HECKERT OIL PUMPINC JACK
.6 mile north of Connoquenessing Creek,
.15 mile east of Powder Mill Creek
Renfrew Vicinity
Butler County
Pennsylvania

HAER No. PA-280

PHOTOCRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENCINEERING RECORD
National Park Service
Northeast Region
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

HISTORIC AMERICAN ENGINEERING RECORD

HECKERT OIL PUMPING JACK

HAER NO. PA-280

Location:

.6 mile north of Connoquenessing Creek,
.15 mile east of Powder Mill Creek
Renfrew Vicinity
Butler County
Pennsylvania

UTM: 17.585970.4518150
Quad: Butler, Penn., 1:24,000

Date of Construction:

Circa 1908

Present Owner:

Stephen T. and Lynn P. Tritch, Pittsburgh, PA

Present Use:

Abandoned Oil Pumping Jack

Significance:

Historically significant as a relatively rare survivor of the early-twentieth-century oil industry in southwestern Pennsylvania; manufactured by a short-lived, small manufacturing division of the T.W. Phillips Gas & Oil Company. Technologically significant as representing an early gear-driven pumping jack, designed during a period of great pumping jack experimentation in the early 1900s.

Project Information:

This documentation was performed in late September/early October 1992 for CNG Transmission Corporation of Clarksburg, West Virginia, to mitigate the adverse effect of long-distance pipeline installation through the site's location. The Pennsylvania Bureau for Historic Preservation and the Federal Energy Regulatory Commission required this documentation for compliance with Section 106 of the National Historic Preservation Act of 1966.

Michael Petraglia, Ph.D., Project Manager; Christopher Martin, M.A., Senior Architectural Historian; Frances Alexander, Senior Architectural Historian; Madeleine Pappas, M.A., Historian; Patrice Gilbert, B.A., Photography; Sulah Lee, B.A., Graphics.

Engineering-Science, Chartered
1133 Fifteenth Street, N.W.
Washington, D.C. 20005

INTRODUCTION

The Heckert Oil Pumping Jack was first identified and documented during Phase I and II archaeology investigations conducted by Engineering-Science for CNG Transmission Corporation during 1991 and 1992 (Petraglia, Knepper, Martin and Rosenthal 1992; Petraglia, Knepper, Martin, Heston, Pappas and Alexander 1992). This industrial site is No. 36BT264 in the inventory of the Pennsylvania Bureau for Historic Preservation, Division of Archaeology. This HAER report builds upon previous research included in the two archaeological reports cited above, particularly the Phase II report.

While conducting research on this industrial site, it became apparent that the western Pennsylvania oil industry still awaits the kind of systematic, comprehensive documentation currently directed at the coal, iron, steel, and transportation industries in southwestern Pennsylvania, which are the primary components of the "America's Industrial Heritage Project" directed by the National Park Service. The early phase of the oil industry has been relatively well documented, particularly in the Titusville/Oil City area, but its later phases (and corresponding oil regions) in the late nineteenth and early twentieth centuries deserve more intensive study. It is hoped that this report will raise an awareness of the historical richness, geographical scope, and longevity of western Pennsylvania's oil heritage.

DESCRIPTION OF SITE/STRUCTURE

Location

The Heckert Oil Pumping Jack is located in the oil region of western Pennsylvania, in southcentral Butler County, 1 mile northwest of the village of Renfrew, in an oil pool historically known as the Bald Ridge oil field (see **Location Map, Pennsylvania Oil Fields**). The structure is located on a gentle slope about .15 miles east of Powder Mill Creek, a tributary of Connoquenessing Creek. The Connoquenessing Creek is located approximately .6 miles south of the structure.

Site Evolution

The Heckert Oil Pumping Jack is located on property that belonged to Michael S. Heckert when mineral exploration first began. Between 1875 and 1880, tax records show a substantial increase in the value of Heckert's land, rising from $900 to $1,850. Beginning in 1880, Heckert began leasing his 100-acre tract for the purpose of extracting petroleum and gas (see **Detail of Bald Ridge and Thorn Creek Oil Fields, 1886**). On July 13, 1881, Heckert leased the entire tract for 10 years to the Bald Ridge Oil and Transportation Company of Butler County. In August 1890, the Bald Ridge Oil and Transportation Company surrendered approximately one-

half of their 100-acre lease (Butler County Deed Book 298:266). During the next two decades, Heckert and his heirs leased oil rights to several individual oil speculators, including John T. Cook, John G. Patterson, John Humphrey and J. H. Coe, William H. Fisher, and William Cowden. When Heckert died in 1899, his estate included $508.42 earned from oil royalties. In addition, $215.00 was given to each heir for "property taken and share of oil" (Butler County Estate File H:462).

According to information contained in well records at the Pennsylvania Topographic and Geological Survey, Pittsburgh, the Heckert Oil Pumping Jack was last operated by the Bream Oil Company and abandoned in August 1939. The documentary evidence does not reveal when this well was originally drilled. E.A. Bream's oil company was based in Pittsburgh and was active in oil exploration in Butler County during the 1910s. Records for other wells on the Heckert property and neighboring property indicate that the Bream Oil Company completed several wells in the immediate vicinity of the Heckert Oil Pumping Jack in 1913 and 1914, so it is likely that its well was drilled about the same time (Well Records, Pennsylvania Topographic and Geological Survey; Lytle and Heeren 1955).

According to the well record, oil was struck in the Third Sand layer, measuring 17 feet deep and reaching a total depth of 1,566 feet. The oil pay streak, where oil was most prevalent, was six feet thick. The well record indicated that all casing had been pulled from the well. The 1955 *Oil and Gas Field Atlas of the Butler Quadrangle* by Lytle and Heeren (see **Detail of Oil/Gas Leases in Butler County, 1955**) identifies the site as abandoned well No. 4 on the Heckert heirs' property.

Oral interviews revealed that several wells on the Heckert property were re-opened in the mid-1970s, when the rise in oil prices made pumping profitable. At this time, the property was owned by John Charles, who hired William List of Meridian to pump the wells. List recalled that before he was hired, Alvin Smith, now deceased, used to pump the same wells for Charles. List quit pumping the wells about 1981, when Melvin Moser of Portersville took over the chore. Moser pumped the wells for the Charles heirs until about 1989, when the property was sold to Stephen T. and Lynn P. Tritch (List Interview 1992).

Both List and Moser remembered the stack of tubing at the Heckert Oil Pumping Jack, and confirmed that this well was pumped as recently as the mid-1980s. During this period only about three wells would be pumped at once on the Charles property, which had seven producing wells, according to Moser. These wells collectively produced about 100 barrels of oil every six weeks. Moser also recalled that the oil on the property and in the immediate vicinity varied in grade. Some wells had heavy or light oil, while others had high concentrations of paraffin or pitch. Moser remembered hearing that the wells on the Charles property and neighboring land were originally pumped with "line jacks," operated by horizontal strings of rods connected to large, centrally located pumping jacks. The main problems prompting conversion to independent pumping jacks at each well were the

difficulty in keeping balanced pressure and the constant repair needed after trees fell on the horizontal rods. Both List and Moser used an electric timer at each pumping jack to regulate pumping twice daily (List Interview 1992; Moser Interview 1992).

All wells on the former Heckert property are now abandoned. Of the eight wells on property shown on the 1955 Lytle and Heeren map, three produced oil, one produced oil and gas, and four were abandoned in 1955 (Lytle and Heeren 1955; Well Records, Pennsylvania Topographic and Geological Survey). Field inspection of some of the wells closest to the Heckert Oil Pumping Jaek revealed the remains of other pumping equipment. The oil and gas well identified as Heckert No. 1 is currently abandoned, but its old, belt-driven wooden band wheel pumping mechanism survives. At Heckert No. 2, completed in 1913 by the Bream Oil Company, the remains of two pumping jacks survive at two different abandoned wells only about 200 feet apart. Since wells were usually spaced about 500 to 600 feet apart, it is likely that one of these pumping jacks succeeded the other in operation. Both operated on the principle of double reduction, one using chain drive and the other using a gear-driven system similar to that used on the Heckert Oil Pumping Jack. Although the manufacturers of these two pumping jacks could not be determined from the limited field inspection, neither appears to have been made by the T.W. Phillips Manufacturing Company.

Physical Description and Operation

The pumping jack is located in the middle of a small cleared field surrounded by secondary forest growth. The field is currently overgrown with briars and small brush. The site shows evidence of being cleared and graded. A gravel surface exists toward the south end of the site. Old access roads crisscross the vicinity.

The site covers an area measuring approximately 75 feet north-south x 45 feet east-west (see **Site Plan**). It consists of the remains of an abandoned oil well and pumping apparatus, commonly known as a "pumping jack." The structure last operated in 1939, and has deteriorated due to neglect and exposure to weather. This apparatus was used solely for pumping; drilling the well occurred initially, but its drilling equipment and derrick have long since been removed from the site. The site currently consists of the pumping jack, a collapsed frame structure that once protected it from the weather, a stack of iron pipes, and remnants of pipelines that carried oil away from the well (see **Site Plan**).

In the Pennsylvania oil region major oil rig components were usually protected from weather by a wood frame housing. Remnants of the frame housing and corrugated tin roof that protected the pumping jack are scattered on the ground around this pumping jack.

The site's major component is the pumping jack, measuring approximately 20 feet long x 3 feet wide. The foundation consists of concrete mud sills supporting two 7-inch iron I-beams running the entire length of the jack. The engine bed plate, flywheels, drive gears, and samson post are all supported by this rigid, dual I-beam frame (see **Site Plan**).

The machinery was originally powered by a natural gas engine, the cylinder of which has been removed and taken away from the site. The surviving engine bed plate on the pumping jack reveals its manufacturer: "T.W. PHILLIPS MFG CO, BUTLER PA." The engine would have been a single cylinder, two-cycle, internal combustion model of about 15 horsepower. Its design was slightly unusual because the charge entered the combustion chamber through an external passage and pressure-operated poppet valve (Harvey Correspondence 1992).

The engine's connecting rod, also taken away from the site, was originally connected to the crankshaft, which rotated dual flywheels measuring 4 feet 5 inches in diameter. One end of the crankshaft is connected to a small pulley wheel 14 inches in diameter, capable of holding a belt about 12 inches wide. The two manually operated hand wheels outside of the pulley wheel allow the clutch to be operated manually, in addition to possible operation from a lever located near the samson post. The canvas belt, portions of which remain, went around a second, larger pulley wheel measuring about 1 foot 10 inches in diameter. The axle of this larger pulley wheel was attached to a small spur gear, which turned the large spur gear, in turn powering the walking beam pumping assembly (see **Schematic View of Heckert Pumping Jack**). This double gear reduction design allowed the relatively slow revolutions required for pumping oil.

The axle of the large gear is also attached to a brake, operated by a lever near the samson post. Levers for both the clutch and brake near the samson post allowed the unit to be operated by a single individual working near the well head. The large drive gear was originally attached to the wooden pitman, which has come apart and partially rests on the ground. The hand-hewn pitman was probably adapted from some older oil rig. The pitman is attached to an iron stirrup, securing it to the cast iron walking beam assembly, supported by a samson post bolted to the I-beam frame. The other end of the walking beam, centered over the well head, was originally attached to a series of rods going down into the well. The rods are no longer attached to the walking beam; some of these rods lay among the collapsed housing pile.

The series of rods was attached to valves at the bottom of the well that raised oil by displacing air in the pipe "tubing" surrounding the rods. A linkage once connected the walking beam to the top iron "polished" rod, which during operation would have been attached to other "sucker" rods running the length of the well. The bottom sucker rod was connected to a valve rod, in turn connected to two ball-and-seat valves separated by a working barrel, which brought oil up via displaced air.

On the downstroke, the oil pressure held the top ("working") valve closed, while the bottom ("standing") valve opened, allowing the working barrel to pass through the fluid. On the upstroke, the standing valve was closed by the pressure of the oil column, and oil was trapped in a working barrel. The relatively small diameter of oil well tubing required a long working barrel to displace a significant volume (see **Detail of Typical Pumping Assembly, C.1910**). Pump speeds typically ranged from 10 strokes per minute to as high as 20 strokes per minute for lighter grades of oil (Phelps and Lake 1924; Leven 1941).

The sucker rods operated within iron tubing measuring 2 inches in diameter. A stack of tubing survives at the site, with each section measuring 20 feet 9 inches in length. The tubing was inserted inside "casing," measuring 5 inches in diameter at this well. The casing was inserted inside an exterior "drive" pipe, measuring about 8 inches in diameter, whose top edges are curled from being beaten into the ground before the casing was installed. A casing head, removed from this site, would have been screwed onto the top of the casing pipe and secured by a clamp. A horizontal pipe still connected to the base of the well head carried oil from the well directly into a gathering pipeline, which would have transported it to centrally located stock tanks that received oil from several wells. Usually there was a receiving tank to hold oil at each well site, and one may have existed at this site, although no evidence of a receiving tank survives. From the centrally located stock tanks, oil was then transported to a refinery through large, long-distance pipelines or by truck.

