West Oil Company:
Endless Wire Pumping Operation
Petroleum vicinity (Volcano vicinity)
Ritchie County
West Virginia

HAER No. WV-9

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
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HISTORIC AMERICAN ENGINEERING RECORD

WEST OIL COMPANY: ENDLESS-WIRE OIL PUMPING RIG

HAER WV-9

Location:	Petroleum vicinity (Volcano), West Virginia Petroleum guad 17.4758184343105
Date of Construction:	1895, 1900, 1902
Present Owner:	Wood County Court
Significance:	A rare example of a technology which was once considered to be the best available means of long distance power transmission. The endless-wire cable method was introduced and advanced in the United States by John Roebling and his sons as a likely market for the products of their cable factory. Its use here was a result of the decline of flowing wells and the increased necessity of pumping the oil out of the ground. The technique was adapted to local conditions by William C. Stiles. This particular installation dates to about 1895 when Michael West first leased the oil rights to this land from the Volcanic Oil and Coal Company.
Historian:	Dennis M. Zembala, 1975

INTRODUCTION

During the summer of 1972, "Old Buckeye," the oil-pumping machinery of the West Oil Co. near Volcano, West Birginia, was still operating after nearly 70 years of service. The incongruity of its Rube Goldberg construction and its sylvan location in the hill country east of Parkersburg was sufficient to inspire curiosity in the most casual observer. From its central powerhouse in an old frame hsed, continuous loops of wire cable, the "endless wires," ran off into the woods from well to well for three-fourths of a mile. At each well, a series of three wheels transformed the linear motion of the cable to a vertical pumping motion by means of a crank and a walking beam. Until 1971, "Old Buckeye" had been run by George West, the 87-year-old son of the man who had built it.

One of the most striking aspects of the whole operation was its similarity to the small and middle-sized farming typical of the surrounding area. Like these farms, the West Oil Company was isolated and quite self-sufficient as both a working and a living unit. With few exceptions, parts for Old Buckeye had been manufactured on the site from local materials. These included two band wheels, one of over 17 feet and the other of 12 feet diameter, made of solid oak segments and spokes. The three smaller wheels at each well were of similar construction, made in West's "machine shop" from timber cut on the site. The machine shop itself was not unlike those found on small farms and included an assortment of general-purpose woodworking machines, such as a table saw, lathe, planer, jigsaw, drill press and wheel lathe. These tools and a small blacksmith's forge made the West Oil Company virtually self-sufficient in terms of replacement and repair of its equipment.

Perhaps the most striking similarity between this "petroleum farm" and small-scale agriculture lay in the daily work routine. [See videotape on Volcano made by WWVU-TV in 1971, WWVU-TV. Morgantown, West Virginia.] Each morning before breakfast, George West would go to the powerhouse to start up his engine. Once Old Buckeye was running, West would lubricate the engine and then begin his circuit of the wells, connecting some to the driving mechanism and disconnecting others. Like the farmer's cow, each well had its idiosyncracies and could only be pumped sporadically. Most were worked from one to four hours in the morning and two hours in the afternoon, each yielding from one-half to two barrels per day. Like local farmers, West spent much of his time during the winter repairing and replacing worn parts. When temperatures fell below freezing, the oil could not be pumped.

Finally, "petroleum farming" like the area's agriculture was often a lonely business. Like a hill country farm, the West Oil Company was relatively isolated. George West lived in a house on the site with his son. The two of them grew much of their food in a small garden at the front of the house. In good weather, a Saturday trip into Parkersburg for shopping and recreation distinguished the end of each week.

The singular and remarkable location of this industrial process in its rural setting demands explanation. Its survival, using primarily wooden technology, seems anacronistic in an era of metal machines and tools. The small scale and almost subsistence level of production seems incongrous in view of the size and technological sophistication of many modern petroleum operations. And, finally, the sheet endurance of the technology and the social and economic conditions of those associated with it seems astounding in view of the speed of recent technological change. The following analysis of the development of the oil industry in the region and of the West Oil Company, in particular, is intended to shed light on these apparent incongruities.

