD FIELD. In some respects the most interesting oil pool in Sumner county is the Oxford field, situated within the city limits and immediately south of Oxford. It ranks second in the county in total production and size, having produced 6,819,375 barrels of oil from 490 acres. The chief source of interest lies in the stratigraphy of its producing horizons, since it is the only field on or west of the "Granite Ridge" that has produced any considerable quantity of oil from the Shawnee group of Pennsylvanian age. Sixteen wells have produced 447,583 barrels of oil from the Shawnee beds, and one well produced for a short time from beds of the Wabaunsee group.

The Oxford field, like Churchill, is located along the axis of the "Granite Ridge." Producing wells have been completed in secs. 11, 14, 22 and 23, T. 32 S., R. 2 E. Its greatest producing length is 1½ miles, with an average width of three-quarters of a mile. The field resulted from core drilling in this area by the Shell Petroleum Corporation.

The discovery well, No. 1 Emrich, is located in the NE cor. NW¼ SW¼ NE¼ (1,090 feet from the south line and 634 feet from the west line of the NE¼) sec. 14, T. 32 S., R. 2 E., and was completed on May 10, 1927, by Shell Petroleum Corporation. The top of the Stalnaker sand, its producing horizon, was encountered at 2,012 feet, and at a total depth of 2,060 feet it had an initial production of 150 barrels.

Peak development of the Oxford field occurred during 1928. At the close of 1927 there were 38 producing wells, whereas 65 producers were completed in 1928. A smaller percentage of acreage at Oxford is held by any one company than in the Churchill field, 4 miles to the north. A total of 123 tests have been drilled which may be classified as follows:

Number producing wells		103
Stalnaker sand wells	86	
Shallow wells	17	
Number of dry holes		19
Number of lost holes		1
Total number of completions		123
Number producing wells plugged		12
Number producing wells December 31, 1929		91

The principal producing horizon in the Oxford field is the Stalnaker sand of lower Douglas-upper Lansing age. Its top is marked generally by a thin limestone "shell," and the sandstone body con-

tains variable amounts of shale. Five tests have drilled completely through the sand in this field, showing its maximum thickness to be 155 feet. The depth and thickness of the Stalnaker sand may be compared with those in the Churchill field. The increased depth at Oxford is due both to a regional southward plunge and a regional southward divergence of all formations.

Comparison of pay sands in the Oxford and Churchill fields.

Field.	Average depth top Stalnaker sand, feet.	Range in depth, feet.	Average penetration of Stalnaker sand feet.	Range in penetration feet.
Oxford	2,020	1,930-2,050	95	30-155
Churchill	1,870	1,790-1,955	60	38-170

Despite the fact that only some 8 per cent of the total recovery from the Oxford field has been derived from horizons shallower than the Stalnaker sand, this shallow production (449,151 barrels) is of considerable interest and importance. Four horizons have been productive: the Emporia limestone of the Wabaunsee group, and the Howard limestone, Severy shale and lower Hoover sandstone in the Shawnee group. Only the latter three of these are producing at present. Originally there were 17 shallow wells; but one has been deepened to the Stalnaker and two have been plugged.

During the development of the field the oil derived from the Howard limestone was referred, apparently by common consent, to the Topeka limestone. Subsequent detailed correlations, extended westward from the outcrop, conclusively indicate that the producing horizon is 110 feet stratigraphically higher than the Topeka and occurs in the Howard limestone. A partial columnar section of the Oxford field is inserted, showing the position of the producing units and their intervening members, together with additional pertinent facts (Table 12).

The discovery wells of the four shallow producing horizons, together with information thereon, are as follows:

Discovery Wells in the Oxford Field.

Producing Horizon.	Well name.	Location.	Depth to top of horizon, ft.	Depth producing horizon, feet.	Initial production, bbls.	Date completed.
Emporia limestone..	Derby Birkett 3.....	14-32S-2E	1,063	1,070-1,080	225	1-20-28
Howard limestone..	Amerada Gassoway 1..	14-32S-2E	1,265	1,265-1,280	220	11-11-27
Severy shale.....	Barnsdall Wenrich 3A..	23-32S-2E	1,305	1,343-1,352	100	5- 3-28
Hoover sand.....	Amerada Gassoway 9..	14-32S-2E	1,605	1,605-1,633	150	5-12-28

TABLE 12.—*Showing partial subsurface columnar section in Oxford field.*

FORMATION.	Member, or groups of members.	Average[1] thickness, feet.	Average interval below top of Neva limestone, feet.	Average depth below surface, feet.	Number of wells which have produced.	Number of producing wells, 12-31-29.	Total production since discovery, barrels.	Approximate producing acreage, acres.	Approximate recovery per acre, barrels.
Wabaunsee.	Eskridge shale	.....	.....	550	.....	.....	.....	.....	.....
	Neva limestone	.....	.....	.....	.....	.....	.....	.....	.....
	Elmdale shale	.....	.....	.....	.....	.....	.....	.....	.....
	Americus limestone	.....	.....	.....	.....	.....	.....	.....	.....
	Admire shale	.....	.....	.....	.....	.....	.....	.....	.....
	McKissick Grove shale	.....	.....	.....	.....	.....	.....	.....	.....
	Tarkio limestone	20	450	1,000	.....	.....	.....	.....	.....
	Willard shale	30	.....	.....	.....	.....	.....	.....	.....
	Emporia limestone	30	500	1,050	1	0	1,568	10	155
	Humphrey shale	110	.....	.....	.....	.....	.....	.....	.....
	Burlingame limestone	10	.....	.....	.....	.....	.....	.....	.....
Shawnee.	Scranton shale	50	.....	.....	.....	.....	.....	.....	.....
	Howard limestone	40	700	1,250	9	7	245,288	65	3,770
	Severy shale	70	.....	.....	1	1	4,022	5	800
	Topeka limestone	.....	810	1,360	.....	.....	.....	.....	.....
	Top Topeka to top Hoover sand	250	.....	.....	.....	.....	.....	.....	.....
	Lower Hoover sand	50	1,060	1,600	6	6	198,273	45	4,400
	Base Hoover to top Oread	100	.....	.....	.....	.....	.....	.....	.....
Upper Douglas.	Oread limestone	50	.....	.....	.....	.....	.....	.....	.....
	Base Oread to top Stalnaker	150	.....	.....	.....	.....	.....	.....	.....
Lower Douglas and Lansing.	Stalnaker sand	150	1,410	2,020[2]	86	77	6,370,224	365	17,450[3]
	Base Stalnaker to top Kansas City	300	.....	.....	.....	.....	.....	.....	.....
Kansas City.	Top Kansas City	.....	1,830	2,410	.....	.....	.....	.....	.....

1. The thicknesses indicated are not from micro-examination, but are based upon the best available strip log correlations extended westward from the outcrop of the various members.

2. Depth based on an average of all Stalnaker wells in the field.

3. High recovery due to town lot drilling and irregularly shaped tracts.

November, 1927, to December, 1929.

Amerada Gassoway No. 10, 14-32S-2E.	Amerada Gassoway No. 11, 14-32S-2E.	Shell Scroggins "B"-1A, 14-32S-2E.	Shell Rothwell No. 2A, 14-32S-2E.	Shell Rothwell No. 3A, 14-32S-2E.	Total production, Hoover sand.	Total production, shallow horizons.
Lower Hoover sandstone.						
.....	.....	.....	.....	.....	.....	15,578
42,912	16,267	6,588	14,002	5,343	105,030	283,339
25,207	15,640	7,607	20,135	16,850	93,243	150,234
68,119	31,907	14,195	34,137	22,193	198,273	449,151

Derby Oil Company No. 3 Birkett, which produced originally from the Emporia limestone, was deepened subsequently to the Stalnaker sand. Its daily production record is of interest and is shown in Table 13. There are no wells producing from the Emporia at the present time.

TABLE 13.—*Daily production record, Derby Oil Co. No. 3 Birkett.*

1928.	Barrels.	1928.	Barrels.
January 20	225	January 28	90
January 21	0	January 29	0
January 22	148	January 30	95
January 23	315	January 31	51
January 24	219	February 1	85
January 25	90	February 2	70
January 26	90	February 3	15
January 27	75	Total	1,568

Completed, January 20, 1928. Last production, February 3, 1928. Started deepening, February 4, 1928. Began producing from Stalnaker, February 27, 1928.

The most prolific Howard lime producer has been Derby Oil Company No. 1 Birkett, which had a cumulative production of 117,929 barrels of oil in 25 months. The best Hoover sand well has been Amerada Petroleum Corporation No. 10 Gassoway, with a 19-month recovery of 68,119 barrels. This latter test is the only shallow-horizon well which has produced much over 1,000 barrels per month. A complete record of the annual production of each well producing from horizons shallower than the Stalnaker sand is given in Table 14.

No deep tests have been drilled in the Oxford field. Two have penetrated to the Kansas City group, and two, well down the flanks, have encountered "Mississippi lime." One well, just west of the producing area, Amerada Petroleum Corporation No. 1 Buffington, sec. 14, T. 32 S., R. 2 E., reached the "Siliceous lime" and was abandoned with a hole full of water.

The average initial production of the 103 producing wells in the Oxford field is 525 barrels, with a range of initial production varying from 10 barrels to 3,200 barrels. Their initial yield groups itself readily into 8 classes, as follows:

25 wells had an initial production ranging from 0 to 100 barrels.
15 wells had an initial production ranging from 100 to 200 barrels.
22 wells had an initial production ranging from 200 to 500 barrels.
27 wells had an initial production ranging from 500 to 1,000 barrels.
5 wells had an initial production ranging from 1,000 to 1,500 barrels.
6 wells had an initial production ranging from 1,500 to 2,000 barrels.
1 well had an initial production ranging from 2,000 to 3,000 barrels.
2 wells had an initial production ranging from 3,000 to 3,200 barrels.

The well having the greatest initial production is Shell Petroleum Corporation No. 4 Emrich, in sec. 14, T. 32 S., R. 2 E.

The proportion of water produced in addition to the oil is unusually large. Unfortunately, complete water statistics for the Oxford field are not available, but certain interesting facts may be presented. Between February 1, 1928, and December 31, 1928, the proportion of oil and water produced (for which figures are available) was 2,210,632 barrels of oil and 2,509,712 barrels of water. During the week ending February 5, 1928, 10 out of 31 wells (on which data are at hand) were producing water, and 56,187 barrels of oil were recovered from these wells against 5,593 barrels of water. But for the week ending December 29, 1929, 54 out of 55 wells (on which data are at hand) were producing water, and only 7,161 barrels of oil were recovered as against 38,553 barrels of water.

Per-acre recovery in the Oxford field, considering wells producing from all horizons, has not been as high as in the Churchill field (15,675 barrels). Between May 10, 1927, and December 31, 1929, the total production for the Oxford field was 6,819,375 barrels from a producing area of 490 acres. The recovery for the field has been 13,920 barrels to the acre. The per-acre recovery for those wells producing from the Howard limestone and Hoover sand are shown in Table 12. During December, 1929, the 91 producing wells had a daily average production of 36 barrels per day per well.

TABLE 14A—*Production of the Oxford field, in barrels, by months(a).*

MONTH.	1927.	1928.	1929.
January	.....	368,395 (53)	187,183 (100)
February	.....	426,159 (61)	165,412 (100)
March	.....	534,945 (75)	177,482 (99)
April	.....	551,514 (83)	150,912 (95)
May	1,910 (1)	416,447 (88)	153,348 (95)
June	2,164 (1)	383,332 (93)	138,399 (95)
July	4,455 (1)	322,646 (95)	132,576 (96)
August	38,851 (9)	294,859 (98)	134,361 (95)
September	72,745 (13)	295,023 (101)	118,258 (95)
October	177,156 (25)	246,857 (102)	115,580 (94)
November	229,410 (30)	228,381 (102)	111,458 (93)
December	338,977 (38)	197,596 (100)	102,584 (91)
Total	865,668	4,266,154	1,687,553
Grand total... 6,819,375	.....	.....	.....

(a) The total number of wells from which the reported production was obtained is indicated by figure in parenthesis.

LATTA OIL AND GAS FIELD. This field is located in sec. 9, T. 30 S., R. 2 W. Oil was discovered by the Champlin Refining Company on

June 9, 1927, and gas on October 24, 1927. The oil is derived from two horizons in the Kansas City group, one from 12 to 28 feet below the top, and the other in the basal portion of the Kansas City group, 175 feet below the top. The average depth to the top of the Kansas City is 3,040 feet. The gas is obtained from the Topeka limestone (middle Shawnee group) at a depth of 2,000 feet. The oil wells have an average initial production of 50 barrels of oil with an average gravity of 35° Bé.

The discovery oil well, Champlin Refining Company No. 1 Latta, is located in the SW cor. SE¼ NW¼ sec. 9, T. 30 S., R. 2 W. Oil was encountered from 3,042 to 3,056 feet, yielding an initial production of 100 barrels testing 39° Bé. The test was completed on June 9, 1927, and the well was put on production on July 3, 1927. The discovery gas well, Champlin Refining Company No. 2B Latta, is located in the SW cor. SE¼ SW¼ NW¼ sec. 9, T. 30 S., R. 2 W., and was completed on October 24, 1927. Six million cubic feet of gas, open flow, was found from 2,015 to 2,031 feet.

But three gas wells have been completed, and gas was run from the field for a period of only seven months. The last gas production taken from the Latta lease was on February 6, 1928, and from the Love lease on May 7, 1928. All of the gas wells were deepened subsequently to the Kansas City group and produced oil.

One test, Champlin Refining Company No. 3 Latta, in the SW cor. NW¼ sec. 9, T. 30 S., R. 2 W., has been drilled to a depth of 4,367 feet and completed in "Siliceous lime." A hole full of water was found in the "Wilcox" sand, which extended from 4,145 to 4,176 feet. This well was plugged back and is now producing from the Kansas City group. Another well, No. 4 Latta, was completed at 3,850 feet in "Mississippi lime."

At the end of 1929 there were seven producing wells. No gas was produced during 1929, since the three gas wells were deepened to the Kansas City group in 1928. A record of the oil and gas production of the Latta oil and gas field follows in Table 15.

TABLE 15.—*Oil and gas production of the Latta oil and gas field, by years.*

YEAR.	No. oil wells.	Oil production (barrels).	No. gas wells.	Gas production (cubic feet).
1927	2	8,360	2	262,345,000
1928	6	22,438	3	215,600,000
1929	7	44,458	None	None
Totals	...	75,256	...	477,945,000

To the end of 1929 the total recovery per acre for the oil wells has been 1,085 barrels. During December, 1929, the average daily production was 15 barrels per well.

Douglas Field. In 1927 the Gypsy Oil Company made a discovery of signal importance to western Kansas through the completion, on July 28, 1927, of their No. 1 Douglas, in the NE cor. SE¼ NW¼ sec. 23, T. 34 S., R. 2 W. This test penetrated the top of the "Wilcox" sand at 4,490 feet and was the discovery well of "Wilcox" sand production in central and western Kansas. In a period of 10 days it swabbed 2,109 barrels and was shut in at 5 p. m. on August 11, 1927, at a total depth of 4,499½ feet. Its initial production was 480 barrels, testing 46° Bé., accompanied by one million cubic feet of gas.

After being shut in for some months the test was opened up and started producing on May 9, 1928, and yielded 8,923 barrels of oil the first month. Decline in production was rapid. By August the monthly yield had dropped to 1,740 barrels, and in November to 894 barrels. Throughout 1929 it averaged less than 300 barrels per month.

Extension of the producing area has been equally unsatisfactory. Three attempts have resulted in dry holes. A north offset was completed October 11, 1928, and an east offset on August 7, 1929. An effort to extend the field three-quarters of a mile southwest (NE cor. NW¼ sec. 27, T. 34 S., R. 2 W.) was equally unsuccessful and was dry and abandoned on November 1, 1929. The north offset penetrated 128 feet of beds referable to the Simpson formation, from 4,491 to 4,619 feet, and was abandoned in the "Siliceous lime" at a total depth of 4,805 feet.

Anson Gas Field. Attention was first directed to this immediate locality as a potential gas area in December, 1926, when Cosden Oil Company drilled its No. 1 Riner, in the NW cor. sec. 36, T. 30 S., R. 2 W., and encountered a showing of 2½ million cubic feet of gas from 1,950 to 1,960 feet, in the top of the Howard limestone. This showing of gas was not sufficiently interesting at that time and the well was deepened to the "Wilcox" sand and abandoned at 4,163 feet.

The discovery well of the Anson gas field was completed in April, 1928. This well, De Forrest Drilling Company No. 1 Meyers, is situated in the SE cor. sec. 26, T. 30 S., R. 2 W. Three gas wells and two dry holes have been drilled as a result of this discovery. The gas wells are located in secs. 25, 26 and 36, T. 30 S., R. 2 W.

The depth to the top of the gas zone ranges from 1,920 to 1,936

feet. All four of the gas wells are producing from the Howard limestone in the Shawnee group of Pennsylvanian age. One well, however, has two gas horizons. This is De Forrest Drilling Company No. 1 Bryan, in the SW cor. sec. 25, T. 30 S., R. 2 W. The Howard limestone in No. 1 Bryan extends from 1,931 to 1,958 feet, underlain by shale to 1,982 feet, which in turn is underlain by a sandstone to 1,985 feet, total depth. One-half million cubic feet of gas was encountered from 1,936 to 1,941 feet, and one million cubic feet of gas was found from 1,982 to 1,985 feet. The upper gas zone is in the Howard limestone and the lower zone is a sandstone horizon in the Severy shale.

These gas wells have an initial production of from 1 to 3 million cubic feet. The gas is taken by the Larutan Gas Company. The total amount of gas recovered has been 665,054,000 cubic feet. See Table 16.

CALDWELL FIELD. The most important oil discovery in western Sumner county in 1929 was on a core-drilled block of the Gypsy Oil Company. Their well, No. 1 Williams, located on the Kansas-Oklahoma state line in the center of the S½ NE¼ SW¼ sec. 16, T. 35 S., R. 3 W., was completed April 10, 1929, at a total depth of 4,784 feet. The producing zone (4,778 to 4,784 feet) is the "Wilcox" sand, the top of which was encountered at 4,765 feet. The well had an initial production of 1,400 barrels of 43° Bé. oil.

Subsequently three offsets have been drilled, one in Kansas and two in Oklahoma, in T. 29 N., R. 4 W. One of the two wells across the line in Oklahoma was dry.

The two producing wells in Kansas have produced 286,114 barrels of oil in nine months, giving a per-acre recovery to the present time of 14,300 barrels. During December, 1929, the average daily production of these two wells was 520 barrels per well. The limits of the field have not been defined.

WELLINGTON FIELD. Only one well has thus far been completed in the Wellington field. On December 4, 1929, Slick Pryor and Lockhart drilled in their No. 1 Peasel, in the NW cor. sec. 33, T. 31 S., R. 1 W., at a total depth of 3,656 feet. The producing horizon, the top of the "Mississippi lime," occurs from 3,655 to 3,656 feet. It had an initial production of 310 barrels and during December produced 3,185 barrels, an average of 118 barrels per day. the discovery was the result of core drilling.

WESTERN KANSAS.

Introduction.

Between January 1, 1924, and December 31, 1929, the recovery of oil from western Kansas has been 17,108,746 barrels from thirteen counties. Eleven of these counties are now actively producing. The recovery by counties has been as follows:

Oil production of western Kansas counties, 1924 to 1929, inclusive.

County.	Production (barrels).	Number wells.	Age oldest production (years).
Sedgwick county (ranges west)	7,420,821*	113	2
Russell county	6,933,643	158	6
Rice county	1,660,144	28	6
McPherson county	499,252	20	2
Sumner county (ranges west)	390,587	11	3
Ellis county	72,493	7	1
Rooks county	57,187	4	3
Reno county	33,121	1	3
Kingman county (abandoned 1927)	27,000	1	2
Trego county	8,034	1	1
Edwards county	3,503	1	1
Ness county	1,660	1	1
Harvey county (ranges west) (abandoned 1929)	1,301	1	1
Total	17,108,746	347	..

* Includes all of Valley Center field.

During 1928, 2,128,178 barrels of oil were produced in western Kansas as against 1,703,005 barrels of oil recovered in 1927. The annual production in 1929 showed a marked increase and reached a total of 9,622,665 barrels. The cause of this increase was chiefly the Valley Center field of Sedgwick county.

A complete summary of the oil and gas development in western Kansas from January, 1924, to December 31, 1929, will be found in Table 16. This summary presents for this period a record of every locality in western Kansas which is producing, or has produced, oil or gas in commercial quantities, together with the cumulative production for each field.

The oil produced in western Kansas is derived from nine horizons. The age of these horizon, together with the total amount of oil recovered from each, follows:

very per acre (barrels) ll to 10 acres.	Daily average per well Dec., 1929.	Producing horizon.
317	72	Pennsylvanian basal conglomerate.
1,530	90	Pennsylvanian basal conglomerate and siliceous lime—Ordovician.
590	45	132-foot pay of "Oswald" series, Pennsylvanian.
130	.....	Mississippi lime.
2,700	.....	Mississippi lime.
780	120	Mississippi lime.
980	23	Mississippi lime.
4,500	320	Mississippi lime.
1,420	(Prorated)	Viola lime—Ordovician; "Wilcox" Sand—Ordovician.
166	128	Pennsylvanian basal conglomerate.
3,310	25	Basal Kansas City formation, Pennsylvanian.
1,150	98	Pennsylvanian basal conglomerate.
6,100	22	Mississippi lime.
1,430	30	30-, 45- and 98-foot pays of "Oswald" series, Penn.
5,480	13	Nine pays in "Oswald" series, Pennsylvanian.

TABLE 17.—*Amount of oil recovered from each producing horizon in western Kansas fields to the close of 1929, in barrels.*

NAME OF FIELD.	PRODUCING HORIZONS.									Totals.
	Simpson dolomite.	Oswald.	"Mississippi lime."	Pennsylvanian basal conglomerate.	"Wilcox sand."	Kansas City.	"Siliceous lime."	Misener sand.	Viola lime.	
Lewis				3,503						3,503
North Ellis				2,391			43,132			45,523
Yocemento		26,970								26,970
Halstead			1,301							1,301
Kingman			27,000							27,000
Grattin			8,337							8,337
McPherson			104,725							104,725
Ritz			315,333							315,333
Voshell					67,797				3,060	70,857
Aldrich				1,660						1,660
Abbeyville						33,121				33,121
Raymond				11,490						11,490
Welch			1,648,654							1,648,654
Laton		57,187								57,187
Fairport		5,414,906								5,414,906
Gorham		393,267		714,737						1,108,004
North Fairport		25,720								25,720
North Gorham		22,532								22,532
Ochs							4,126			4,126
South Fairport		328,429								328,429
Susank				9,492			20,434			29,926
Cross						2,347				2,347
Curry	11,031									11,031
Valley Center	7,356,732							50,711		7,407,443
Caldwell					286,114					286,114
Douglas					26,032					26,032
Love & Latta						75,256				75,256
Wellington			3,185							3,185
Rega				8,034						8,034
Totals	7,367,763	6,269,011	2,108,535	751,307	379,943	110,724	67,692	50,711	3,060	17,108,746

TABLE 18.—*Production of oil in western Kansas for 1928 and 1929, Ranges 1 to 43 West.*

COUNTY.	Field.	No. wells producing at end of 1928.	Production 1928, barrels.	No. wells producing at end of 1929.	Production 1929, barrels.
Russell	Fairport	100	617,314	100	501,365
	South Fairport	9	72,319	21	256,840
	North Fairport	2	4,766	4	20,954
	Gorham	20	571,442	26	462,823
	North Gorham	1	7,530	1	8,191
	Susank	.....	.....	3	29,926
	Ochs lease	.....	.....	1	4,126
	Totals	132	1,273,371	156	1,284,225
Ellis	Yocemento	.....	.....	4	26,970
	North Ellis	.....	.....	3	45,523
	Totals	.....	.....	7	72,493
Trego	.....	.....	.....	1	8,034
Rooks	.....	4	25,102	2	24,256
Ness	.....	.....	.....	1	1,660
Edwards	.....	.....	.....	1	3,503
Rice	Welch	27	446,202	27	279,373
	Raymond	.....	.....	1	11,490
	Totals	27	446,202	28	290,863
Reno	.....	1	8,136	1	9,490
McPherson	McPherson	2	28,074	7	76,051
	Ritz	.....	.....	7	315,333
	Voshell	.....	.....	5	70,857
	Grattin lease	.....	.....	1	8,337
	Totals	2	28,074	20	471,178
Harvey	.....	.....	.....	1	1,301
Sumner	Love & Latta lease	6	22,438	7	44,458
	Jewel Douglas lease	1	22,615	1	3,417
	Caldwell	.....	.....	2	286,114
	Peasel lease	.....	.....	1	3,185
	Totals	7	45,053	11	337,174
Sedgwick	Valley Center	5	302,333	111	7,105,110
	Cross lease	.....	.....	1	2,347
	Curray lease	.....	.....	1	11,031
	Totals	5	302,333	113	7,118,488
	Gross production	178	2,128,271	343	9,622,665

Development.

A total of 900 tests, drilled for oil or gas, have been completed in western Kansas, ranges 1 to 43 west, to the close of 1929. Of this number, 300 have produced oil and 45 are either producing or capable of producing gas, making a total of 345 producing wells, or 38 per cent of the total number of wells drilled.

Oil has been recovered from 29 fields, of which 27 are producing actively at the present time. Gas has been found in twelve localities, of which nine were yielding gas at the end of the year.

The relationship between producing wells and dry holes during the last three years is shown in the following table:

TABLE 19.—*Western Kansas development, Ranges 1 to 43 West.*

	1927.	1928.	Total for 1929.*	1905-1929.
Total completions	117	106	277	900
Oil wells	30	36	122	300
Gas wells	6	22	13	45
Total oil and gas wells	36	58	135	345
Dry holes	81	48	142	555
Percentage of producing wells to total completions	30	54	48	38

* The figures for 1929 *do not include* those wells completed in secs. 6 and 7; T. 26 S., R. 1 E., of the Valley Center field.

Important Discoveries and Extensions, 1928 and 1929.

During 1928 and 1929 there were a number of important discoveries of oil and gas in western Kansas. These discoveries, in the order of importance, are as follows:

(1) The discovery of oil in the Simpson dolomite (Ordovician) in Sedgwick county.
(2) The discovery of oil in the "Wilcox" sand (Ordovician) in Sumner and McPherson counties.
(3) The discovery of oil in the Pennsylvanian basal conglomerate in Russell, Ellis, Trego, Edwards, Rice and Ness counties.
(4) The discovery of oil in the Ordovician "Siliceous lime" in Ellis, Rice and Russell counties.
(5) The discovery of new areas producing oil from the "Mississippi lime" in McPherson, Sumner and Harvey counties, and of gas in McPherson and Harvey counties.
(6) The discovery of new areas producing oil from the Pennsylvanian "Oswald series" in Russell and Ellis counties.

Three fields have received important extensions. These are:

Gorham field, Oil, T. 13 and 14 S., R. 15 W., Russell county.
McPherson field, Gas, T. 18 S., R. 2 W., McPherson county.
South Fairport field, Oil, T. 12 and 13 S., R. 15 and 16 W., Russell county.

New Producing Horizons in Western Kansas.

The principal new producing horizons of western Kansas are the Pennsylvanian basal conglomerate, and the "Wilcox" sand and "Siliceous lime" of Ordovician age.

THE PENNSYLVANIAN BASAL CONGLOMERATE. This is a contact deposit marking the zone of unconformity between Pennsylvanian and Ordovician or older rocks. When present it occupies a stratigraphic position at the base of the Pennsylvanian, but it is not earliest Pennsylvanian in age. Oil was first discovered in this horizon in the Gorham field of Russell county, in January, 1928. At this locality the Pennsylvanian basal conglomerate occurs immediately below the "Oswald series" of Pennsylvanian age and rests directly on pre-Cambrian on the apex of the dome, and on Ordovician farther down the flanks. Here the conglomerate is apparently of earliest Kansas City age. To the northwest it rises in the section and to the southeast it lowers in the section. It may be the same age in separated localities, but it is more likely to be of a slightly different age. The highest stratigraphic position that it is known to occupy is in the upper Shawnee group.[12] Undoubtedly it extends as low in the section as the Marmaton group, and it may be possibly Cherokee in age in certain localities. It rests directly upon Ordovician, Cambrian, or pre-Cambrian. The Pennsylvanian age of the conglomerate has been proved by fossils in several areas.

The lithology of the Pennsylvanian basal conglomerate is just such an admixture of erosional debris as might be expected at an unconformable zone. It is composed of sand; red, green, yellow and white chert; red, green, blue and yellow shale; red, white and yellow limestone; light-brown and cream-colored dolomite; flint; arkosic material; and, rarely, glauconite. The presence of shale is not always evident, since it is often washed out at the rig before the cuttings can be examined. In some areas chert and dolomite, often reworked, are the principal constituents; in other areas the sample may be composed almost entirely of varicolored shale and, in a few localities, of sand.

In the Gorham field the conglomerate zone is almost wholly a sandstone (shale is present, but it is usually washed out of the sample), hence the popular name for this horizon of "Gorham sand." If the name Gorham is to be used at all, it should be spoken of as

12. Present information suggests that the conglomerate does not, as far as known at present, occupy a higher stratigraphic position than the upper part of the Kansas City group.

the "Gorham pay horizon." Since the conglomerate zone is seldom of the same age as in the Gorham field, it is preferable to speak of it as the Pennsylvanian basal conglomerate, which adequately describes the deposit, regardless of its position stratigraphically in the Pennsylvanian section. In other areas production in this conglomerate horizon is derived from dolomite, chert and sand lenses. It is strongly urged, therefore, that the term Pennsylvanian basal conglomerate[13] be adopted for this erosional or detrital zone between Pennsylvanian and Ordovician or older sediments. Care must be taken not to refer to it as basal Pennsylvanian conglomerate, because, while it always occupies a stratigrahic position at the base of the Pennsylvanian section at any specific locality, it has a different age in different places and is never actually of earliest Pennsylvanian age.

The conglomerate varies in thickness from a few feet to more than 275 feet. It is relatively thin in the Gorham field. In other productive areas its thickness is unknown, since the conglomerate zone has just been topped. Cases exist where a hole full of water has been encountered in the top of the conglomerate, and when shut off and drilled deeper production was found lower in the conglomerate section. It is not necessarily true that to produce oil the Pennsylvanian basal conglomerate must be thin. One case is on record in which a well produces oil from the top of the conglomerate, and yet its nonproductive offset penetrated 250 feet of conglomerate before reaching the Ordovician.