Across from the oil pipe at the base of the casing head is a narrow pipe and valve that carried natural gas produced by the well to the natural gas engine powering the pumping jack. The regulator that once controlled the gas flow to the engine survives on the ground at the site. Raised lettering on the regulator indicates it was manufactured by the Chaplin Fulton Manufacturing Company, based in Pittsburgh.

Fragments of iron hardware, such as small pipe segments, fasteners, nails and bolts were also found at the site. An overturned drum lying near the collapsed housing contained ashy debris and recent trash. The drum could have been used to keep workers warm, but is not thought to have been related to the operation of the pumping jack.

Derricks were used when wells were drilled, and were often left standing over relatively deep wells to allow greater lengths of tubing to be pulled out of the well at one time. When derricks were taken away, as was the case here, a ladder-like portable "pulling machine" would have been used to raise and lower tubing and rods when servicing the well.

BACKGROUND INFORMATION ON THE OIL INDUSTRY IN WESTERN PENNSYLVANIA AND BUTLER COUNTY

Geological Context

The Heckert Oil Pumping Jack is located in the Pennsylvania oil region, which produces a paraffin-based oil regarded for its excellent lubricating ability when exposed to the high temperatures of internal combustion gasoline engines. The western Pennsylvania oil region is geologically part of the northern Appalachian oil and gas region, an elliptically shaped area that extends from Ontario through New York, Pennsylvania, Ohio, West Virginia, and eastern Kentucky. The location of oil, gas, and coal in this region is determined by the structure of underlying rocks. Subsurface rock layers are not flatly stratified but form a series of long, narrow basins (synclines) running northeast-southwest, separated by equally long divides (anticlines), sometimes corresponding with surface ridges (Sisler *et al.* 1933; Ashley and Robinson 1922).

It was not until the third Pennsylvania Geological Survey, however, completed in 1914, when it was realized that the underlying rock folds were very irregular. As the western border of Pennsylvania is approached, the folds sometimes run perpendicular to the main northeast-southwest folding orientation. The disruptive folding that has driven oil and gas out of rocks east of the Allegheny Front decreases gradually west of the Front, preserving oil and gas in that region. Within Pennsylvania's oil and gas belt, gas is usually found east of oil, corresponding to a greater percentage of gases and volatile matter in the bituminous coal (Ashley and Robinson 1922).

Oil and gas were formed from partially decomposed plant and animal matter caught among layers of rock deposited in the ocean during dramatic shifts of the earth's crust. Concentrations of oil and gas are commonly referred to as "pools" or "fields." Concentrations do not occur in underground cavities, however, but in the open spaces between the grains of coarse-grained sandstones, porous limestones, or other rock. Oil "sands" lie underneath finer grained rocks that prevent oil and gas from escaping to the surface. For concentrations of oil and gas to occur, there must be sufficient natural pressure to separate oil, gas, and water, and force oil up through a drilled well. Most oil wells stop flowing naturally due to loss of gas pressure, rather than to exhaustion of oil; this condition allows secondary recovery through various methods of repressurization (Ashley and Robinson 1922).

In Pennsylvania, oil wells vary in depth from less than 200 feet to about 3,000 feet. Compared to the relatively shallow wells of the "upper" Pennsylvania oil district (centered in McKean County), Butler County wells were relatively deep, averaging between 1,500 and 2,000 feet, sometimes reaching 3,000 feet (Ashley and Robinson 1922). Butler County is located in the "lower" oil district, which includes parts of nine counties in southwestern Pennsylvania. The average depth of oil wells

generally increases when moving from north to south through the 18 counties in the Pennsylvania oil region.

In Butler County, oil and gas pools become unevenly distributed moving from the large concentration in the northeast to the spotty, but often highly productive, pools in the eastern and southcentral portions of the county (see **Pennsylvania Oil Fields**). The oil and gas sands are generally fine- to coarse-grained in texture, commonly containing streaks of pebbles. They are composed chiefly of quartzose but also contain feldspars, flakes of mica, and some ferromagnesiam minerals embedded in clay, cemented by silica and subordinate calcite. The oil sands lie below the Vanport (Ferriferous) limestone level, which occurs about 300 feet below ground level. The oil sands are located between 340 and 2,200 below the Vanport limestone, and have "pay" (oil producing) streaks averaging between 2 and 10 feet thick. The most productive sand is the Hundred-foot, present in almost every well. Other productive horizons in the county include the Butler, Thirty-foot, Gordon, Fifth, and Speechley horizons. The largest wells in the Bald Ridge and adjacent Thorn Creek oil fields obtained their oil from the Third and Fourth sands at a depth of about 1,500 feet (Sisler *et al.* 1933; Richardson 1936).

Historical Development of the Oil Industry in Western Pennsylvania and Butler County

In the early twentieth century, petroleum replaced iron ore as Pennsylvania's second-most important (next to coal) extractive product. Petroleum, called "Seneca Oil" by Indians, was skimmed from the surface of springs along the upper Allegheny River and used by both Indians and early white settlers for medicinal purposes (Donehoo 1928). It was also used as a lubricant by white settlers, but it was not until 1859 that it was drilled successfully and extracted in large volumes. In that year, Edwin L. Drake drilled the first deep oil well in Titusville, in southwestern Crawford County, Pennsylvania. Drake's strike began a boom in the area, and by 1860, 74 wells were in operation between Titusville and Oil City. By the early 1900s, oil extraction occurred in 18 western Pennsylvania counties, with most activity occurring within a belt extending from McKean County in the north to Washington County in the southwest corner of the state (Doherty 1989).

The impact of oil discovery was tremendous due to petroleum's many uses as a fuel and lubricant. It could be refined into kerosene, used for illumination. Oil towns sprang up almost overnight as new fields were discovered, and large refineries were built in cities including Pittsburgh, Philadelphia, Cleveland, and New York. The invention of the automobile created an even greater demand for petroleum, but the discovery of new oil fields in other states--notably Texas, California, Kansas, and Oklahoma--greatly reduced Pennsylvania's oil producing rank by the early twentieth century. Pennsylvania's peak production occurred in 1891. In 1900, the fields of

Appalachia (including western Pennsylvania) and Indiana produced 95% of U.S. oil, but by 1905 output from these two areas fell to 40% of total production (Doherty 1990; McLean and Haigh 1954). By 1920, Pennsylvania had fallen to 10th place compared to other oil producing states (Ashley and Robinson 1922). By 1946, it was estimated that approximately 80% of Pennsylvania's petroleum fields had been developed (Miller 1946). By 1970, Pennsylvania produced $^1/_9$ of 1% of the nation's oil. The impact of the Pennsylvania petroleum industry is still felt, however, through its prized lubricating oil and the growth of the state's refining capacity, currently second only to Texas (Klein and Hoogenboon 1980).

Butler County maintained a rank among the top three oil-producing Pennsylvania counties (with McKean and Venango) from 1889 into the 1920s (Hice 1916; Doherty 1989). Shortly after the discovery of oil in 1859 in the Oil Creek valley in Venango County, petroleum deposits were found in the valley of Slippery Rock Creek in northwestern Butler County. Hoping to repeat the success of the Drake well and attract some of the international attention focused on activity in Venango County, a number of companies were organized in Butler County in quick succession. The earliest oil company in Butler County was organized in 1860 as the Butler County Oil Company. The Butler Pioneer Oil Company was organized the next year and operations began on John Negley's tract southwest of Butler. In 1862, the Enterprise Oil Company was established at Prospect, and drilling by the company began along Slippery Rock Creek (*History of Butler County, Pennsylvania* 1895).

After the Civil War, several oil companies were formed throughout the oil region. A second firm using the name Butler County Oil Company was started in August 1865 when the directors leased 12,000 acres between Martinsburg and Millerstown, in northeastern Butler County. Although this belt later proved to contain rich petroleum deposits, these initial wells were not drilled deeply enough to reach oil, and the oil company was disbanded in disappointment. Ironically, these fields later produced some the largest wells found in Butler County to that date, when the firm of Shreve and Kingsley drilled a 140-barrel well on the Stewart farm in 1873. The Jacob's Oil Company, formed in 1868 by the directors of the first Butler County Oil Company, began exploration in the Martinsburg field, in Parker Township, and hit the first paying well in Butler County. The strike of the Martinsburg well proved that Butler County had oil fields worth developing (McKee 1909; *History of Butler County, Pennsylvania* 1895).

One of the most important Butler County oil operators was H.L. Taylor and Company, which began drilling in the county in 1871 and eventually owned 300 wells, 40 of which were located in the Petrolia, Millerstown, and Karns City fields (McKee 1909). The largest operator in the county during the 1870s, however, was an individual, Dunc Kearns, who in 1872 bought the prolific McClymonds farm, located in Fairview Township. Within a year the boom town of Karns City, named after Kearns, had arisen on the McClymonds farm. Kearns was also instrumental in

the construction of a number of pipelines from Butler County to the Allegheny River. After drilling was completed in the extensive oil belt from Parker's Landing south to St. Joe, southwest of Millerstown, Butler County was abandoned by oil scouts who moved explorations to the lucrative Bradford field in McKean County by the late 1870s (McKee 1909).

Oil was first discovered in the Connoquenessing Valley in May 1872 on the Jamison farm two miles north of Boydstown in Concord Township. Excitement centered around the Morrison well, which initially produced 700 barrels per day but quickly dropped to 300 and within a month to 150 barrels per day. Other gushers in the vicinity gave rise to the boom town of Greece City, which, according to one local history, "sprung up as if by magic, and in the fall of 1872 the surrounding country was dotted with derricks and drilling wells...." (McKee 1909). Overall production was inconsistent, however, and the Greece City oil pool soon became exhausted as exploration shifted to the Millerstown field in Donegal Township.

The Heckert Oil Pumping Jack is located in the Bald Ridge oil field, centered along the Connoquenessing Creek at its junction with Thorn Creek. Exploration of this area began in 1880 when the firm of Reiber Huselton of Butler leased 780 acres in Penn and Forward Townships and began drilling near the settlement of Bald Ridge, later known as Renfrew, on the Connoquenessing Creek. The first strike in this field occurred in the spring of 1881 on the Smitb farm, adjoining property owned by Michael Heckert where the Heckert Oil Pumping Jack would later be located (see **Detail of Bald Ridge and Thorn Creek Oil Fields, 1886**). The Smith farm well was struck at 1,620 feet resulting in a 6-barrel-per-hour well. Success prompted the formation of the Bald Ridge Oil and Transportation Company in May 1881. Its directors were: J.D. McJunkin, John S. Campbell, Fred Reiber, S.H. Peirsol, W.D. Brandon, W.H. Hoffman, J.A. Hawk, H.L. Westerman, W.H. Ritter, R.P. Scott, G.W. Fleeger, John N. Patterson, D.A. Heck, H.A. Krug, Jr., George Krug, O.D. Thompson, W.C. Neeley, Henry Bauer, Philip Bauer, B.C. Huselton, M. Reiber, Harvey Colbert, H. Eitenmiller, Jacob Reiber, and Simon Yetter.

Several wells were completed in the Bald Ridge field in 1881. Other operators in the field included Simcox and Myers, who began drilling in 1881 near the community of Bald Ridge. The following year Agnew and Egbert began drilling on the McCalmont farm, on the Connoquenessing Creek less than a mile nortb of Bald Ridge. The McCalmont farm ultimately proved to be one of the most valuable tracts in the district. Two other companies joined oil exploration at Bald Ridge when the Forrest Oil Company purchased one-half interest in the Simcox and Myers leases and Yeagle and Campbell purchased oil rights for the Smith farm, where initial Bald Ridge drilling had begun.

In August 1882, the Bald Ridge Oil and Transportation Company sold their leases, equipment, and wells to Phillips Brothers Company for $160,000. With the

sale, an oil pipeline was extended south from the fields around Petrolia, in northeastern Butler County, to the new Bald Ridge field. In December 1882, Phillips Brothers leased portions of the Wallace farm north of Thorn Creek, which became one of the most profitable farms in the area. By 1883, there were 47 wells in the Bald Ridge field, of which 37 were producing a total of 642 barrels a day (Sipe 1927; *History of Butler County, Pennsylvania* 1895).

The development of the Bald Ridge field accelerated when Phillips Brothers, a firm operating in the upper and middle oil districts, refused to follow scouts to newly discovered fields in McKean County, instead opting for further exploration in Butler County. Phillips's success in what became known as the Thorn Creek oil field, adjoining the Bald Ridge field to the east, stemmed from his belief that there were significant oil deposits near the confluence of the Connoquenessing and Thorn Creeks. His first wells were not large producers, but the nature of the wells and the geological formation of the area confirmed his theory that profitable wells were located in the vicinity. On August 29, 1884, Phillips Brothers hit paying sand on a well that at first was not predicted to be productive. As drilling went deeper, however, it flowed 225 barrels per hour by September 3, immediately attracting oil scouts from other fields. By September 15, the well flowed 4,200 barrels per day, making it the best producer in the state (and country) at the time. This Phillips well surpassed the Tarr farm well along Oil Creek (Venango County), which for 23 years had held the initial production record of 4,000 barrels per day. The tremendous volume and potential of the Phillips well caused the price of oil to drop 8 cents per barrel (Sipe 1927; McCorry 1970).