"Wilcox" Sand. The first production of oil from the "Wilcox" sand in western Kansas was found in Sumner county, in sec. 23, T. 34 S., R. 2 W., in July, 1927. Subsequently, in 1929, two additional areas of "Wilcox" sand production were found—one in T. 35 S., R. 3 W., Sumner county, and the other in T. 21 S., R. 3 W., McPherson county. In each of these fields the oil is produced at or near the top of the "Wilcox" sand. While not strictly in western Kansas, the most interesting "Wilcox" sand production has been discovered by Shell Petroleum Corporation in their No. 2 Borg, in sec. 14, T. 26 S.,

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13. One of the earliest workers to recognize the conglomeratic nature of this zone was Fanny Carter Edson. During the early part of 1925 she called (in unpublished reports) this horizon the "Sooy" conglomerate (from the test of Cheyenne Oil and Gas Company No. 1 Sooy, SW cor. sec. 27, T. 18 S., R. 12 W., completed November, 1924). Mrs. Edson has referred to this zone as the "Sooy" conglomerate in a paper entitled "Pre-Mississippian Sediments in Central Kansas." Bull. Am. Assoc. Petroleum Geol., vol. 13, pp. 447-445; May, 1929. The term "Sooy" conglomerate never has been generally recognized, whereas the term Pennsylvanian basal conglomerate is now quite frequently used by Kansas geologists in oral discussions. The first appearance of this name in print dates to a discussion by Roy H. Hull (Bull. Am. Assoc. Petroleum Geol., vol. 12, pp. 190-194; Feb., 1928) of John S. Barwick's paper on "The Salina Basin of North-Central Kansas."

R. 2 E., Sedgwick county. In this test oil is produced from a horizon in the "Wilcox" sand 70 feet below the top, and about 50 feet above the "Siliceous lime."

"SILICEOUS LIME." The first definitely known occurrence of oil in the "Siliceous lime" in western Kansas was in the Susank field, in T. 15 S., R. 13 W., Russell county, in the latter part of 1929. The discovery well, after producing a small amount of oil from the Pennsylvanian basal conglomerate, was deepened to a dolomite horizon and all oil and water shut off. It was then successfully drilled 10 feet into this dolomite with an initial production in excess of 500 barrels of oil and no water. Samples from this dolomite horizon are conclusively "Siliceous lime." The remaining two wells in this field were then deepened and are producing from both "Siliceous lime" and Pennsylvanian basal conglomerate.

The establishment of the "Siliceous lime" age of this production led to a consideration of other producing wells, supposedly producing from the Pennsylvanian basal conglomerate, but which might derive their oil from the "Siliceous lime." It was found that Phillips Petroleum Company No. 1 and No. 2 Shutts, in sec. 5, T. 12 S., R. 17 W., Ellis county, are producing from the "Siliceous lime." As No. 1 Shutts was completed in December, 1928, this automatically renders this the discovery well of "Siliceous lime" production in western Kansas.

Added interest in the possibilities of "Siliceous lime" production was contributed on February 3, 1930, by the completion of Producers and Refiners Corporation No. 1 Thompson, in the SE cor. NW¼ of sec. 21, T. 20 S., R. 10 W., Rice county. This well offsets No. 1 Schurr (described below), which produces from the Pennsylvanian basal conglomerate. In the case of No. 1 Thompson a hole full of water was encountered in the conglomerate and, after being shut off, the well was deepened. The well is producing from 3,330 to 3,331 feet in a dolomite definitely referred to the "Siliceous lime."

Production in the "Oswald Series."

The "Oswald series" of Lansing-Kansas City (Pennsylvanian) age is productive in Russell, Ellis and Rooks counties. Production was discovered in this horizon on November 24, 1923, in the Fairport field of Russell county, where 100 wells produce from nine pay zones.

During the past few years six additional fields have been discovered which produce from the "Oswald series." The oil in these

fields is recovered from ten pay zones, some of which are not equivalent to the productive zones in the Fairport field. For this reason it is necessary to supplement the table given for the Fairport field, which was published in 1928 by L. W. Kesler,[14] with a table showing the productive zones of the "Oswald series" in the six additional fields.

The productive zones of the "Oswald series" are porous oölitic streaks in the limestone and are measured in feet below the top of the "Oswald lime." Since wells are often dry, or encounter a hole full of water, in two or more of the pay zones, the second oil pay (for example) in one well is not necessarily equivalent to the second oil pay in another well, unless it occurs the same number of feet below the top of the "Oswald lime." Production is not always found at exactly the depths given in Table 20; but, wherever present, it closely corresponds to one of them.

There are fifty wells producing from the "Oswald series" outside of the Fairport field. Many of these wells produce from two or more pays in the "Oswald series," so that the total number of wells shown as productive from the ten pay zones in the accompanying table is greater than the actual number of producing wells.

TABLE 20.—*Producing horizons of the "Oswald series" in Russell, Ellis and Rooks counties, exclusive of the Fairport field of Russell county.*

HORIZONS.	Fields from which production is obtained	Number producing wells.
"Oswald pay".....	South Fairport	19
30-foot pay.....	South Fairport, North Fairport, Gorham, North Gorham, Laton	28
45-foot pay.....	South Fairport, Gorham, North Gorham, Laton,	5
65-foot pay.....	Gorham	1
75-foot pay.....	North Gorham	1
98-foot pay.....	Laton	1
115-foot pay.....	North Gorham	1
132-foot pay.....	Yocemento	4
190-foot pay.....	North Fairport	2
220-foot pay.....	South Fairport, North Fairport.....	4

New Development by Counties.

The following discussion of new development (1928-1929) in western Kansas is considered alphabetically by counties. For a complete summary of oil and gas produced in western Kansas to the close of 1927 the reader is referred to Kesler's paper.[15]

14. Kesler, L. W., Oil and Gas Resources of Kansas in 1927: Min. Res. Circ. 1, Kan. Geol. Survey, p. 39, Table 7, 1929.

15. Kesler, L. W., Op. cit., pp. 31-56.

Barber County.

From 1927 to 1929 steady exploitation was carried on in Barber county in an effort to obtain production from the Simpson formation. As a result of this play, based on geology, a number of very deep tests were drilled, but thus far no oil production has been obtained, although the Simpson formation is present in considerable thickness. One of these tests in particular—Shaffer Oil and Gas Company No. 1 Boggs, in the center SW¼ sec. 19, T. 33 S., R. 12 W., penetrated the top of the "Siliceous lime" at 5,234 feet and was completed at a total depth of 6,185 feet in rocks of pre-Cambrian age. Incidentally, this was at that time the deepest test in Kansas.[16]

The first commercial production found in Barber county was obtained in January, 1927, with completion of a gas well by Shaffer Oil and Gas Company, No. 1 Alexander, located in the NW cor. SE¼ sec. 13, T. 33 S., R. 13 W., at a total depth of 4,447 feet. Its volume was variously estimated at from 4 to 10 million cubic feet. The gas is wet, showing a small gasoline content.

Subsequently three other gas wells were completed, and the producing area, 9 miles southwest of Medicine Lodge, is referred to as the Medicine Lodge gas field. Information on these wells will be found in the table on page 84.

No gas was produced from these wells during 1927 and 1928. The gross yield of gas from the above four wells for 1929 has been 471,930,000 cubic feet. The gas is taken by the Winchester Oil and Gas Company and the Kansas Pipeline and Gas Company.

Clark County.

Gas was first discovered in Clark county in the early part of 1926 by the Watchorn Oil and Gas Company. This well, No. 1 Morrison, located in the SE cor. NE¼ NE¼ sec. 20, T. 32 S., R. 21 W., encountered a sand yielding gas from 5,304 to 5,312 feet. Desirous of testing deeper horizons the well was drilled to a total depth of 5,683 feet without further success, and plugged. In 1927 this company again attempted to reach the gas horizon and drilled two rotary holes in the NE¼ NW¼ sec. 21, T. 32 S., R. 21 W., but both were abandoned above the gas zone. In November, 1928, a third effort was rewarded through the completion of No. 3 Stephens, in the NW cor. sec. 21, T. 32 S., R. 21 W., as a 20-million-cubic-foot gas well from 5,443 to 5,465 feet, in the same horizon as No. 1 Morrison.

16. A still deeper test—Watchorn Oil and Gas Company No. 2 Morrison, in the center NW¼ NE¼ sec. 20, T. 32 S., R. 21 W., Clark county, was completed in 1930 at a total depth of 6,906 feet.

Wells in the Medicine Lodge gas field.

Name.	Location.	Completion date.	Total depth.	Depth to pay horizon.	I. P. million cu. ft.	Producing horizon.
Shaffer Oil & Gas Co. No. 1 Alexander.....	13-33S-13W	Jan., 1927	4,447	4,441-4,447	10	Pennsylvanian basal conglomerate.
Shaffer Oil & Gas Co. No. 2 Carter.....	11-33S-13W	Nov., 1928	4,556	4,528-4,556	45	Pennsylvanian basal conglomerate.
Barbara Oil & Gas Co. No. 1 Lytle.....	12-33S-13W	Apr., 1929	4,650	4,558-4,580	22	Pennsylvanian basal conglomerate.
Barbara Oil & Gas Co. No. 1 Angel.....	14-33S-13W	July, 1929	4,637	4,550-4,571	8	Pennsylvanian basal conglomerate.

The gas is produced from a sand which occurs close to the top of the "Mississippi lime" and corresponds in stratigraphic position to the Pennsylvanian basal conglomerate. The Public Service Company of Kansas constructed a pipe line to Pratt and took 64,728,786 cubic feet of gas from this well between August 15 and December 31, 1929.

Edwards County.

The first producing well in Edwards county was completed on May 22, 1929, by the British American Oil Company at their No. 1 McCarty, in the NE cor. NW¼ sec. 31, T. 25 S., R. 17 W. The top of the Pennsylvanian basal conglomerate was reached at 4,535 feet, and the well was drilled to a total depth of 4,571 feet. From 4,545 to 4,553 feet there was encountered 7 million cubic feet of gas and 60 barrels of 35° Bé. oil. The gas increased to 15 million cubic feet from 4,566 to 4,571 feet.

No. 1 McCarty commenced producing gas on October 23, 1929, and to December 31, 1929, yielded 147,276,500 cubic feet of gas. The gas is taken by the Kansas Pipe Line and Gas Company. Production of oil did not begin until November 22, 1929. During November the production was 1,334 barrels, and during December, 2,169 barrels, resulting in a total of 3,503 barrels of oil in five weeks.

Ellis County.

Commercial production (exclusive of the South Fairport field) was first found in Ellis county during 1928 by Phillips Petroleum Company in their No. 1 Shutts, in the center NE¼ sec. 5, T. 12 S., R. 17 W., from 3,569 to 3,575 feet. The top of the "Oswald lime" was reached at 3,331 feet, so that the producing horizon is 238 feet below the top of the "Oswald lime," and is now assigned definitely to the "Siliceous lime." The well was completed in the early part of December, 1928, and a 17-hour gauge yielded 205 barrels of oil, or at the rate of 290 barrels per day. The gravity is 33.5° Bé. at 64° F. No oil showings were encountered in the "Oswald series." This test constitutes the discovery well of "Siliceous lime" production in western Kansas.

This discovery of commercial production in Ellis county was of such significance that it resulted in a considerable wildcat play. By the end of 1929 34 tests had been completed, inclusive of those few drilled prior to the discovery of oil in the No. 1 Shutts, and exclusive of the wells in the South Fairport field of Russell county, which

extends just across the line into Ellis county. Of this number 2 stopped in the Permian, 5 stopped in the Pennsylvanian "Oswald series," 5 stopped in the Pennsylvanian basal conglomerate, 17 stopped in the Ordovician "Siliceous lime" and 5 stopped in the pre-Cambrian. Out of these 34 completions 8 wells have been productive of oil, representing two fields—the North Ellis field and the Yocemento field. Should it be considered that these 8 producing wells are in reality but two unit discoveries represented by the two fields, this would mean but two productive completions out of 34, or, in the ratio of 1 to 17. Such a ratio is not very satisfactory.

A consideration of the 1928-29 completions in Ellis county show four outstanding disappointments. These are:

Data on certain Ellis county wells.

Name.	Location.	Total depth.	Pennsylvania basal conglomerate.	Stratigraphic depth reached.	Water.
Derby No. 1 Wiegel.....	25-12S-17W	4,068	3,627-3,687	"Siliceous lime".....	HFW 3,642-57
Empire No. 1 Waun.....	21-12S-19W	3,985	3,790-3,852	"Siliceous lime".....	HFW 3,850-52
Midwest No. 1 Riedel.....	27-13S-16W	3,872	3,430-3,507	Pre-Cambrian.....	.....
Derby No. 1 Kraus.....	17-14S-19W	3,881	3,802-3,881	Pennsylvanian basal conglomerate.	HFW 3,880-81

North Ellis Field. The discovery well of this field, Phillips Petroleum Company No. 1 Shutts, located in sec. 5, T. 12 S., R. 17 W., was completed in December, 1928. The details of its initial production appear above. Following are the wells which comprise the field, listed in their order of completion:

Wells in the North Ellis field.

Name.	Location.	Status.	Pay.	Producing horizon.
Phillips Petr. Co., No. 1 Shutts.....	5-12S-17W	Producing.....	3,569-75	"Siliceous lime."
Burgher Oil Co., No. 1 Hadley.....	20-11S-17W	Shut in.....	3,428-40	Penn. basal conglom.
Phillips Petr. Co., No. 2 Shutts.....	5-12S-17W	Producing.....	3,635-38	"Siliceous lime."
Phillips Petr. Co., No. 1 Weigel.....	18-12S-17W	Producing.....	3,683-86	Penn. basal conglom.
Phillips Petr. Co., No. 1 Schmeidler..	20-12S-17W	Abandoned.....	None	———

Despite the fact that as much as three miles separate some of these wells, they are all located on the same line of folding and are, at least for the present, considered as forming one field. Produc-

tion is found in the "Siliceous lime" and the Pennsylvanian basal conglomerate. The average interval between the top of the "Oswald lime" and the top of the conglomerate is 250 feet. The wells have an initial production of 300 barrels of 32° Bé. oil. Actual producing of the North Ellis field did not commence until July, 1929, and in 6 months it has yielded 45,523 barrels from three wells. During December, 1929, the average daily production per well was 90 barrels. The amount of "Siliceous lime" production has been 43,132 barrels. The recovery for the field has been 1,530 barrels to the acre.

YOCEMENTO FIELD. On June 17, 1929, Phillips Petroleum Company completed their No. 1 Sophus Johnson, in the SW cor. NE¼ sec. 9, T. 13 S., R. 19 W., for an initial production of 480 barrels of oil from 3,592 to 3,597 feet, 132 feet below the top of the "Oswald lime." Subsequently the well was deepened to 3,684 feet and penetrated the top of the Pennsylvanian basal conglomerate, 200 feet below the top of the "Oswald lime." No further oil horizons were found and the well was plugged back. A total of four wells have been drilled around the center of sec. 9, and all have been productive. The producing horizon is the 132-foot pay of the "Oswald series" of Lansing-Kansas City age. This pay is not present in the Fairport field of Russell county.[17] The field was not produced until August, 1929, and in five months yielded 26,970 barrels of oil. During December, 1929, the average daily production per well was 45 barrels. The recovery to date has been 590 barrels to the acre. The Yocemento field has been limited only on the east by the completion in January, 1930, of Mid-Kansas Oil and Gas Company No. 1 Johnson, in the SW cor. SE¼ NE¼ sec. 9, T. 13 S., R. 19 W., at a total depth of 4,360 feet in pre-Cambrian.

McPHERSON COUNTY.

McPherson county has been one of the most active areas in western Kansas during the 1928-1929 period. At the close of 1927 there had been developed but one gas field, containing three wells. The end of 1929 saw five gas and oil fields with 37 producing wells, as shown in Table 21.

The wells in the Voshell oil field are at the present time prorated to 50 barrels per day.

All of the fields in McPherson county, with the exception of the McPherson field, were defined by core-drilling prior to development.

17. Kesler, L. W., op. cit., p. 39, Table 7.

TABLE 21.—*Oil and gas development in McPherson county.*

FIELD.	Location.	Producing wells.		Gross oil production, barrels.	Gross gas production, M. cu. ft.	Producing horizon.
		Oil.	Gas.			
McPherson	T. 18 S., R. 2 W.	7	13	104,725	7,590,479	"Mississippi lime."
Voshell	T. 21 S., R. 3 W.	5	.....	70,857	.....	Viola "lime," "Wilcox" sand.
Ritz	T. 20 S., R. 2 W.	7	1	315,333	195,644	"Mississippi lime."
Galva	T. 19 S., R. 2 W.	.....	3	.....	749,874	"Mississippi lime."
Grattan	T. 20 S., R. 3 W.	1	.....	8,337	.....	"Mississippi lime."
Totals	.....	20	17	499,252	8,535,997	———

MCPHERSON GAS AND OIL FIELD. At the close of 1930 this was the most important gas field in western Kansas. Gas was discovered in September, 1929, by Merriam, Reeves and Shidell No. 1 Anderson, situated in the center SW¼ sec. 29, T. 18 S., R. 2 W., at a depth of 2,927 feet, 22 feet below the top of the "Mississippi lime." The initial yield was 7½ million cubic feet of gas. The discovery oil well was Mid-Kansas Oil and Gas Company No. 1 Larson, in the center NE¼ SW¼ sec. 31, T. 18 S., R. 2 W., completed on July 7, 1928, for an initial production of 30 barrels of 37° Bé. oil. This well found the top of the "Mississippi lime" at 2,950 feet, and produces gas from 2,952 to 2,965 feet. The oil-producing horizon is 27 feet below the top of the "Mississippi lime," from 2,977 to 2,978 feet, and is 101 feet structurally down the southwest flank of the dome.

The McPherson field is situated in secs. 29, 30, 31 and 32, T. 18 S., R. 2 W. Production is found in a triangular-shaped area, two miles wide and one mile long. The producing wells are all south of the apex; northward no wells have been drilled. The oil wells are located on the southwest and southeast flanks of the dome, and some of them are the lowest wells, structurally, in the field. As developed on top of the "Mississippi lime," the McPherson field has in excess of 100 feet of closure. The top of the "Mississippi lime" ranges in depth from 2,855 to 2,973 feet.

The gas production occurs in the top of the "Mississippi lime." Thirteen gas wells have been completed. The thickness of limestone penetrated in the producing wells varies from 22 to 50 feet. The initial production of gas ranges from 4½ million to 20 million cubic feet and averages 10 million cubic feet. The amount of gas is not controlled by the structural position of the well on the dome.

The vertical range, structurally, of gas production is 66 feet, and the lowest producing gas well is 106 feet down the flank. The immediate apex of the dome is barren of gas and oil, and the highest gas well is 41 feet structurally lower than the apical well.

Following are statistics on the yearly yield of the gas wells in the McPherson field:

Year.	Production, cubic feet.
1927	668,430,000
1928	2,705,327,000
1929	4,216,722,000
Gross yield	7,590,479,000

The oil production occurs in the top 50 feet of the "Mississippi lime" and varies in depth below the top from 8 to 50 feet; the average is 35 feet. Seven oil wells have been completed. The oil wells comprise the extreme southwest and southeast producing wells in the field. The vertical range, structurally, of oil production is 70 feet, and the lowest producing oil well is 130 feet down from the apical well. The initial production varies from 80 to 335 barrels; and, in some cases, the amount of water produced with the oil is equal to, or exceeds, the oil production. The recovery to the close of 1929 has been 980 barrels to the acre. During December, 1929, the average daily production was 23 barrels per well. A record of the yearly production in this field is shown in Table 22.

Table 22.—*Production McPherson oil field, 1928 and 1929.*

	Mid-Kansas Larson No. 1.	Midco Oil Co. Hawkinson No. 1.	Texas Chindberg Nos. 2 and 3.	Amerada Rosberger No. 1.	Gardner Petr. Corp. Bentson Nos. 1 and 2.	Totals.
1928....	23,755	4,299	20	.....	.....	28,074
1929....	16,967	11,408	5,412	20,210	22,654	76,651
Total.	40,722	15,707	5,432	20,210	22,654	104,725

The McPherson field has been defined only to the southwest, where a well was abandoned, 131 feet structurally lower than the highest well. No attempt has been made to exploit that area north of the apex of the dome. Should such exploitation be successful, the producing area of the McPherson field may exceed 2,500 acres.

No systematic attempt has been made to develop oil from the Ordovician in this field. What little effort has been made has been highly disappointing. Three wells have been drilled below the Mississippian; one in sec. 30, a second in sec. 31 and the third in sec. 32.

These penetrated the "Siliceous lime," "Wilcox" sand and Viola limestone respectively. The thickness of the "Mississippi lime" ranges from 86 to 185 feet. The two wells which penetrated the "Wilcox" sand encountered a hole full of water. Evidence is accumulating that the apex of folding in the Ordovician is not directly beneath the apex in the "Mississippi lime," which may explain, in part, the failure of these tests.

VOSHELL OIL FIELD. The Voshell field is located in secs. 9 and 10,[18] T. 21 S., R. 3 W. Its discovery was the most important development in western Kansas during 1929. The discovery well, Washabaugh *et al.* No. 1 Voshell (later purchased by W. C. McBride, Inc.), is located in the NE cor. sec. 9, T. 21 S., R. 3 W., and was completed in August, 1929, at a total depth of 3,304 feet for an initial production of 40 barrels. The producing zone, 3,301 to 3,304 feet, is in the Viola limestone. Mechanical difficulties in drilling-in this well have prevented it from ever being of much commercial importance. All of the five wells completed by the end of 1929 are situated on the eastern flank of the structure, and in January, 1930, the field was producing from more than 100 feet structurally down the east flank.

Proration has limited the wells to 50 barrels per day. The field is (January, 1930) one-half mile wide and one mile in length. No dry holes have been drilled, so the limits of the field are wholly undefined. The principal producing horizon is the "Wilcox" sand[19] of Ordovician age, but a small amount of oil is being recovered from one well producing from the Viola limestone (Ordovician). The field is on the same line of folding as the McPherson gas and oil field. The recovery per acre to the close of 1929 has been 1,420 barrels. During 1929 the field produced 70,857 barrels.

RITZ OIL AND GAS FIELD. The Ritz field is located in secs. 1 and 12, T. 20 S., R. 2 W. It is essentially an oil field, although the discovery well yielded gas. This well, McPherson Oil and Gas Company No. 1 Wedel, in the center SW¼ sec. 12, T. 20 S., R. 2 W., was completed on December 28, 1928, and encountered 6½ million cubic feet of gas from 2,972 to 2,983 feet in the upper part of the Mississippi lime." During 1929 it yielded 195,644,000 cubic feet of gas.

18. Wells have been completed in the W½ W½ sec. 10, T. 21 S., R. 3 W., during January, 1930.

19. In March, 1930, the "Siliceous lime" contributed a new and important producing horizon to the Voshell field. Subsequently many wells have been deepened to this horizon, and the "Wilcox" sand and "Siliceous lime" are now the most important producing horizons in this field.

Subsequently seven oil wells have been brought in. The depth to the top of the "Mississippi lime" ranges from 2,925 to 2,960 feet. The oil is produced in the top 51 feet of the "Mississippi lime," and the pay zone averages 40 feet below the top. Gravity of the oil varies from 34° to 38° Bé. The initial production of these wells ranged from 1,500 to 35,000 barrels for the first week. The field is about two miles long and one-half mile wide. It is wholly undefined, and no dry holes have been drilled. Up to the end of 1929 the seven wells produced 315,333 barrels of oil and 75,320 barrels of water. The recovery has been 4,500 barrels to the acre. During December, 1929, the average daily production was 320 barrels.

The percentage of water recovered with the oil is 24 per cent. The following table shows the production of oil and water for the field:

TABLE 23.—*Amount of oil and water in the Ritz field during 1929.*

1929.	Oil, barrels.	Water, barrels.	Wells producing.
July	32,400	.....	1
August	33,550	621	1
September	40,613	1,871	2
October	69,438	19,485	5
November	72,580	30,524	5
December	66,752	22,889	7
Totals	315,333	75,390	7

GALVA GAS FIELD. The Galva gas field is located in sec. 11, T. 19 S., R. 2 W. The discovery well, McPherson Oil and Gas Company No. 1 Decker, in the center SE¼ sec. 11, T. 19 S., R. 2 W., was completed during July, 1929, for 18 million cubic feet of gas from 2,892 to 2,914 feet, 7 feet below the top of the "'Mississippi lime." Two additional gas wells have been drilled, of which the largest yielded, initially, 30 million cubic feet of gas. The limits of the field are undefined. During 1929 the production of gas was 749,874,000 million cubic feet.

GRATTAN LEASE.[20] On October 28, 1929, Slick, Pryor and Lockhart completed their No. 1 Grattan, in the NE cor. NW¼ NW¼ sec. 34, T. 20 S., R. 3 W., at a total depth of 3,108 feet, for an initial production of 256 barrels of 36° Bé. oil. Production was obtained from 3,093 to 3,098 feet in the "Mississippi lime," the top of which was penetrated at 3,055 feet. The peak production was 350 barrels on November 9, 1929. Its gross production for 1929 has been 8,337

20. Although carried as a separate producing area in the report because at the end of 1929 its relation to the Voshell field was unknown, it now forms an integral part of that pool, and its production figures will hereafter be included with those of the Voshell field.

barrels, and the daily average production during December, 1929, was 120 barrels per day.

Ness County.

The most westerly production of oil in western Kansas was found in October, 1929, by the Continental Oil Company in their No. 1 Aldrich, in the NE cor. SE¼ sec. 17, T. 18 S., R. 25 W. The "Oswald series" was penetrated at 3,855 feet. Production was encountered 573 feet below the top of the "Oswald lime" from 4,428 to 4,430 feet, in a reworked dolomite of the Pennsylvanian basal conglomerate. The gravity is 33° Bé. During a six-day official pumping test the well made 910 barrels of oil and 9 bailers of water. The well was pumped but four days in November and nine days in December, and yielded a total, during these two months, of 1,660 barrels of oil, or a daily average of 128 barrels. In January, 1930, the well was pumped just often enough to remove the water since it had no pipe-line connections.

The only other important Ness county test in 1929 was the completion, unsuccessfully, of Barnsdall Oil Company No. 1 Lank, in the center SW¼ sec. 35, T. 18 S., R. 21 W., at a total depth of 4,755 feet in strata of lower Cambro-Ordovician age. After reaching the "Oswald lime" at 3,698 feet water was encountered in the "Oswald pay," 30-foot pay, and 90-foot pay of the "Oswald series." Two very interesting shows of oil were found. The first, which was in a sand from 4,178 to 4,183 feet in the Pensylvanian basal conglomerate (which extended from 4,140 to 4,207 feet), swabbed 70 barrels of oil in 19 hours and was exhausted. The second showing occurred at 4,224 to 4,229 feet, in the upper part of the "Mississippi lime," and swabbed 220 barrels of 40° Bé. oil before it also was exhausted.

Rice County.

Because of the completion of an oil well in the Pennsylvanian basal conglomerate in August, 1929, a renewal of interest in this county manifested itself during the latter part of 1929. Further interest has been occasioned by the completion of a shallow gas well early in 1930, and it is probable that in the coming year exploitation for oil will bring definite economic results. No activity took place during 1928-'29 in the Welch field, although one well was deepened unsuccessfully to the Ordovician.

In August, 1929, Slick, Pyor and Lockhart completed their No. 1 Schurr, in the NE cor. SW¼ sec. 21, T. 20 S., R. 10 W., at a total

depth of 3,289 feet. The top of the "Oswald series" was reached at 3,005 feet, and the Pennsylvanian basal conglomerate was penetrated at 3,278 feet. The well had an initial production of 240 barrels of 52° Bé. oil from 3,278 to 3,284 feet in the Pensylvanian basal conglomerate. It produced 11,490 barrels of oil to the end of 1929. Three offsets and one well one-quarter mile distant are being drilled.[21]

Gas was discovered on January 15, 1930, in Boucher Oil Company No. 1 Boy, in the SW cor. sec. 16, T. 21 S., R. 10 W. The producing horizon is a sand lens in the Severy shale at a depth of 2,550 to 2,553 feet, 65 feet below the top of the Howard limestone. Its initial production is 11 million cubic feet of gas.[22] The only other well yielding gas from this horizon (in western Kansas) is the De Forrest Drilling Company No. 1 Bryan, in the SW cor. sec. 25, T. 30 S., R. 2 W., Sumner county, which produces gas both from the Howard limestone and from a sand zone in the Severy shale.

Rooks County.

Four oil wells, producing from the "Oswald series," have been completed in Rooks county. Two of these have been abandoned. These wells comprise the Laton oil field of east-central Rooks county.

The discovery well, Vickers Petroleum Company No. 1 Luhman, located in the SW cor. SE¼ sec. 11, T. 9 S., R. 16 W., was completed on July 5, 1927, with an initial production of 238 barrels of 41.5° Bé. oil. It settled immediately to a production of 80 barrels of oil per day for the first month. The top of the "Oswald lime" was reached at 3,228 feet, and production is obtained at 3,261 feet in the 30-foot pay of the "Oswald series." This well has produced 36,043 barrels of oil to the close of 1929, or over half of the oil recovered from Rooks county.

Shortly afterwards Derby Oil Company completed their No. 1 Kruse, in the NW cor. NE¼ NE¼ sec. 3, T. 10 S., R. 16 W., in the latter part of December, 1927. It had an initial production of 42 barrels of 41° Bé. oil from 3,126 to 3,134 feet. The producing horizon occurs 51 feet below the top of the "Oswald lime" and corresponds to the 45-foot pay of the "Oswald series." The well was produced from February, 1928, to February, 1929, and yielded 6,202

21. On February 8, 1930, one of these offsets was completed as a producing well in the "Siliceous lime." The producing area is now referred to as the Raymond field.

22. When this gas showing was tested the yield of gas was disappointing. Accordingly, the test was carried deeper and finally abandoned at a total depth of 3,434 feet, in September, 1930.

barrels of oil. In March, 1929, it was deepened to a total depth of 3,425 feet in the Pensylvanian basal conglomerate, and plugged in May, 1929. No further showings of oil were found.

Krueger *et al.* No. 1 Tatkenhorst, in the SE cor. SW¼ sec 11, T. 9 S., R. 16 W., penetrated the top of the "Oswald" at 3,228 feet, and was completed at the total depth of 3,332 feet. In the "Oswald" pay from 3,332 to 3,340 feet an oil showing estimated at 40 barrels was encountered. The producing horizon was found from 3,318 to 3,323 feet, 90 feet below the top of the "Oswald lime" and corresponding to the 98-foot pay in the Fairport field. The initial production of the well was 175 barrels of 40° Bé. oil. The well began producing in September, 1928.