The Phillips well attracted oil scouts and dozens of oil prospectors causing, according to one local historian, "a stampede from the upper fields, and in [a] short time Thorn Creek was the scene of one of the largest excitements since the days of Millerstown" (McKee 1909). The gusher also attracted thousands of curious spectators, arriving on special excursion trains from Pittsburgh (Giddens 1964; *History of Butler County, Pennsylvania* 1895; McCorry 1970; Goldinger n.d.). T.W. Phillips instantly became pivotal in the development of the Butler County oil industry, ultimately using success in the Thorn Creek, Glade Run, and Thorn Creek Extension fields to grow into one of the largest and most successful independent operators in Pennsylvania.

After the Phillips well was struck, oil scouts established a headquarters at the nearest town, McBride, located less than .5 mile to the east along Thorn Creek. The professional oil scout first became prominent in the early 1880s. Prior to that time, regional and local newspapers were the primary source of information about new wells and fields. Wild speculation often occurred in the oil fields, and accurate information was carefully guarded by successful prospectors. This secrecy resulted in several "mystery wells," often protected at gunpoint. Oil scouts maneuvered at night to spy on mystery wells and monitor activity for their employers, most often oil companies. The telegraph office, quickly erected when a large gusher well was

struck, was a main focus of attention for the oil scout (Giddens 1964; McCorry Collection, Butler County Historical Society).

In early October 1884, just 360 feet west of the Phillips well, also on the Bartley farm, the Christie well was begun. This well surpassed the Phillips well by producing over 5,000 barrels the first day, 7,000 barrels per day for several days, and a sustained high volume for a month. The Christie brothers refused an offer of $100,000 for the well. On October 27, 1884, about 400 feet south of the Phillips well on the adjacent Marshall farm, Colonel S.P. Armstrong drilled the famous Armstrong No. 2 well, which flowed 8,800 barrels for the first 24 hours. Production gradually dropped, however, to 6,000 barrels by November 1, and 600 by December 1, before it stopped completely on December 2.

In the history of Pennsylvania oil production, the Armstrong No. 2 well's production rate was surpassed by only two other wells, both located in Allegheny County (Giddens 1964; McCorry 1970). The excitement of the Armstrong well, which initially appeared to be a "dry hole," is vividly recorded in the local histories:

> On October 26 [1884] the Armstrong was drilled through the sand with no show of oil.... One of the scouts laughingly offered Armstrong a cigar for the well. Armstrong thought this just could not happen, for a well to be within 500 feet of other tremendous gushers and be a 'dry hole'. At noon on October 27 he made arrangements with the 'torpedo man' to try a 60 quart nitroglycerine torpedo in the well, where the pay sand should be. All scouts, oil prospectors, and sight-seers cleared from the derrick to the school yard and the telegraph carriage across the wagon-road, near the Phillips [well]. The torpedo man dropped the 'go-devil' (a triangular piece of metal to explode the shell); a few moments of silence, then a heavy earth rumble--gas vapors started to cloud the derrick--then a rain of pebbles and slate. A few more seconds went by and there was a six-inch diameter golden colored column, straight as a mountain-pine until it was broken into rain fragments 80 feet above at the crown-pulley--THE JUMBO OIL WELL STRUCK (McCorry 1970).

By November 1884, Phillips Brothers had six new producing wells on the Bartley farm and Dodds farm, adjacent to the Wallace farm to the east. By December 1, Phillips and others had 24 wells in operation, with 29 more being drilled. Other operators who found oil on these two farms were Boyd & Semple, Conner & Fishel, Greenlee & Company, Gibson & Company, and several small operators drilling around the edge of the pool. Within only a few months, production from the Thorn Creek field was totalling 16,000 barrels per day. By 1885, there were 147 producing wells in the Thorn Creek field (Sipe 1927).

Immediately after the Phillips well was struck in August 1884, the boom town of Phillips City was quickly built on top of the oil pool under the Bartley and Dodds farms (see **Detail of Bald Ridge and Thorn Creek Oil Fields, 1886**). By November, bolstered by the success of the Christie and Armstrong No. 2 wells, the town had spread south, occupying both banks of Thorn Creek. New buildings were erected to serve the workers and their families, including two boarding houses, a grocery store, a school, and two telegraph offices. Scores of new dwellings and large oil storage tanks were also constructed. But on December 19, 1884 five storage tanks caught fire, destroying much of the town and causing over $11,000 in property damage. By 1886, the boom towns of Phillips City and McBride City, located .75 mile to the east on Thorn Creek, had fallen into decay, as well pressures dropped and drilling activity migrated to new fields in Parker Township (Goldinger n.d; McCorry 1970).

The Thorn Creek field's reign as the largest oil producing field in the world was relatively brief, reflecting the great mobility of an industry that constantly sought new areas to drill. Compared to other extractive industries--coal mining, for example--the average life expectancy of an oil boom town was brief. Often, as in the case of Phillips City, it lasted less than two years. Although boom town wells continued to produce oil in paying quantities, production usually subsided after they were initially "creamed" of high initial volumes for several months (Packard Interview 1992). Oil company workers and independent operators who lived in a boom town usually stayed until the volume of oil decreased significantly or until new oil fields were discovered.

During the late 1880s and 1890s, the principal oil centers of Butler County were confined to Jefferson, Cranberry, Lancaster, and Penn Townships. The Brownsdale field was found in the latter township, created by the striking of another Phillips well. In 1894, the deepest well (2,005 feet) in Butler County up to that time was drilled in this district on the Campbell heirs' farm in Middlesex Township by McJunkin and Brandon. It was predicted that Cooperstown would be the last large development in Butler County, but oil was struck in Campbell Hollow in Concord and Washington Townships, which produced 3,000,000 barrels in a 4- to 5-year period.

In addition, the Thorn Creek field was revived in 1908 on the Dodds farm, and during the first decade of the twentieth century the South Penn Oil Company, Phillips Gas and Oil Company, Culbertson and McKee, and McCollough and Bernard were all operating in the district. Nonetheless, by 1902 the main producing areas in the vicinity were discovered and drained of their maximum yields.

The height of Butler County's oil production occurred between 1870 and 1890. By the 1890s, petroleum discoveries in other areas of the U.S. and the expansion of the industry world-wide made Pennsylvania oil expensive by comparison. Butler County is distinguished, however, for having wells with record-setting initial capacity and also the longest life of any Pennsylvania wells. Many

Butler County wells are still in operation today, and when the price of oil rises significantly, many old wells are reopened (Richardson 1936; Doherty 1989).

Technological Development of Oil Field Equipment

In discussing the use of oil field equipment, it is important to note that it is nearly impossible to identify a date that a certain class of equipment came into universal usage. The primary reason for this condition is that oil field equipment generally has a long life, and was used, rebuilt, modified, or abandoned to minimize production costs. In the oil industry particularly, basic types of equipment were used for very long periods, making modernization at particular wells unprofitable. This fact is reinforced by the nature of oil wells, which generally produce large volumes of oil initially, then quickly decrease production as pressure drops and oil pools are drained of their maximum yields. It is possible, however, to identify trends in equipment development and the approximate dates of major innovations.

Drilling the Well

From the drilling of the Drake well in 1859 through the early twentieth century, the oil fields of Pennsylvania were exploited by essentially the same extraction technique. The cable-tool system, also known as the percussion or churn-drill method, was developed during the earliest period of oil exploration, and it survived as the standard drilling method in American oil and gas fields until the widespread adoption of the rotary system beginning in the 1930s. In Pennsylvania's hard rock formations, the cable system remained the preferred method, while the rotary system was well suited for the softer soils of the Texas and Gulf Coast fields.

With the cable system, a heavy steel bit suspended from a rope or wire cable was raised by cable through the center of the derrick and dropped into the well hole, pounding its way through the rocks. The system was particularly good for drilling in hard formations because the sides of the hole remained intact despite the force of the percussion, allowing the driller to see if water or gas strata were hit before a casing was inserted.

Certain preconditions had to be met before drilling could begin. The abundance of water sources, coal, and timber meant that the Pennsylvania oil fields did not have the problems of extraction associated with later western fields. Drilling could begin only after the erection of a power plant and derrick, with necessary drilling tools, casings and other equipment brought to the site. All oil or gas drilling required an adequate water supply to run the steam boilers that powered the drilling and pumping equipment. Steam engines provided power for both drilling and pumping into the early 1900s. Steam engine boilers were fueled by wood, coal, natural gas, or oil, depending on local conditions (*The Petroleum Industry...* 1934).

Until the adoption of iron and steel equipment, timber was necessary for the construction of derricks and other features of the rig. After steel derricks became available beginning in the 1880s, many derricks continued to be made out of wood, which had the advantage of giving under stress. Rigid tubular steel derricks lasted longer and were not threatened by the fire hazard in closely drilled areas. Steel derricks were also easily dismantled and reassembled, making them portable and offsetting their initially higher cost (Phelps and Lake 1924). Derricks were also frequently made from the abundance of spare pipe in the oil fields, joined together with a variety of patented joints.

Derricks were usually between 60 and 90 feet tall. Deeper wells contributed to the use of a derrick at the site after the well was drilled because derricks reduced labor during servicing. Compared to a portable "pulling machine," also used to remove tubing in the early twentieth century, a 80- or 90-foot derrick allowed the removal of twice the pipe per pull. The greater well depth in the lower oil district, including southcentral Butler County, has contributed to the survival of some old derricks in that district. By contrast, virtually no derricks survive in Venango County, and only a few are known to exist in the Bradford area of McKean County, where the wells were shallower (Packard Interview 1992).

Timber foundations for drilling and pumping equipment were often of standardized sizes. When the well was started, a hole was dug, often 10 to 15 feet to bedrock, for inserting the drilling tools. When the bedrock was too deep, an iron drive-pipe attached to a sharp, steel "shoe" was driven into the formation to reach the height of the suspended tools. If the bedrock was less than 60 feet from the surface of the ground, the process known as "spudding" was necessary because the boring tools could not be operated from the walking beam of the derrick until the tools were below the derrick floor. During the spudding process, the drilling tools were raised and dropped from a cable with a "jerk rope" held by the driller and attached to the axle of the bull wheel. The tools would be raised and dropped over the hole with the driller turning the drill to ensure that the hole was round. By pulling and slackening the rope, the driller performed manually the function of the walking beam until the necessary depth was reached (Carll 1880).

The bull wheel was usually a set of wheels, constructed first of oak and later of iron or steel, with a brake on one side controlled by the driller. Driven by a 2-inch bull rope with iron couplings, the bull wheel was used to withdraw tools from the hole. One end of the drilling cable was attached to the bull wheel, around which the cable was spooled. The cable passed over a crown pulley attached to the top of the derrick before running through the temper screw, fastened to the end of a walking beam, and from there the cable passed into the hole. Drilling occurred by raising and lowering the clamped end of the walking beam (McBeth 1919).

The drilling crew consisted of a driller, a tool dresser, and an engineer. The driller rotated the drill using a lever inserted into the temper screw. During the

process, he lowered the temper screw at intervals allowing the cable to sink into the hole. After the tools were pulled from the hole, the dresser removed the bit for sharpening, and a bailer or sand pump was inserted to clear crushed material and water. The sand pump used a separate cable line which also passed over the pulley. In cases where water or soft sides were encountered, casings were inserted and drilling resumed with a smaller bit.

In the hard rock formations of the western Pennsylvania oil fields, casings often were unnecessary, and drilling was possible to depths of 2,600 feet without casings. Hard rock meant slow progress, however, as the earliest drilling crews could only accomplish about three feet per day (Eaton 1912). At that rate, a well 1,500 feet deep took more than one year to complete. As described by John Carll in 1880, the routine of drilling was "very monotonous, unless some accident occurs to diversify it" (Carll 1880, quoted in Bacon and Hamor 1916).

The process of "shooting" a well was used in hard rock formations, in densely packed sands, or where existing gas pressure was insufficient to allow the oil to flow. In the Pennsylvania fields, nitroglycerin was selectively used on nonproducing wells. The explosion created a reservoir at the bottom of the casing to collect any oil. Shooting was also sometimes used when production of an established well dropped to a point where it was unprofitable.

Before the 1870s, narrow wells often became filled with water during drilling. Water required pumping and reduced the speed of drilling, while the narrow casings dictated the use of light-weight drilling tools, which also slowed the process. Although the process of drilling remained basically unchanged, technological advances by the 1880s contributed to more efficient production. One development was the increased weight of the cable tools from 100 to 200 pounds to sets weighing 2,000 to 3,000 pounds. During this period, the mechanics of drilling operations were simplified with increases in the horsepower of the boilers and engines. Stronger machinery and tools and increases in power were necessary as wells were dug deeper and larger, requiring larger casing ranging from 5-1/2 to 8 inches (Brantly 1971; *The Petroleum Industry...* 1934).

By the 1890s, technological improvements continued, especially in materials and size of drilling equipment. A declining lumber supply and the growth and proximity of Pittsburgh steel mills contributed to the use of iron or steel for many oil field components. Derricks, jack posts, and walking beams of steel were developed in this period, as well as wire drilling lines (Brantly 1971; *The Petroleum Industry...* 1934).

By the 1920s, new technological improvements were transforming oil extraction. During the 1920s and 1930s, oil production became more precise with sophisticated geological equipment and increased knowledge of subsurface geology. It became possible to drill a straight vertical hole to reach a predetermined point at

the bottom. Wire line core barrels were invented to take samples of formations; electrical logging devices were used in rotary drilled holes to determine permeability, porosity, and the oil and gas contents of the sands. Improvements in materials and tool casting continued in the mid-twentieth century, as oil wells were dug at depths of 10,000 to 14,000 feet. The greater depths demanded heavier equipment made of harder metals and alloys, as well as more accurate measuring instruments (Clark 1958).

Rotary drilling, developed in the early 1900s, was more expensive than the standard cable system. With this system, the bit was rotated by a gear, operated by a gas or steam engine. A pump sent water through the drill stem to the bit with the water returning through the outside of the stem. The water kept the bit cool and removed debris from inside the hole. The rotary system was used primarily along the Gulf Coast and in some parts of California, where the formations were very soft. The bit used for the rotary drill was developed by the father of millionaire Howard Hughes while employed at Price Brothers Machine and Boiler Shop in Renfrew, Pennsylvania. Hughes moved to Texas, where he made his fortune from the use of his rotary bit in the new oil fields (Goldinger n.d).

During the 1890s, manufacturers developed combination engines with convertible steam and gas cylinders to utilize the advantages of each method. Despite the development of reversible clutches for gas engines circa 1901, the more powerful steam engine continued to be preferred for drilling and servicing operations until about 1935, when the cable tool method gave way to rotary drilling. Rotary operations employed high-speed, multiple cylinder internal combustion engines (*History of Petroleum Engineering* 1961; Brantly 1971; Beeby-Thompson 1950).

Oil Pumping Mechanisms

Successful oil wells required sufficient natural gas pressure to naturally raise oil above ground level. After the pressure dropped, a pump was installed on wells with the potential to be productive for long periods. In the older, partially depleted oil fields of western Pennsylvania, pumps were often necessary for new wells drilled after the boom period.

Single cylinder gas engines designed exclusively for pumping came into use in 1894 and by 1910 had fully replaced steam engines for pumping wells. Gas engines utilized natural gas drawn directly from the well head with a suction pipe and compressor. Other fuel sources were gasoline or light crude oil. The early "hit and miss" gas engine type was a heavy, slow-speed, flame-ignited version distinguished by its sound, as described by J.E. Brantly:

> In many pumping oil fields, these engines could be heard with a chug, chug, rattle, rattle, rattle, chug, chug, chug, rattle, rattle, rattle,

> rattle, chug, chug, chug and then there was a sort of a wheeze, a gasp and a cough, as though the last breath had been taken. At this instant, the kinetics of the flywheels took over and momentarily restored complete and serene composure. Then the clamorous cycle was started over again. All this was a melody to the pumper's ears and to the producer who was producing inexpensive oil for the market, because these engines were usually run on casinghead gas and were so sturdy they needed little attention or repair (Brantly 1971).

Varieties of beam pumping to raise the oil up from a non-flowing well were used on the first oil rigs and continue to be used today on modern unit pumpers. In principle, oil lift pumps are similar to those used for the deep pumping of water, working on the principle of displaced air. The relationship between pumping motions and loads is complex, however, and was not fully understood until the 1920s, resulting in many experimental beam pumping innovations between 1900 and 1920, most of which did not gain general acceptance. It was not until the period from 1922 to 1932 that the oil industry standardized beam pumping units (*History of Petroleum Engineering* 1961).

Examination of supply catalogs and trade journals from 1900 to 1920 illustrates the transition from powering by belt-driven band wheel to various types of smaller pumping jacks--made mostly of iron and steel--which were easier to maintain than the larger, older type of pumping apparatus. There were two major factors leading to the widespread acceptance of the unit pumping jack. The first was the development of efficient gear reduction designs, which allowed the use of multi-cylinder, high-speed gas engines. The second was the development of mobile well-servicing units, which eliminated the need for engine-powered derrick hoists at each well site (*History of Petroleum Engineering* 1961).

Engineers and manufacturers designing the first generation of pumping jacks were concerned primarily with the method of speed reduction, necessary with smaller diameter pulley wheels. The most common method was a system of double reduction, essentially employing an additional set of two wheels or gears to slow the pitman to proper oil pumping cadence, varying from between 15 to 60 revolutions per minute. The earliest designs between 1900 and 1915 combined the familiar belt-drive concept of the old-style rig with a set of two spur gears, where the belt-driven pulley-wheel axle was attached to a small spur gear, which in turn moved a larger spur gear attached to the pitman. The Heckert Oil Pumping Jack, manufactured by the T.W. Phillips Manufacturing Company circa 1908, used this system of double reduction.

Another method of driving the reducing spur gears, also used during this formative phase of pumping jack evolution, employed chain-driven sprockets substituted for belt-driven pulley wheels. By 1910, the first "directly connected"

pumping jacks appeared in advertisements in oil trade journals. Manufacturers of this type proudly proclaimed "No belts to buy," as the design eliminated belts and chains, instead substituting two sets of spur gears directly connected to the crankshaft for double reduction (*Oil and Gas Man's Magazine* 1907-1913).

In relatively shallow oil fields where wells are close together, central pumping units were often used to pump several--and as many as 20 or 30--wells at one time, with the pumping strokes synchronized for constant oil pool pressure and maximum pumping efficiency (Eaton 1912). This method was common in the upper and middle oil districts, and as far south as northern Butler County. The deeper wells of central and southern Butler County, spaced farther apart compared to areas northward, relied almost exclusively on individual pumping jacks (Levin 1941; Weber Interview 1992).

Deeper wells increased the prohlems of extreme loads placed on long strings of pumping rods, inspiring a search for alternative methods of lifting oil. About 1930, the electric submersible pump became commercially acceptable as a substitute for sucker-rod pumping. About the same time, a system of using hydraulic power transmission was introduced and accepted commercially. By the late 1930s, a variety of gas lift devices were successfully marketed for artificially lifting oil (*History of Petroleum Engineering* 1961).

Butler County's oil fields generally contained a lot of water, requiring larger than average pumping equipment because water is heavier than oil. Also due to the presence of water, Butler County rigs often operated 24 hours per day to constantly pump water out. Compared to wells of the upper district (centered in Venango County), Butler County wells generally had larger tubing, up to 3 inches in diameter compared to standard 2-inch tubing. Separator tanks were also common in Butler County, used at the site to separate water from oil (Packard Interview 1992).

When the oil pressure of a well dropped significantly, various repressurization methods could be used. Natural gas was used to inject pressure into old pools. Gas could also be pumped into the head of a well and forced to the bottom, where it mixed with oil and expanded, lifting the frothy oil to the surface. Compressed air, without a pump, could be piped into the bottom of a well with the same result. By the 1920s, vacuum pumps were used to change the pressure differential, but this method was sometimes inefficient due to leaks. Other methods involved repressurizing with steam or water. The latter method was considered a last resort, however, because its failure could result in the loss of the oil reservoir (Phelps and Lake 1924). In Butler County, the most common method of repressurization was gas injected into both wells and pools. In both the Bald Ridge and adjacent Thorn Creek oil fields, vacuum pumps were used exclusively with success; no other secondary recovery methods were ever tried (Lytle 1950).

The standardization of oil field equipment began in the 1920s with various standardization committees of the newly formed American Petroleum Institute (API). These committees were composed of engineers, manufacturers' representatives, and production men. Previous to their work, manufacturers rated equipment by different criteria, such as the size of crankshaft, horsepower, pounds of crank pull, torque, and feet of tubing a certain unit could handle. In the 1930s and early 1940s, various API committees worked to standardize the sizes of pumping structures and speed reducers and adopt certain formulae for determining working loads.

Oil Equipment Manufacturers

In the late nineteenth and early twentieth centuries, the two largest oil equipment supply companies were the Oil Well Supply Company and the National Supply Company. These companies supplied an array of equipment, including derricks, rigs, boilers, steam and gas engines, drilling tools, cables, pipes, and fittings. The Oil Well Supply Company was created by John Eaton, who migrated to western Pennsylvania from Massachusetts after the Drake well was struck. In the early 1860s, Eaton established the firm of Eaton, Cole and Burnham, which in 1878 became the Oil Well Supply Company. This company began with its main manufacturing department in Oil City. By 1902, it had additional factories in Pittsburgh and Bradford, Pennsylvania; Oswego, New York; Parkersburg, West Virginia; Van Wert, Ohio; and Poplar Bluff, Missouri. It also had 25 branch stores in all the major oil districts, as well as several agencies handling international trade. At Harmony, a small railroad junction town on the Connoquenessing Creek about 8 miles west of the Heckert Oil Pumping Jack's location, the Oil Well Supply Company had a machine shop and forge for manufacturing tools and repairing engines (*The Petroleum Industry...* 1934; Crum 1911; *Derrick's Handbook of Petroleum* 1898).

The firm of Bayne, Wilson and Pratt--formed in 1875 to supply the busy Bradford oil field--was enlarged and incorporated as the National Supply Company in 1894. This company was closely related to the National Transit Company, a subsidiary of the Standard Oil Company. With the acquisitions of the Buckeye Supply Company serving Ohio, Indiana, and the west, and Shaw, Kendall & Company of Toledo, the National Supply Company quickly became the largest manufacturer of oil supply equipment in the world, with major manufacturing plants in Pittsburgh and Toledo (*The Petroleum Industry...* 1934; Crum 1911; *Derrick's Handbook of Petroleum* 1898).

Other oil supply manufacturers in western Pennsylvania included: Bovaird & Seyfang Manufacturing Company, Bradford; Titusville Iron Company, Titusville; Ajax Iron Works, Corry; and the Oil City Boiler Works, Oil City. The oil industry also benefitted from design advances in engines used for agriculture, industry, and the numerous small shops and factories in the late nineteenth century. Between

1880 and 1930, western Pennsylvania fostered nearly 100 manufacturers of internal combustion gas engines, many with models specifically for powering oil pumping machinery (*Oil and Gas Man's Magazine* 1907-1913; "Cool Spring Power Museum" n.d.).

By the early 1900s, the lower oil district (including Butler County) had developed several manufacturers of oil field equipment. Many of these were located in Butler, located just 30 miles north of Pittsburgh, including: Spang & Company, Evans Manufacturing Company, Etna Manufacturing Company, Walter Campbell Machinery, T.W. Phillips Manufacturing Company, Kesselman & Company (specializing in drilling tools), Larkin and Company (specializing in packers), and Masseth Packer and Machine Works (*Oil and Gas Man's Magazine* 1907-1913; *R.L. Polk & Co.'s Butler Directory* 1896-1914).

T.W. Phillips and the T.W. Phillips Manufacturing Company

The Heckert Oil Pumping Jack was manufactured by the T.W. Phillips Manufacturing Company, a short-lived division of the T.W. Phillips Gas and Oil Company, both founded by Thomas W. Phillips. After unsuccessful oil exploration in Lawrence County, T W. Phillips (1835-1912) went to Oil Creek in 1861, where the first successful oil well was drilled two years earlier. With brothers Isaac, John, and Charles, he established the firm of Phillips Brothers, beginning a career that would make him one of the largest independent operators in the country. By 1873, Phillips Brothers was among the largest producers in the Parker and Troutman fields. During the oil price depression of 1873, however, the firm became heavily in debt, owing creditors $800,000 for loans related to oil exploration. Under great financial pressure, T.W. Phillips, who operated individually after the death of his brother Isaac, began vast oil exploration. Within 15 years the debt was fully repaid, largely with profits from the Bullion pool in Venango County (1876) and the Thorn Creek field in Butler County (1884) (Crum 1911; Sipe 1927).