Phillips Petroleum Company No. 1 Tatkenhorst, in the NE¼ NW¼ sec. 14, T. 9 S., R. 16 W., reached the top of the "Oswald" at 3,236 feet, and was completed at the total depth of 3,613 feet. Originally it was completed at the total depth of 3,510 feet and produced oil from 3,292 to 3,298 feet, 56 feet below the "Oswald" pay, in a horizon corresponding to the 45-foot pay in the Fairport field. The initial production of the well was 40 barrels of 38° Bé. oil. The well produced during August and September, 1928. It was then deepened to its total depth of 3,613 feet, and in February, 1929, encountered 2,800 feet of oil and 700 feet of water from 3,602 to 3,612 feet, 366 feet below the top of the "Oswald lime," in the Pennsylvanian basal conglomerate. It is of interest to note that this is the first well to obtain an oil show in the conglomerate horizon in Rooks county. The well failed to make a commercial producer and was abandoned in February, 1929.

The total recovery of oil from Rooks county has been 57,187 barrels. A record of the individual production from each well will be found in Table 24.

TABLE 24.—*Rooks county oil production, August, 1927, to December, 1929.*

	Vickers Petr. Co. No. 1 Luhman 11-9S-16W.	Derby Oil Co. No. 1 Kruse 3-10S-16W.	Kruger *et al.* No. 1 Tatkenhorst 11-9S-16W.	Phillips Petr. Co. No. 1 Tatkenhorst 14-9S-16W.	Totals.
1927	7,829	.....	.....	.....	7,829
1928	14,879	5,469	4,397	357	25,102
1929	13,335	733	10,188	.....	24,256
Totals	36,043	6,202	14,585	357	57,187

Rush County.

Gas was encountered in Rush county during 1928 by Danciger Oil and Gas Company in their No. 1 Scheuerman, in the center NE¼ sec. 27, T. 17 S., R. 17 W., on November 4, 1928. The total depth of the well is 3,579 feet. The top of the "Oswald" was encountered at 3,340 feet and the gas is being produced from the Pennsylvanian basal conglomerate, the top of which was reached at 3,573 feet, 214 feet below the top of the "Oswald lime." From 3,575 to 3,576 feet the well yielded 4 million cubic feet of gas and from 3,576 to 3,579 feet, 12 million cubic feet of gas with 800 pounds rock pressure. This is the first well in western Kansas to produce gas from the Pennsylvanian basal conglomerate this far north, and for this reason the discovery is of the greatest importance. The Kansas Pipe Line and Gas Company took 203,647,000 cubic feet of gas from April 1 to December 31, 1929. The producing area is called the La Crosse gas field.

Subsequent completions have been unfortunate. Three wells, one located in the NE cor. NW¼ SW¼ sec. 27, another in the SW cor. sec. 22, and a third in the SE cor. sec. 21, all in T. 17 S., R. 17 W., were nonproductive of gas. All either passed directly from Pennsylvanian basal conglomerate into pre-Cambrian, or from the basal "Oswald series" into pre-Cambrian, with an absence of the conglomerate horizon. Only one well had even a small showing of gas. All were structurally higher than the discovery gas well and therein, possibly, is the explanation. An analogous condition exists in the "Mississippi lime" production of the McPherson gas and oil field wherein the structurally highest wells yield the smallest amount of gas, with the apical well completely barren of gas. Lower down on the flanks of this dome gas production is prolific, and lower still, small oil wells are found. Possibly a somewhat similar picture will be found at this Rush county locality (excepting that here Pennsylvanian rests on pre-Cambrian), provided too many dry holes do not hinder or stop persistent exploitation.

By far the greatest disappointment in Rush county was the failure of Sinclair Oil and Gas Company No. 1 Seuser, in the SE cor. NW¼ NW¼ sec. 8, T. 18 S., R. 17 W., completed at a total depth of 3,840 feet. This well reached the "Oswald lime" at 3,429 feet, and the Pennsylvanian basal conglomerate (3,765 to 3,807 feet) rested directly on pre-Cambrian. No showings of oil or gas were found,

despite the fact that this well was drilled on one of the most favorable surface structures in western Kansas.

Russell County.

To the close of 1929 Russell county has produced a total of 6,933,643 barrels of oil from seven fields. Their individual production is as follows:

Production of Russell county fields.

Field.	Total production, barrels.	Number producing wells, Dec., 1929.	Age in years.	Per acre recovery, barrels.
Fairport	5,414,906	100	6	5,480
Gorham	1,108,004	26	4	4,100
South Fairport	328,429	21	4	1,700
Susank	29,926	3	1	930
North Fairport	25,720	4	2	642
North Gorham	22,532	1	3	2,260
Ochs Lease	4,126	1	1	412

In January, 1928, Russell county contributed a factor of immeasurable significance to the oil possibilities of western Kansas by establishing the presence of a new producing horizon in the Gorham field, the Pennsylvanian basal conglomerate. Not only did this raise the Gorham field from comparative insignificance at the end of 1927 with an accumulated production of 73,783 barrels from four wells, to one of importance in 1929 with an accumulated production of 1,108,004 barrels from 27 wells, but it also produced an incentive to explore for oil from this horizon in other localities. That such exploitation was successful is evidenced by the fact that in Russell county alone two additional fields were discovered in 1929, having their production in this conglomerate zone and in the "Siliceous lime."

Another factor of importance for Russell county during the 1928-'29 period, was the extension of the South Fairport field from an accumulated production of 28,729 barrels from four wells to an accumulated production at the end of 1929 of 328,429 barrels from 21 wells.

In 1928 Russell county maintained its lead as the principal oil producing county of western Kansas, with a gross yield for the year of 1,273,371 barrels from 132 wells. During 1929 it dropped to second place, despite its production for the year of 1,284,225 barrels from 156 wells. The total amount of oil produced in Russell county to the close of 1929 has been 6,933,643 barrels.

GORHAM FIELD. The Gorham field is located in secs. 32 and 33, T. 13 S., R. 15 W., and secs. 4 and 5, T. 14 S., R. 15 W. Development progressed slowly from its date of discovery on October 15, 1926, to the end of 1927, at which time there were only four producing wells. However, in 1928 16 producing wells were added, together with 7 wells in 1929, making a total of 27 producing wells. The total number of completions have been 35, of which 8 were dry.

Production is obtained in the top 65 feet of the "Oswald series," and from a true sand in the Pennsylvanian basal conglomerate. The discovery well of "Oswald" production, Midwest Exploration Company No. 36 Dortland, located in the SE cor. NW¼ sec. 5, T. 14 S., R. 15 W., was completed on October 15, 1926, with an initial production of 120 barrels of 37° Bé. oil at 3,057 feet, 30 feet below the top of the "Oswald lime." The discovery well of Pennsylvanian basal conglomerate production, Stearns-Streeter Company No. 1 Mermis, located in the SW cor. NW¼ SW¼ sec. 33, T. 13 S., R. 15 W., was completed in January, 1928, for an initial production of 1,000 barrels of 36° Bé. oil at 3,300 feet, 257 feet below the top of the "Oswald lime."

The average depth to the top of the "Oswald lime" in the Gorham field is 3,055 feet. Of the 15 wells producing oil from the "Oswald series," 13 wells produce from the 30-foot pay, 2 wells from the 45-foot pay, and 1 well from the 65-foot pay. The wells producing from the "Oswald series" are scattered throughout sec. 32, T. 13 S., R. 15 W., sec. 5 and the W½ W½ sec. 4, T. 14 S., R. 15 W.

Twelve wells produce from Pennsylvanian basal conglomerate. These are confined to section 32, and the W½ W½ sec. 33, T. 13 S., R. 15 W. The average depth to the top of this conglomerate zone is 3,317 feet. In the 18 wells which have been drilled to this horizon, the average interval between the top of the "Oswald lime" and the top of the Pennsylvanian basal conglomerate is 258 feet. Five of these 18 wells have penetrated completely the conglomerate zone. In three of these the Pennsylvanian basal conglomerate was underlain by pre-Cambrian, and in two wells by Ordovician. In the twelve producing wells of this horizon the amount of penetration is but a few feet.

In the Gorham field the Pennsylvanian basal conglomerate is in contact with either Ordovician or crystalline rocks. It represents an unconformable zone which occupies, at this locality, a stratigraphic position at or near the base of the Kansas City group.

The following four wells limit in part the northeast, north, and northwest portions of the field:

Edge wells in the Gorham field.

Name.	Location.	Depth "Oswald lime."	Pennsylvania basal conglomerate.	Remarks.
Stearns-Streeter, No. 1 Gorham..	SW NE 33-13S-15W	3,068	3,318-3,344	HFW 3,344-3,350.
Eskridge et al., No. 1 U. P. R. R.	NE NE NW 32-13S-15W	3,084	3,341-3,363	HFW 3,364-3,366
Griffin et al., No. 1 Gorham ...	NE SE SE 30-13S-15W	3,089	3,357-3,383	HFW in conglom.
Empire, No. 1 Polcyn.....	NE SW NW 31-13S-15W	3,083	3,325-3,335	Good show oil and HFW in conglom.

In no other direction has the field been limited. A dry hole in the NE cor. NW¼ NE¼ sec. 8, T. 14 S., R. 15 W., was abandoned 10 feet below the top of the "Oswald lime" and did not constitute an adequate test. Another dry hole in the SW cor. NW¼ NE¼ sec. 9, T. 14 S., R. 15 W., penetrated pre-Cambrian rocks, and while it precludes production at this immediate location, it by no means limits or condemns the possibilities of production in that direction. At the present time the proven area of the Gorham field is two miles north and south, and one mile east and west. The final productive area probably will include considerable territory and will occupy presumably a relatively square-shaped area in contrast to the long and narrow shape of the Fairport field.

During the 1928-'29 period the Gorham field produced 1,034,265 barrels of oil. Of this amount 70 per cent was produced from the Pennsylvanian basal conglomerate. The actual amount recovered from each horizon is shown in Table 25. It is significant that the average production of the Pennsylvanian basal conglomerate wells declined from 580 barrels per day in February, 1928, to 57 barrels per day in December, 1929. Part of this is normal decline, and part appears to be due to the fact that, since the producing sand is connected, as each new well is completed it reduces the production of all the wells.

The average recovery per acre to the close of 1929, and the average daily production during December, 1929, appears below:

Production of the Gorham field.

Producing Horizon.	Number producing wells.	Per acre recovery to close of 1929, bbls.	Proven average.	Daily average production Dec., 1929, bbls.
Pennsylvanian basal conglomerate.....	12	6,000	120	57
"Oswald series".....	15	2,020	150	34
Gorham field average.....	27	4,100	270	44

TABLE 25.—*Yearly production Gorham field, 1926 to 1929.*

	Pennsylvanian basal conglomerate production by leases.						Total production from Pennsylvanian basal conglomerate.	Total production from "Oswald series."	Gross production Gorham field.
	Stearns-Streeter Mermis Nos. 1 and 2.	Johnson & Vickers Gorham No. 1.	R. E. Day Mermis Nos. 1, 2, 3 and 4.	Keys Petroleum Co. Mermis Nos. 1, 2 and 8.	Midwest Exploration Co. Mermis No. 4.	Midwest Exploration Co. Baxter No. 4.			
1926.....	.....	.....	.....	.....	.....	.....	.....	6,020	6,020
1927.....	.....	.....	.....	.....	.....	.....	.....	67,719	67,719
1928.....	193,269	56,173	104,858	34,081	24,852	.....	413,233	158,209	571,442
1929.....	98,418	16,236	71,437	73,308	35,592	6,513	301,504	161,319	462,823
Total....	291,687	72,409	176,295	107,389	60,444	6,513	714,737	393,267	1,108,004

South Fairport Field. In a previous publication[23] this was called the Austin field. Since that time it has received the name South Fairport field, and the term Austin should be dropped.

The discovery well of this field, Midwest Exploration Company No. 1 Austin, is located in the NE cor. SW¼ sec. 30, T. 12 S., R. 15 W. It was completed on March 13, 1926, with an initial production of 24 barrels of 38° Bé. oil at 3,060 feet, from the 30-foot pay of the "Oswald series." Development was fairly slow to the close of 1928, but during the past year 12 wells have been drilled, bringing the total completions to 21 producing wells. No dry holes exist in the immediate producing area.

The South Fairport field is situated in the W½ of secs. 30 and 31, T. 12 S., R. 16 W., the SE¼ SE¼ sec. 25, and the E½ sec. 36, T. 12 S., R. 16 W., the NW¼ sec. 16, T. 13 S., R. 15 W., and the NE¼ sec. 1, T. 13 S., R. 16 W. The field is one-half mile wide and two miles long. It is located on the same line of folding as the Fairport field and is separated therefrom by a structural saddle.

The average depth to the top of the "Oswald lime" is 3,030 feet. Production is from four pays in the "Oswald series." Of the 21 producing wells, 19 wells produce from the "Oswald" pay, 12 wells from the 30-foot pay, 1 well from the 45-foot pay, and 2 wells from the 220-foot pay.

Four wells have penetrated into either the Pennsylvanian basal conglomerate or the underlying Ordovician without finding production in the conglomerate zone. Two of these wells are located in the field and were plugged back to produce from the "Oswald series," and two are dry holes situated immediately to the southwest. In these wells the average interval from the top of the "Oswald lime" to the Pennsylvanian basal conglomerate is 288 feet.

The South Fairport field has been limited only to the southwest. Presumably it will be similar in shape and history to the Fairport field, but not as large. It has produced 328,429 barrels of oil in four years. The per acre recovery to the close of 1929 was 1,700 barrels. During the month of December, 1929, the average daily production was 50 barrels of oil per well.

North Fairport Field. Four wells have been drilled along the axis of the Fairport anticline, from 1 to 3 miles northeast of the most northern well in the Fairport field. A distance of two miles separates two of these wells, a third lies half way between, and the

23. Kesler, L. W., op. cit., p. 40.

fourth well offsets to the north the southernmost well. These four wells comprise the present, and wholly undeveloped, North Fairport field. Its width is as yet but one location. It is situated in secs. 9, 20 and 29, T. 11 S., R. 15 W., and production was first discovered on June 14, 1928.

Because of the distance that separates these four wells, information is inserted below for each in the order of its completion:

Wells in the North Fairport field.

Name.	Location.	Completed.	Total depth.	Depth top "Oswald."	Depth to pay.	Depth pay below top "Oswald."	I. P. bbls.
Liggett, No. 1 Chrisler..	SW NW SW, 9-11S-15W	6-14-28	3,105	3,040	3,073-3,075	33	40
Midwest, No. 33 Bronson.....	SE SW SE, 20-11S-15W	11-10-28	.....	2,950	3,131-3,135 3,145-3,152 3,204-3,206	181 195 214	35
Midwest, No. 4 Booth.....	NE NW NE, 29-11S-15W	3-13-29	3,157	2,930	3,151-3,157	221	22½
Liggett, No. 1 Durham.....	NE cor., 20-11S-15W	4-20-29	3,172	2,975	3,165-3,172	190	40

The producing horizon of these four wells is from three pays in the "Oswald series." One well is producing from the 30-foot pay, two wells from the 190-foot pay, and two wells from the 220-foot pay. The 190-foot pay is not present in the Fairport field.

One dry hole, offsetting production, exists. In November, 1928, J. H. Liggett completed his No. 1 Mair, in the SE cor. NE¼ SE¼ sec. 8, T. 11 S., R. 15 W., at a total depth of 3,433 feet in the Pennsylvanian basal conglomerate. Numerous shows of oil were found in the "Oswald series" and in the Pennsylvanian basal conglomerate. None of these were commercial.

The limits of the North Fairport field are wholly undefined. Its shape and history, apparently, will be analogous to that of the South Fairport field. The cumulative production to the end of 1929 has been 25,720 barrels. The present recovery is 642 barrels to the acre. During December, 1929, the average daily production was 17 barrels.

Susank Field. The discovery well of this field, T. B. Slick No. 1 Sellens, located in the SW cor. NE¼ sec. 36, T. 15 S., R. 13 W., was

completed on June 20, 1929, at a depth of 3,352 feet in the Pennsylvanian basal conglomerate. Since the well made about 50 per cent oil and 50 per cent water, it was deepened. Pipe was set on top of the "Siliceous lime" and all oil and water shut off. It was then drilled into the "Siliceous lime" to a total depth of 3,365 feet, and came in for an initial production in excess of 500 barrels and no water. By the close of 1929 two additional producing wells, offsetting the discovery, had been completed. Both of these have penetrated into the "Siliceous lime" and derive their production approximately half from the Pennsylvanian basal conglomerate and half from the "Siliceous lime."

Some years ago an interesting dry hole, Alcorn Oil Company No. 1 Sellens, was drilled one-half mile southeast of the discovery well of the Susank field in the SE cor. sec. 36, T. 15 S., R. 13 W., and carried to a total depth of 3,645 feet. The test swabbed 40 barrels of oil per day for five days from the conglomerate zone before exhaustion.

The limits of the Susank field are wholly undefined. When developed it will be similar, presumably, to the Gorham field, both in size and shape. In six months it has produced 29,926 barrels of oil from three wells. The second well was not completed until October 25, 1929. The present recovery has been 930 barrels per acre. During December, 1929, the average daily production was 125 barrels.

A detailed record of the production from this field follows:

Production of the Susank field.

Name of Well.	Location.	Production from Penn. basal conglom.	Production from "Siliceous" lime.	Totals.
Prairie No. 1 Sellens	SW NE sec. 36	.....	10,941	10,941
Slick No. 1 Sellens	NW SE sec. 36	5,824*	5,824*	11,648
Prairie & Slick No. 1 Sellens	NE SW sec. 36	3,668*	3,669*	7,337
Totals	.....	9,492	20,434	29,926

* Approximate.

Ochs Lease. On October 14, 1929, the Empire Oil and Refining Company completed their No. 1 Ochs, located in the SE cor. NE¼ NE¼ sec. 23, T. 15 S., R. 14 W., at a total depth of 3,369 feet. It had an initial production of 232 barrels of 36° Bé. oil. Production

is obtained from 3,364 to 3,369 feet in the "Siliceous lime," 254 feet below the top of the "Oswald lime." To date no additional wells have been completed, and as yet the field has no accepted name. Production for the three months of its life totals 4,126 barrels. During December, 1929, its daily average yield was but 35 barrels.

Seward and Stevens Counties.

The first producing well in western Kansas was completed in Seward county in December, 1922, eleven months prior to the discovery of oil in the Fairport field of Russell county on November 24, 1923. This well, Defenders and Traders Oil Company No. 1 Boles, in the NE cor. NW¼ sec. 3, T. 35 S., R. 34 W., yielded 5 million cubic feet of gas from 2,718 to 2,755 feet. The test has now been plugged for some years, but gas is still escaping.

This area remained relatively inactive until May, 1927, when the Independent Oil and Gas Company completed their No. 1 Crawford, in the center SW¼ sec. 31, T. 33 S., R. 37 W., constituting the first gas well in Stevens county.

Subsequently a number of gas wells have been completed in these two counties, making a total of nine wells, of which two are plugged. A record of these wells is shown in Table 26.

Table 26.—*Gas development in Seward and Stevens counties.*

Name.	Location.	Completed.	County.	Total depth.	Depth to producing horizon.	Initial production.	Present status.
Vickers Petr. Co., No. 1 Hitch	33-32S- 4W	1927	Seward	4,015	2,647-2,675	Small show	Plugged
Ben S. Ash, No. 1 Pyle	14-33S-33W	1928	Seward	5,036	2,610-2,650	Small show	Plugged
Seward Oil & Gas, No. 1 Sealey	20-33S-33W	1924	Seward	2,764	2,645-2,749	1,000,000	Shut in
Defenders & Trad. Oil Co. No. 1 Boles	3-35S-34W	1922	Seward	2,920	2,718-2,755	5,000,000	Plugged
Wilson & Moore, No. 2 Boles	3-35S-34W	1927	Seward	2,735	2,702-2,735	3,000,000	Shut in
Argus Gas Co., No. 1 Carpenter	29-33S-36W	1929	Stevens	2,790	2,620-2,780	8,000,000	Shut in
Independ. Oil & Gas Co., No 1 Crawford.	31-33S-37W	1927	Stevens	3,502	2,612-2,805	10,000,000	Shut in
McKnabb and McKenna, No. 1 Hamm	10-33S-38W	1929	Stevens	2,713	2,495-2,713	10,000,000	Shut in
Trees Oil Co., No. 1-A Grundy	3-35S-38W	1929	Stevens	2,780	2,616-2,760	11,000,000	Shut in

The gas zone in these wells occupies a stratigraphic zone with a thickness of approximately 200 feet. The top of this gas horizon in Stevens county averages 350 feet, and in Seward county 500 feet, below the base of the Cimarron group of Permian age. There appear to be three principal gas horizons. The top of the zone corresponds closely to the top of the Chase group of the Big Blue series (Permian). As near as can be ascertained, all of the gas is produced from the Winfield, Fort Riley, Florence flint, and Wreford formations of the Chase group.[24]

In the fall of 1929 a pipe line was laid into this area, and Dodge City and small towns in southwestern Kansas are now ready to be supplied with gas. The Seward county wells are referred to as the Liberal gas field, and the Stevens county wells as the Hugoton gas field. All of the wells have a rock pressure of 400 pounds per square foot.

Trego County.

Oil was first discovered in Trego county on May 19, 1929, by Central Commercial Oil Company in their No. 1 Ellis King, in the NE cor. SW¼ NE¼ sec. 20, T. 13 S., R. 21 W., in the extreme east-central part of the county. The producing area has been named the Rega field. The production, at 3,960 to 3,972 feet, was found in the top of the Pennsylvanian basal conglomerate, 294 feet below the top of the "Oswald series," which was reached at 3,666 feet. The initial production was 290 barrels of oil. No offsets to the discovery well have been started.

Prior to the discovery of oil in the Rega field but three wells had been drilled for oil in Trego county. One of these was completed in the Permian, another in the middle Pennsylvanian, and the third in the Ordovician. Subsequent to this discovery one test has been drilled without success to the pre-Cambrian on the same line of folding, while two others are drilling at interesting depths. Two additional wells on other lines of folding have been abandoned recently in the Pennsylvanian basal conglomerate with only small shows of oil in this horizon.

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24. More recent sample analysis by Loren A. Crum indicates conclusively that the three principal gas-producing zones in this field occur in the Herington limestone of the Sumner group, and in the Winfield and Fort Riley limestones of the Chase group. Showings of gas, however, are found sometimes slightly deeper stratigraphically in the Florence flint and Wreford limestones of the Chase group.

CORE DRILLS AND GEOPHYSICAL OPERATIONS.

Core drills have been operated in Kansas by practically all of the major oil and gas companies during the last four years. In January, 1930, there were 50 drills in operation.

The greatest activity is in the central-western part of the state, and numerous pools have been discovered as a direct result of core-hole information. Included in the list are the Valley Center field, opened in sec. 12, T. 26 S., R. 1 W.; the Goodrich field, in sec. 16, T. 25 S., R. 1 E.; the Greenwich field, opened in sec. 15, T. 26 S., R. 2 E.; and the Robbins field, in T. 28 S., R. 1 E., all in Sedgwick county; and the Caldwell field in T. 35 S., R. 3 W., and the Peasel well in sec. 33, T. 31, S., R. 1 W., in Sumner county.

Several gas fields and two oil pools that give promise of very large production, the Voshell field in T. 21 S., R. 3 W., and the Ritz-Galva fields in Ts. 19 and 20 S., R. 2 W., in McPherson county, have been discovered on favorable structure worked out by use of the core drills.

In western Kansas the Sellens field, in sec. 36, T. 15 S., R. 13 W.; the Ochs lease, in sec. 23, T. 15 S., R. 14 W.; and the North Fairport field, in T. 11 S., R. 15 W., all in Russell county, were discovered as a result of core-drill information. Successful core-drill discoveries in Ellis county include the North Ellis and Yocemento fields.

A small number of torsion balances and seismographs have been in use, particularly in the following western counties: Barton, Pawnee and Edwards. Many magnetometers have been in use, but in recent months have given way to the more expensive but more reliable information obtained by core drilling. A considerable number of areas in western Kansas have been investigated by field parties using magnetometers, and their findings later checked by core drilling.

Very little geophysical work has been done in the eastern part of the state.

Part II.

Development of the Oil and Gas Resources of Kansas in 1930.

Roy H. Hall

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Development of the Oil and Gas Resources of Kansas in 1930.

Roy H. Hall.[1]

INTRODUCTION.

The year 1930 was a hectic one in the history of oil and gas production. It was quite evident early in the year that overproduction of oil in 1929 would be continued into 1930, although proration would be effective in reducing the total output. Kansas was a contributing factor to overproduction, but not a dangerous one. Proration was effective in only two fields in the state. Complete lack of pipe-line connections held back development in five fields, so that little oil was produced from them. Prices of crude oil were lowered February 15. In the Eastborough, Ritz and Voshell pools pipe-line capacities were inadequate to care for flush production. Some "distress" oil was contracted for and sold under the posted market early in the year. These "distress" sales were probably a factor in the price cuts of April and October. Drilling activities in new fields were not slackened appreciably, in spite of the difficulties encountered in making pipe-line connections. Production continued to rise in the state until a daily average of about 130,000 barrels was reached in May. The posted price of crude was again lowered April 10, and although two fields were prorated, drilling continued at a rapid pace. The second and third quarters of the year saw the completion of 576 wells, more than half of the total for the year. Price concessions were again made by producers with "distress" crude in August and September, and another slash of posted quotations was made October 25. Further distress was caused among producers, especially those in the "stripper" fields of southeastern Kansas, by the announcement of one of the major purchasing agencies that they would discontinue the purchase of oil after December 31, 1930.

1. Division Geologist, Gypsy Oil Company, Wichita, Kansas.

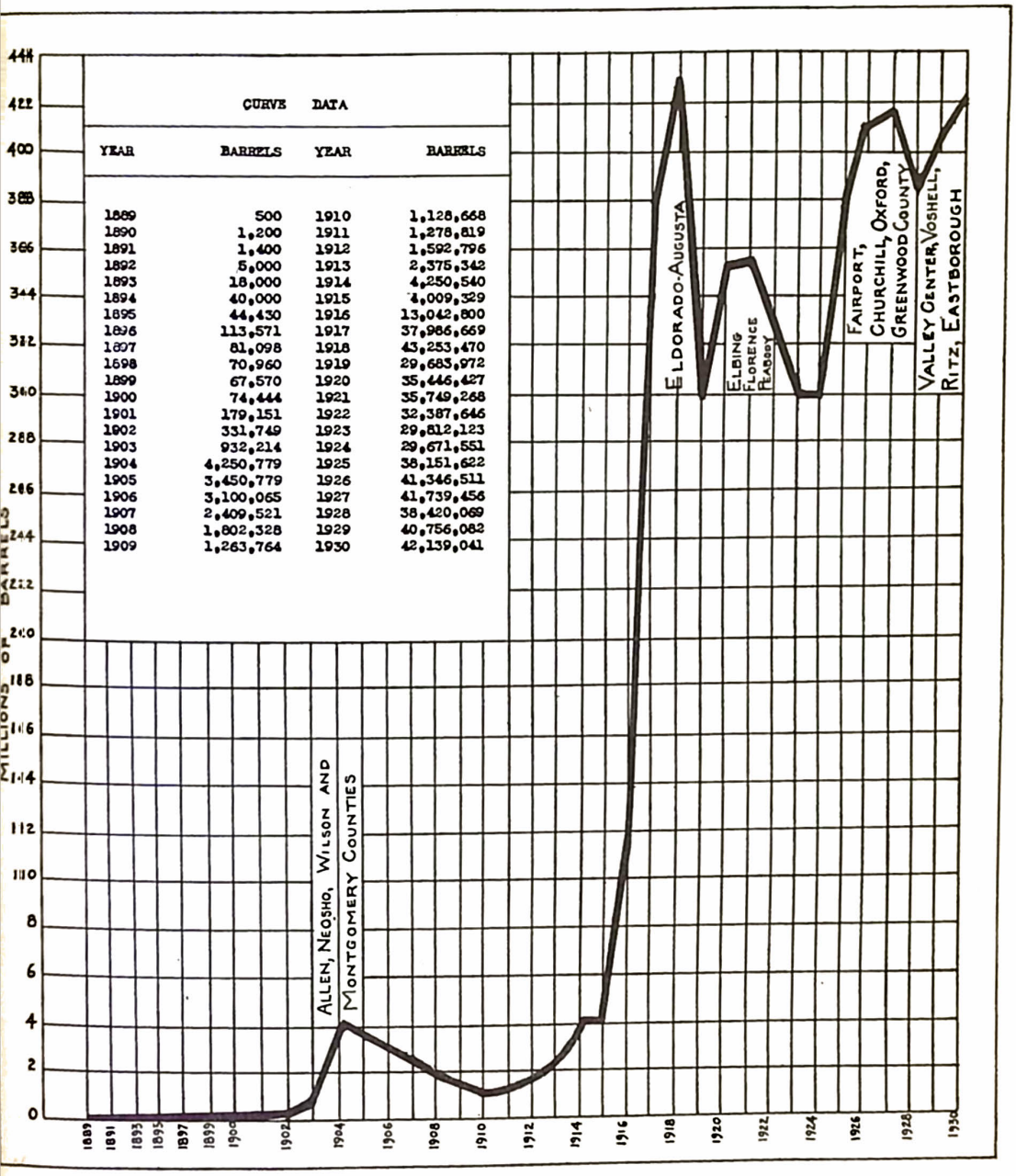

FIG. 1.—Graph showing estimated annual production in Kansas from 1889 to 1930, inclusive. (IBased on production figures from the *Oil and Gas Journal* and "Mineral Resources of Kansas, 19903," by Erasmus Haworth, Kansas Geological Survey, 1904.)

Kansas was the fourth state in oil production of the United States during the year 1930. In 1926 Kansas was fifth in the producing column, but has held fourth place since 1927. Total estimated crude oil production in 1930, according to sources available to the writer, was 42,139,041 barrels. Oil remaining in storage at the end of 1930 was estimated to be 15,315,985 barrels.