In 1890 T.W. Phillips formed the firm of T.W. Phillips Sons and Company. The Phillips Gas Company was organized in 1896. In 1904, T.W. Phillips Gas and Oil Company was formed after acquisition of the Home Gas Company of Butler, Enterprise Natural Gas Company of Freeport, and the Citizens Fuel Company of Punxsutawney. At the time of Phillips's death in 1912, his company owned 850 oil and gas wells, 900 miles of gas pipeline, and a great amount of oil and gas leases throughout western Pennsylvania (Crum 1911; *Dictionary of American Biography* 1934). As chronicled in one of Butler County's superb local histories, "the development of the oil fields of Butler County and the oil business generally in western Pennsylvania owes more to the Honorable Thomas W. Phillips than any other man living or dead since the beginning of oil operations in 1859" (McKee 1909).

T.W. Phillips was active in the oil industry, local civic affairs, national politics, religion, and philanthropy. In 1887 he became president of the Producers' Protective Association, a secret organization of about 2,000 oil men formed to combat the Standard Oil monopoly. He was elected to Congress in 1892 and reelected in 1894, voluntarily retiring at the close of his second term. One of his greatest achievements in Congress was to introduce the bill creating the Industrial Commission, which led to the creation of the Department of Commerce and Labor and laws regulating corporations. While deviating from a childhood ambition to become a minister, Phillips was a licensed preacher and devoted much time and money to religion, erecting the First Christian Church of New Castle in 1865 and publishing *The Church of Christ* in 1905, an exposition about the Disciples of Christ. Phillips was also the primary founder of Oklahoma Christian University, renamed Phillips University after his death, and gave generous financial support to other institutions including Bethany and Hiram colleges ("Thomas W. Phillips" 1912; *Dictionary of American Biography* 1934) (see **Thomas W. Phillips**).

The expansion and diversification of T.W. Phillips Gas and Oil Company during the first decade of the twentieth century was due largely to the growing role of the sons of T.W. Phillips. During this period, T.W. Phillips, Jr. (born 1874) served as secretary, treasurer, and vice-president, becoming president at his father's death in 1912. Diversification was largely due to T.W. Phillips Jr., who was also interested in banks and mining companies, serving as a director of the Shell Union Oil Corporation of New York, Manufacturers Light and Heat Company, Pittsburgh, and west Penn Cement Company, Butler (Sipe 1927).

This climate of expansion fostered the T.W. Phillips Manufacturing Company, which apparently existed from 1905 through 1912. This small arm of the larger company is not mentioned in the brief histories of T.W. Phillips and his company, and staff of the current T.W. Phillips Gas and Oil Company know very little about it (Swanton Interview 1992). There are no known supply catalogs for this company. Information about this manufacturing company was gleaned from oral interviews with oil technology specialists and the scant information contained in city directories, business directories, and advertisements in trade journals.

The Butler city directory's first listing for the T.W. Phillips Manufacturing Company in 1906 shows the officers as T.W. Phillips as president with T.W. Phillips, Jr. as secretary and treasurer. By 1907, T.W. Phillips, Jr. had become president, with Felix C. Negley as secretary, and Benjamin Phillips as treasurer. A blank piece of letterhead in the file of the Drake Well Museum, Titusville, also lists the chief engineer, A.F. Clarke. The T.W. Phillips Manufacturing Company first appears in the Butler city directory for 1906; since this directory was copyrighted in 1905, we can surmise that the company was founded some time in 1905. Its latest appearance is in the 1912 city directory. Company advertisements appeared in the *Oil and Gas Man's Magazine* during exactly this same period.

The T.W. Phillips Manufacturing Company was a small machine shop, located at the corner of Monroe and Cunningham Streets, Butler, where the current T.W. Phillips Gas and Oil Company has a warehouse (Weber Interview 1992; Swanton Interview 1992). Advertisements for the T.W. Phillips Manufacturing Company were typical of other small manufacturing companies of the period. The scope of advertising, however, appears to have been limited to the oil market in western Pennsylvania, probably due to the relatively small size of the company. There was no entry for the company, for example, in the *National Iron and Steel, Coal and Coke Blue Book*, published in Pittsburgh, the standard reference for the region with information on a variety of manufacturing companies, including oil field suppliers.

From the beginning, the company was advertised as both manufacturer and dealer in an array of oil field products, including gas engines, pumping jacks, water pumps, packers, casing, tubing, and pipe. The earliest ads, appearing through 1908, indicate that the company manufactured their specialty--gas engines--and packers during its first three years. Ads beginning in 1909 reveal that pumping jacks, reversible clutches, and wire line pumping outfits were added to the repertoire, with other items obtained from other suppliers (see **1909 Ad for T.W. Phillips Manufacturing Company**).

A search of the *Annual Report of the Commissioner of Patents* from 1901 through 1914 did not reveal a patent for the Phillips pumping jack. These *Annual Reports* contain only three patents assigned to the T.W. Phillips Manufacturing Company. The first, entered in 1906, was for a clutch (Patent No. 823,260) patented by John J. Campbell and Hiram C. Johnson of Butler, with the patent assigned to the T.W. Phillips Manufacturing Company. The second patent assigned to the Company was entered in 1908 by V.H. Palm of Butler, for a sand pump and bail (No. 880,462). The third was entered in 1910 by Arthur F. Clarke, the Company's engineer, for a reversible gearing mechanism (No. 954,169) separate from the engine.

It is likely that some products made by the T.W. Phillips Manufacturing Company were never patented. A few of its products were patented under the name of the individual inventor. Interestingly, Thomas W. Phillips, Jr. patented an oil well packer in 1905 (No. 802,880), which is undoubtedly the packer referred to in the early Phillips ads. There were no other entries by Thomas Phillips, Jr. during the period when his manufacturing company was in existence. Other patents by A.F. Clarke during this period were for an "adjusting device" (1906), a discharge valve for gas compressors and a lubricating device (1907), an "explosive engine" and ignition device for engines (1909), a releasing device for well pumps and a combination stuffing box/clamp (1910) (*Annual Report of the Commissioner of Patents*, 1905-1910).

It is not known with certainty why the T.W. Phillips Manufacturing Company ceased production in 1912, coinciding with the death of T.W. Phillips that same year. It is apparent that his sons decided to focus on other areas of expansion, perhaps determining that the manufacturing division was unprofitable. Whatever the reasons, the larger company's foray into manufacturing gas engines, pumping jacks, and other items typifies the western Pennsylvania oil man's tendencies toward continual mechanical experimentation, improvement, and financial risk.

SOURCES OF INFORMATION

The written narrative and graphics resulted from research at a variety of federal, state, and local repositories, archives, and agencies including: the Library of Congress, Washington, D.C.; Smithsonian Institution, Division of Agriculture and Natural Resources, Division of Engineering and Industries, Washington, D.C.; National Park Service, HABS/HAER division, Washington, D.C.; American Petroleum Institute library, Washington, D.C.; United States Geological Survey, Cartographic Information Section library, Reston, Virginia; University of Pittsburgh library, Pittsburgh; Carnegie Library, Pittsburgh; Historical Society of Western Pennsylvania, Pittsburgh; Butler County Courthouse, Butler, Pennsylvania; Butler County public library, Butler; Butler County Historical Society, Butler; Pennsylvania Geological Survey, Pittsburgh; Pennsylvania Bureau of Archives and History library, Harrisburg; Drake Well Museum archives and library, Titusville, Pennsylvania; and the Cool Spring Power Museum library, Cool Spring, Pennsylvania.

Personal and telephone interviews with local residents familiar with this structure and related land use history were also helpful for the current study. These interviews are included in the Bibliography.

Information about the T.W. Pbillips Manufacturing Company and its products was gathered from a variety of sources. However, there are no known supply catalogs for the company, probably due to its small size and short duration. No other Phillips pumping jacks were identified during this project, either in the field or in museum collections. According to John W. Neth, owner of a Phillips gas engine, there are at least four known Phillips engines owned by individuals in addition to two owned by the Cool Spring Power Museum (Neth Interview 1992).

BIBLIOGRAPHY

Annual Report of the Commissioner of Patents
1901-1914 Washington, D.C.: n.p.

Ashley, George H. and J. French Robinson
1922 *The Oil and Gas Fields of Pennsylvania.* Volume 1. Harrisburg: Pennsylvania Bureau of Topographic and Geological Survey.

Bacon, Raymond Foss and William Allen Hamor
1916 *The American Petroleum Industry.* Volume 1. New York: McGraw-Hill Book Company, Inc.

Beeby-Thompson, A.
1950 *Oil-Field Exploration and Development.* Volume 2, *Oil-Field Practice.* Kingston Hill, Surrey: Technical Press, Ltd.

Brandon, J. Campbell
1962 *A Concise History of Butler County, Pennsylvania, 1800-1950.* Butler: Butler County Historical Society.

Brannt, William T.
1895 *Petroleum: Its History, Origin, Occurrence, Production, Physical and Chemical Constitution, Technology, Examination and Uses; Together with the Occurrence and Uses of Natural Gas.* Philadelphia: Henry Carey Baird & Co.

Brantly, J.E.
1971 *History of Oil Well Drilling.* Houston: Gulf Book Publishing Company.

Butler County, Pennsylvania
1950 n.p.: Butler County Sesqui-Centennial Association.

Butler County Deed Books, Will Books, Sheriff's Books, Tax Assessments, Court Records and Estate Files at the Butler County Courthouse, Butler, Pennsylvania.

Carll, John F.
1880 *The Geology of the Oil Regions of Warren, Venango, Clarion, and Butler Counties, including Surveys of the Garland and Panama Conglomerates in Warren and Crawford, and in Chautauqua County, New York, Descriptions of Oil Well Rig and Tools, and a Discussion of the Preglacial and Postglacial Drainage of the Lake Erie Country.* Harrisburg: Board of Commissioners for the Second Geological Survey.

Clark, Joseph S.
1957 *The Oil Century.* Norman: University of Oklahoma Press.

"Cool Spring Power Museum"
n.d. Brochure of the Cool Spring Power Museum, Cool Spring, Pennsylvania.

Cross, Roy
1928 *A Handbook of Petroleum, Asphalt, and Natural Gas.* Bulletin No. 25. Kansas City, Missouri: Kansas City Testing Laboratory.

Crum, A.R., ed.
1911 *Romance of American Petroleum and Gas.* Volume 1. New York: Romance of American Petroleum and Gas Company.

Day, David T.
1922 *A Handbook of the Petroleum Industry.* Volume 1. New York: John Wiley & Sons, Inc.

The Derrick's Hand-Book of Petroleum: A Complete Chronological and Statistical Review of Petroleum Developments form 1859 to 1898
1898 Volume 1. Oil City: Derrick Publishing Company.

The Derrick's Hand-Book of Petroleum: A Complete Chronological and Statistical Review of Petroleum Developments form 1859 to 1898
1900 Volume 2. Oil City: Derrick Publishing Company.

Dictionary of American Biography
1934 s.v. "Phillips, Thomas Wharton."

Doherty, Robert G., comp.
1989 "Mining and Energy." In *The Atlas of Pennsylvania,* edited by David J. Cuff, William J. Young, Edward K. Muller, Wilbur Zelinsky, Ronald F. Abler, 104-107. Philadelphia: Temple University Press.

Donehoo, George P., ed.
1926 *Pennsylvania: A History.* Volume 4. New York: Lewis Historical Publishing Company.

Eaton, John
1912 "Evolution of Oil Well Machinery." *Oil and Gas Man's Magazine* 7:313-329.

Fronczek, William
1992 Telephone interview. Pittsburgh, Pennsylvania, 5 April 1992,

Giddens, Paul H.
1964 *Early Days of Oil: A Pictorial History of the Beginnings of the Industry in Pennsylvania.* Gloucester, Massachusetts: Peter Smith.

1974 *The Early Petroleum Industry*. Philadelphia: Porcupine Press.

Goldinger, Ralph
n.d. *Historic Saxonburg and Its Neighbors.* Apollo, Pennsylvania: Saxonburg Historical and Restoration Commission.

Harvey, Paul
1992 Letter to Christopher Martin, Engineering-Science, Chartered, 14 October 1992.

History of Butler County, Pennsylvania
1895 Volume 1. n.p.: R.C. Brown & Co., Publishers.

History of Petroleum Engineering
1961 New York: American Petroleum Institute.

Kearns, Arthur
1992 Tape-recorded interview. Renfrew, Pennsylvania, 6 April 1992.

Klein, Philip S. and Ari Hoogenboon
1980 *A History of Pennsylvania.* 2nd Edition. University Park: Pennsylvania State University Press.

Leven, David D.
1941 *Petroleum Encyclopedia, Done in Oil.* New York: Ranger Press, Inc.

List, William J.
1992 Telephone interview. Meridian, Pennsylvania, 4 November 1992.

Lytle, William S.
1950 *Crude Oil Reserves of Pennsylvania.* Bulletin M32. [Harrisburg:] Pennsylvania Geological Survey.

McBeth, Reid Sayers
1919 *Oil: The New Monarch of Motion.* New York: Markets Publishing Corporation.

McCorry, Len G., Collection
Butler County Historical Society, Butler, Pennsylvania.