The gross production of oil in the state by counties in 1930 is shown in the following table:

TABLE 1.—*Oil production of Kansas by counties in 1930.*

COUNTY.	Barrels.	COUNTY.	Barrels.
Allen	169,068	Marion	1,166,253
Anderson	566,673	Miami	405,606
Barton*	2,000	Montgomery	488,014
Bourbon	21,626	McPherson	5,566,281
Butler	9,098,055	Neosho	179,159
Chase	6,425	Ness	2,438
Chautauqua	991,395	Reno	11,061
Coffey	93,008	Rice‡	282,887
Cowley	2,015,142	Rooks‖	20,526
Douglas	4,594	Russell‡‡	1,340,006
Edwards	48,407	Saline††	1,405
Elk	625,626	Sedgwick	7,656,070
Ellis	177,572	Stafford**	2,000
Ellsworth†	1,150	Sumner	3,076,315
Franklin	111,659	Trego	2,793
Greenwood	7,269,885	Wilson	56,098
Harvey	23,467	Woodson	342,274
Labette	8,568		
Linn	50,852	Grand total	42,139,041
Lyon	254,683		

* Barton county production stored on Davidson lease sec. 4, T. 16 S., R. 11 W.
† Ellsworth county production stored on Heiken lease, sec. 25, T. 17 S., R. 10 W.
‡ 4,135 barrels of Rice county total stored on Ploog lease, sec. 33, T. 18 S., R. 9 W.
‖ 985 barrels Rooks county total stored on Silvers lease, sec. 21, T. 8 S., R. 19 W.
‡‡ 1,150 barrels Russell county total stored on Gideon lease, sec. 8, T. 15 S., R. 14 W.
†† Saline county producing well abandoned Dec. 28, 1930.
** Stafford county production stored on Richardson lease, sec. 36, T. 22 S., R. 12 W.

The great development of gas reserves, especially in the southwestern part of the state, was one of the outstanding features of 1930. It is estimated that more than 800 million cubic feet were added to reserves. Gas sold to pipe lines in 1930 reached an estimated total of 14 billion cubic feet. As a result of the vast reserve developed in Morton, Stevens and Grant counties, amounting to 684,782,483 cubic feet, five trunk lines are completed or building into this area for part or all of their supply. These trunk lines will extend from near Hugoton to distant cities, among which are Lincoln, Neb.; Council Bluffs, Ia.; Colorado Springs, Colo.; Lamar, Colo.; and numerous cities in western Kansas, Nebraska and eastern Wyoming. The building of these lengthy gas pipe lines to tap

southwestern Kansas reserves may be considered one of the outstanding developments of 1930.

A comparison of the completions in 1929 and 1930 in Kansas is shown in the following table:

TABLE 2.—*Summary of completions in 1929 and 1930.*

	1929.	1930.
Total completions	1,056	1,036
Oil wells	591	445
Initial production (barrels)	165,611	228,301
Dry holes	453	423
Gas wells	52	168

The increasing importance of the western portion of the state in the producing column is noted in the past three years. In 1930 about 30 per cent of the oil and 85 per cent of the gas produced was in ranges west of the sixth principal meridian. Oil produced in ranges west during 1930 increased about 26 per cent and gas production about 50 per cent over 1929. In addition to these facts it must be noted that six potential fields located in ranges west were without outlet or development beyond the one well stage (see Table 9). Of the ten areas considered flush pools in 1930, nine of them are located in ranges west. It is therefore evident that the western portion of the state will eventually occupy the most important place in the producing column. The following table shows a summary of completions in ranges west for the year 1930, compared with the year 1929:

TABLE 3.—*Summary of completions in ranges west in 1929 and 1930.*

	1929.	1930.
Total completions	277	477
Oil wells	122	182*
Dry holes	142	165
Gas wells	13	130*
Percentage producing wells to total completions	48	65
Percentage oil wells ranges west to total oil wells completed in state	20	40
Percentage dry holes ranges west to total dry holes completed in state	31	39
Percentage gas wells ranges west to total gas wells completed in state	25	77

* One well included in total produces both oil and gas.

ACKNOWLEDGMENTS.

The writer is indebted to the various oil and gas companies and individual producers who have furnished production data compiled and appearing in this bulletin. Acknowledgment is also due the *Oil and Gas Journal* for use of production data and tables. Valuable information was contributed by the following men: Thomas H. Allan, Midwest Refining Company; Geo. F. Berry, Jr., Empire Oil & Refining Company; Ernest Moncrief, Derby Oil Company; James I. Daniels, Continental Oil Company; John Garlough, Lee & Garlough, consulting geologists; Louis Lieberman, Shell Petroleum Company; Claude Valerius, M. M. Valerius Royalty Company; E. A. Wyman, Amerada Petroleum Company; Howard Bryant, Skelly Oil Company; W. L. Stryker, consulting geologist; Frank Anderson, consulting geologist; Cecil Albert, G. E. Mitchell and Anthony Folger, Gypsy Oil Company.

EASTERN KANSAS.

The southeastern portion of Kansas has suffered greatly from the current unsettled and depressed condition of the oil industry. This area is the oldest producing section of Kansas, and the fields are of the "stripper" class. Initial production of oil is small, and although the cost of drilling is low the low price of crude and competition of flush fields in Kansas and elsewhere were sufficient to almost stop new exploration. No new discoveries of consequence were made during 1930. Some inside or proven locations in old fields and a few "wildcats" were drilled with indifferent results. The end of the year found most of the producers in this area without a market for their small production, due to withdrawal of the principal purchasing agency. The net results of the current depression has been the almost complete suspension of operations. Future developments in this area will depend on the price of oil and a purchaser willing to gather small quantities of oil in scattered districts.

The same conditions prevailing in southeastern Kansas served almost to stop developments in northeastern Kansas. No new discoveries of special interest were made in this area during 1930. No new completions were recorded in Miami county, and only one each in Franklin, Douglas, Shawnee and Leavenworth counties, all of which were dry. The district as a whole was practically without development during the year.

Total oil production of southeastern Kansas (Allen, Anderson,

Bourbon, Coffey, Labette, Linn, Montgomery, Neosho, Wilson and Woodson counties) for the year 1930 was 1,975,340 barrels. The total oil production of northeastern Kansas (Douglas, Franklin and Miami counties) was 521,859 barrels. The production of individual counties is shown in Table 1.

Other counties of east ranges are discussed in alphabetical order. Complete production data on most of these counties have been obtained from the *Oil and Gas Journal.*

Butler County.

Gelwicks Pool. The only discovery of importance in Butler county for 1930 was the Gelwicks pool. Gelwicks No. 1 in the NE cor. SW¼ sec. 6, T. 27 S., R. 4 E., was completed in April, 1930, by Sullivan and Melrose for 360 barrels in an Ordovician limestone, which is probably of Trenton age and is commonly referred to as Viola "lime," encountered at 2,924 feet. The north and northeast offsets were producers, while the east offset was dry. The latest completion was a producer, about one-fourth mile northeast of the discovery. One other dry hole was completed to the Ordovician in the immediate area. The gravity of the oil is about 26.5° Bé.

Haverhill Pool. This field, a Bartlesville sand trend, was discovered in April, 1927, and has received continued development. Seven producers were completed for an average initial production of 146 barrels each during 1930. The sand is encountered at an average depth of 2,700 feet. A total of 66 oil wells have been completed to date. The pool is practically drilled up. Recovery will be about 4,000 barrels per acre. The gravity of the oil is 40° Bé.

Eldorado Field. Development of the deep pay in sections 18, 19, 20 and 21, T. 26 S., R. 5 E., consisted of fifteen producing wells completed in the Viola (?) limestone (Trenton), and "Wilcox" sand (Ordovician) for an average initial production of 132 barrels. One dry hole was drilled to the Ordovician. The pay is encountered at around 2,600 feet on proven areas. A recovery of about 7,000 barrels per acre is expected. The oil is about 35° Bé. gravity.

In the 700-foot shallow sand (Admire) area, about thirty-five wells were completed for an average initial production of 14 barrels. The oil is about 36° Bé., and recovery is around 2,000 barrels per acre.

Pierce Pool. The discovery of this pool was in January, 1927. The only addition during 1930 was Allison and Fitzwilliam No. 2 Pierce, in the NW¼ NE¼ NE¼ sec. 28, T. 25 S., R. 4 E., which

was completed in "Mississippi lime," encountered at 2,554 feet for an initial production of 52 barrels. A total of five wells are now producing. The gravity of the oil is 43° Bé. Two dry holes were drilled to the Ordovician in the immediate area.

GARDEN (SLUSS) POOL. This pool, discovered in March, 1928, is located in sec. 6, T. 27 S., R. 6 E. Production is found at an average depth of 2,700 feet. One well, a northwest extension of the Bartlesville sand trend, was completed for 50 barrels by H. B. Garden. There are now approximately 35 producing wells. Recovery is estimated at 5,000 to 7,000 barrels per acre. The oil is 39° Bé. gravity.

BEADLES-MCGINNIS POOL (SHAFFER AREA). One well was completed by the Richmond Drilling Company in the NE¼ sec. 17, T. 27 S., R. 6 E., for ten barrels in the Viola (?) (Trenton) limestone (Ordovician) which was encountered at 3,125 feet. The lower pay in this area was discovered in 1926.

STEARNS POOL. Two wells were completed in the SE¼ sec. 28, T. 27 S., R. 6 E., for an average initial production of 75 barrels each in the Viola (?) limestone (Trenton), which is found at an average depth of 3,050 feet.

KEIGHLEY POOL. At the northeast extension of the trend, Aladdin Petroleum Company completed No. 1 Seward, in the SW¼ SE¼ NE¼ sec. 14, T. 27 S., R. 7 E., for 60 barrels in the Bartlesville sand from 2,620 to 2,647 feet.

BRUCE POOL. This pool is located in sec. 24, T. 27 S., R. 3 E., and production is from the "Wilcox" sand (Ordovician) encountered at around 3,000 feet. One light producer, southeast of the discovery well, together with two dry holes, were completed in this area. Four producing wells have been drilled to date.

MISCELLANEOUS. Joe Liggett completed No. 1 Gunther, in the SE¼ NE¼ NW¼ sec. 29, T. 26 S., R. 7 E., for 65 barrels in "Mississippi lime," which was encountered at 2,740 feet. Pay was from 2,785 to 2,793 feet.

Pyle and Sutter completed a well in the SE¼ sec. 34, T. 28 S., R. 6 E., for 50 barrels in the "Mississippi lime," which was encountered at 2,833 feet.

Approximately 45 scattered dry holes were drilled during the year, the majority of which were completed in the Ordovician.

Butler county produced a total of 9,098,055 barrels of oil in 1930 from 3,278 wells.

TABLE 4.—*Summary of developments in Butler county, 1930.*

FIELD.	Location.	Discovery date.	No. wells producing, Dec., 1930.	Average depth, feet.	Gravity of oil, degrees Baume.	Producing horizon.
Gelwicks pool.....	6-27S-4E.....	April, 1930	4	2,900	26.5	Viola ls. (Ordovician).
Haverhill pool.....	15, 22, 27, 34-27S-5E....	April, 1927	66	2,750	40	Bartlesville.
Eldorado pool.....	25 and 26 S, 4 and 5E.....	Sept. 1, 1915	1,000	2,600	35	Viola, "Wilcox," "Siliceous" (Arbuckle) ls.
Eldorado shallow pool...	25 S-4 and 5E,	Sept. 1, 1915	1,143	700	36	Admire sh.
Pierce pool.....	28-25S-4E....	Jan., 1927	5	2,550	43	"Miss. lime."
Garden (Sluss) pool.....	5 and 6-27S-6E	Mar., . 1928	35	2,700	39	Bartlesville.
Beadles McGinnis (Shaffer area) pool....	3, 4, 8, 9, 10 17-26S-7E....	1926	62	2,750 3,150	.....	"Miss. lime," Viola ls.
Stearns pool.....	27, 28, 33 and 34-27S-6E....	.....	13	3,050	.....	Viola ls.
Keighley pool.....	27S-7E.....	.....	83	2,650	41	Bartlesville.
Bruce pool.....	24-27S-3E....	July, 1929	4	3,010	41	"Wilcox" sand.

GREENWOOD COUNTY.

NORTON POOL. This pool is located in sections 15, 22 and 23, T. 22 S., R. 12 E., near Lamont, Kan. It was discovered by Empire Oil and Refining Company and Rhodes No. 1 Norton, in the NW cor. NE¼ sec. 22, and was completed April 23, 1929, for 365 barrels of oil in Bartlesville sand from 1,712 to 1,738 feet. Four producers were added to this area during 1930 for an average of 70 barrels per well, and no dry holes were drilled. The oil is 41° Bé. Production is found along a narrow trend. Limits of the pool to the north, east and west are well defined. Water is present in the lower part of the sand body. Fourteen wells were producing on December 31, 1930.

EDWARDS EXTENSION POOL. In 1929 the Edwards pool was extended southeast into sections 21, 22, 27 and 28, T. 23 S., R. 11 E. Production is from Bartlesville sand at an average depth of 1,900 feet. Seven oil wells were completed in 1930 for an average of 160 barrels initial. Recovery per acre is estimated at around 6,000 barrels. The oil is 42° Bé. gravity.

PATTERSON POOL. The Patterson pool was discovered by the Empire Oil and Refining Company Patterson No. 1A, in the NW¼ NE¼ SW¼ sec. 36, T. 23 S., R. 11 E., completed May 19, 1929, for 392 barrels from Bartlesville sand from 1,765 to 1,837 feet. This pool is located in sec. 36, T. 23 S., R. 11 E., sec. 1, T. 24 S., R. 11 E., and sec. 6, T. 24 S., R. 12 E. During the latter part of 1929, Prairie Oil and Gas extended the field to the southeast with a completion in sec. 16, T. 24 S., R. 12 E., good for 75 barrels in Bartlesville sand from 1,578 to 1,603 feet. Derby extended this pool into sec. 25, T. 24 S., R. 12 E., in March, 1930, and the area has since had continued development. Twenty producing wells, with an average initial production of 245 barrels, and five dry holes, were drilled in 1930. Recovery per acre will be around 6,000 barrels. The oil is 41° Bé. gravity. There are now 31 producing wells in the field.

HARRIS POOL. The Harris pool is located in sections 19 and 30, T. 22 S., R. 11 E., and production is from the Bartlesville sand, which is encountered around 2,100 feet. Seven oil wells were completed during 1930 for an average of 180 barrels initial production each. One dry hole was drilled.

SEELEY-WICK POOL. This is a northeast-southwest Bartlesville sand trend in Ts. 22 and 23 S., R. 11 E. Pay is encountered around 1,800 to 1,900 feet. Six oil wells were completed during 1930 in sections 27 and 24, T. 22 S., R. 11 E., for an average of 120 barrels initial production.

LAMONT POOL. The Lamont pool is on an east-west Bartlesville sand trend in T. 22 S., Rs. 12 and 13 E., south of the town of Lamont. Production is found at an average depth of 1,650 feet. Six wells were completed during 1930 in the area, and the initial production averaged 65 barrels.

VIRGIL POOL. Ten oil wells were completed in the Virgil pool, located in Ts. 23 and 24 S., Rs. 12 and 13 E., with an average of 30 barrels initial production during the year. Six of these were Bartlesville sand wells and the other four went to the "Mississippi lime." Bartlesville sand is encountered at around 1,600 feet and "Mississippi lime" at about 1,750 feet.

MISCELLANEOUS COMPLETIONS. Four wells were completed for an average of 125 barrels oil each in sec. 36, T. 24 S., R. 10 E., in the Wiggins pool. Production was from sand encountered around 1,885 feet.

Wildcatting was carried on throughout the county with a few scattered producers of no great importance and about 40 dry holes completed.

The total production of oil in Greenwood county during the year 1930 was 7,269,885 barrels from 2,920 wells.

TABLE 5.—*Summary of developments in Greenwood county, 1930.*

NAME.	Location.	Discovery date.	No. wells producing, Dec., 1930.	Average depth, feet.	Gravity of oil, degrees Baume.	Producing horizon.
Norton pool.....	15, 22 and 23-22S-12E.....	Apr., 1929	14	1,700	41	Bartlesville sand
Edwards extension..	21, 22, 27 and 28-23S-11E.....	1927	53	1,900	42	Bartlesville sand.
Patterson pool.....	36-23S-11E 1-24S-11E, 6-24S-12E.....	May, 1929	31	1,800	41	Bartlesville sand.
Harris pool.....	19-22S-11E.....	.....	18	2,100	.....	Bartlesville sand.
Seeley-Wick pool...	22-23S-11E.....	.....	.....	1,800-1,900	41	Bartlesville sand.
Lamont pool.....	22S-12 and 13E..	1927	106	1,650	40	Bartlesville sand.
Virgil pool.....	23 and 24S-12 and 13E.....	.....	Approx. 981	1,600 Bart. 1,750 Miss.	35-40	Bartlesville sand, "Miss. lime."

LYON COUNTY.

ATYEO POOL. Lyon county recorded only twelve completions in 1930. Only two of these were oil wells and the remainder were dry. Two wells were completed in sec. 19, T. 21 S., R. 10 E., the Atyeo pool, to the "Mississippi lime," but were plugged back to make small producers in the Bartlesville sand at depths of about 2,000 feet. Attempts to extend the Atyeo pool to the north and northeast were failures. No other developments of interest took place in 1930.

Lyon county produced 254,683 barrels of oil in 1930, most of which was produced from the Atyeo pool.

MARION AND CHASE COUNTIES.

HILLSBORO POOL. The discovery well in this pool was drilled by Courtney Davis in October, 1928, at Rempel No. 1A, in the SW cor. NE¼ sec. 7, T. 19 S., R. 3 E., which was completed in the "Missis-

sippi lime," topped at 2,425 feet and drilled to 2,458 feet for an initial production of 8¾ million cubic feet of gas. On June 27, 1929, the Empire Oil and Refining Company completed Suderman No. 1, in the SE¼ NE¼ sec. 12, T. 19 S., R. 2 E., to the Viola ? (Trenton) limestone (Ordovician) found at 2,827 feet. Initial production was 350 barrels. About one week later Davis drilled his Rempel No. 1A to the Viola lime, found at 2,807 feet for an initial production of 300 barrels. No new developments were recorded in this pool during 1930.

A total of eighteen wells have been drilled to date, fifteen of which are producers having an average initial production of 230 barrels. The gravity of the oil is about 34° Bé. The pool is practically drilled up. Total production for 1930 was 257,570 barrels.

Lost Springs Pool. This pool is located in sections 14, 15, 22 and 23, T. 17 S., R. 4 E., the town of Lost Springs. Approximately 54 producers and 33 dry holes have been completed in the immediate area to date. Production is from the "Mississippi lime" (chat), found at a depth of about 2,400 feet.

Developments at Lost Springs in 1930 consisted of the addition of six new wells averaging 100 barrels each. No dry holes were drilled in the pool. The total production of the field in 1930 was 264,860 barrels.

Propps Gas Field. The discovery well was drilled in April, 1926, in sec. 8, T. 19 S., R. 4 E. Gas is produced from the "Mississippi lime" (chat), at a depth of about 2,370 feet. No new developments were recorded in this field during 1930. Production of gas was 270,000,000 cubic feet.

Marion county produced 1,166,253 barrels of oil in 1930 from five fields. No new developments of interest were recorded in the Peabody, Florence and Covert-Sellers pools during the year.

Lipps Gas Field. This gas field is located in secs. 25 and 26, T. 18 S., R. 6 E., and secs. 29, 30, 31 and 32, T. 18 S., R. 7 E., Chase county. The field was discovered by Preston and Pasewalk late in 1925 and reached its peak in 1927. Production is obtained from a sand in the Lawrence shale at about 1,200 feet. An effort to extend the field to the northeast in 1930 resulted in a dry hole.

Total production of gas in 1930 was 104,626,000 cubic feet from 13 wells. Oil produced from part of the Atyeo pool in T. 21 S., R. 9 E., and the Browning pool in sec. 36, T. 22 S., R. 9 E., was 6,425 barrels. No new discoveries were made during 1930.

Cowley County.

Burden Pool. This pool is located in secs. 19, 20, 30 and 31, T. 31 S., R. 6 E., and production is from Bartlesville sand, found at an average depth of 2,900 feet. During 1930 eight oil wells were completed for an average initial production of 188 barrels each. The stimulation of drilling in this area was due to a completion in July by Lewis Petroleum and Shell Headley No. 1, in the SE cor. sec. 19, T. 31 S., R. 6 E., with initial production of 150 barrels from Bartlesville sand, found from 2,865 to 2,923 feet. One unprofitable well, a southwest extension, was drilled, together with four dry holes, three of which reached the "Mississippi lime." Five gas wells were completed in secs. 16, 17, 20 and 21, T. 31 S., R. 6 E., northeast of the pool, and one at the end of the oil-producing area in the SE¼ SW¼ NW¼ sec. 20, T. 31 S., R. 6 E. The gas is encountered in three horizons, at average depths of 1,600 feet in the Lawrence shale, at 2,000 feet in Weston shale, and 2,200 feet in the Lansing group. A total of 21 oil wells have been completed, 18 of which are producing. The total production for 1930 was 140,759 barrels of 38° Bé. oil.

Winfield Pool. Roth and Faurot made a new discovery in the north end of the old Winfield pool in February. Their Holt No. 1, in the SE¼ NE¼ SE¼ sec. 12, T. 31 S., R. 4 E., found oil in the Kansas City group from 2,588 to 2,593 feet, which produced 115 barrels initial production of 34° Bé. oil. Subsequently four other wells were completed to this horizon in the same section with initial production of 25, 50, 184 and 500 barrels. The gravity of the oil varies from 34° to 37° Bé. Production from the same horizon in this section was discovered in May, 1924, by the Arkansas Fuel Oil Company in the NE¼ SE¼ sec. 12. The well produced a small amount of oil, but was finally abandoned without additional development to the south until 1930. Several dry holes have been drilled in the north half of the section. Gas was found at a depth of 722 to 738 feet in one well, a twin to the largest producer, located in the SE¼ SW¼ NE¼ sec. 12, T. 32 S., R. 4 E. One small, shallow gas well was completed in the NE¼ SE¼ sec. 23, T. 32 S., R. 4 E., at a depth of 635 to 657 feet, for an initial production of three-fourths million cubic feet. One small oil well in section 24 and a 2 million-cubic-foot gas well in section 22 from the Bartlesville sand complete the story of new production in the Winfield pool for 1930.

New Salem Gas Field. This development is mostly south of the old Elrod oil-producing area located in secs. 3 and 4, T. 32 S., R. 5

E. Twelve gas wells have been completed in the field at an average depth of 700 feet with initial productions ranging from 100,000 to 1½ million cubic feet. Six of these gas wells were completed in 1930 in sections 4, 8 and 9. Only one well was drilled to the Ordovician, where water was found at 3,650 feet.

ESTES GAS FIELD. A slight north extension of this field was made by the Trees Oil Company, the Estes No. 3, in the center NE¼ NW¼ sec. 12, T. 32 S., R. 6 E. Gas amounting to 1½ million cubic feet was found from 2,471 to 2,493 feet from near the base of the Kansas City group. A show of oil was found in the top of the Kansas City group in sand from 2,187 to 2,197 feet.

COUNTRYMAN POOL. Two inside wells were drilled in the Countryman pool, in sec. 33, T. 32 S., R. 7 E. They produced 100 barrels each from sand at approximately 1,950 feet. Production is from the Kansas City group.

SHAFFER POOL. The discovery well of the Shaffer pool was drilled by the Trees Oil Company, in the SE¼ NE¼ sec. 10, T. 31 S., R. 3 E., in November, 1924. At a depth of 3,050 feet the Bartlesville sand was found, with an initial production of 250 barrels. Gravity of the oil varies from 37.5 to 38.5 degrees Bé. Fourteen oil wells have been completed in this pool to date. The pool was extended a short distance south in June, 1929, with a small well in the NE¼ NW¼ sec. 15, by Shawver and others. In 1930 Derby Oil Company completed the north offset to this well, in the SE¼ SW¼ sec. 10 from Bartlesville sand, found at a depth of 3,062 to 3,073 feet, with an initial production of 60 barrels.

ARKANSAS CITY GAS FIELD. Gas is produced over a rather wide area along the west side of T. 34 S., R. 4 E., and extending down into secs. 3 and 4, T. 35 S., R. 4 E., from a thin sand in the Admire shale at depths ranging from 650 to 850 feet. Edenfield and Fair extended the gas area a short distance east, with a completion near the center of the west line of the NE¼ sec. 17, T. 34 S., R. 4 E. The well was good for 2 million cubic feet, from sand at 365 to 370 feet. The regular productive sand in the Admire shale was found from 638 to 639 feet, but contained water.

No other extensions or completions of importance were recorded during the year. The development of the Bartlesville sand trend in the Burden pool and the gas found at the northeast end of this trend rank as the most important developments in Cowley county in 1930. Total production for 1930 was 2,015,142 barrels distributed as follows:

Oil production of Cowley county fields, in barrels.

Rainbow Bend	581,249
Winfield-New Salem	663,010
Graham	98,554
Slick-Carson	167,121
Eastman	118,812
Clark	40,592
Rock	49,760
Shaffer, Fall City, etc.	296,044
Total, 1930	2,015,142

Elk County.

The year 1930 saw but very little development in Elk county, only two new fields of any promise having been discovered. Both of these fields, one located in T. 29 S., R. 9 E., and the other in T. 30 S., R. 8 E., are producing supposedly from the "Wilcox" sand horizon, but more probably from the "Siliceous" or Arbuckle "lime."

The discovery well of the pool in T. 29 S., R. 9 E., was drilled by the Flemoor Oil Company, in the SW cor. sec. 9, T. 29 S., R. 9 E., on the Sloan farm. Its initial production was 120 barrels of 33° Bé. oil in a sandy lime from 2,369 to 2,641 feet. This well was completed in December, 1929, and later two more wells were added—the Rader No. 1, in the NW cor. sec. 16, T. 29 S., R. 9 E., and the Morgan No. 1, in the SE cor. sec. 8, T. 29 S., R. 9 E. Lack of outlet for these wells has made it impossible to produce them at full capacity, but it is estimated that the combined production of the three wells is around 350 barrels daily.

Wm. Ferguson *et al.* deepened an old gas well in the SW¼ NE¼ sec. 23, T. 30 S., R. 8 E., from 1,796 to 2,912 feet, where, in a sand which they term "Wilcox" (Ordovician), a hole full of 37° Bé. oil was encountered. This well was completed in October, 1930, but tankage has not been erected and no pipe-line connection has been obtained. The well filled to the top very rapidly and is estimated to be good for 600 barrels daily. It is probable that the producing horizon is Arbuckle "lime" instead of "Wilcox" sand.

No other fields were opened up in the county and no important extensions made to older gas and oil fields. Total oil production for 1930 was 625,626 barrels.

Chautauqua County.

Chautauqua county was very quiet during 1930, and the only discovery of note was a gas well by C. W. Leighty on the Carr farm in the center NW¼ SE¼ sec. 5, T. 33 S., R. 9 E. This well was completed in September for 2½ million cubic feet of gas daily at a

depth of 1,360 feet. Two wells were added to the "Oswego lime" pool in secs. 1 and 12, T. 32 S., R. 10 E. These wells show an initial production of about 80 barrels each of 39° Bé. oil at approximately 1,670 feet. In the same area two gas wells were discovered in the top of the "Mississippi lime." These wells are the J. E. Julian No. 2, in the NE¼ SE¼ NW¼ sec. 12, T. 32 S., R. 10 E., drilled by the Elbar Corporation in February, 1930, with an initial production of 410,000 cubic feet daily from a depth of 1,995 to 2,012 feet, and the Oliver No. 7, in the NW¼ SW¼ SE¼ sec. 1, T. 32 S., R. 10 E., drilled by Griffin & Bell, with an initial production of 4 million cubic feet from a depth of 1,965 to 1,984 feet.

The National Refining Company made an addition to the Elgin pool, in T. 35 S., R. 10 E—the Newman No. 33 in the NE¼ NW¼ SW¼ sec. 18, T. 35 S., R. 10 E—with an initial production of 25 barrels at 1,595 feet. The total production of Chautauqua county for 1930 was 991,395 barrels.

WESTERN KANSAS.

Western Kansas includes all west ranges from 1 to 43 west, and all townships from 1 to 35 south, inclusive. In addition, for convenience of discussion, Harvey, Sedgwick and Sumner counties are included under the Western Kansas heading, although each of these counties have two tiers of townships, ranges 1 and 2, east of the sixth principal meridian.

It may be said with one exception, that all the flush pools of 1930 in Kansas are located in west ranges. The one exception is the Eastborough pool, in T. 27 S., R. 2 E., Sedgwick county. The new or flush pools of 1930, their production and status at end of the year, are shown in the following table:

TABLE 6.—*Flush pools of Kansas in 1930.*

FIELD AND LOCATION.	County.	No. wells, Dec., 1930.	Production, 1930.	Status at end of year.
Davidson, 4-16S-11W	Barton	1	2,000	Shut in.
Bushton, 25-17S-10W	Ellsworth	1	1,150	Shut in.
Ritz, 19-20S-1 and 3W	McPherson	21	1,348,080	Prorated.
Canton, 30-19S-1W	McPherson	4	61,790	Prorated.
Voshell, 20-31S-3W	McPherson	94	4,080,785	Prorated.
Raymond, 21-20S-10W	Rice	9	80,551	Prorated.
Plogg, 33-18S-9W	Rice	1	4,135	Shut in.
Gideon, 8-15S-14W	Russell	1	1,150	Shut in.
Richardson, 36-22S-12W	Stafford	1	2,000	Shut in.
Eastborough, T. 27S. Rs. 1 and 3E	Sedgwick	32	1,161,526	Unrestricted.

The total number of wells drilled in western ranges from the beginning of operations in 1905 to December 31, 1930, is 1,377. The following table shows the division of these wells into oil and gas wells and dry holes:

TABLE 7.—*Wells drilled in western Kansas through 1930.*

Total completions	1,377
Oil wells	482*
Gas wells	175*
Dry holes	720
Percentage producing wells to total completions	40
Percentage oil wells to total completions	35
Percentage gas wells to total completions	5

* One well in each total produces both oil and gas.

The total recovery of oil by counties in ranges west, from January 1, 1924, to December 31, 1930, has been 30,194,680 barrels from 17 counties. The cumulative recovery of oil per county is as follows:

TABLE 8.—*Cumulative oil recovery of western Kansas by counties.*

COUNTY.	Production.	Number wells.	Age oldest production in years.
Barton (Davidson lease)	2,000†	1	½
Edwards	51,910	3	2
Ellis	249,065	9	2
Ellsworth (Heiken lease)	1,150†	1	½
Harvey (Ranges West)	21,139	2	2
Kingman (Abandoned, 1927)	27,000	1	2
McPherson	6,065,533	130	3
Ness (Aldrich lease)	4,098†	1	2
Reno	44,182	2	4
Rice (including 4,135 barrels, Ploog lease)†	1,943,031	38	7
Rooks (including 985 barrels, Silvers lease)†	77,713	5	4
Russell (including 1,150 barrels, Gideon lease)†	8,275,649	166	7
Saline (abandoned, 1930)	1,405	1	1
Sedgwick (ranges west)	12,616,915‡	129	3
Stafford (Richardson lease)	2,000†	1	½
Sumner (ranges west)	803,062	15	4
Trego	10,828	1	2
Total	30,194,680	505	.....

† Production as of 12/31/30, stored on lease.
‡ Includes Valley Center field with two productive sections in T. 26 S., R. 1 E.

The shut-in production of western Kansas as of December 31, 1930, where the oil produced is stored on the leases, is shown in Table 9.

TABLE 9.—*One-well oil pools in western Kansas, shut in for lack of pipe-line connection, as of December 31, 1930.*

NAME OF FIELD.	Location.	County.	Discovery date, 1930.	No. wells shut in.	Production, 1930.	Status of well, Dec., 1930.	Gravity.	Initial production, barrels.	Producing horizon.	Depth, feet.
Davidson....	Sec. 4, T. 16 S., R. 11 W...	Barton.....	Mar. 17	1	2,000	Shut in	38	193 oil, 7 water	Ordovician "Siliceous lime."	3,340
Bushton.....	Sec. 25, T. 17 S., R. 10 W..	Ellsworth...	Oct. 15	1	1,150	Shut in	42	1,800 est.	Ordovician "Siliceous lime."	3,242
Ploog.....	Sec. 33, T. 18 S., R. 9 W...	Rice.....	Aug. 2	1	4,135	Shut in	46	3,000 est.	Ordovician "Siliceous lime."	3,253
Webster.....	Sec. 21, T. 8 S., R. 19 W...	Rooks.....	Oct. 1	1	985	Shut in	20	300	Penn. basal conglomerate.	3,445
Gideon.....	Sec. 8, T. 15 S., R. 14 W...	Russell.....	June 8	1	1,150	Shut in	38	60	Penn. basal conglomerate.	3,294
Richardson...	Sec. 36, T. 22 S., R. 12 W..	Stafford....	Sept. 9	1	2,000	Shut in	46	1,000 est.	Ordovician "Siliceous lime."	3,599
Total....	.....	.....	.....	6	11,420	.....	.....	.....	.....	.....

Field.	Producing horizon.	Average depth.
Lewis	asal conglomerate	4,550
North Ellis	asal conglomerate; "Sililime."	3,428 to 3,683
Yocemento	l lime"	3,590
Halstead	sippi lime"	2,970
McPherson	sippi lime"	2,975
Canton	lime"; Bromide formation	2,925 to 3,400
Galva	sippi lime"	2,900
Ritz	sippi lime"	2,900 to 2,950
Voshell	" sand; "Siliceous lime"	3,350
Aldrich lease	asal conglomerate	4,428
Abbeyville	City group	3,540
Haven	sippi lime"	3,600
Raymond	us lime"	3,300
Welch	sippi lime"	3,375
Laton	d lime"	3,125 to 3,320
Fairport	d lime"	2,950 to 3,300
Gorham	d lime"; Penn. basal conrate.	3,025 to 3,317
Balta (Dillner)	us lime"	3,300
North Fairport	d lime"	3,073 to 3,204
North Gorham	d lime"	3,100
Susank (Ochs)	ian and Penn. basal congrate.	3,365

Oil produced from pools shown in the western Kansas production table (No. 10) is derived from eight horizons. Up to and including December 31, 1929, it was possible to keep an accurate account of production from each of these formations. However, in March, 1930, Derby Oil Company drilled deeper their Stucky No. 1, in the NE cor SE¼ sec. 9, T. 21 S., R. 3 W., Voshell pool, which had been producing from the "Wilcox" sand, to the Arbuckle or "Siliceous lime," increasing the oil production. Following this completion 50 wells were drilled through the "Wilcox" sand into the "Siliceous" or Arbuckle limestone. By the end of 1930, 51 wells were producing from both the "Wilcox" sand of the Simpson formation and the Arbuckle limestone, two wells from the "Mississippi lime," and three from the Misener sand (Mississippian) and an Ordovician limestone, generally called the Viola but now classed as a member of the Bromide formation. That is, the production of 51 wells is from two horizons, of 3 wells from three horizons, and the remaining 38 from one horizon. After deducting the "Mississippi lime" production of 10,663 barrels, it was necessary to estimate the remaining production as 75 per cent from the "Wilcox" sand and 25 per cent from the Arbuckle or "Siliceous lime." No effort was made to estimate the very small amount of oil produced from the Misener sand and the so-called Viola "lime" (Bromide).

The Misener sand production, in Table 12, is derived from one well, the Gypsy-Continental Oil Companies Byers No. 1, in the NW¼ SW¼ SE¼ sec. 7, T. 26 S., R. 1 E., Valley Center pool. The total for the Valley Center field is given in Table 10, and also in Table 12, which shows the production of western Kansas by horizons. The Valley Center pool includes two producing sections, secs. 6 and 7, T. 26 S., R. 1 E., placed in western Kansas tables for convenience of discussion. Production listed as from the Bromide dolomite has appeared in previous published tables (Oil and Gas Resources, 1927, 1928 and 1929; Kansas Geological Survey), under the heading of Simpson dolomite and Viola "lime" (Ordovician). It is now thought that the Simpson dolomite and Viola "lime," as formerly used, are one and the same, and are probably of Black River and Trenton age (Ordovician). It is believed that the term Bromide dolomite will place this producing horizon more accurately, according to newer correlations of the Ordovician.

Recent investigations tend to indicate that the "Oswald" lime series is mostly of Kansas City age in the producing fields. Since it

has also been correlated as Lansing-Kansas City and Marmaton, the term "Oswald" series has been retained.

The "Siliceous lime" or Arbuckle production of the North Ellis field may be classified incorrectly in following tables, but the best information to date indicates that most of the production is from the "Siliceous" or Arbuckle lime.

Production of oil from western Kansas by horizons is shown in the following table:

TABLE 11.—*Cumulative oil production of western Kansas by horizons, as of December 31, 1930.*

PRODUCING HORIZON.	Total production.	Age of producing, horizon.	Number wells.	Age oldest production in years.
Bromide dolomite	12,584,217	Ordovician	131	3
"Oswald series"	7,267,612	Pennsylvanian	191	6
"Mississippi lime"	3,855,122	Mississippian	68	7
Pennsylvanian basal conglomerate	1,072,189	Pennsylvanian	25	3
"Wilcox" sand	3,713,921a	Ordovician	102	3
Kansas City group	178,627	Pennsylvanian	12	4
Arbuckle ("Siliceous lime")	1,435,696a	Ordovician	69	2
Misener sand	75,876	Mississippian	1	2
Total	30,183,260		599	

a. Division of production of "Wilcox" sand and Arbuckle "lime" in Voshell pool was estimated.

Table 11 does not include 11,420 barrels produced, but not run, and shown in Table 8 and Table 9. This accounts for the difference in the two totals.

According to the classification of production shown in Table 11, Ordovician formations have produced 17,733,834 barrels, Pennsylvanian formations 8,518,428 barrels, and the Mississippian 3,930,998 barrels of oil in ranges west.

Statistics of the total volume of gas produced in western Kansas are available with the exception of one field. The production from this field has been estimated and is a close approximation. Five productive horizons are listed in Table 13, ranging in age from Mississippian through the Pennsylvanian into the Permian. By far the greatest potential production and area have been developed in the Big Blue group of the Permian of southwestern Kansas.

TABLE 12.—*Amount of oil recovered from each producing horizon in western Kansas fields to the close of 1930.*

NAME OF FIELD.	Producing horizons.								Total cumulative production by fields, barrels.
	Bromide dolomite.	"Oswald."	"Mississippi lime."	Pennsylvanian basal conglomerate.	"Wilcox sand."	Kansas City.	Arbuckle or "Siliceous lime."	Misener sand.	
Lewis				51,910					51,910
N. Ellis		7,491		35,786			159,292		202,569
Yocemento		46,496							46,496
Halstead			21,139						21,139
McPherson			149,712			600			150,312
Canton	61,790								61,790
Galva			30,039						30,039
Ritz			1,663,413						1,663,413
Voshell	3,060		19,000		3,120,387		1,017,532		4,159,979
Aldrich				4,098					4,098
Abbeyville						38,713			38,713
Haven			5,469						5,469
Raymond				13,694			79,143		92,837
Welch			1,846,059						1,846,059
Laton		76,728							76,728
Fairport		5,840,718							5,840,718
Gorham		567,647		911,285					1,478,932
Balta							17,701		17,701
N. Fairport		43,154							43,154
N. Gorham		29,387							29,387
Susank (Ochs)							69,990		69,990
S. Fairport		655,991							655,991
Susank (Sellens)				44,588			92,038		136,626
Olson	1,405								1,405
Cross						5,353			5,353
Cornfield	24,632								24,632
Valley Center	12,493,330					17,724		75,876	12,586,930
Caldwell					565,420				565,420
Douglas					28,114				28,114
Love & Latta						116,237			116,237
Wellington			93,291						93,291
Rega				10,828					10,828
Abandoned			27,000						27,000
Total production to 12-31-'30	12,584,217	7,267,612	3,855,122	1,072,189	3,713,921	178,627	1,435,696	75,876	30,183,260

TABLE 13.—*Cumulative gas production of western Kansas by horizons, as of December 31, 1930.*

PRODUCING HORIZON.	Total cumulative production to Dec. 31, 1930, cubic feet.	Age.	No. wells.	Year discovered.	First active production, year.
"Mississippi lime"	14,737,682,000	Mississippian	37	1926	1927
Pennsylvanian basal conglomerate	6,612,043,745	Pennsylvanian	13	1927	1927
Howard limestone and Severy shale (Shawnee group)	873,509,000	Pennsylvanian	4	1928	1928
Topeka limestone (Shawnee group)	477,945,000	Pennsylvanian	3	1927	1927
Big Blue group	1,140,994,000	Permian	.....	1922	1929
Total	23,842,175,745				

Development in western Kansas had reached a grand total of 1,377 completions by the end of 1930, with 477 wells completed during the year. Of the total number of completed tests 482 produced oil, 175 have produced gas in commercial quantities, and 720 have been dry and abandoned. The total number of wells producing oil or gas has been 657, or about 48 per cent of the total completions. This is about 10 per cent improvement in number of productive completions as of December 31, 1930, over December 31, 1929.

Important discoveries in 1930 include the opening of the Bromide (Viola) "lime" production in the center sec. 30, T. 19 S., R. 1 W., McPherson county. This pool has been placed by itself in the production table for western Kansas, although future development will probably connect the Ritz-Canton-Galva area as one pool. The Ploog discovery well drilled by J. H. Tatlock *et al.*, in the center SW¼ SE¼ sec. 33, T. 18 S., R. 9 W., Rice county, opened a new Ordovician, or possibly Pennsylvanian basal conglomerate producing horizon in July, 1930. A new Arbuckle or "Siliceous lime" pool was opened near Bushton by Darby, Ainsworth Bros., and Slick, Pryor and Lockhart, with their No. 1 Heiken, in the NW cor. sec. 25, T. 17 S., R. 10 W., Ellsworth county, on October 15, 1930. The Midwest Oil & Refining Company Richardson No. 36, in the SE cor. sec. 36, T. 22 S., R. 12 W., placed Stafford county in the producing column September 9, 1930, by finding oil in the Arbuckle or "Siliceous lime." Likewise the Prairie Oil & Gas Company Davidson No. 1, in the NW¼ SE¼ sec. 4, T. 16 S., R. 11 W., placed Barton county among the oil-producing areas by opening a small Arbuckle "lime" pool. Several important extensions and discoveries were recorded in Russell county. The Empire

Oil & Refining Company opened a new Pennsylvanian basal conglomerate productive area in the NW cor. sec. 36, T. 13 S., R. 15 W., May 11, 1930. The E. W. Marland Company, in the NW¼ NE¼ sec. 8, T. 15 S., R. 14 W., may have opened a small Pennsylvanian basal conglomerate pool. The discovery was made June 8, 1930. The Susank (Ochs) pool was extended by two offset wells, the Empire-Ochs No. 2, in the SE¼ NE¼ sec. 23, T. 16 S., R. 14 W., and the Krug No. 1, in the SW¼ NW¼ NW¼ sec. 24, T. 15 S., R. 14 W., in April and July. The Sellens part of the Susank pool was also extended by Prairie Oil & Gas Company at Berrick No. 1, in the SE¼ SW¼ sec. 23, T. 15 S., R. 13 W., and Signal Oil Company Rude No. 1, in the NE¼ SE¼ SE¼ sec. 28, and in the SE¼ NW¼ sec. 26, T. 15 S., R. 13 W. The Prairie extension was in July and that of the Signal Oil Company, December 28, 1930, both producing from the Arbuckle "lime."

The development of the Voshell pool in Ts. 20 and 21 S., R. 3 W., McPherson county, and the discovery of Arbuckle or "Siliceous lime" production by Derby Oil Company Stucky No. 1, in the NE cor. SE¼ sec. 9, T. 21 S., R. 3 W., ranks as one of the important developments of 1930. The discovery of gas by Study and Turner, in the NE¼ SW¼ sec. 1, T. 23 S., R. 4 W., Reno county, in the "Mississippi lime," will probably result in the finding of oil in this horizon with future development. A small "Mississippi lime" producer was discovered by J. H. Tatlock and Shell Petroleum Corporation No. 1 Tonn, in the center NW¼ NW¼ sec. 17, T. 25 S., R. 4 W., Reno county.

The discovery of an extensive gas-producing area in Stevens and Morton counties, and extending northward into Grant county, southwestern Kansas, ranks as one of the most important developments of the year 1930. At the close of the year the limits of the gas area had not been determined.

New discoveries and extensions of 1930 in western Kansas are ranked as follows in order of importance:

(1) Ordovician "lime" (Trenton member of the Bromide formation) production in sec. 30, T. 19 S., R. 1 W., Canton-Ritz area (commonly referred to as Viola "lime").
(2) Arbuckle or "Siliceous lime" production in Stafford county, sec. 36, T. 22 S., R. 12 W., and Ellsworth county, sec. 25, T. 17 S., R. 10 W.
(3) Possible Arbuckle "lime" or Pennsylvanian basal conglomerate production in sec. 33, T. 18 S., R. 9 W., Rice county.
(4) Arbuckle or "Siliceous lime" production in Voshell pool. Ts. 20 and 21 S., R. 3 W.

(5) Extension of Arbuckle or "Siliceous lime" producing area in the Susank (Sellens) pool, secs. 26 and 28, T. 15 S., R. 13 W.
(6) Opening of "Mississippi lime" gas area in sec. 1, T. 23 S., R. 4 W.
(7) The extension of the Permian gas area in Stevens, Morton and Grant counties, southwestern Kansas.
(8) Discovery of what may develop into a Pennsylvanian basal conglomerate pool, sec. 8, T. 15 S., R. 14 W., Russell county.

A further explanation for placing Simpson dolomite and Viola "lime" as generally used under the common heading of the Bromide formation may be in order. The producing dolomite of the Valley Center pool was variously called Simpson dolomite and Viola "lime," but was generally thought to be different from the dolomite and limestone found above the Simpson sand and green shale series in the Voshell pool. However, most micropaleontologists and lithologists now think that the dolomite at Valley Center overlying Simpson green shales and sands is the stratigraphic equivalent of the crystalline limestone and dolomite found above the Simpson in the Voshell pool and at Canton. This conclusion seems to be correct. However, strictly speaking, neither of these formations can be termed Viola "lime" according to newer classifications.[2] The Bromide formation of Oklahoma of Black River and Trenton age would seem to be more fitting, in view of the fact that the so-called Viola "lime" of the Valley Center and Voshell pools is generally conceded to be of either Black River or Trenton age. The name Decorah formation might be applied, since it includes both Black River and Trenton members, but Bromide has been used for the reason that it covers a somewhat wider stratigraphic range than the Decorah. At any rate, all formations previously referred to as Simpson dolomite and Viola "lime" are herein called the Bromide dolomite or Bromide formation. This term may not prove the proper one to use, as there is as yet only meager paleontologic support for its use. However, in view of the fact that most evidence seems to point to Black River-Trenton age for the dolomite or limestone immediately above the Simpson green shales and sandstone, the terms Viola and Simpson dolomite have been set aside for the present and the term Bromide dolomite substituted.

New developments in 1930 are discussed by counties in alphabetical arrangement.

2. Dake, C. L., Oral communication, quoting E. O. Ulrich.

Barber County.

Barber county remains outside the oil-producing column in 1930, but gas development continued to attract attention. Several deep tests were put down into Ordovician rocks in an effort to find "Wilcox" and "Siliceous lime" production, but nothing more encouraging than showings were encountered. A total of seven dry holes and three gas wells were completed during the year within the county.

Medicine Lodge Gas Field. Three gas wells and five dry holes were completed in the Medicine Lodge gas field in 1930. A total of eight gas wells and eight dry holes have been completed in the immediate vicinity of the field. Of the eight dry holes, seven of them have reached the gas horizon at the base of the Pennsylvanian at a depth of about 4,500 feet. Five wells have reached Ordovician rocks, and a sixth stopped in Kinderhook shale. One well, in the center SW¼ sec. 19, T. 33 S., R. 12 W., was drilled in 1928 to pre-Cambrian rocks found at a depth of 6,130 feet, and abandoned at 6,185 feet.

The discovery well of the Medicine Lodge gas field was completed by Shaffer Oil & Gas Company No. 1 Alexander, in the NW¼ SE¼ sec. 13, T. 33 S., R. 13 W., in January, 1927. The volume was estimated to be about 4 million cubic feet, from a chert conglomerate at 4,447 feet, believed to be basal Pennsylvanian. Subsequent drilling indicated that the porous cherty material from which the gas is produced rests directly on an erosional remnant of the "Mississippi lime."

In 1930 five deep dry holes were completed in the Medicine Lodge field which served to test the Ordovician and outline the productive gas area of the Pennsylvanian basal conglomerate on the northeast, northwest, west and south sides. The productive gas area was already limited and the Ordovician tested on the east flank before 1930. Some inside locations, if drilled, will probably prove to be productive of gas in the base of the Pennsylvanian, but the Ordovician prospects of the structure appear to have been adequately tested. Small shows of oil found in "Wilcox" sand may cause additional deep drilling.

The four gas wells completed in 1930 had a total initial open flow of 53 million cubic feet, all from the same horizon, Pennsylvanian basal conglomerate and possibly top of the "Mississippi lime" found at an average depth of 4,468 feet. Total gas production for the year 1930 was 4,194,605,000 cubic feet, and total cumulative production to December 31, 1930, was 4,666,535,000 cubic feet from eight wells.

Miscellaneous. There were only two completions in Barber county outside of the Medicine Lodge gas field. One of these completions was in the SE cor. sec. 11, T. 32 S., R. 10 W., and was drilled to a total depth of 4,868 feet by Phillips Petroleum Company and Jack Robertson on the Powell farm. This test stopped in the Simpson formation topped at 4,757 feet, finding a hole full of water. Gas shows, variously estimated at from one to three million cubic feet, were encountered at 3,485 and 3,835 feet in Pennsylvanian limestones. This test was an interesting one, as it is located in an area of little development.

Skelly Oil Company completed a very interesting test in the SE¼ NE¼ sec. 13, T. 34 S., R. 15 W., on the Temple ranch. It was drilled to a total depth of 5,664 feet, reaching the Arbuckle or "Siliceous lime" at a depth of 5,644 feet. A small showing of oil and gas was reported at 5,256 to 5,251 feet in Viola (?) "lime" (Maysville-Eden?). A gas showing, estimated at less than one million cubic feet, was reported at 4,777 feet in Pennsylvanian rocks. Another gas show of one million cubic feet was found in top of the "Mississippi lime" at 4,668 to 4,674 feet.

An interesting comparison of the Simpson formations of the above two dry holes shows a change from about 90 per cent sand and about 10 per cent green shale in the northeast part of the county to more than 80 per cent green shale and dolomite in the southwest part of the county.

Barton County.

Davidson Pool. Barton county entered the oil-producing column March 27, 1930, by the completion of an oil well in sec. 4, T. 16 S., R. 11 W., drilled by the Prairie Oil and Gas Company on the Davidson farm. Top of the Arbuckle or "Siliceous lime" (Ordovician) was reported at a depth of 3,314 feet, and the formation was penetrated at 3,340 feet, the total depth. Later the well was plugged back to 3,338 feet and produced 193 barrels of oil and 7 barrels of water by initial test. A total of 2,000 barrels of oil was produced in 1930 and stored on the lease. The well was shut in, due to lack of pipe-line outlet. The north offset to the discovery well, the Syndicate Oil Company No. 1 Peirano, in the SW¼ NE¼ sec. 4, T. 16 S., R. 11 W., failed to extend the productive area, finding only a small show of oil in the "Siliceous lime" from 3,311 to 3,313 feet. A hole full of water resulted when the well was deepened to 3,341 feet, and it was aban-

doned at this depth. The extent of the producing area is, of course, unknown, as no additional wells have been drilled.

Three important wildcats were completed during 1930 in Barton county, all resulting in dry holes. One of these, Slick, Pryor and Lockhart No. 1 Rude, in the SE cor. sec. 11, T. 16 S., R. 13 W., was an attempt to extend the Sellens or Susank pool to the southwest. A hole full of water was found in the "Siliceous lime" from 3,376 to 3,379 feet. The other two tests in Barton county, located in the NE cor. sec. 19, T. 16 S., R. 12 W., and in the SW¼ NE¼ sec. 23, T. 17 S., R. 11 W., both encountered water in the "Siliceous lime."

Clark County.

Morrison Gas Field. Clark county does not produce oil but does produce gas from one well, the Watchorn Oil and Gas Company Stephens No. 3, in the NW cor. sec. 21, T. 32 S., R. 21 W. The discovery well of the area was drilled by the Watchorn Company in the SE¼ NE¼ NE¼ sec. 20, T. 32 S., R. 21 W., which found gas at a depth of 5,304 to 5,312 feet. The production from this horizon at the base of the Pennsylvanian was variously estimated from 4 to 15 million cubic feet. Later the hole was deepened into the "Mississippi lime," tools lost and the well abandoned.

One of the most important deep tests in Kansas was completed in Clark county in 1930, due to the persistent efforts of the Watchorn Oil and Gas Company. Their Morrison No. 2, located in the center NW¼ NE¼ sec. 20, T. 32 S., R. 21 W., was abandoned in the Arbuckle or "Siliceous lime" (Ordovician) at a total depth of 6,096 feet. This test was very interesting in that it is the only test in the southwestern part of Kansas to have reached the "Siliceous lime." An unusually thick "Mississippi lime" section was encountered from 5,377 to 6,380 feet. Most of this thickness (5,377 to 6,057 feet) was found to be of Chester age. Top of an Ordovician limestone, probably of Trenton age, was encountered at 6,528 feet, top of the Simpson green shales and sand series at 6,696 feet, and top of the "Siliceous lime" at 6,853 feet. No oil or gas shows of importance were encountered below the base of the Pennsylvanian. This is the deepest well ever to be drilled in Kansas.

The Stephens No. 3, in sec. 21, T. 32 S., R. 21 W., gas well, produced 71,787,459 cubic feet of gas in 1930 and has produced a total of 136,516,245 cubic feet to December 31, 1930. No other gas wells have been successfully completed in Clark county.

Edwards County.

Lewis Pool. The Lewis oil and gas field is the only producing area in Edwards county. The table on page 135 shows summary of completions within the producing area during 1930.

This field was discovered May 22, 1929, by the British American Oil Company, at their P. D. McCarty No. 1, in the NE¼ NW¼ sec. 31, T. 25 S., R. 17 W. The producing horizon was finally determined to be a sandy zone in the Pennsylvanian basal conglomerate, found at a depth of 4,535 feet and completed at 4,571 feet. Wells drilled through the Pennsylvanian have found Ordovician rocks underlying. Initial production was 15 million cubic feet of gas and 60 barrels of oil daily. No additional completions followed this discovery in 1929, but several tests were started late in that year and early in 1930.

The gas-producing area was extended northeast into the southwest corner of sec. 22, T. 25 S., R 17 W., and southeast into the center SW¼ sec. 32, T. 25 S., R. 17 W. Two offsets to the discovery well were completed, one of them having a rather large initial production (see table). The oil wells have had a rapid decline, and at the present time the Lewis field seems to give more promise as a gas field. The proven productive area for gas is more than 1,500 acres.

Total recovery of oil to December 31, 1930, has been 51,910 barrels from three wells. Total gas recovered to December 31, 1930, was 588,126,500 cubic feet from five wells. The per acre recovery of oil is expected to total about 3,000 barrels.

Ellis County.

There are two producing oil pools in Ellis county—North Ellis, or the Shutts pool, and the Yocemento pool. The North Ellis pool, located in secs. 20 and 32, T. 11 S., R. 17 W., and secs. 5, 8 and 19, T. 25 S., R. 17 W., was discovered in December, 1928. The Yocemento pool is located in sec. 9, T. 13 S., R. 19 W., and was discovered June 17, 1929. The South Fairport pool extends over into Ellis county in secs. 25 and 36, T. 12 S., R. 16 W., and sec. 1, T. 13 S., R. 16 W., but has been included in the production of Russell county for convenience. At the end of 1930 there were 9 wells producing, which made 176,572 barrels of oil during the year. Eleven oil wells were completed in Ellis county in 1930 and 1 producing well was deepened and abandoned. Seven dry holes were drilled. Four of the oil wells and one of the dry holes completed are in the South Fairport pool.

Well completions in Edwards county in 1930.

Company and Farm.	Location.	Date completed.	Date of first active production.	Depth producing horizon, feet.	Intital production.	
					Oil, bbls.	Gas, cu. ft.
Barnsdall Oil Co., S. N. McCarty No. 1.....	NW cor. NE¼, 31-25S-17W.....	Apr. 23, 1930	Apr. 30, 1930	4,527-4,546	512	3,000,000
Stanolind-Amerada-Wilcox, J. L. McCarty No. 1....	SW cor. SW¼, 22-25S-17W.....	May 30, 1930	*.....	4,480-4,489	.....	8,700,000
Stanolind-Amerada-Wilcox, S. N. McCarty No. 1...	SW cor. SE¼, 30-25S-17W.....	Nov. 1, 1930	Nov. 8, 1930	4,560-4,580	50	1,500,000
Barnsdall Oil Co., Maude Carroll No. 1.....	Center SW¼, 32-25S-17W.....	Dec. 9, 1930	Dec. 17, 1930	4,547-4,563	.....	9,000,000

* Gas used for drilling only.

Seven producing wells and two dry holes were completed in the North Ellis pool in 1930. Most of these completions were shut in.

North Ellis Pool. The North Ellis pool is the most important producing area in Ellis county. Production is from the "Oswald lime," Pennsylvanian basal conglomerate, and the Arbuckle or "Siliceous lime" of Ordovician age. In 1930 two wells, Phillips Petroleum Company No. 1 Kessler, in the SE cor. sec. 32, T. 11 S., R. 17 W., and Schneider No. 1, in the SE cor. sec. 18, T. 12 S., R. 17 W., were completed in the "Oswald lime." The Phillips Petroleum Company No. 1 Schmeidler, in the NW cor. sec. 20, T. 12 S., R. 17 W., another "Oswald lime" producer, declined to 8 barrels per day and was deepened from its old total depth of 3,439 feet into the "Siliceous lime." It was abandoned in January, 1930, at a total depth of 3,903 feet. "Oswald lime" production of the two wells, according to the Phillips Petroleum Company, was 7,491 barrels. Only 161 barrels of this was produced from Kessler No. 1 before it was shut in, and the remainder from Schneider No. 1.

Two wells of the North Ellis pool, Phillips Petroleum Company Weigel No. 1, in the NE cor. sec. 19, T. 12 S., R. 17 W., and Deep Rock Petroleum Company Headley No. 1, in the SE¼ NW¼ sec. 20, T. 11 S., R. 17 W., both completed previous to 1930, produced 34,395 barrels of oil from the Pennsylvanian basal conglomerate.

Five wells were completed as producing wells in the Arbuckle or "Siliceous lime" in 1930. The best initial production was from Texas and Skelly Oil Companies Shutts No. 1, in the NW¼ SE¼ sec. 5, T. 12 S., R. 17 W., with an initial production of 600 barrels of 32° Bé. oil, from 3,608 to 3,656 feet. Phillips Petroleum Company completed a 500-barrel well, their Horn No. 1, in the NE¼ SW¼ sec. 5, T. 12 S., R. 17 W., from 3,633 to 3,646 feet in June, 1930. The other three Arbuckle or "Siliceous lime" completions were of smaller size, and one of them made considerable water. Total production of the pool in 1930 was 157,046 barrels.

Yocemento Pool. Two dry holes were drilled in the Yocemento pool, indicating that this pool will probably be of small extent. The Barnsdall Oil Company Johnson No. 2, in the SE¼ NE¼ SW¼ sec. 9, T. 13 S., R. 19 W., had only a small show of oil at 3,616 feet, and a hole full of water at 3,674 feet. It was abandoned at 3,805 feet. The Mid-Kansas completed the Johnson No. 1, in the SW¼ SE¼ NE¼ sec. 9, T. 13 S., R. 19 W., and was abandoned at a total depth of 4,360 feet. This well is reported to have reached pre-Cambrian rocks. Four wells produced the first six months, three wells the fol-

lowing five months, and two wells in December. Total production of the pool for 1930 was 19,526 barrels.

MISCELLANEOUS. Four wildcat dry holes were abandoned in Ellis county in 1930. They are as follows:

Byrens *et al.*, Fisher No. 1:
Cen. SE¼, sec. 4, T. 11 S., R. 20 W., total depth..... 872 feet
Central Commercial, Helms No. 1:
SE¼ NE¼, sec. 2. T. 12 S., R. 20 W., total depth..... 4,250 feet
Stearns-Streeter, Leiker No. 1:
SW¼ NE¼, sec. 26, T. 13 S., R. 20 W., total depth..... 3,864 feet
Rush Oil Company, Gatewood No. 1:
NW cor. sec. 4, T. 15 S., R. 20 W., total depth..... 3,825 feet

The last mentioned of the above wells had a small showing of oil in the "Dodge lime" at a depth of 3,055 feet.

HARVEY COUNTY.

A summary of wells completed in Harvey county since the first development in 1923 shows a total of 72 completions. Twenty-one wells have been completed in ranges west and 51 in ranges east. Only 15 wells have produced oil or gas in commercial quantities. Four wells were producing December 31, 1930. Two of these are gas wells.

In 1930 fourteen wells were completed in Harvey county. Twelve completions were abandoned, of which three were oil wells (one was an exhausted gas well) which had been drilled deeper. Two producing oil wells were completed in the "Mississippi lime." Of the abandoned wells, five reached Arbuckle "lime," five the Simpson formation, and two the "Mississippi lime."