McCorry, Len G.
1970 *Beautiful Bountiful Butler County, 1776-1983.* Butler: Butler County Historical Society.

McKee, James A.
1909 *20th Century History of Butler and Butler County, Pa. and Representative Citizens.* Chicago: Richmond-Arnold Publishing Co.

McLean, John G. and Robert W. Haigh
1954 *The Growth of Integrated Oil Companies.* Boston: Harvard University Press.

Miller, Ernest C.
1946 *Oil Mining in Pennsylvania.* University Park, Pennsylvania: Pennsylvania Historical Association.

1969 "A Guide to the Early History of Pennsylvania Petroleum." *Western Pennsylvania Historical Magazine* 52 (October):363-385.

Miller, H.C.
1929 *Function of Natural Gas in the Production of Oil.* New York: American Petroleum Institute in cooperation with the Bureau of Mines.

Moser, Melvin
1992 Telephone interview. Portersville, Pennsylvania, 17 November 1992.

National Iron and Steel, Coal and Coke Blue Book
1902-1916 Pittsburgh: R.L. Polk & Company.

National Park Service
1991 "Guide for the Preparation of Photographic Documentation in Accordance with the Standards of the Historic American Buildings Survey/Historic American Engineering Record." Prepared by the Cultural Resource Planning Branch, Mid-Atlantic Region, National Park Service.

1992 "Guide to Written Reports for the Historic American Engineering Record." Prepared by the Cultural Resource Planning Branch, Mid-Atlantic Region, National Park Service.

National Supply Company
1921 *Machinery, Tubular Goods, Tools and Supplies for Oil, Gas and Water Wells.* Toledo, Ohio: The National Supply Companies.

Neth, John W.
1992 Telephone interview. Johnson City, Tennessee, 4 November 1992.

Oil and Gas Man's Magazine
1907-1913 Butler, Pennsylvania: Oil and Gas Men's Association of Western Pennsylvania.

Oil Well Supply Company
1902 *Price List: Gas, Oil, Water Wells.* Pittsburgh: Oil Well Supply Company.

1904 *Well-Drilling Machinery and Tools, No. 15.* Pittsburgh: Oil Well Supply Co.

1916 *General Catalogue and Price List.* Pittsburgh: Oil Well Supply Company.

Packard, Vance
1992 Telephone interview. Pennsylvania Bureau for Historic Preservation, Harrisburg, Pennsylvania, 5 May 1992.

Petraglia, Michael D., Dennis A. Knepper, Christopher Martin and Mara E. Rosenthal
1992 *Phase 1 Survey and Phase II Testing Along the CNG Natural Gas Pipeline (TL-400 Extension 1), Beaver, Butler and Armstrong Counties, Pennsylvania.* Report submitted to CNG Transmission Corporation, Clarksburg, West Virginia.

Petraglia, Michael D., Dennis A. Knepper, Christopher Martin, Holly Heston, Madeleine Pappas and Frances Alexander
1992 *Phase II Testing and Additional Phase I Survey Along the CNG Natural Gas Pipeline (TL-400 Extension 1), Beaver, Butler and Armstrong Counties, Pennsylvania.* Report submitted to CNG Transmission Corporation, Clarksburg, West Virginia.

The Petroleum Industry, 1859-1934
1934 Tulsa, Oklahoma and Oil City, Pennsylvania: *The Oil and Gas Journal* and *The Oil City Derrick.*

Pozar, Stephen M. and Jean B. Purvis
n.d. *Butler: A Pictorial History* Virginia Beach: Donning Company.

Richardson, G.B.
1936 *Geology and Mineral Resources of the Butler and Zelienople Quadrangles, Pennsylvania.* Geological Survey Bulletin No. 873. Washington, D.C.: U.S. Department of the Interior.

Saylor, Roger B.
1964 *The Railroads of Pennsylvania.* Industrial Research Report No. 4. University Park: Pennsylvania State University Press.

Sipe, C. Hale
1927 *History of Butler County, Pennsylvania.* Volume 1. Topeka: Historical Publishing Company.

Sisler, J.D., G.H. Ashley, F.T. Moyer and W.O. Hickok, 4th
1933 *Contributions to Oil and Gas Geology of Western Pennsylvania.* Bulletin M19. Harrisburg: Pennsylvania Topographic and Geologic Survey.

Swanson, E. B.
1960 *A Century of Oil and Gas in Books.* New York: Appleton-Century-Crofts, Inc.

Swanton, Keith
1991 Telephone interview. T.W. Phillips Gas & Oil Company, Butler, Pennsylvania, 6 August 1992.

Taber, Thomas T., III
1987 *Railroads of Pennsylvania Encyclopedia and Atlas.* Muncy, Pennsylvania: Published by author.

"Thomas W. Phillips"
1912 Obituary in *Oil and Gas Man's Magazine.*

Weber, David
1992 Personal interview. Drake Well Museum, Titusville, Pennsylvania, 1 October 1992.

Weeks, Jos. D.
1887 "Petroleum" and "Natural Gas." In David T. Day, *Mineral Resources of the United States.* Washington, D.C.: United States Geological Survey, 1887.

Well Records
Pennsylvania Topographic and Geological Survey, Department of Environmental Resources, Pittsburgh.

Wilson, Charles Morrow
1946 *Oil Across the World.* New York: Longmans, Green and Company.

MAPS CONSULTED

Regional/County Maps

1858 Dunlap, Jas. Hugh McKee, David Scott, E. Maurhoff, and J.W. Kirker. Land ownership map for Butler County. n.p.

1871 Aschback, G.A. *Map of the Lehigh Valley Rail Road, Penna. & N.Y. Canal & Rail Road and Connecting Lines.* In *Railroad Maps of North America: The First Hundred Years.* Washington, D.C.: Library of Congress.

1874 *Combination Atlas of the County of Butler and the State of Pennsylvania.* Philadelphia: G.M. Hopkins & Co.

1876 Caldwell, J.A. *Railway Map of the State of Pennsylvania.*

1895 *Outline Map of Butler Co., Penn.* In *History of Butler County, Pennsylvania.* n.p.: R.C. Brown & Co., Publishers.

1916 Hammond, C.S. & Company. *Road and Township Map: Butler County, Pennsylvania.* New York: Orange Judd Company.

1925 *Bessemer and Lake Erie Railroad.* In Bessemer and Lake Erie Railroad Time Tables, No. 63.

Geology/Oil and Gas Fields

1871 Wrigley, Henry E. *Map of the Pennsylvania Oil Region with part of Crawford, Erie, Warren, Forest, Armstrong, Butler, Clarion, Lawrence, and Mercer Counties Showing the County Township and Tract Lines, Cities, Towns, Villages, Railroads, Pipelines, and Outlines of the Territory Now Producing.* n.p.

1874 Wrigley, Henry E. *Condensed Map of the Pennsylvania Oil Region Showing the Entire District So Far Developed and the Actual Productive Areas Together with the Railroads, Pipelines and Other Useful Details to Date.* New York: American Photo-Lithographic Company.

1876 Heydrick Brothers and Stevenson. *Map of Petroleum Oil Sands Known as the Third Sand Oil Belt in Butler County, Pennsylvania.* Millerstown, Pa.: n.p.

1885 Lesley, J.P. *A Geological Hand Atlas of the Sixty-Seven Counties of Pennsylvania, Embodying the Results of the Field Work of the Survey, From 1874 to 1884.* Harrisburg: Board of Commissioners for the Second Geological Survey.

1886 *Heydrick's Map of the Oil Field from Thorn Creek to Shannopin.* Barnhart Mills, Pennsylvania: J.A. Heydrick & Son.

1887 Carll, John F. *Map of the Oil Regions of Pennsylvania and New York.* n.p.: Geological Survey of Pennsylvania.

1889 Harden, E.B. *Map of Western Pennsylvania and Contiguous Portions of New York, Ohio and West Virginia Showing the General Outlines of Oil and Gas Producing Areas.* [Harrisburg:] Geological Survey of Pennsylvania.

c.1890 Opperman, J. *Map Showing the Developed Oil Fields of Western Pennsylvania and New York.* Bradford, Pennsylvania: n.p.

1896 Douglas and Heydrick. Untitled map of oil fields in Butler County, Pennsylvania. n.p.

c.1902 *The Oil Regions of Pennsylvania, Ohio, and West Virginia.* n.p.

1915 Hice, Richard R. *Oil and Gas Pools of Southwestern Pennsylvania.* Topographic and Geologic Survey of Pennsylvania. Harrisburg: W.S. Ray.

1921 Richardson, G.B., comp. *Oil and Gas Fields of Pennsylvania.* Washington, D.C.: United States Geological Survey.

1932 Sisler, James D. *Oil and Gas Fields of Pennsylvania.* [Harrisburg:] Pennsylvania Department of Internal Affairs.

1932 Hickok, William O., 4th. *Crude Oil and Gasoline Pipe Lines.* Harrisburg: Pennsylvania Bureau of Topographic and Geologic Survey.

1950 Lytle, William S. *Principle Oil Fields of Pennsylvania.* In *Crude Oil Reserves of Pennsylvania.* Bulletin M32. Harrisburg: Pennsylvania Geological Survey.

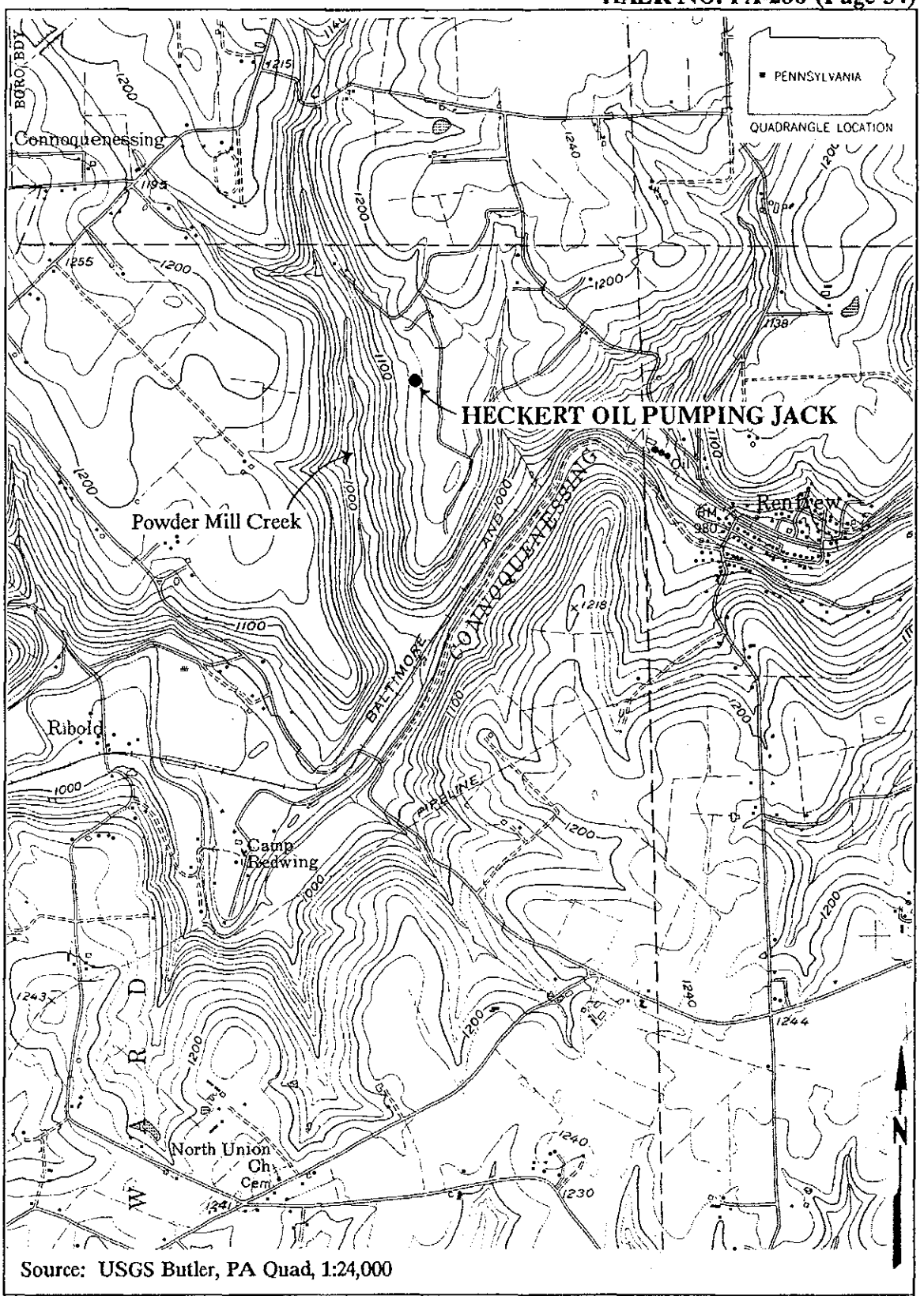
1953 Jones, Thomas H. and Lillian Heeren, comp. *Oil and Gas Fields of Pennsylvania.* [Harrisburg:] Pennsylvania Geological Survey.