WALTON POOL. The Walton pool, oldest producing area in Harvey county (discovered December, 1923), located in sec. 4, T. 23 S., R. 2 E., produces oil from the Kansas City group. Ten productive wells, all in section 4, have been completed in this pool, but only one well, Mohawk Oil Company Hawk No. 1, survived December 31, 1930. Production for 1930 and total to date is shown in the following table:

TABLE 15.—*Cumulative production and production of the Walton pool in 1930, by months.*

Month.	Barrels of oil.	Month.	Barrels of oil.
January	193.32	October	385.32
February	366.32	November	576.24
March	.....	December	382.84
April	450.68		
May	.....	Total Dec. 31, 1930.....	3,629.48
June	358.40	Cumulative prod., Dec. 31, 1929	103,850.00
July	189.52		
August	176.80	Total cumulative prod., Dec. 31, 1930.....	107,479.48
September	550.04		

HALSTEAD POOL. Both oil and gas is produced in the Halstead area from the "Mississippi lime." The discovery well was drilled by the Shell Petroleum Company Haury No. 1, in the NE¼ SW¼ SE¼ sec. 11, T. 23 S., R. 2 W., in August, 1928. It had an initial production of 8,400,000 cubic feet of gas from a depth of 2,961 to 2,972 feet in the "Mississippi lime." In 1930 two oil wells extended the producing area of the Halstead pool into secs. 35 and 36, T. 22 S., R. 2 W. The McPherson Oil and Gas Company Palmer No. 1, in the center SW¼ NW¼ sec. 36, T. 22 S., R. 2 W., reached the top of the "Mississippi lime" at 2,970 feet and was completed at 3,002 feet. It flowed 240 barrels of 31° Bé. oil the first 24 hours. Jones *et al.*, Lehman No. 1, in the center SE¼ NE¼ sec. 35, T. 22 S., R. 2 W., showed for a small well in the "Mississippi lime," found at a depth of 2,965 to 2,987 feet. The initial gas production was gauged at 14,886,000 cubic feet. Oil production was estimated to be about 250 barrels daily. This well was not produced in 1930.

Late in 1930 McPherson Oil and Gas Company and Shell Petroleum Company drilled Haury No. 1A, in the SW¼ NE¼ SW¼ sec. 11, T. 23 S., R. 2 W., deeper from 2,955½ to 3,000 feet. At a depth of 2,959 feet gas production was increased from 6,415,000 cubic feet to 11,115,000 cubic feet. Water and a show of oil were encountered at 2,988 feet, which could not be shut off and the well was abandoned. The McPherson Oil and Gas Company completed Haury No. 2, in the SE cor. sec. 11, T. 23 S., R. 2 W., in the "Mississippi lime." Top of the lime was found at a depth of 2,936 feet and abandoned at 3,009 feet. The well swabbed 196 barrels of oil and 110 barrels of water from 2,974 to 2,989 feet. The water increased with deeper drilling and the well was abandoned at a total depth of 3,009 feet.

Several important wildcat wells were completed as dry holes and served to partially condemn a large area. They are as listed below:

NAME.	Location	Formation at total depth.	Total depth, feet.
E. W. Marland Inc., Chambers No. 1	NE SE 8-24S-2E	Arbuckle	3,511
Gypsy Oil Company, Hege No. 1	SE NW SE 13-22S-2W	Arbuckle	3,539
Texas Company Zook No. 1	Cen. NE SW 36-22S-2W	Arbuckle	3,550
Superior Oil Company, Regier No. 1	SE NW 11-22S-3W	Simpson	3,752
Gypsy Oil Company, Shive No. 1	SE SW 26-22S-3W	Arbuckle	3,777
McCullough et al., Prouty No. 1	NW SW 3 23-1W	Simpson	3,504
Gay Oil Company, Grove No. 1	NW NE NW 29-23S-1W	Simpson	3,630
Jolly & Ogg, Hupp No. 1	SE NE 22-23S-1W	Simpson	3,535
Jolly & Ogg, Schowalter No. 1	NE cor. 11-24S-1W	Arbuckle	3,760
Independent and Reserve Oil Co., Moulds No. 1	Cen. NE 7-24S-1W	Simpson	3,815

Harvey county produced 23,468 barrels of oil from two wells in 1930. Total gas production for 1930 was 57,226,000 cubic feet from two wells.

McPherson County.

In 1930 McPherson county led in western Kansas in active developments and completions. The chief cause for this activity was the development of the Voshell and Ritz-Galva-Canton areas. In January, 1930, the Voshell pool had 6 producing wells and by December this number had increased to 94. The Ritz-Galva-Canton area had 7 producing wells at the beginning of 1930 and 27 producing at the close of the year. Developments late in 1930 were speeded up by a large number of locations on Shell Petroleum Company acreage in the Ritz-Galva-Canton area. Indications early in 1931 are that these three separate pools will be connected as one producing area.

The total number of completions in McPherson county during 1930 was 156. Of these 29 were dry holes, 13 were gas wells (one of which was later deepened and abandoned), and 114 were oil wells. The oil and gas wells are distributed in five pools and fields shown in the following table:

Table 16.—*Oil and gas pools and fields of McPherson county, 1930.*

Name and Location.	Number of wells.		1930 oil production, bbls.	Cumulative gas production, M. cu ft.	Producing horizon.
	Oil.	Gas.			
McPherson, T. 18 S., R. 2 W.	9*	14	150,312	9,083,480	"Miss. limes." Kansas City.
Canton,† T. 19 S., R. 1 W.	4	.....	61,790	.....	Bromide form.
Galva,† T. 19 S., R. 2 W.	2	14	30,039	4,120,671	"Miss. limes."
Ritz,† T. 20 S., R. 1-2 W.	21	3	1,663,413	410,778	"Miss. limes."
Voshell, T. 20-21 S., R. 3 W.	94	3	4,159,979	947,103	"Miss. limes." "Wilcox" sand. Arbuckle limes.
Total	130	34	6,065,533	14,562,032	

* Eight of nine wells producing oil also produce gas. Output of one well sold for drilling.
† Developments early in 1931 indicate these three fields will merge into one producing area.

McPherson Gas Field and Oil Pool. This area has produced gas and some oil since the discovery by Merriam, Reeves and Shidell in their Anderson No. 1, in the center SW¼ sec. 29, T. 18 S., R. 2 W., in September, 1926. Production was found in the Kansas City group at a depth of 2,340 to 2,395 feet. Gravity of the oil tested

35.5° Bé. One gas well, Sinclair Oil and Gas Company Clark No. 1, in the center NE¼ SE¼ sec. 31, T. 19 S., R. 2 W., started producing some oil in September, 1930. Two dry holes were completed during the year, both reaching Ordovician rocks. The 1930 production of the McPherson pool was 45,587 barrels from 9 wells, including 600 barrels produced and sold for fuel from Graham Bros. Rolander No. 1A, in the SW cor. sec. 30, T. 18 S., R. 2 W. Total gas produced in this field in 1930 was 1,493,001,000 cubic feet from 14 wells.

CANTON POOL. The Canton pool is located around the center of sec. 30, T. 19 S., R. 1 W. Only four wells had been completed in December, 1930, producing from a dolomitic limestone popularly referred to as the Viola "lime." It is quite probable that the producing formation in these four wells is equivalent to the producing horizon of the Valley Center field in T. 26 S., R. 1 E. and 1 W., Sedgwick county, Kansas, which has been placed in the Bromide formation. It underlies a shale section of Kinderhook (Mississippian) and Maquoketa ? (Ordovician) age. Developments since December, 1930, indicate that the producing area of the Galva gas field in T. 19 S., R. 2 W., the Canton in sec. 30, T. 19 S., R. 1 W., and Ritz pools, T. 20 S., R. 1 and 2 W., will connect as one large producing area. The following data show the status of the four Canton-pool wells as of December 31, 1930:

NAME.	Location.	Top of Mississippi limes.	Top of Bromide (Viola) lime.	Production 1930, barrels.
McBride, Inc. Whitright No. 1	NE NW 30-19S-1W	2,947	3,414	14,685
Mid-Kansas Garrett No. 1	SW NE 30-19S-1W	?	3,412½	34,042
Shell Petr. Anderson No. 1	SE NW 30-19S-1W	2,953	3,410	1,843
Shell Petr. Lewis No. 1	NW SE 30-19S-1W	2,953	3,412	11,220
Total				61,790

The discovery well of the Canton area was McBride, Inc., Whitright No. 1, in the NE¼ SW¼ sec. 30, T. 19 S., R. 1 W., which found 3 million cubic feet of gas in the top of the "Mississippi lime" from 2,947 to 2,958 feet, June 3, 1930. It was deepened to 3,011 feet, where it flowed 124 barrels of water and 171 barrels of oil the first 24 hours, with an increase of gas to 5 million cubic feet. The discovery well of the Bromide (Viola ?) formation was the Mid-Kansas Oil and Gas Company Garrett No. 1, in the SW¼ NE¼ sec. 30, T. 19 S., R. 1 W. It failed to find oil in top of the "Missis-

sippi lime," although offsetting a small "Mississippi lime" producer, and was deepened without much hope of finding oil in the Ordovician. It caused considerable excitement when an Ordovician dolomitic limestone member of the Bromide formation (Viola ?) was found at a depth of 3,412 to 3,414 feet, October 21, 1930. It was not tested until November 21, 1930, when it swabbed 3,567½ barrels of 37.8° Bé. oil in 24 hours. This discovery caused the drilling of the Whitright No. 1 to the Ordovician limestone. The other two offsets were quickly put down to the producing horizon, one being completed December 15 and the other December 22, 1930. At present the Ordovician producing area of the Canton pool is undefined, except by a dry hole to the southwest in the SE¼ SW¼ SW¼ sec. 1, T. 20 S., R. 2 W., which was completed in 1929.

Galva Oil and Gas Field. The Galva gas field is located in secs. 2, 10, 11, 12, 13, 14 and 15, T. 19 S., R. 2 W. At the end of 1929 the gas production was confined to sec. 11, T. 19 S., R. 2 W. The discovery well was drilled in this section on the Decker farm, by the McPherson Oil and Gas Company, in the center SE¼ sec. 11, T. 19 S., R. 2 W. The producing horizon, top of the "Mississippi lime," was found at a depth of 2,892 feet and drilled to 2,914 feet for an initial production of 18 million cubic feet per day. In 1930 prospecting for gas extended the limits of the field into five additional sections, as mentioned above, with the completion of ten gas wells, all in the "Mississippi lime." Initial productions have ranged from 8 million to 28,300,000 cubic feet daily. The limits of the producing area had not been defined late in 1930, but by the early part of 1931 a dry hole in the gas horizon had been found in sec. 1, T. 19 S., R. 2 W. Developments in the southeast part of the field point to the joining of the Galva, Canton, and Ritz pools into one producing area.

Two wells produced oil as well as gas during 1930 in the Galva field. One of these wells, the Mid-Kansas Oil and Gas Company Pitts No. 1, in sec. 2, T. 19 S., R. 2 W., was discovered in April, finding oil at a depth of 2,950 feet. It produced 18,220 barrels of oil during 1930. The other well was brought in June 6, 1930, by McPherson Oil and Gas Company on the Robinson farm in the center SW¼ sec. 10, T. 19 S., R. 2 W., at a depth of 2,956 to 2,957 feet, for an initial production of 190 barrels of 37° Bé. oil. Initial gas production was 1¼ million cubic feet. A total of 11,819 barrels of oil were produced in 1930. There seems to be every reason to believe the oil-producing area of the "Mississippi lime" will be extended.

There exists a very good chance, also, that Ordovician formations may be productive of oil under this structure.

Ritz Pool. This pool, located in secs. 6 and 7, T. 20 S., R. 1 W., and secs. 1 and 12, T. 20 S., R. 2 W., came into prominence in 1930. The discovery well, the McPherson Oil and Gas Company Wedel No. 1, in the center SW¼ sec. 12, T. 20 S., R. 2 W., was completed as a gas well in the "Mississippi lime" December 28, 1928, at a total depth of 2,972 to 2,983 feet. Initial production was 6½ million cubic feet of gas. Since that time gas production has assumed a minor role, owing to the completion of several large oil wells. By the end of 1930 there were 21 oil and 3 gas wells, all of the oil and gas being produced from about 40 to 50 feet below the top of the "Mississippi lime." Three wells, one of them an old gas producer, were drilled to the Ordovician, stopping either in the "Wilcox" sand or the Arbuckle "Siliceous lime," without finding commercial oil or gas production. The average depth to top of the Bromide formation (Viola?) is about 3,400 feet.

The oil producing area of the "Mississippi lime" is defined to the south, southeast and southwest. The producing area in the north end of the pool will probably extend northward to connect with the Canton area in the center of sec. 30, T. 19 S., R. 1 W.

The Ritz pool bears the distinction of having produced an average of 8,000 barrels of oil per acre from the "Mississippi lime" in slightly less than two years time. This yield is exceptional for "Mississippi lime" pools. Total oil production from 21 wells in 1930 was 1,348,-080 barrels. Total gas produced was 215,134,000 cubic feet from 3 wells. The oil production was prorated part of the time during 1930.

Voshell Pool. The Voshell pool was discovered in August, 1929, by Washabaugh *et al.*, Voshell No. 1, in the NE cor. sec. 9, T. 21 S., R. 3 W., at a depth of 3,301 to 3,304 feet in the Bromide formation (Viola ?), with an initial production of about 40 barrels. At the end of 1929 four additional wells had been completed in the "Wilcox" sand. At the end of 1930 there were 94 producing wells making oil from the "Mississippi lime," Misener sand, Bromide (Viola ?) lime, "Wilcox" sand and Arbuckle or "Siliceous lime." The principal producing horizon is the "Wilcox" sand. Only three wells produced small amounts of oil from the Misener sand and the Bromide (Viola ?) "lime," while 51 wells produced oil from the "Wilcox" and Arbuckle or "Siliceous lime," 2 wells produced oil and gas from the

"Mississippi lime," and the remaining 38 wells produced from the "Wilcox" sand alone.

The producing area of the Voshell pool was extended from secs. 9 and 10, T. 21 S., R. 3 W., and sec. 34, T. 20 S., R. 3 W., at the end of 1929, to include secs. 3, 4, 15 and 16, T. 21 S., R. 3 W. Most of the wells early in 1930 were completed to the "Wilcox" sand. In January, Derby Oil Company started deepening and testing Stucky No. 1, in the NE¼ SE¼ sec. 9, T. 21 S., R. 3 W. It was originally completed in the "Wilcox" sand at a depth of 3,322 to 3,325 feet. It was deepened slowly through the "Wilcox" sand to the Arbuckle or "Siliceous lime" which was encountered at a depth of 3,380 feet, and drilled to 3,395 feet. The initial production was doubled, making 1,800 barrels per day after the "Siliceous lime" was reached. This completion caused other operators in the field to deepen their wells to the "Siliceous lime," and by the end of 1930, 51 wells were producing from both the "Wilcox" sand and "Siliceous lime." A peak potential production of about 70,000 barrels was built up for the field early in August, and the wells were prorated to about 20 per cent of their rated potential.

The producing area is six locations (¾ mile) at its widest extent, along the north line of section 9 and the south line of sec. 4, T. 21 S., R. 3 W. It narrows to five, then four, locations both north and south of the above-mentioned area. The greatest length of the field is 3¾ miles, with some possibility of further extensions both to the north and south. There is very little chance of the productive area being widened, except in sec. 33, T. 20 S., R. 3 W., and secs. 15 and 16, T. 21 S., R. 3 W., the north and south ends of the pool.

One of the interesting developments of 1930 was the discovery of a north-south trending fault with the downthrow side to the west on the west flank of the structure. This fault marks the west limit of production. The east side of the structure is quite steep, and several wells on this flank began showing water early in 1930. Although there are no dry holes directly east of these wells, the fact that they are making water indicates that the east edge of the pool has been reached in this locality. Further north, in the NE¼ NW¼ SW¼ sec. 34, and south, in the SE¼ SW¼ NW¼ and NE¼ NW¼ SW¼ sec. 10, T. 21 S., R. 3 W., dry holes have outlined the east limit of the productive area.

Although a large potential production was built up in the middle part of 1930 and the pool prorated to about 20 per cent of this

There exists a very good chance, also, that Ordovician formations may be productive of oil under this structure.

RITZ POOL. This pool, located in secs. 6 and 7, T. 20 S., R. 1 W., and secs. 1 and 12, T. 20 S., R. 2 W., came into prominence in 1930. The discovery well, the McPherson Oil and Gas Company Wedel No. 1, in the center SW¼ sec. 12, T. 20 S., R. 2 W., was completed as a gas well in the "Mississippi lime" December 28, 1928, at a total depth of 2,972 to 2,983 feet. Initial production was 6½ million cubic feet of gas. Since that time gas production has assumed a minor role, owing to the completion of several large oil wells. By the end of 1930 there were 21 oil and 3 gas wells, all of the oil and gas being produced from about 40 to 50 feet below the top of the "Mississippi lime." Three wells, one of them an old gas producer, were drilled to the Ordovician, stopping either in the "Wilcox" sand or the Arbuckle "Siliceous lime," without finding commercial oil or gas production. The average depth to top of the Bromide formation (Viola?) is about 3,400 feet.

The oil producing area of the "Mississippi lime" is defined to the south, southeast and southwest. The producing area in the north end of the pool will probably extend northward to connect with the Canton area in the center of sec. 30, T. 19 S., R. 1 W.

The Ritz pool bears the distinction of having produced an average of 8,000 barrels of oil per acre from the "Mississippi lime" in slightly less than two years time. This yield is exceptional for "Mississippi lime" pools. Total oil production from 21 wells in 1930 was 1,348,-080 barrels. Total gas produced was 215,134,000 cubic feet from 3 wells. The oil production was prorated part of the time during 1930.

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"Mississippi lime," and the remaining 38 wells produced from the "Wilcox" sand alone.

The producing area of the Voshell pool was extended from secs. 9 and 10, T. 21 S., R. 3 W., and sec. 34, T. 20 S., R. 3 W., at the end of 1929, to include secs. 3, 4, 15 and 16, T. 21 S., R. 3 W. Most of the wells early in 1930 were completed to the "Wilcox" sand. In January, Derby Oil Company started deepening and testing Stucky No. 1, in the NE¼ SE¼ sec. 9, T. 21 S., R. 3 W. It was originally completed in the "Wilcox" sand at a depth of 3,322 to 3,325 feet. It was deepened slowly through the "Wilcox" sand to the Arbuckle or "Siliceous lime" which was encountered at a depth of 3,380 feet, and drilled to 3,395 feet. The initial production was doubled, making 1,800 barrels per day after the "Siliceous lime" was reached. This completion caused other operators in the field to deepen their wells to the "Siliceous lime," and by the end of 1930, 51 wells were producing from both the "Wilcox" sand and "Siliceous lime." A peak potential production of about 70,000 barrels was built up for the field early in August, and the wells were prorated to about 20 per cent of their rated potential.

The producing area is six locations (¾ mile) at its widest extent, along the north line of section 9 and the south line of sec. 4, T. 21 S., R. 3 W. It narrows to five, then four, locations both north and south of the above-mentioned area. The greatest length of the field is 3¾ miles, with some possibility of further extensions both to the north and south. There is very little chance of the productive area being widened, except in sec. 33, T. 20 S., R. 3 W., and secs. 15 and 16, T. 21 S., R. 3 W., the north and south ends of the pool.

One of the interesting developments of 1930 was the discovery of a north-south trending fault with the downthrow side to the west on the west flank of the structure. This fault marks the west limit of production. The east side of the structure is quite steep, and several wells on this flank began showing water early in 1930. Although there are no dry holes directly east of these wells, the fact that they are making water indicates that the east edge of the pool has been reached in this locality. Further north, in the NE¼ NW¼ SW¼ sec. 34, and south, in the SE¼ SW¼ NW¼ and NE¼ NW¼ SW¼ sec. 10, T. 21 S., R. 3 W., dry holes have outlined the east limit of the productive area.

Although a large potential production was built up in the middle part of 1930 and the pool prorated to about 20 per cent of this

potential, it was evident late in the year that water encroachment and natural decline had lowered the potential to near the actual production. Early in 1931 gauging of all wells showed that the 20 per cent of 70,000 barrels potential was very near actual production. Proration was therefore abandoned February 1, 1931.

The Voshell pool produced a total of 4,080,785 barrels of oil during 1930, 10,663 barrels of which were produced from the "Mississippi lime." It also produced 947,103,000 cubic feet of gas during 1930 from 3 wells. Total recovery of oil has averaged slightly over 4,400 barrels per acre.

Ness County.

Only four wells have been drilled in Ness county. Three of these have been dry and one a small producer. Two tests are thought to have reached the Ordovician, although there is a difference of opinion among geologists on at least one of these tests. Only one well was drilled in the county in 1930.

Gypsy Oil Company No. 1 Coleman, in the SW¼ NE¼ sec. 25, T. 17 S., R. 25 W., was drilled to a total depth of 4,807 feet and abandoned. This test started drilling about 25 feet above the base of the Fort Hays (Cretaceous) limestone and found the top of the Dakota group at 460 feet. The Dakota, Fuson (?), and Lakota (?) extended to 880 feet, where the top of the Permian red beds was encountered. The top of the Pennsylvanian system was reported at 2,980 feet and the base at 4,418 feet. The Mississippian extended from 4,418 to 4,493 feet, where the top of the Ordovician was encountered. Ordovician cherts and dolomite, which may possibly correlate with the Galena, were reported to a depth of 4,600 feet. The material from 4,600 to 4,709 feet was classed as Simpson age and consisted principally of dolomite with some interstratified green shale. Top of the Arbuckle or Ordovician "Siliceous lime" extended from 4,709 feet to the total depth of 4,807 feet. A showing of oil was found from 4,374 to 4,376 feet in a sandy member of the Pennsylvanian basal conglomerate. Oil rose in the hole about 500 feet. This showing is thought to have been from the same horizon as that producing in sec. 7, T. 18 S., R. 25 W.

Considerable doubt has been expressed as to the age of the dolomite near the bottom of the Gypsy test. Some geologists have maintained that the well was stopped in Mississippian limestones. Other determinations agree in general with those given above. The owners

were apparently satisfied that the well reached the Ordovician "Siliceous lime."

Ness county produced 2,438 barrels of oil in 1930 from one well, which was pumped at irregular intervals.

Reno County.

Reno county was comparatively inactive in 1930. However, fourteen wells were completed within the county during the year, eleven of which were dry, two were gas wells and one an oil well.

Burrton Gas Field. A new gas field was opened by the Empire Oil and Gas Company and E. H. Sturdy with their Haury No. 1, in the NE¼ SW¼ sec. 1, T. 23 S., R. 4 W., late in September. The well had an initial production of 22 million cubic feet from 3,301 to 3,333 feet in the "Mississippi lime." Top of the Mississippian was found at 3,260 feet, where a small showing of oil and gas was recorded. This well also had 1 million cubic feet of gas from sandy lime from 3,026 to 3,028 feet, probably from a member of the Marmaton group. This well was produced a short time during 1930 and made 20,762,000 cubic feet of gas.

Abbeyville Gas Field. The Abbeyville gas field is an entirely prospective affair and is represented by only one well. Skelly Oil Company *et al.*, Trembly No. 1 in the NE¼ SW¼ sec. 30, T. 24 S., R. 7 W., was started as a deep test and was drilled to a total depth of 4,247 feet. The top of the Ordovician "Siliceous lime" was encountered at 4,238 feet. The top of the Bromide formation was encountered at 4,135 feet and drilled to 4,163 feet. The Simpson extended from 4,163 to 4,238 feet. The "Mississippi lime" extended from 3,775 to 3,910 feet. None of the Mississippian or pre-Mississippian formations showed either oil or gas, so the well was plugged back to 2,191 feet and completed as a 1½ million-foot gas well from sand at 2,075 to 2,087 feet in the Admire shale of the Pennsylvanian system. The well was shut in and no subsequent development has taken place in this field.

Abbeyville Pool. At the end of 1930 this pool was still represented by one oil well, located in sec. 24, T. 24 S., R. 8 W., discovered January 1, 1927. This well made 5,592 barrels of oil in 1930 from a member of the Kansas City group of the Pennsylvanian at a depth of 3,871 feet. No new developments took place in this area during the year.

HAVEN POOL. This pool was discovered June 26, 1930, by J. H. Tatlock and Shell Petroleum Company Tonn No. 1, in the center NW¼ NW¼ sec. 17, T. 25 S., R. 4 W. A small showing of gas was recorded from 3,550 to 3,551 feet near the base of the Pennsylvanian. Top of the "Mississippi lime" was found at 3,566 feet and the formation was drilled to 3,611 feet. Oil was found from 3,605 to 3,609 feet, followed by 12 barrels of water per day. The initial production was 197 barrels of 35° Bé. oil and 40 barrels of water. No new developments have been attempted.

The Haven pool produced 5,469 barrels of oil during 1930.

Eleven dry holes were drilled in Reno county in 1930. These are shown in the following list:

Location.	Total depth, feet.	Formation at bottom of hole.
SE NE sec. 6, T. 22 S., R. 4 W.....	4,030	"Siliceous lime."
SE NW sec. 14, T. 22 S., R. 6 W.....	4,084	Simpson formation.
SE cor. sec. 16, T. 22 S., R. 7 W.....	3,932	"Siliceous lime."
NW cor. sec. 4, T. 22 S., R. 10 W.....	3,544	"Siliceous lime."
SW NE SW sec. 36, T. 23 S., R. 5 W....	3,934	"Siliceous lime."
SE NW sec. 31, T. 25 S., R. 4 W.....	4,125	"Siliceous lime."
NE NW sec. 36, T. 25 S., R. 4 W.....	4,305	"Siliceous lime."
NW cor. sec. 11, T. 25 S., R 5 W.....	4,043	"Siliceous lime."
NE SE sec. 14, T. 26 S., R. 5 W.....	4,108	Simpson formation.
NE SE NE sec. 6, T. 26 S., R. 7 W.....	4,266	Simpson formation.
C S½ NW sec. 22, T. 26 S., R. 8 W.....	4,360	"Siliceous lime."

Four of the above dry holes aroused a great deal of interest and served to condemn areas which had been thought to be promising. W. C. McBride, Inc. Bacon No. 1, in the SW¼ NE¼ SW¼ sec. 36, T. 23 S., R. 5 W., had a small showing of oil in the "Mississippi lime" from 3,410 to 3,418 feet, followed by water. Top of the Mississippian was found at 3,375 feet and base at 3,580 feet. Another showing was found in Bromide (Trenton ?) limestone from 3,812 to 3,817 feet. This showing was about 2½ barrels per hour. Drilling was continued to 3,934 feet through the Simpson, found from 3,830 to 3,926 feet. Drilling stopped in the Arbuckle or "Siliceous lime."

Shell Petroleum Company Popp No. 1, in the NW cor. sec. 11, T. 25 S., R. 5 W., had a small showing of oil, in what was thought to be Fernvale limestone, from 3,887 to 3,892 feet. Top of the Simpson formation was 3,901 feet and top of the "Siliceous lime" 3,995 feet. Drilling was stopped at 4,043 feet in "Siliceous lime." This test was drilled on a core drilled structure and the results were rather disappointing.

Palmer and Phillips Petroleum Company Harsch No. 1, in the NE¼ SE¼ sec. 14, T. 26 S., R. 5 W., had a showing of oil and water

near the base of the Kansas City group from 3,230 to 3,240 feet. Gas was found in the "Mississippi lime" at 3,620 and 3,635 feet, the volume reaching 1½ million cubic feet at the latter depth. The well was abandoned after finding a hole full of water in the Simpson formation at a total depth of 4,105 feet.

John Rogers *et al.*, McPheeter No. 1, in the center S½ NW¼ sec. 22, T. 26 S., R. 8 W., reported a showing of oil with water in sand near the top of the Pennsylvanian at 2,030 to 2,045 feet. A second showing of oil and water was reported in a sand member of the Admire shale at 2,280 to 2,290 feet. A small showing of gas was encountered in the Topeka lime at 2,820 feet, and a third oil showing in the Lansing at 3,346 feet. Water was encountered in the Simpson formation at 4,370 feet and the well was abandoned in the "Siliceous lime" at a total depth of 4,360 feet.

Reno county produced 11,061 barrels of oil and 20,762,000 cubic feet of gas in 1930.

Rice County.

Rice county was one of the most active areas within the state during 1930. This activity was caused by the discovery of Ordovician "Siliceous lime" production in the Raymond pool. There were a total of 35 completions, of which 22 were dry holes, 12 oil wells, and 1 gas well. One of the abandoned wells was a gas well completed early in 1930.

One of the most important discoveries was by the Tatlock *et al.*, Ploog No. 1, in the center SW¼ SE¼ sec. 33, T. 18 S., R. 9 W., discovered in January, 1930. This well had an initial production of about 3,000 barrels of 43° Bé. oil from the Ordovician "Siliceous lime" found at 3,252 to 3,253 feet. It flowed a part of its initial production, but after producing 4,135 barrels it was shut in for lack of pipe-line outlet.

The Boucher Oil Company No. 1 Boy, in the SW cor. sec. 16, T. 21 S., R. 10 W., which was drilled in as a gas well January 15, 1930, was deepened to the "Siliceous lime" in September. The gas was produced from a sand lens in the Severy shale at a depth of 2,550 to 2,553 feet. Top of the "Siliceous lime" was encountered at 3,385 feet, where a small showing of 33° Bé. oil was found. It was deepened to 3,434 feet, finding a hole full of sulphur water at 3,430 feet. Several other tests were drilled along the trend of the Ellsworth anticline in an effort to find "Siliceous lime" production, but without success.

Welch Pool. The Welch pool was discovered April, 1924, and produces oil from a "chat" which either rests directly on or is a part of the "Mississippi lime." The only completion of interest in this pool in 1930 was that by Hipple and Rogers in their Rainey No. 1, in the NW¼ NE¼ SE¼ sec. 3, T. 21 S., R. 6 W., which found the top of the pay horizon at 3,368 feet and drilled to 3,391 feet. The well flowed 1,290 barrels in 15½ hours and was generally rated as a 2,000-barrel well. Lack of a purchaser for all of the oil caused it to be shut in to 250 barrels per day. This pool produced 197,405 barrels of oil in 1930.

Raymond Pool. The Slick, Pryor and Lockhart Schurr No. 1, in the NE¼ SW¼ sec. 21, T. 20 S., R. 10 W., was deepened in March from an old total depth of 3,284 feet to the "Siliceous lime." It was completed with an initial production of about 1,000 barrels at 3,308 feet. This well had previously produced 13,694 barrels of 53° Bé. oil, 2,204 barrels of which was produced in 1930, from the Pennsylvanian basal conglomerate at a depth of 3,277 to 3,284 feet. It was discovered in August, 1929. Before deepening it had declined from an initial production of 167 barrels of oil to 47 barrels of oil and 25 barrels of water.