1953 Jones, Thomas H. and Lillian Heeren, comp. *Principal Crude Oil and Product Pipe Lines of Pennsylvania.* [Harrisburg:] Pennsylvania Geological Survey.

1955 Lytle, William S. and Lillian A. Heeren, comp. *Oil and Gas Field Atlas of the Butler Quadrangle.* Harrisburg: Pennsylvania Department of Internal Affairs, Topographic and Geologic Survey.

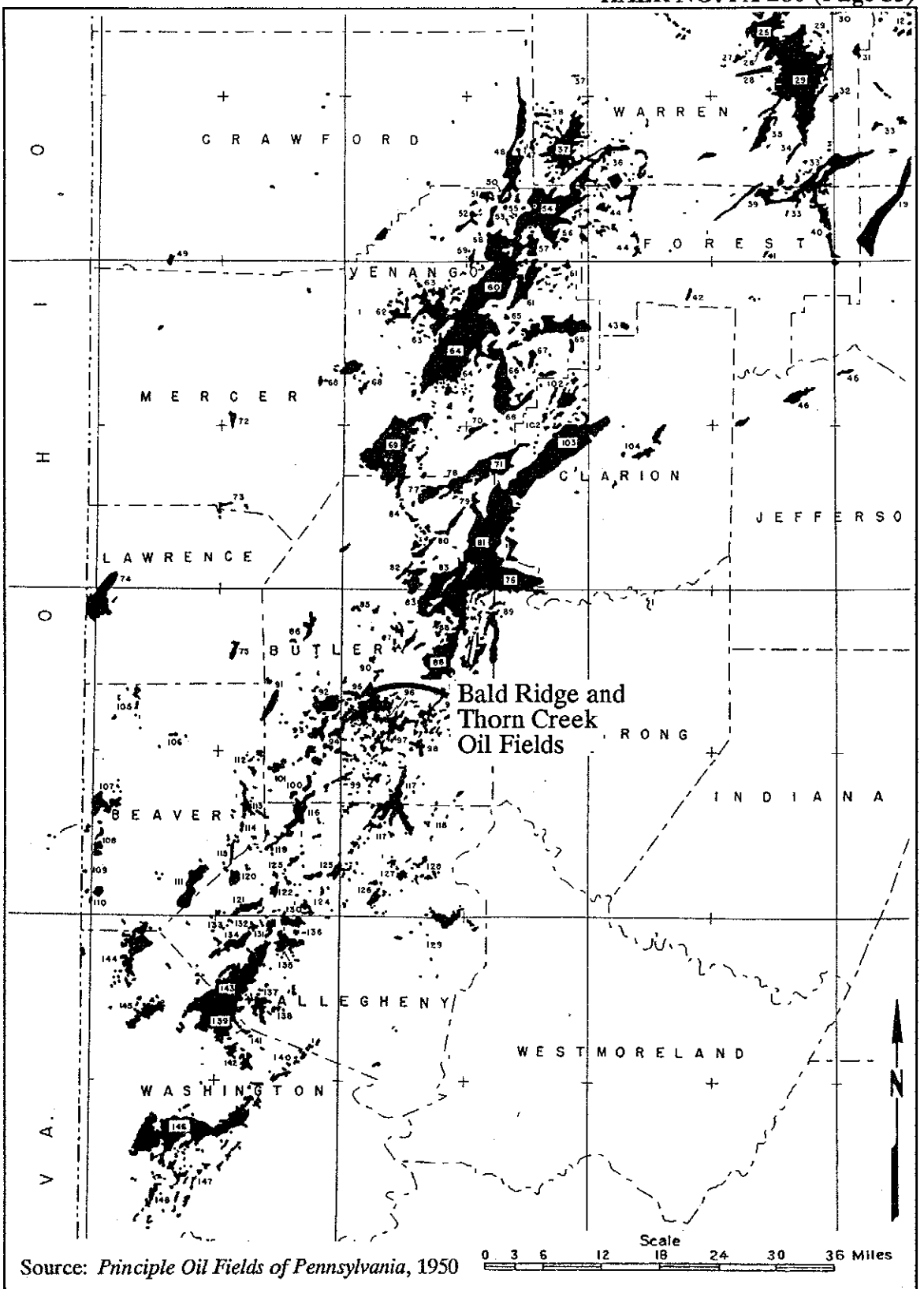
1975 Lytle, W.S. and L. Balogh. *Greater Pittsburgh Region Oil and Gas Field Map.* [Harrisburg:] Pennsylvania Bureau of Topographic and Geologic Survey.

1989 Oil and Gas, Butler, Pennsylvania Quadrangle. Washington, D.C.: United States Geological Survey.



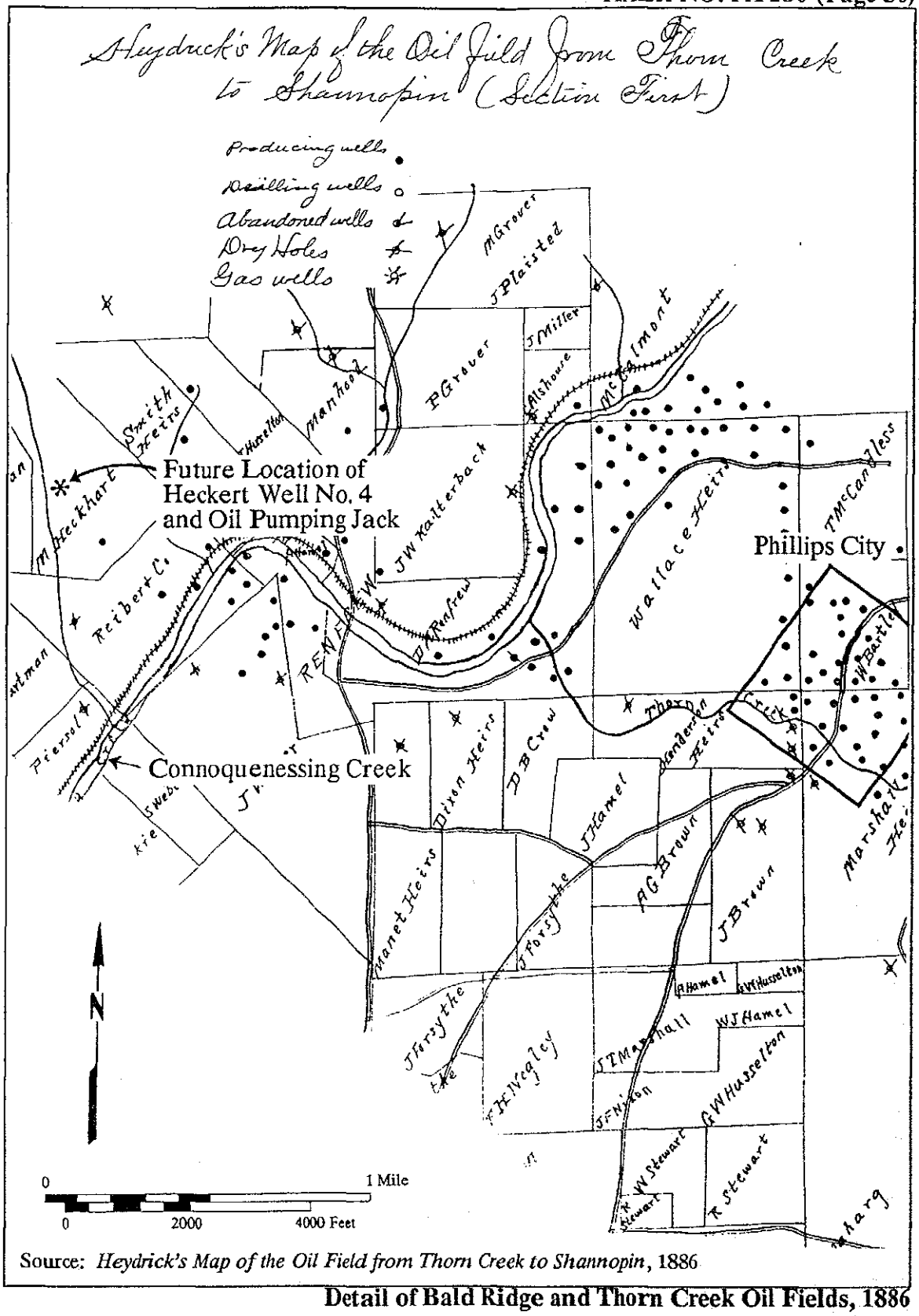
Source: USGS Butler, PA Quad, 1:24,000

Location Map



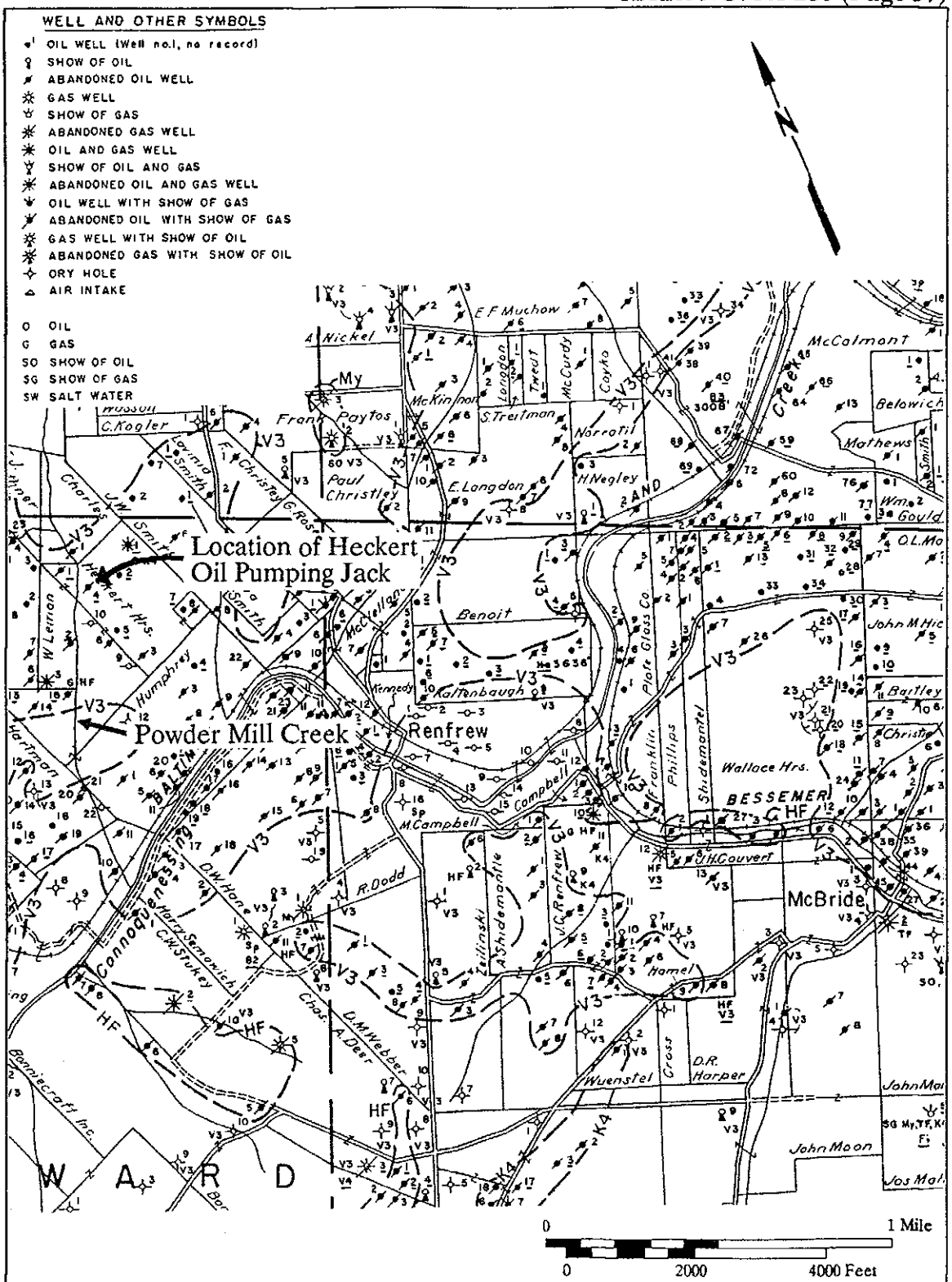
Source: *Principle Oil Fields of Pennsylvania*, 1950

Pennsylvania Oil Fields



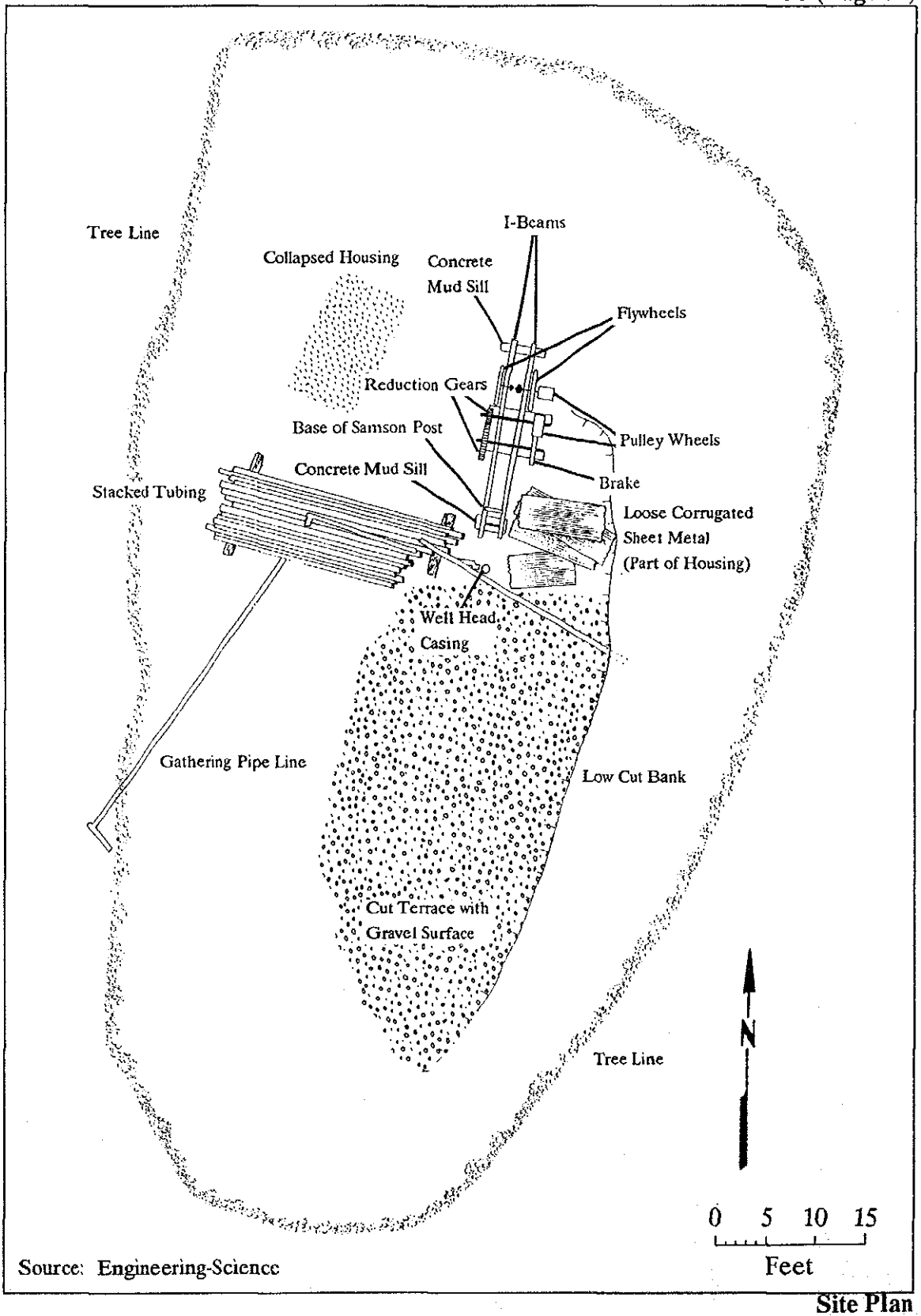
Source: *Heydrick's Map of the Oil Field from Thorn Creek to Shannopin*, 1886

Detail of Bald Ridge and Thorn Creek Oil Fields, 1886



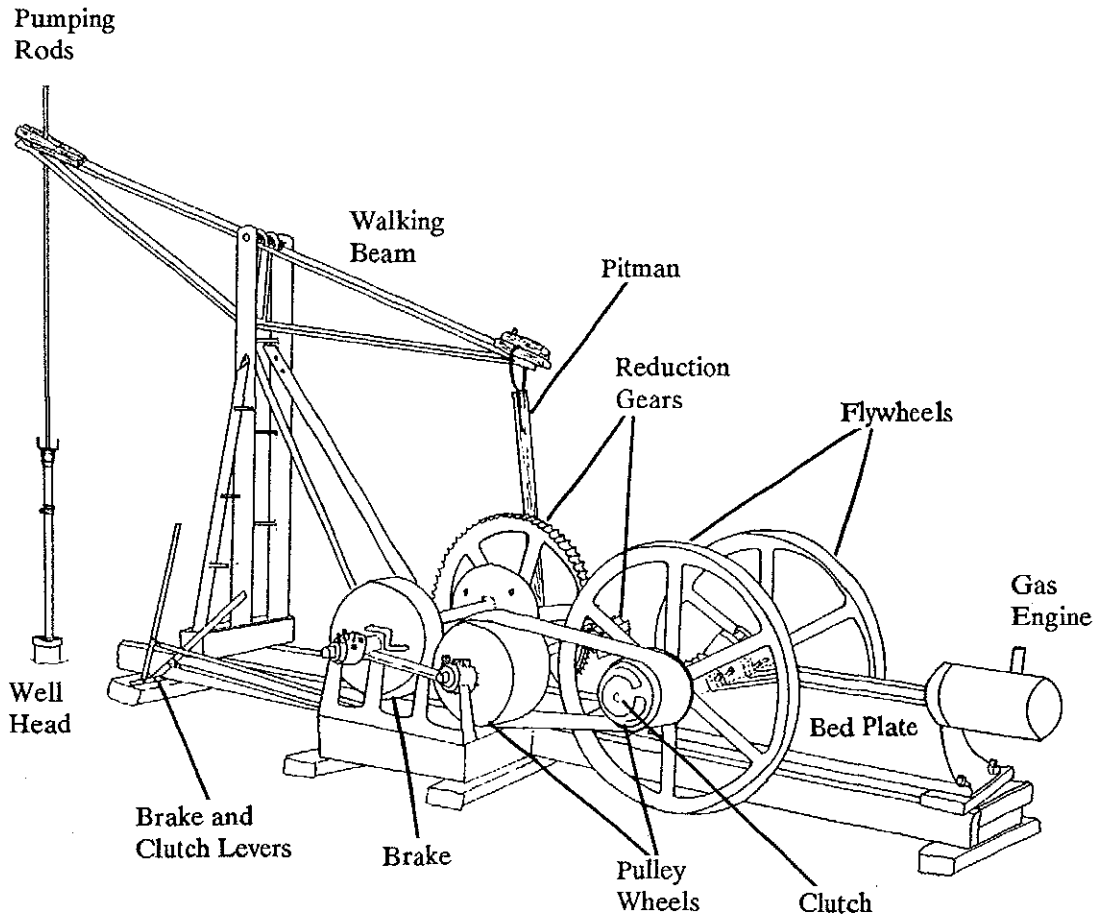
Source: *Oil and Gas Field Atlas of the Butler Quadrangle*, 1955

Detail of Oil/Gas Leases in Butler County, 1955



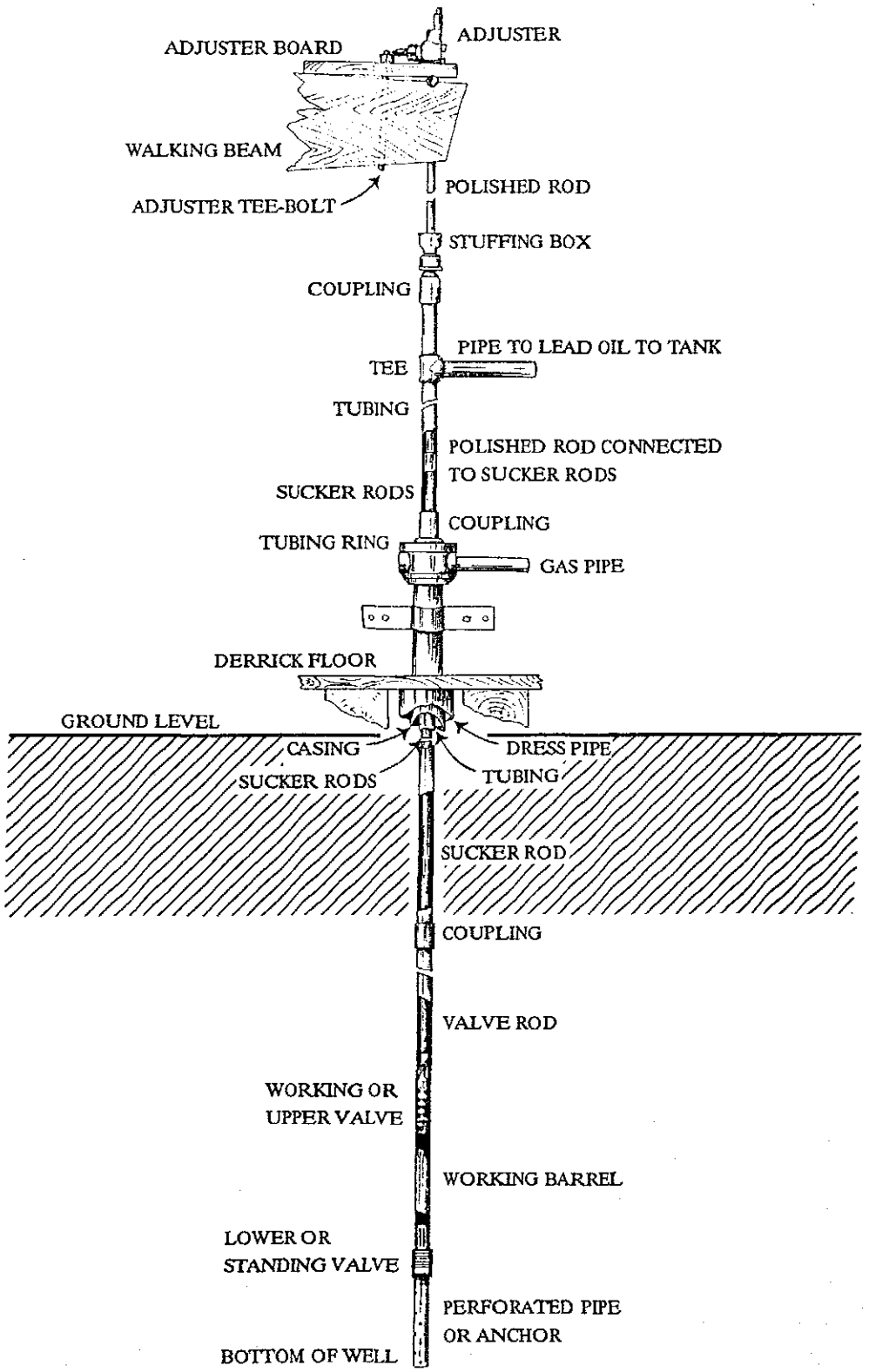
Source: Engineering-Science

Site Plan



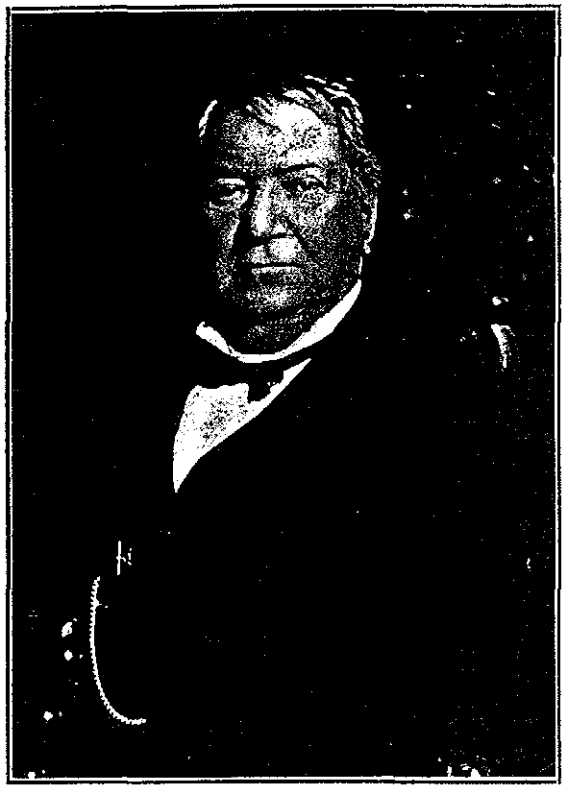
Source: Engineering-Science

Schematic View of Heckert Pumping Jack



Source: Adapted from *Handbook of the Petroleum Industry*, 1922

Detail of Typical Pumping Assembly, C.1910



Source: *Romance of American Petroleum and Gas*, 1911

Thomas W. Phillips, C.1905

Source: *Oil and Gas Man's Magazine*, 1909

1909 Ad for T.W. Phillips Manufacturing Company