The discovery well in the "Siliceous lime" of the Raymond pool was the Producers and Refiners Company Thompson No. 1, in the SE¼ NW¼ sec. 21, T. 20 S., R. 10 W., a north offset to the Schurr No. 1, mentioned in the preceding paragraph. The "Siliceous lime" was encountered early in January, 1930, at a depth of 3,330 to 3,331 feet, and swabbed 440 barrels of oil the first 24 hours. It was later deepened to 3,351 feet and produced about 1,200 barrels the first 24 hours after deepening. Subsequent to this completion 9 oil wells, 1 gas well, and 6 dry holes were completed in and surrounding the pool. All but one of these wells were completed in the Ordovician. The Courtney Davis *et al.*, Kelly No. 1, in the SW¼ NW¼ sec. 22, T. 20 S., R. 10 W., was completed as a 2,400,000-cubic-foot gas well at a total depth of 2,593 feet. A small amount of oil was found in the gas sand at 2,584 feet. This sand is a lens in the Severy shale.

The Raymond pool was without pipe-line outlet early in 1930 and was prorated or shut in most of the time. Total production was 81,347 barrels of oil.

At the end of 1930 Rice county was one of the most promising areas within the state. Early in 1931 a large well was completed in the "Siliceous lime" in sec. 13, T. 20 S., R. 10 W. A smaller well was

completed in sec. 21, T. 19 S., R. 9 W. Both of these tests opened new pools. Lack of a purchasing agent and only one pipe-line outlet for western Rice county will be limiting factors in 1931. Total production for 1930 was 282,887 barrels, including 4,135 barrels stored on the Ploog lease. Total production to December 31, 1930, has been 1,943,031 barrels from 38 wells.

Rooks County.

Only four wells were completed in Rooks county in 1930. Three of these were dry holes, and the fourth opened a new oil pool.

Laton Pool. The only producing oil field in Rooks county, located in sec. 11, T. 9 S., R. 16 W., was quiet during the year. One test was started in the NW¼ SE¼ SW¼ sec. 12, T. 9 S., R. 16 W., and abandoned at a depth of 575 feet. The Laton pool was discovered July 5, 1927, and has never been a very active area. Only two wells were producing on December 31, 1930. Production for the year was 19,541 barrels.

Webster Pool. The Webster pool was discovered October 1, 1930, by the H. K. Boysen *et al.*, Silvers No. 1, in the center NE¼ sec. 21, T. 8 S., R. 19 W. Oil was found in a sandy dolomite, probably near the base of the Pennsylvanian system, at a depth of 3,442 to 3,445 feet. The oil is black and heavy, with a gravity of 26° Bé. When the well was discovered 1,100 feet of oil rose in the hole in a half hour, and it was thought the well would be a large one. Subsequent tests, however, rated the well as capable of producing about 300 barrels per day. After swabbing and pumping about 985 barrels the well was shut in for the lack of pipe-line outlet.

Two deep dry holes were drilled in Rooks county in 1930. The Central Commercial Oil Company Baxa No. 1, in the NE¼ SW¼ SE¼ sec. 22, T. 9 S., R. 17 W., found a hole full of water from 3,686 to 3,689 feet in Pennsylvanian basal conglomerate and was abandoned at a total depth of 3,692 feet. The Stearns-Streeter Company Conger No. 1, in the SE¼ NW¼ NE¼ sec. 16, T. 10 S., R. 16 W., found water in the "Siliceous lime" from 3,470 to 3,475 feet. Total depth was 3,485 feet.

Rush County.

Two gas fields have been partially developed in Rush county; one in sec. 27, T. 17 S., R. 17 W., discovered in November, 1928, and the other consisting of one gas well in sec. 11, T. 18 S., R. 16 W., dis-

covered in March, 1930. Both wells produce gas from the Pennsylvanian basal conglomerate. It is doubtful if additional gas will be developed around the producer in sec. 27, T. 17 S., R. 17 W., as it has been almost surrounded by dry holes. The field in sec. 11, T. 18 S., R. 16 W., has been limited to the north only. Rush county produced 1,017,219,000 cubic feet of gas from two wells in 1930.

Five dry holes and one gas well were completed in 1930. Another gas well was completed early in January, 1931. The Milmack Oil Company Mohr No. 1, in the center NW¼ sec. 11, T. 18 S., R. 16 W., was completed in March, 1930. Initial production was gauged at 26 million cubic feet of gas from a depth of 3,507 to 3,509 feet. Shut in pressure was rated at 1,180 pounds per square inch. The Western Gas Company takes the gas from this well. On January 5, 1931, the Flynn, Morgan *et al.*, Rammen No. 1, in the center SW¼ sec. 11, T. 18 S., R. 16 W., was brought in with an initial production of 32 million cubic feet of gas from a depth of 3,499 to 3,510 feet.

Prairie Oil and Gas Company Leiker No. 1, in the NW¼ SW¼ SW¼ sec. 5, T. 16 S., R. 18 W., was completed in November, 1930, at a total depth of 3,759 feet as a dry hole. A showing of oil, estimated at about 30 barrels per day, was found in the "Oswald series" at 3,333 to 3,339 feet. This showing was tested and 42 barrels of oil were swabbed in 3½ hours, but the rate of fill up was not great enough to make a commercial producer. The well was deepened to 3,759 feet to pre-Cambrian granite. Water was found in Pennsylvanian basal conglomerate at 3,605 feet, which increased to a hole full at 3,657 feet.

Four other dry holes were drilled in Rush county in 1930, located as follows:

McPherson Oil & Gas Company, Brock No. 1:
C NW¼ sec. 24, T. 17 S., R. 16 W., total depth..... 3,980 feet
Danciger *et al.*, Neve No. 1:
NE cor. sec. 26, T. 17 S., R. 17 W., total depth..... 3,606 feet
Syndicate Oil Company, Mohr No. 1:
C SW¼ sec. 2, T. 18 S., R. 16 W., total depth..... 3,763 feet
Wentz and Independent, Kershner No. 1:
C SE NE sec. 23, T. 18 S., R. 19 W., total depth..... 3,885 feet.

Three of the above wells were drilled into pre-Cambrian rocks, the fourth stopped in Ordovician rocks.

Russell County.

Twenty-two wells were completed in Russell county in 1930, nine of which were dry holes, and thirteen were oil wells. Four new pro-

ducing areas or extensions of old areas were opened by the Empire Oil and Gas Company Dillner No. 1 (Balta), in the NW cor. sec. 36, T. 13 S., R. 15 W.; Prairie Oil and Gas Company Berrick No. 1, in the SW¼ SW¼ sec. 23, T. 15 S., R. 13 W.; E. W. Marland, Inc., Gideon No. 1, in the NW¼ NE¼ sec. 8, T. 15 S., R. 14 W.; and Signal Oil Company Rude No. 1, in the NE¼ SE¼ SE¼ sec. 28, T. 15 S., R. 13 W. In addition, the Signal Oil Company completed a well in the SE¼ NW¼ sec. 26, T. 15 S., R. 13 W., between the old production in section 36 and Prairie's discovery in section 23 of the same township, which may be regarded as an extension of the Susank (Sellens) pool.

The older pools of Russell county were comparatively quiet. No completions were recorded from the North Fairport and Fairport pools in 1930. An old producer in the South Fairport pool, the Texas Company Leonard No. 2 in the SW¼ NW¼ NW¼ sec. 6, T. 13 S., R. 15 W., was deepened from 3,148 to 3,440 feet. Water was found at 3,275 feet and the well abandoned.

Gorham Pool. Eight wells were completed in the Gorham pool in 1930. Five of these were oil wells and three were dry holes.

The Midwest Exploration Company Speer No. 33, in the SE¼ SW¼ NW¼ sec. 32, T. 13 S., R. 15 W., extended the Gorham sand producing area one location north. Sand was found from 3,316 to 3,317 feet which had an initial production of 100 barrels of 32.9° Bé. oil and 50 barrels of water the first 24 hours on the pump. The east offset to this well, the Midwest Exploration Company J. Mermis No. 34, was dry in the Gorham sand. Granite was found at 3,356 feet. It was completed in the 30-foot pay of the "Oswald lime" at a depth of 3,096 feet to 3,102 feet for an initial production of 30 barrels.

The Keys Petroleum Company A. Mermis No. 11, in the NE¼ SW¼ SW¼ sec. 33, T. 13 S., R. 15 W., extended the "Oswald-lime" producing area one location east with a 130-barrel well from pay from 3,072 to 3,080 feet. Top of the "Oswald lime" was 3,044 feet. Two other completions of 40 barrels each were drilled in secs. 5 and 9, T. 14 S., R. 15 W. They are relatively unimportant.

Two dry holes drilled in secs. 4 and 8, T. 14 S., R. 15 W., reached pre-Cambrian rocks at 3,265 and 3,251 feet respectively. A third dry hole was drilled on the southwest flank of the pool in the NE cor. sec. 18, T. 14 S., R. 15 W. Water was found in conglomerate at the base of the Pennsylvanian from 3,435 to 3,440 feet, the total depth.

Production for 1930 was 370,928 barrels of oil, of which 196,548 barrels was from Gorham sand and 174,380 barrels from "Oswald lime."

Balta (Dillner) Pool. A new productive area was opened May 11, 1930, three miles east and about one-half mile north of the Gorham pool after core drill operations by the Empire Oil and Gas Company. The discovery well, the Dillner No. 1, in the NW cor. sec. 36, T. 13 S., R. 15 W., found the top of the Ordovician "Siliceous lime" at 3,300 feet, and was drilled to 3,309 feet. Some water was found from 3,308 to 3,309 feet and the well was plugged back to 3,308 feet, where it pumped 190 barrels of 30° Bé. oil and 10 barrels of water the first 24 hours. Only one other well has been completed in this pool. The Empire Company B. Dillner No. 1, in the NE cor. sec. 35, T. 13 S., R. 15 W., was completed November 18, 1930, in "Siliceous lime" from 3,304 to 3,313 feet, where it produced 175 barrels of oil and 30 barrels of water on the pump. The Balta pool produced 17,701 barrels of oil to December 31, 1930.

Susank (Sellens) Pool. The Prairie Oil and Gas Company Berrick No. 1, in the SE¼ SW¼ sec. 23, T. 15 S., R. 13 W., was first completed July 21, 1930. A hole full of water was found in the "Siliceous lime" from 3,316 to 3,322 feet. It was plugged back to a showing in the top of the "Siliceous lime" found from 3,291 to 3,307 feet, and completed as a 9-barrel well on the pump. It was subsequently shut in for lack of pipe-line connection. Evidently this well is near the north limit of the Susank pool. In November the Signal Oil Company drilled Sellens No. 1, in the SE cor. NW¼ sec. 26, T. 15 S., R. 13 W., into the "Siliceous lime" found from 3,231 to 3,249 feet. The well swabbed 425 barrels of oil in the first 12-hour test and was generally rated as a 600-barrel well. It subsequently made about 350 barrels per day on the pump. It was produced part of the time during the last two months of the year. This completion put new life into this area and several new tests were started, but not completed, in 1930.

The Signal Oil Company Rude No. 1, in the NE¼ SE¼ SE¼ sec. 28, T. 15 S., R. 13 W., may have extended the Susank (Sellens) pool northwest, or opened an entirely new area. The above well was completed December 28, 1930, in the "Siliceous lime," found from 3,347 to 3,352 feet, for an initial production of 400 barrels. It was shut in for lack of pipe-line connection. This completion added to the interest in the Susank (Sellens) district.

The Susank (Sellens) pool produced 106,700 barrels of oil in 1930.

Susank (Ochs) Pool. This pool was extended one location east by Empire-Prairie Companies' Krug No. 1, in the SW¼ NW¼ NW¼ sec. 24, T. 15 S., R. 14 W., which found pay from 3,363 to 3,375 feet. It pumped 327 barrels the first 24 hours. The Empire Oil and Gas Company extended the pool two locations south with Ochs No. 2, in the SE¼ NE¼ sec. 23, T. 15 S., R. 14 W. Pay was found from 3,361 to 3,371 feet, and the first 24-hour pumping test grossed 230 barrels of oil. These two tests have been carried in Table 12 as producing from the "Siliceous lime." As there is some question as to the producing horizon, the pool is shown in the general western Kansas table (No. 10) as producing from both the "Siliceous lime" and the Pennsylvanian basal conglomerate. The Susank (Ochs) pool produced 65,864 barrels of oil during 1930.

Gideon Pool. E. W. Marland, Inc., Gideon (Maier) No. 1, in the NE¼ NW¼ sec. 8, T. 15 S., R. 14 W., may have opened a new oil pool northwest of the Susank (Ochs) area. The well was first drilled to a total depth of 3,325 feet where a hole full of water was found in the "Siliceous lime" at 3,317 feet. It was plugged back to 3,294 feet where it produced 60 barrels the first 24 hours from conglomerate pay found from 3,266 to 3,272 feet. It was completed June 8, 1930, and shut in after producing 1,150 barrels of 38° Bé. oil, which is stored on the lease.

An attempt to extend the Gideon pool one-half mile west resulted in failure. The Stearns-Streeter Company Mitchell No. 1, in the SE cor. sec. 6, T. 15 S., R. 14 W., had a small showing of oil in "Oswald lime" from 3,328 to 3,332 feet. It was drilled to 3,390 feet and abandoned.

Three interesting dry holes were drilled in Russell county in 1930. The Empire Oil and Gas Company Sherwood No. 1, in the SE¼ NW¼ NW¼ sec. 21, T. 14 S., R. 13 W., was drilled to a total depth of 3,333 feet, stopping in Cambrian sand. The base of the Pennsylvanian was reached at 3,248 feet, where a hole full of water was encountered. Top of the Cambrian sand was found at 3,285 feet. The dolomite intervening between the base of the Pennsylvanian and top of the Cambrian was found to be only 37 feet thick.

Imo Oil Company Brown No. 1, in the SE¼ NW¼ NE¼ sec. 7, T. 14 S., R. 14 W., had several showings of oil in the "Oswald series" at 3,092, 3,125, and 3,165 feet. A fourth showing of oil from 3,325 to 3,328 feet in the Pennsylvanian basal conglomerate was followed by a hole full of sulphur water in the "Siliceous lime" at 3,330 feet

The Empire Oil and Gas Company Herble No. 1, in the NW¼ NE¼ SW¼ sec. 26, T. 14 S., R. 14 W., found Pennsylvanian limestones resting on pre-Cambrian arkoses and granite at a depth of 3,209 feet. The well was drilled in granite to a total depth of 3,323 feet.

Russell county produced 1,340,006 barrels of oil in 1930, 1,150 barrels of which was stored on the Gideon lease in sec. 8, T. 15 S., R. 14 W., and does not appear in Table 10.

Saline County.

Four wells were completed in Saline county in 1930. Three were dry holes. The fourth well was completed December 8, 1929, and temporarily abandoned. Early in 1930 it was decided to test the oil showing and the well was tubed and completed as a producer after considerable difficulty, only to be abandoned December 18, 1930. Thus, Saline county was in the producing column only a short period of time.

Olsson Pool. The Dixie (Stanolind) Oil Company Olsson No. 1, in the NW¼ NE¼ sec. 10, T. 16 S., R. 3 W., found the top of the Galena cherty dolomite (Bromide? or Viola?) at 3,302 feet, with a good showing of oil. Drilling was continued to 3,603 feet where a hole full of water was found in the "Siliceous lime." The well was then plugged back to 3,323 feet and shot with 20 quarts of nitroglycerine from 3,304 to 3,315 feet. It was tubed and pumped about 5 barrels of oil and 1 barrel of water, making a total of 1,405 barrels of oil before being abandoned December 18, 1930.

The "Mississippi lime" was found in this test from 2,813 to 3,058 feet and Ordovician dolomites and limestones from 3,302 to 3,440 feet. The Simpson formation occurred between 3,340 and 3,532 feet, and the Arbuckle or "Siliceous lime" from 3,532 to 3,603 feet.

The production from this well has been carried as from the Bromide formation, but this conclusion may well be questioned.

The Dixie Oil Company Miller No. 1, in the SE¼ SE¼ NE¼ SE¼ sec. 9, T. 16 S., R. 3 W., was an attempt to find production or extend the Olsson producing area. It ended in failure when water was found in the "Siliceous lime" from 3,555 to 3,556 feet, the total depth.

The Ira Keith *et al.*, Holmquist No. 1, in the SW¼ SE¼ SW¼ SE¼ sec. 10, T. 15 S., R. 4 W., was abandoned with a hole full of water in the Ordovician (?) at a total depth of 3,672 feet.

Templeman *et al.*, Laubengayer No. 1, in the center SW¼ sec. 20, T. 15 S., R. 5 W., was also a dry hole and was abandoned in the Ordovician at a total depth of 3,825 feet.

Sedgwick County.

Sedgwick county had a very active year, due to extensions and developments in the Eastborough pool. The county produced 7,656,070 barrels of oil in 1930 from 195 wells, producing as of December 31. This is 1,154,977 barrels less than was produced in 1929. Proration was effective in the Valley Center pool during the early part of the year. Total cumulative production to December 31, 1930, reached a grand total of 16,795,498 barrels. The main producing formations include Ordovician dolomite of Black River-Trenton (Bromide) age, "Mississippi lime," Misener sand and the Kansas City group.

Valley Center Pool. This field was discovered August 21, 1928, by Bu-Vi-Bar, Continental and Gypsy Oil Companies' Wright No. 1, in the SE¼ NE¼ SE¼ sec. 12, T. 26 S., R. 1 W., with an initial production of 1,700 barrels from 3,367 feet. Most of the active development of the field took place in the year 1929. Only 8 new oil wells were added to the producing column during 1930. Seven dry holes were drilled which, with others outline the productive area, were in every direction except due west. Five producing wells were abandoned, due to water encroachment. One producing well was deepened to the "Siliceous lime" before it was abandoned.

Summary of total completions.

Total number oil wells completed to Dec. 31, 1930	127
Total number of dry holes completed to Dec. 31, 1930	21
Total completions to Dec. 31, 1930	148

One hundred and thirteen wells were producing in December, 1930, the field averaging 8,428 barrels of oil and about 22,000 barrels of water daily. Total production for the year was 5,179,487 barrels, which was 1,925,623 barrels less than was produced in 1929.

The J. S. Cosden Company completed Devesse No. 1, located in the NE¼ NW¼ SW¼ sec. 1, T. 26 S., R. 1 W., at a total depth of 4,015 feet. Only a small show of oil was found in the regular producing dolomite of the field found from 3,369 to 3,387 feet. Another show of oil was found in sand from 3,387 to 3,396 feet, and 2,000 feet of oil with some water rose in the hole. The well was deepened and top of the "Siliceous lime" (Ordovician) was found at 3,476 feet,

with a hole full of water at 3,482 feet. Drilling was continued 539 feet in the "Siliceous lime" to a total depth of 4,015 feet and abandoned. This test was an attempt to extend the producing area to the west. Attempts to extend the producing area to the north also ended in failure when Prairie Oil and Gas Company completed 4 dry holes along the south line of sec. 36, T. 25 S., R. 1 W., on the Smyser land. Only one well, Smyser No. 3 in the SE¼ SW¼ sec. 36, made any oil. This well was tested for a short period of time, making 25 barrels of oil and 75 barrels of water per day during the test. Magnolia and Tidal also failed to extend the producing area, finding a hole full of water in the producing dolomite in Anderson No. 1, in the NE¼ NW¼ SW¼ sec. 18, T. 26 S., R. 1 E. It was abandoned at a total depth of 3,522 feet in the Simpson formation.

Derby Oil Company completed Gorman No. 3, in the NW¼ SW¼ sec. 6, T. 26 S., R. 1 E., in August, 1930. This old producer was drilled from a total depth of 3,364½ to 3,607 feet, stopping in the "Siliceous lime." A small amount of oil was found in the Simpson formation at 3,389 feet. The showing of oil was in sand below the regular dolomite pay of the field. Two wells, Wentz Oil Company Bright No. 1A, in the SW¼ SE¼ NW¼ sec. 1, T. 26 S., R. 1 W., and Aladdin Petroleum Company Benningfield No. 3, in the SW¼ NW¼ SW¼ sec. 6, T. 26 S., R. 1 E., were completed in the Kansas City group with small initial productions. These two wells are the only producers from the Kansas City group in the Valley Center pool.

Greenwich Pool. The Shell Petroleum Corporation discovered the Greenwich pool April 27, 1929, when their Lygrisse No. 1, in the SE¼ NE¼ sec. 15, T. 26 S., R. 2 E., found oil in Bromide dolomite from 3,164 to 3,170 feet, with an initial production of 2,118 barrels. The field produced a total of 1,021,302 barrels in 1930 from the "Mississippi lime," "Wilcox" sand and Bromide dolomite. This is 31,063 barrels less than was produced in 1929. Total production to December 31, 1930, was 2,067,733 barrels. Total number of wells producing December 31, 1930, was 35, compared with 38 producing December 31, 1929. In 1930 there were 8 new oil wells completed and 5 old "Mississippi lime" producers deepened to the dolomite pay in the Ordovician. Two of the old wells drilled deeper produced oil and three were dry. In addition five dry holes were completed, both within and outside of the boundary of the field. Five old wells were abandoned during the year on account of water trouble.

Probably the best completion in the Greenwich pool was the Shell Petroleum Company Fisher No. 6, in the NE¼ SE¼ SE¼ sec. 15, T. 26 S., R. 2 E., which made 698 barrels initial production from Bromide dolomite found from 3,208 to 3,209½ feet.

Dixie and Amerada drilled Foulston No. 1, in the SW¼ NW¼ sec 11, T. 26 S., R. 2 E., to the "Siliceous lime" found at 3,333 to 3,336 feet. It failed to extend the producing area, finding a hole full of water.

The Bromide dolomite referred to is believed to be the approximate equivalent of the producing dolomite in Valley Center, Voshell, Canton and Eastborough pools.

Eastborough Pool. The first well drilled in what is now the Eastborough pool was completed in September, 1916. It was drilled by the Citizens Oil and Gas Company, in the SE¼ NE¼ NW¼ sec. 31, T. 27 S., R. 2 E., to a total depth of 3,060 feet. A showing of oil was reported in sand at a depth of 2,950 feet. This sand was probably a mixture of sand, chert and red rock found in this district at the base of the Cherokee shales. Top of the Mississippian was found at 2,973 feet and drilled to 3,060 feet, where water was found and the well abandoned. No additional development took place until May, 1929, when E. W. Marland, Inc., Producers and Refiners, and Fisher and Lauck drilled Mackey No. 1, in the SE¼ NW¼ SW¼ sec. 30, T. 27 S., R. 2 E. Oil was found in the top of the "Mississippi lime" in August at a depth of 2,957 feet. Initial production was about 70 barrels of 41° Bé. oil and 41 barrels of water. This well was deepened in 1930 from the old total depth of 2,970 to 2,983 feet, without increasing the production. This well may be considered the discovery well of the Eastborough field, although the first well drilled indicated that oil might be found in the basal Pennsylvanian or in top of the Mississippian.

Developments followed very slowly, due, possibly, to the low price of oil and the disorganized condition of the industry. In October, 1929, Fisher and Lauck started their Trustee No. 1, in the NE¼ SW¼ SE¼ sec. 19, T. 27 S., R. 2 E. It was completed in December, 1929, with an initial production of 125 barrels from the top of the "Mississippi lime," found at 2,927 feet and drilled to 2,938 feet. Gravity of the oil was 44.5° Bé. Early in 1930 additional wells were started and completions continued through the remainder of the year. This pool was the most active area in Sedgwick county in 1930.

The first well to discover production below the "Mississippi lime" was Vickers and Hinkle Keys No. 1, in the NE¼ NW¼ NE¼ sec. 30, T. 27 S., R. 2 E., which found a sand below the Chattanooga shale at a depth of 3,238 feet. The discovery was made July 21, 1930. It was drilled slowly to 3,242½ feet, where it was tested and found to have an initial production of about 1,000 barrels per day. The well was prorated to 200 barrels per day. The producing horizon of the well has generally been classed as basal Mississippian or Misener sand. Two other wells offsetting found a similar sand productive, while the direct northeast offset found production in a dolomite of Ordovician age underlying the Misener sand.

Some question of the age of the Ordovician dolomite exists, but it is probably equivalent to some part of the Bromide formation (Ordovician). The discovery well in this formation was Fisher and Lauck's Trustee No. 5, which found Misener sand from 3,236 to 3,250 feet, with a showing of oil, and the Bromide dolomite from 3,250 to 3,251½ feet. This well had an initial production of 1,500 barrels. It was also capable of producing about 300 barrels from the "Mississippi lime" found from 2,935 to 2,939 feet.

A total of 42 wells were completed in the Eastborough pool in 1930. Nineteen wells have been drilled into the Ordovician, five of which reached the "Siliceous lime."

Total completions 1930	42
Total dry holes	9
Total oil wells producing from "Mississippi lime"	24
Total oil wells producing from Misener sand	3
Total oil wells producing from Bromide and Misener sand (?),	5
Total oil wells producing end of 1930	31
Total oil wells shut down without connections, Dec., 1930	2

The production in the Misener sand and Bromide dolomite is confined to the S½ sec. 19, and N½ sec. 30, T. 29 S., R. 2 E., to date. However, the producing limits of the deeper horizons is only definitely limited along the east side of the field by seven dry holes in sections 17, 20, 29, 30 and 31, by one dry hole in sec. 25, T. 27 S., R. 1 E. on the west side of the pool, and to the north by a dry hole in the SW¼ SE¼ sec. 7, T. 27 S., R. 2 E. The "Mississippi lime" production has and probably will remain beyond the limits of the Misener sand and Bromide dolomite production. It produces in secs. 17, 18, 19, 29, 30 and 31, T. 27 S., R. 2 E., and sec. 24, T. 27 S., R. 1 E. Although this horizon is now making a large amount of water with the oil produced, the area covered and the initial yields have been surprising. One lease has yielded over 3,500 barrels per

acre in less than one year from the "Mississippi lime." The Bromide dolomite and Misener sand wells have produced about 3,800 barrels per acre to December 31, 1930.

The total production of the Eastborough pool for 1930 was 1,161,526 barrels. The total yield to December 31, 1930, is 1,173,636 barrels.

Goodrich Pool. The Goodrich pool is located in sec. 16, T. 25 S., R. 1 E., Sedgwick county. There were no new developments in this pool during 1930, the same four wells producing at the end of 1929 were pumping at the end of the year 1930. Total production for the year was 147,218 barrels of oil. Total cumulative production to December 31, 1930, was 587,608 barrels.

Robbins Pool. This pool is located in secs. 20 and 21, T. 28 S., R. 1 E. At the end of 1930 there were eight wells producing from the top of the "Mississippi lime." Three dry holes have been drilled in secs. 20 and 21, and four others in secs. 28 and 29, T. 28 S., R. 1 E., adjoining the producing area on the south. The field was discovered by Shell Petroleum Robbins No. 1, in the NW¼ SW¼ sec. 21, T. 28 S., R. 1 E., which was completed for an initial production of 218 barrels of 41° Bé. oil in the "Mississippi lime," at a depth of 3,092 to 3,102 feet. The only late completion in this pool had not been entirely drilled in by the last of 1930. It is Robbins No. 2, drilled by E. B. Shawver, in the SE¼ NW¼ SW¼ sec. 21, T. 28 S., R. 1 E., in the "Mississippi lime" at a depth of 3,080 to 3,114 feet. Initial production was 150 barrels of 39° Bé. oil. The final completion was in January, 1931. The field is practically limited to the west and south and will probably never extend beyond the limits of secs. 20 and 21, T. 28 S., R. 1 E. Two wells have been deepened to the Ordovician in section 21. One of these was abandoned in the Simpson formation at 3,542 feet, and the other at 3,540 feet. Several other tests have found water in Ordovician formations in T. 28 S., R. 1 E.

Total production of the Robbins pool for 1930 was 128,760 barrels. Total cumulative production was 286,981 barrels as of December 31, 1930.

Miscellaneous. There were no new pools discovered in Sedgwick county in 1930, and very few interesting wildcats were drilled. The Continental Oil Company Semsworth No. 1, in the NW cor. sec. 25, T. 28 S., R. 4 W., was probably the only one of interest. It was drilled on a core-drilled structure, but failed to find oil in any formation. It was drilled into the "Siliceous lime" at 4,292 feet and abandoned at 4,309 feet in February, 1930.

The drilling around Curry No. 1, in sec. 2, T. 27 S., R. 1 W., during 1930 was unsuccessful. After two attempts the Shell Petroleum Corporation failed to extend the producing area. The production of Curry No. 1 declined steadily in 1930. Only 13,601 barrels of oil were produced the past year, whereas 11,031 were produced in the first three months of its history in 1929. This well was finally abandoned February 1, 1931, after producing a total of 25,151 barrels of oil.

Seward County.

Gas was discovered in Seward county in December, 1922. This completion, the Defenders and Traders Oil Company Boles No. 1, in the NE cor. NW¼ sec. 3, T. 35 S., R. 34 W., had an initial production of 5 million cubic feet of gas from 2,718 to 2,755 feet. It was the first well to produce either oil or gas in commercial quantities in western Kansas.

Only one well was completed in Seward county in 1930. The Liberal Oil and Gas Company Boles No. 4, in the center N½ NE¼ sec. 4, T. 35 S., R. 34 W., was completed at a total depth of 2,755 feet. Gas was found from 2,640 to 2,730 feet. It was shot with 30 quarts of nitroglycerine at a depth of 2,715 to 2,730 feet, and made about 1½ million cubic feet of gas the first 24 hours. The producing horizon has been correlated with the Big Blue group of the Permian.

Four producing gas wells have been completed in the Liberal gas field. The discovery well was abandoned after water shut off the gas flow, and only three wells were producing December 31, 1930. The largest initial production has been 5 million cubic feet of gas. Rock pressure averages about 440 pounds per square inch. No data are available on the amount of gas produced in 1930. The total production since discovery is estimated at 400,000,000 cubic feet.

Stevens, Morton and Grant Counties.

The Hugoton gas field, located in Stevens, Morton and Grant counties, was the scene of extensive developments for gas in 1930. Gas was first discovered in Stevens county in May, 1927, by the Independent Oil and Gas Company Crawford No. 1, in the center SW¼ sec. 31, T. 33 S., R. 39 W. Subsequent to this completion three additional gas wells were completed to the end of 1929. In 1930, 77 wells were completed in Stevens county, 27 in Morton county, and one in Grant county. The wells completed and pro-

ducing in this vast gas area on December 31, 1930, including Seward county, are shown in the following table:

TABLE 17.—*Total initial gas production of southwestern Kansas.*

LOCATION.	County.	Date of discovery.	Initial open flow gauge.	No. wells, Dec., 1930.	Average depth range, feet.
Sec. 12, T. 29 S., R. 38 W.....	Grant.....	12- 3-30	6,100,000	1	2,455 to 2,715
Ts. 33 to 35 S., Rs. 39 to 40 W.....	Morton....	4-24-30	78,000,000	27	2,450 to 2,800
Ts. 31 to 35 S., Rs. 36 to 39 W.....	Stevens....	8-30-27	591,652,483	81	2,450 to 2,650
Secs. 2, 3 and 4, T. 35 S., R. 34 W..	Seward.....	12- 5-22	6,030,000	3	2,600 to 2,750
Total.....	4	.....	684,782,483	112	.....

The discovery of gas in Morton county was by the Argus Gas Company Armstrong No. 1, in the center NW¼ sec. 16, T. 34 S., R. 39 W., which was completed April 24, 1930. It had an initial production of 14,133,280 cubic feet of gas from 2,652 to 2,933 feet. Most of this gas was found from 2,652 to 2,800 feet. This discovery was followed by additional development in Morton county, and the gas producing area was extended into Range 40 W.

The Grant county discovery well was drilled by A. J. Hardendorf *et al.*, at Sullivan No. 1, in the NE cor. sec. 12, T. 29 S., R. 38 W. A showing of gas was encountered at 2,455 feet and increased to 1½ million cubic feet at 2,545 feet. The production was increased to 3½ million cubic feet from 2,690 to 2,695 feet, and the well completed at a total depth of 2,710 feet. The producing horizon is the Big Blue group of the Permian, the same horizon as that producing in Seward, Stevens and Morton counties.

A deep test was started by the Argus Production Company in the western part of Stevens county in the center NE¼ sec. 10, T. 33 S., R. 39 W. It was drilled to a total depth of 5,521 feet and abandoned July 8, 1931. Two other tests started in 1930, but not completed until 1931, drilled through the gas zone. One of these was the Argus Production Company Plummer No. 1, in the center NE¼ sec. 11, T. 29 S., R. 41 W., Stanton county, completed at a total depth of 3,005 feet, and the other the Hydraulic Oil Company Butts No. 1, in the NW¼ SE¼ sec. 22, T. 34 S., R. 43 W., Morton county, which stopped at 3,465 feet. None of these three tests reached the Mississippian limestone, according to available information.

One rather interesting fact in connection with the gas area of

southwestern Kansas is the remarkable uniformity of pressure over the entire district. Tests have shown that the rock pressure of individual wells is almost the same, ranging between 420 and 440 pounds per square inch. The natural supposition is that the gas area is a connected reservoir with uniform pressure over the entire area. It is estimated that there are over 500,000 acres that will produce gas in Stevens, Morton and Grant counties.

The gas is found in a series of porous dolomites in the Big Blue group of the Permian, ranging from 150 to 250 feet thick. A number of wells produce from three zones in this series. The depth is remarkably uniform over a wide area in western Stevens and eastern Morton counties, the gas horizon being generally found between 2,600 and 2,800 feet below the surface. The initial open flow gauge averages about 6¼ million cubic feet, and the average rock pressure is 440 pounds per square inch.

Late in 1929 and early in 1930 the Argus Pipe Line Company completed an 8-inch gas line from Dodge City and Garden City into the Hugoton area. A. J. Hardendorf completed a 6-inch gas line into Grant and Stevens counties in November, 1930, which serves several southwestern Kansas and southeastern Colorado cities. These two lines and the Liberal Gas Company line in Seward county were the only ones in actual operation in December, 1930. Two large trunk lines were being constructed into the area in 1930. It was expected these lines would be taking gas from the district late in 1931.

The total gas produced in Stevens and Grant counties in 1930 amounted to 740,994,000 cubic feet. No gas was produced in Morton county during the year. A large part of the gas produced in Stevens county was supplied to drilling wells.

Sumner County.

The discovery of gas in Sumner county dates back to June 1, 1915. The discovery well, Empire Gas and Fuel Company Horton No. 1, in the center NE¼ NW¼ sec. 15, T. 35 S., R. 2 E., found 5 million cubic feet of gas in a sand in the Severy shale (Pennsylvanian) at a depth of 1,490 to 1,508 feet. Initial rock pressure was 500 pounds per square inch.

The first oil discovery was made April 19, 1925, almost ten years after the discovery of gas. The discovery well was the Continental Oil Company E. A. Heskett No. 1, in the SE cor. NW¼ sec. 19, T.

33 S., R. 3 E. Oil was found in the Burbank sand (Pennsylvanian) at a depth of 3,185 to 3,207 feet. Initial production was 75 barrels of 38° Bé. oil. The fields are discussed in the order of their discovery.

North Vernon Oil and Gas Field. The first discovery of either oil or gas in Sumner county was made in the North Vernon field by the Empire Gas and Fuel Company Horton No. 1, in the center NE¼ NW¼ sec. 15, T. 35 S., R. 2 E., on June 1, 1915. A total of ten wells were subsequently drilled in sections 15, 16 and 17, only six of which produced gas. The last gas production was October 15, 1929. Gas production was from sand in the Severy shale (Pennsylvanian), found from 1,490 to 1,508 feet in the discovery well. No oil was produced from the pool until August 13, 1930. The Prairie Oil and Gas Company Herrick No. 1, in the NE cor. SW¼ NE¼ sec. 15, T. 35 S., R. 2 E., found oil in the "Mississippi lime" from 3,443 to 3,465 feet, with an initial production of 395 barrels of oil.

Gas was discovered in the "Mississippi lime" by Morgan *et al.*, Meyers No. 1, in the SW cor. sec. 16, T. 35 S., R. 2 E., in September 5, 1928, at a depth of 3,302 to 3,358 feet. Initial production was 7½ million cubic feet. In November, 1930, this well was deepened from 3,358 to 3,382 feet, and started producing oil at the rate of about 5 barrels per hour. It was shut in for lack of a market. No oil was produced from this well in 1930, according to available data.

The estimated oil production from the North Vernon area for 1930 is 13,031 barrels produced as follows:

	Barrels.	Wells.
August	3,138	1
September	2,511	1
October	2,630	1
November	2,559	1
December	2,193	1
Total	13,031	1

The total estimated gas production from the "Mississippi lime" from three wells for 1930 was 165,449,000 cubic feet. The exact data from two of the three wells were not available and have been estimated to be 120,000,000 cubic feet of the above total.

Padgett Oil and Gas Field. The Padgett oil and gas area is located in secs. 14, 22, 23, 26, 27, 34 and 35, T. 34 S., R. 2 E., and sec. 3, T. 35 S., R. 2 E. The initial gas discovery was made October 6, 1924, by the Continental Oil Company Padgett No. 1, in the NW

cor. SW¼ sec. 23, T. 34 S., R. 2 E., which produced 40 million cubic feet of gas from the "Mississippi lime" found at 3,455 feet. The discovery of oil was also made by the Continental Oil Company at their Thiessen No. 1, in the SW cor. SE¼ SE¼ sec. 22, T. 34 S., R. 2 E., on May 23, 1925. Oil was found in the "Mississippi lime" from 3,468 to 3,497 feet, with an initial production of 315 barrels on the swab. The gravity of the oil was reported as 39.8° Bé. Later this well was deepened to the "Siliceous lime" found from 3,807 to 3,920 feet, but failed to find either oil or gas. It was plugged back to 3,506 feet and produced both oil and water from this depth in the "Mississippi lime."

The discovery and only producing well in the "Wilcox" sand is the Harris and Haun Hendrix No. 1, in the center SW¼ SE¼ sec. 14, T. 34 S., R. 2 E. It was completed in July, 1927, at a depth of 3,772 to 3,778 feet, for an initial production of 230 barrels of 41° Bé. oil.

The 1930 oil completions were three in number. They are listed in the following table:

TABLE 18.—*Completed oil wells in the Padgett pool, 1930.*

COMPANY AND LOCATION.	Date completed.	Initial production, bbls.	Depth.	Producing formation.
Davis & Harold Petroleum Co., Schwartz No. 2, NE cor. 27-34S-2E	1-15-30	15	3,510-48	"Miss. lime."
Prairie Oil & Gas Co. McIrvin No. 2, NE¼ SE¼ NW¼ 3-35S-2E	8- 6-30	60	3,412-60	"Miss. lime."
Prairie Oil & Gas Co. Olson No. 5, SE¼ NE¼ NW¼ 3-35S-2E	8- 6-30	20	3,417-66	"Miss. lime."

One oil well was drilled to the "Wilcox" sand and "Siliceous lime," where water was found. It was plugged back and made a small producer in the "Mississippi lime." Another well found water in the "Mississippi lime," and two found water in the Severy shale gas sand and were abandoned during the year.

The 1930 gas completions in the Padgett area were four in number. Three of them produced from the Severy shale and one from the Kansas City "lime." These completions are listed as follows:

TABLE 19.—*Completed gas wells in the Padgett pool, 1930.*

COMPANY AND LOCATION.	Date completed.	Initial production, cu. ft.	Depth, feet.	Producing formation.
Shawver *et al.*, Curry No. 2, C NW¼ SE¼ 26-34S-2E,	5- 8-30	2,250,000	1,555	Severy shale.
Shawver *et al.*, Kratz No. 3, SW cor. NW¼ 26-34S-2E,	2-13-30	5,700,000	1,570	Severy shale.
Continental Oil Co. Spence No. 1, C SE¼ NE¼ 27-34S-2E	3-30-30	6,500,000	1,556	Severy shale.
Shawver *et al.*, Norrish No. 1, NW cor. 35-34S-2E*	2-30-30 P B 3-30-30	8,250,000	2,770	Kansas City.

* Drilled to 3,547 feet in "Mississippi lime" and plugged back to 2,770 feet.

The Padgett pool produced 236,032 barrels of oil in 1930. All of this oil, except 9,372 barrels, was produced from the "Mississippi lime." One "Wilcox" sand well made the excepted amount of oil.

The gas production of the Padgett field in 1930 amounted to 364,079,000 cubic feet from 8 wells. It was divided as shown in the following table:

TABLE 20.—*Gas production by horizon in the Padgett field, 1930.*

	Horizon	Volume, M. cu. ft.	Number wells.
1930 gas production from	"Mississippi lime"	257,358	3
1930 gas production from	Severy shale	91,065	3
1930 gas production from	Kansas City	15,656	1
Totals		364,079	7

WEST EXTENSION RAINBOW BEND POOL. This pool, located in sec. 19, T. 33 S., R. 3 E., and sec. 24, T. 33 S., R. 2 E., formerly produced a small amount of oil from the "Siliceous lime." The last "Siliceous lime" production was in January, 1929. The discovery well of the pool was the Continental Oil Company E. A. Heskett No. 1, in the SE cor. NW¼ sec. 19, T. 33 S., R. 3 E., completed in April, 1925. This well is in Cowley county. It found oil in the Burbank sand (Pennsylvanian) at 3,207 feet, with an initial production of 75 barrels of 38° Bé. oil. Present production is from 8 wells producing from the Burbank sand.

The 1930 production of the west extension of the Rainbow Bend pool was 22,472 barrels. The total recovery per acre from both the

Burbank sand and the "Siliceous lime" has been 2,780 barrels to December 31, 1930. No new wells were completed in this pool in 1930.

MILLER POOL. The Miller pool was developed as the result of core-drill operations by the Shell Petroleum Corporation. It is located in sec. 17, T. 32 S., R. 2 E. The discovery well, Shell Petroleum Corporation Miller No. 1, in the NE cor. SW¼ sec. 17, T. 32 S., R. 2 E., was completed June 10, 1926. It had a show of oil in the "Mississippi lime" at 3,355 feet. Oil was found in the "Wilcox" sand from 3,615 to 3,662 feet, and was estimated at 200 barrels per day. Drilling was continued into the "Siliceous lime," found from 3,662 to 3,671 feet, and the production increased to 800 barrels per day. There were no new developments in this pool in 1930.

At the present time 5 wells are producing in the Miller pool. Two of these are producing from the "Siliceous lime," 2 from the Kansas City "lime," and 1 from the "Mississippi lime." The production for 1930 was 34,145 barrels. The total recovery per acre has been 6,223 barrels.

RUTTER POOL. The Rutter pool, located in sec. 21, T. 33 S., R. 2 E., was discovered by the Shell Petroleum Corporation Rutter No. 1, in the SW cor. SE¼ NW¼ sec. 21, T. 33 S., R. 2 E., on June 19, 1926. The discovery well was the only well to produce in the pool. It was drilled to 3,621 feet in the "Siliceous lime," where water was found. Later it was plugged back to the "Mississippi lime" at 3,323 feet and shot. Initial production was only 18 barrels per day. Several wells were drilled previous to 1930 near this test, but all were failures.

The production of the Rutter No. 1 for the year 1930 is shown in the following table. The well ceased to produce June 22, 1930, and was abandoned July 13, 1930.

Month.	Production, barrels.	Month.	Production, barrels.
January	161	May	195
February	127	June	117
March	169		
April	152	Total	921

The total production of this well amounted to 15,696 barrels of oil.

CHURCHILL POOL. Oil was discovered in the Churchill pool by the Shell Petroleum Corporation Churchill No. 1, in the NE cor. SW¼ sec. 25, T. 31 S., R. 2 E., June 23, 1926. Production was secured from the Stalnaker sand at a total depth of 1,822 feet for an initial production of 200 barrels. The pool spread out in a north-south di-

rection from the discovery well into secs. 24, 26 and 36, T. 31 S., R. 2 E., and into sec. 19, T. 31 S., R. 3 E.

In 1930 five dry holes and two oil wells were completed in the Churchill pool. Two of the dry holes were drilled for the purpose of repressuring the sand. This practice has met with considerable success in this field.

The peak of production in the Churchill pool was reached in 1927. In 1930 the production from the field totaled 1,382,869 barrels, with 81 wells producing in December. The yield per acre from the Stalnaker sand, which is the only producing horizon, has been exceptionally good. On December 31, 1930, the recovery had reached a total of 17,415 barrels per acre. This recovery ranks near the top for average recoveries from various horizons which are producing or have produced oil in Kansas.

Oxford Pool. The Oxford pool is located in secs. 11, 12, 13, 14, 22 and 23, T. 32 S., R. 2 E. It was discovered May 10, 1927, by the Shell Petroleum Corporation Emrick No. 1, in the NE cor. NW¼ SW¼ NE¼ sec. 14, T. 32 S., R. 2 E., which found oil in the Stalnaker sand from 2,012 to 2,060 feet, with an initial production of 200 barrels per day. Later several wells were drilled in the townsite of Oxford, but most of them were unsuccessful or small wells. The number of producing wells which have been drilled in the pool reached a total of 105, of which 97 were producing December 31, 1930. Two oil wells and one dry hole were completed during 1930.

The producing horizons of the Oxford pool, listed in their order of importance, are the Stalnaker sand, found at an average depth of 2,275 feet; Howard limestone at 1,250 feet; Hoover sand at 1,600 feet; Severy shale at 1,345 feet; and the Emporia limestone at 1,050 feet. The average yield per acre from all horizons to December 31, 1930, has amounted to 15,910 barrels. The total production for 1930 was 974,370 barrels from 97 wells producing in December. Of the 97 producing wells, 6 were producing from Howard limestone, 1 from the Severy shale, 6 from the Hoover sand, and 83 were producing from the Stalnaker sand.

Love and Latta Oil and Gas Field. This oil and gas field is located in sec. 9, T. 30 S., R. 2 W. The discovery well, the Latta No. 1, in the SW¼ SE¼ NW¼ sec. 9, T. 30 S., R. 2 W., was drilled by the Champlin Refining Company and was completed June 6, 1927. Oil was found in the Kansas City group at a depth of 3,042 to 3,056 feet. Initial production was reported as 100 barrels of 39.6°

Bé. oil. The discovery of gas from the Topeka "lime" was made by the same well. Gas was found from 2,020 to 2,023 feet, with an initial production of 15 million cubic feet per day. No gas has been produced from this field since May 7, 1928, but oil production continued through 1930.

The 1930 operations in the Love and Latta field resulted in 3 dry holes and 1 producing oil well. One of the dry holes was the result of drilling an old gas well in the Topeka "lime" deeper to the "Mississippi lime," where water was found.

The Love and Latta pool has produced 1,700 barrels of oil per acre. The 1930 oil production was 40,981 barrels. This field produced 477,945,000 cubic feet of gas before abandonment.

Douglas Pool. The discovery well, and the only producer in the field, was drilled in by the Gypsy Oil Company on July 28, 1927. This well, the Jewel Douglas No. 1, is located in the NE¼ SE¼ NW¼ sec. 23, T. 34 S., R. 2 W., and found production in the "Wilcox" sand from 4,490 to 4,505 feet, with an initial production of 500 barrels. Subsequent to this completion four additional wells were completed to the producing horizon in sections 23 and 27, all of which were dry holes.

Only one well was drilled in the Douglas area in 1930. The Gypsy Oil Company Sturm No. 1, in the NW cor. SW¼ sec. 23, T. 34 S., R. 2 W., found water in the "Wilcox" sand from 4,517 to 4,550 feet. This pool produced 2,082 barrels in 1930, and has yielded 2,811 barrels per acre to December 31, 1930.

Anson Gas Field. Four gas wells, completed in secs. 25, 26 and 35, T. 30 S., R. 2 W., comprise the Anson gas field. The DeForrest Drilling Company Bryan No. 1, in the SW cor. sec. 25, T. 30 S., R. 2 W., was completed January 25, 1928. Gas was found in a sand lens in the Howard lime from 1,936 to 1,941 feet, and in another sand lens in the Severy shale from 1,982 to 1,985 feet. Initial production was reported as 1½ million cubic feet. No new developments were reported from this field in 1930.

During 1930 three wells produced 208,455,000 cubic feet of gas.

Caldwell Pool. The Caldwell pool was discovered April 10, 1929, by the Gypsy Oil Company Williams No. 1, in the SW¼ NE¼ SW¼ sec. 16, T. 35 S., R. 3 W. Oil was found in the "Wilcox" sand from 4,769 to 4,784 feet, with an initial production of 1,700 barrels per day. Subsequent to this completion 3 oil wells and 1 dry hole

	Average gravity, degrees Baume.	Producing oil, acreage.	Recovery per acre.	Producing horizon.	Age.	Average depth, feet.
Nort	40	10	1,303	Severy shale.	Pennsylvanian.	1,510
				"Mississippi lime."	Mississippian.	3,300
Padg	38	200	3,900	"Mississippi lime."	Mississippian.	3,460
				"Wilcox" sand.	Ordovician.	3,785
				Severy shale.	Pennsylvanian.	1,560
				Kansas City group.		2,770
West	40	80	2,780	Burbank sand.	Pennsylvanian.	3,195
				"Siliceous lime"(*b*).	Ordovician.	3,565
Mille	37	50	6,223	"Siliceous lime."	Ordovician.	3,685
				Kansas City group.	Pennsylvanian.	2,955
				"Mississippi lime."	Mississippian.	3,355
Rutt	39	10	1,567	"Mississippi lime."	Mississippian.	3,315
Chur	40	795	17,415	Stalnaker sand.	Pennsylvanian.	1,870
Hum	.....	.....	.....	Hoover sand.	Pennsylvanian.	2,150
				Lawrence shale.		2,275
Oxfo	40	490	15,910	Stalnaker sand.	Pennsylvanian.	2,020
				Howard limestone.		1,250
				Hoover sand.		1,600
				Severy shale(*e*).		1,345
				Emporia limestone.		1,050
Love	40	70	1,700	Kansas City group.	Pennsylvanian.	3,040
				Topeka limestone.		2,000
Dou	46	10	2,811	"Wilcox" sand.	Ordovician.	4,492
Ansc	.....	.....	.....	Howard limestone.	Pennsylvania.	1,920
				Severy shale.		1,960
Cald	47	30	18,850	"Wilcox" sand.	Ordovician.	4,778
Well	40	40	2,332	"Mississippi lime."	Mississippian.	3,650
	.....	1,785	.....	.....	.....	.....

well in T. 29 N., R. 4 W., Oklahoma.

31, 1930.

	Formation or gr	r of first duction.	Remarks.
		Gas.	
Pennsylvanian.	Wabaunsee.	.....	Last production, Feb. 3, 1928.
	Shawnee.	1928	———
		1915	Last prod., N. Vernon field, Oct. 8, 1929
		1927	Last production, May 7, 1928.
		1928	Last gas production, Aug. 31, 1928.
	Douglas.	1927	Last production, Oct. 31, 1928.
	Douglas and Lan	.....	———
	Kansas City.	.....	———
	Cherokee.	.....	———
Mississippian.		1924	———
Ordovician.	Simpson.	.....	———
	Arbuckle.	.....	———
Totals.....	.....	.....	———

* No record available prior to 1

† Estimated. Actual record of

feet. A good showing of oil was encountered at 3,163 feet in the "Oswald lime" series. A small showing of gas was found at 3,684 feet and another at 3,787 feet in the Pennsylvanian basal conglomerate. Top of the Ordovician "Siliceous lime" was encountered at 3,832 feet with a hole full of sulphur water at 3,840 feet.

The Phillips Petroleum Company Spitz No. 1, in the SE cor. sec. 24, T. 12 S., R. 25 W., was abandoned at a total depth of 4,670 feet. Base of the Pennsylvanian system was found at 4,610 feet. Material resembling Decorah shale, with considerable dolomite and chert, was drilled from 4,610 to 4,650 feet, and the top of the Arbuckle or "Siliceous lime" was encountered at the last-mentioned depth. A hole full of water was found in the Arbuckle and the well abandoned. A 10-barrel-per-day showing of oil was found in the "Oswald" from 4,160 to 4,170 feet.

The Prairie Oil and Gas Company Kutina No. 1, in the NE¼ SW¼ NE¼ sec. 29, T. 15 S., R. 21 W., also failed to find commercial production, although several shows of oil were reported. Top of the "Oswald series" was reported at 3,840, with a hole full of water at 3,910 feet. The Pennsylvanian basal conglomerate was found at 4,161 feet, with shows of oil at 4,180, 4,205, 4,245 and 4,255 feet in sandy and cherty zones of this horizon. Apparently the well failed to reach the Ordovician "Siliceous lime," as drilling was stopped at 4,383 feet in cherty material, with some red rock and sand showing in the cuttings.

Trego county produced 2,794 barrels from one well, which was shut in at intervals during the year.

Miscellaneous Developments

By far the most important wildcat developments of 1930 include the opening of new pools along the Ellsworth "arch" or anticline. Table 9 includes three new pools along this fold, located in Ellsworth, Rice and Stafford counties. The Ploog well, located in sec. 33, T. 18 S., R. 9 W., has been discussed under the heading of Rice county. The Ellsworth and Stafford county discoveries will be discussed here. Several tests along the Ellsworth anticline started in 1930 will be completed in 1931 and will serve to prove or disprove a considerable part of this important area. Early in January, 1931, a new discovery was made near Cunningham, in Kingman county.

The discovery of oil in Ellsworth county was made by the Slick, Pryor and Lockhart Heiken No. 1, in the NW cor. sec. 25, T. 17 S.,

R. 10 W. This test was completed October 15, 1930, and was shut in for lack of pipe-line outlet. The test was started in June, 1930, and aroused considerable interest when about 1½ million cubic feet of gas was encountered from 2,495 to 2,500 feet, near the top of the Topeka "lime." This well again attracted attention when 6 million cubic feet of gas was encountered from 2,980 to 2,982 feet in the Lansing-Kansas City "lime" series. Oil was found in the Ordovician "Siliceous lime" from 3,221 to 3,242 feet, and the well made approximately 1,800 barrels on a 24-hour swabbing test. Very little gas accompanies the oil. After producing about 1,150 barrels of oil the well was shut in.

Previous to the discovery of oil in Ellsworth county a number of salt exploratory wells were drilled around the town of Ellsworth in T. 15 S., R. 8 W. Some gas was discovered, at depths ranging from 1,050 to 1,100 feet, which was used locally. This area remains untested in the "Siliceous lime." A few wells have tested other parts of Ellsworth county. One dry hole, completed in 1930, reached the "Siliceous lime." The Tatlock *et al.*, Soeken No. 1, in the SW¼ SW¼ SE¼ sec. 25, T. 17 S., R. 9 W., was completed at a total depth of 3,395 feet. Top of the "Siliceous lime was found at a depth of 3,283 feet. A small showing of oil was reported at 3,265 feet in green shale.

The south part of the Ellsworth anticline received considerable attention when the Midwest Exploration Company Richardson No. 1, in the SE cor. sec. 36, T. 22 S., R. 12 W., found the "Siliceous lime" September 9, 1930. Oil was found at a depth of 3,542 to 3,545 feet. Deeper drilling resulted in the discovery of another pay zone in dolomite from 3,580 to 3,583 feet. The two pays were tested by intermittent swabbing tests, and the well estimated to be good for more than 1,000 barrels per day. Total depth when completed was 3,599 feet. It was shut in for lack of pipe-line connection.

Two dry holes were completed in Stafford county, and four in Rice county between the Raymond pool, T. 20 S., R. 10 W., and the Richardson pool, T. 22 S., R. 12 W., in 1930. All of these tests reached the "Siliceous lime" and served to condemn a considerable area. A number of tests started along the Ellsworth fold in 1930 will be completed in 1931. From present indications this area appears to be very promising territory for exploration.

The Skelly Oil Company Miles No. 1, in the NE cor. sec. 30, T. 27 S., R. 10 W., Kingman county, found a good showing of gas from 3,385 to 3,392 feet and oil from 3,390 to 3,393 feet. This discovery

was made in January, 1931. The oil was found in the Lansing-Kansas City series and when tested made 216 barrels in 12 hours. This test opened a new productive area, the limits of which are unknown. No additional wells were started and the producer was shut in for lack of pipe-line connection.

A number of important "wildcat" tests drilled in various parts of western Kansas resulted in dry holes. The Gibson *et al.* well, in the center SW¼ sec. 11, T. 23 S., R. 14 W., Stafford county, was a failure at a total depth of 4,500 feet. No oil or gas showings were reported. Top of the Arbuckle or "Siliceous lime" was found at 4,005 feet. Another important test, the Phillips Petroleum Company Houseman No. 1, in the NW¼ NE¼ NE¼ sec. 30, T. 22 S., R. 22 W., failed to find commercial production of either oil or gas in 5,120 feet of drilling. A small showing of oil was reported in the Mississippi lime at 4,615 feet. Top of the Simpson formation was found at 5,023 feet, and the test stopped in this formation at 5,120 feet. This test is in Hodgeman county.

Two deep tests were completed in Pratt county in 1930. Jones and O'Haver Lunt No. 1, in the SW¼ NW¼ sec. 15, T. 28 S., R. 14 W., found a hole full of water in the "Siliceous lime" at a total depth of 4,754 feet. No oil or gas shows were reported. Top of the Pennsylvanian conglomerate was reported at 4,477 feet, top of the Simpson at 4,635 feet, and top of the "Siliceous lime" at 4,745 feet. The other deep dry hole in Pratt county was also drilled by Jones and O'Haver. This test, the Gereke No. 1, in the NE¼ SW¼ sec. 7, T. 26 S., R. 14 W., was abandoned in the "Siliceous lime" at a total depth of 4,743 feet. A showing of oil was reported at 3,210 feet in lime, and at 3,843 to 3,859 feet in the Lansing-Kansas City groups. Base of the Pennsylvanian was reported at 4,400 feet. Top of the "Siliceous lime" was probably found at about 4,500 feet. These two deep tests were important, revealing the underground stratigraphy of this part of Kansas.

The old Kingman district saw a slight revival of wildcatting during 1930. The results were unsatisfactory, as so many others have been in the past. Fleeger *et al.*, Ashcraft No. 1, in the SW¼ SW¼ NE¼ sec. 16, T. 28 S., R. 7 W., reported about ¼ million cubic feet of gas in the "Mississippi lime" at 3,970 feet. Top of the "lime" was found at 3,948 feet and base at 4,224 feet. Drilling was stopped at 4,532 feet in the "Siliceous lime," the top of which was found at 4,480 feet. Top of the Simpson (Ordovician) formation was found at 4,340 feet. The White Eagle Oil Company Lorenz No. 1, in the

SW¼ NE¼ SW¼ sec. 25, T. 27 S., R. 5 W., reported a small show of oil in "Mississippi lime" at 3,830 feet. Top of the Simpson formation was found at 4,122 feet, with water. Top of the "Siliceous lime" at 4,255 feet also contained water, and the test was abandoned at 4,262 feet. These two dry holes are in Kingman county.

Harper, Pawnee and Graham counties all contributed to the deep dry hole column in 1930. Pawnee county had 3 deep and dry completions; Graham county 2, and Harper county 1. In Harper county the Dixie-Amerada and Atkinson Misak No. 1, in the SE cor. sec. 25, T. 34 S., R. 6 W., was a failure in the Simpson formation at 5,232 feet. This test was a rotary to 4,648 feet. Top of the "Mississippi lime" was found at 4,635 feet and top of the Ordovician at 5,208 feet.

The Prairie Oil and Gas Company Black No. 1, in the SW¼ NE¼ NE¼ sec. 11, T. 20 S., R. 18 W., Pawnee county, was abandoned at a depth of 4,048 feet, probably still in Pennsylvanian formations. No showings of oil or gas were reported. The Amerada Petroleum Company Welch No. 1, in the SE cor. sec. 30, T. 21 S., R. 17 W., drilled the only well in Pawnee county to reach pre-Cambrian rocks. Granite was reported at a depth of 4,195 feet, and the well was abandoned at 4,220 feet. A small showing of gas was reported at 2,010 feet, at about the horizon of the Winfield (Permian) limestone. The "Siliceous lime" was reported at 3,955 feet. This test was one of the most important wildcats completed in 1930. The third deep dry hole completed in Pawnee county in 1930 was drilled by Skelly Oil Company. The Millhouse No. 1, in the center SW¼ sec. 34, T. 23 S., R. 17 W., was abandoned at a total depth of 5,002 feet in the "Siliceous lime." Top of this formation was reported at 4,590 feet. A show of oil was reported at 4.297 feet and a gas showing at 4,330 feet in the Pennsylvanian conglomerate.

Graham county's two deep dry holes are located in the SE¼ sec. 27, T. 8 S., R. 25 W. Both were drilled on the St. John's property by the Gulf Coast Drilling Company with rotary equipment. Several other attempts have been made to complete deep tests in this quarter section by the same company, all of which have failed to get below 3,100 feet. However, the St. John No. 2 (?), in the SE¼ NE¼ SW¼ SE¼ sec. 27, was drilled to 5,052 feet and abandoned in September, 1930. This was reported to have reached the Ordovician "Siliceous lime" at 4,460 feet. The other deep test, located in the NW¼ SW¼ SE¼ sec. 27, probably stopped in Pennsylvanian

formations at a total depth of 4,345 feet. Several oil showings we reported.

The foregoing discussion includes the important dry holes drill in various sections of western Kansas in 1930. The discovery several new oil fields in the Ordovicion "Siliceous lime" again dem onstrates the importance of completing all tests below the top this formation. New developments in Kansas in 1931 and 19 will probably be concentrated in ranges west. There is little dou that this area will overshadow the eastern portion of the state new development and new production in the future.

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