Although the early history of the oil industry in West Virginia is overhsowed by the rapid growth of the western Pennsylvania fields, Drake's well in Titusville (1859) preceeded the West Virginia discoveries by only a few months. The presence of oil in the salt wells along the Kanawha and Little Kanawha Rivers had long been known, but it was considered a nuisance rather than a valuable commodity. During the 1830's and 40's, the country was subjected to an "illumination revolution" based on oil and gas derived from coal. The discovery that illuminating oil could also be derived from petroleum led to the rapid exploitation of known sources. During 1859, while Drake was drilling at Titusville, Charles Shattuck, a Pittsburgh coal-oil refiner, was similarly occupied on the banks of the Hughes River near Burning Springs - at that time, part of the State of Virginia. Unlike Drake's well, the two drilled by Shattuck turned out to be dry holes, but the following spring, two of Shattuck's friends from Pittsburg, along with their brother, Samuel P. Karnes, began pumping oil from an old salt well at Burning Springs on the Little Kanawha. This well had been leased from J. V. Rathbone, a local farmer and salt boiler, and in April, seeing Karnes' success, Rathbone began drilling his own well nearby. In July, 1860, the Rathbone well began producing 100 barrels a day at a depth of 303 feet. Shortly after, Hazletts and Company of Wheeling brought in a well near what is now Petroleu , West Virginia, on the Parkersburg Branch of the Baltimore & Ohio Railroad (then known as the Northwestern Virginia Railroad). The next three years saw development in the Burning Springs field rivaling that at Titusville. The population of Burning Springs in 1860 rose from 20 in the spring to approximately six thousand by August. [2] By the spring of 1863, an estimated 225 productive wells had been brought in by entrepreneurs paying $1,000 per acre and royalties of 1/3 of production to the Rathbones and their associates. Production for the year 1861 reached an estimated 4 million gallons. [3] The influx of oil seekers led to the growth of a substantial town at the site, and in April of 1861, the Virginia Legislature passed an act of incorporation for the town of Rathbone. It also authorized construction of a turnpike to carry the oil in barrels to the mouth of Burnign Springs where they could be loaded onto boats on the Little Kanawha. [4] By 1863, the development of the Burning Springs field gave every inidcation of rivaling that of the Pennsylvania regions.

The spread of development northward from Burning Springs into the Volcano field was delayed by the advent of the Civil War. Many of those involved in the Burning Springs enterprise left to fight on both sides, leaving a shortage of manpower and capital. Those who remained saw their efforts go up in smoke when the Confederate forces under General Imboden destroyed the entire complex on May 9, 1863. Rebuilding was impossible, while the area was in damger of attack, and new discoveries in Pennsylvania at Cherry Run (1864) and Pithole (1865) focused attention away from West Virginia.

The opening of the Volcano field at the end of the war was largely the work of Johnson Camden, a lawyer and land speculator from Weston. Camden had been one of the first to exploit the Burning Springs field in 1860. After arranging to purchase 200 acres from Rathbone for $100,000, he raised the money be selling three-fourths interest to several relatives and friends. This group formed the Kanawha Burning Springs Petroleum Company and leased lots to those desiring to drill wells.* [5] After the destruction of the Burning Springs field, Rathbone and Camden moved the scene of their activities north to the banks of the Hughes River, where flowing wells were bored early in 1864. (See map. HAER, sheet 1 of 5) Camden soon acquired a tract of 3000 acres in Wood County and 1300 acres on the border of Wood and Pleasants counties to the north. [6] As at Burning Springs, he financed this transaction by selling shares to others, in this case, to a group of Philadelphia investors headed by William C. Stiles, Jr. - soon to become one of the leading figures in the Volcano field. The group then formed the Volcanic Oil and Coal Company and deeded their holdings to the new corporation in return for stock valued at $380,000. [7] Under the direction of Stiles, the company immediately began developing its holdings, following the practices which Camden had evolved at Burning Springs. [8] During 1865, drilling began in earnest as numerous companies were formed on the basis of leases from Volcanic Oil and Coal. The following year, a pipeline carried oil to the Kanawha River, where it could be loaded on barges bound for Parkersburg. The rail spur joined the Baltimore & Ohio at Petroleum Junction (WV - 9 -) and carried the oil east to Baltimore. Born in 1865, the town of Volcano soon beacme the largest population center in the county, surpassing even Parkersburg, a well-established river town on the Ohio.

The characteristic boom town pattern of early oil field development was largely determined by the primitive state of drilling technology. At the average rate of 3 to 4 feet per day, even shallow wells required months of backbreaking labor. Once an initial strike had demonstrated the presence of oil, development of an entire field consumed many months and required a virtual army of drillers and operators. Like Burning Springs and the more famous boom towns of the Pennsylvania fields, Volcano exhibited the high degree of specialization characteristic of this type of settlement. Early development of the field was labor intensive. Drilling demanded a large labor force, since each rig required the round-the-clock supervision of at least two men. A larger number were engaged in support functions, such as tool supply and maintenance, fueling steam engines and transporting the crude oil.

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* The lease book in Camden's land shows that within 45 days, 94 leases were signed. When the war called most of the partners away in the fall of 1861, Camden and J. V. Rathbone bought them out and formed a new company. Rathbone and Camden operated the field until 1863, shipping oil to Pittsburgh, Boston, New York, and Baltimore.

Even after the introduction of the rail spur and the pipeline, a large number of teamsters were constantly employed hauling tools, machinery, fueld and crude oil. By 1870, the town of Volcano boasted a full assortment of trades involved in supplying the drillers: blacksmiths, boiler-makers, carpenters, coopers, harness-makers, and machinists. In addition, a sizeable segment of the population engaged in secondary support, by providing for the basic needs of food, shelter, clothing and entertainment. Like other boom towns, Volcano had numerous hotels, boarding houses, saloons, brothels, an "opera house," and three churches, Episcopal, Methodist, and Baptist. [10] (see old view of the town WV - 9 - 1 through WV - 1 - 28.)

Gushers and Pumpers

The public image of the petroleum industry has always focused on the picture of a "gusher" blowing half a million dollars over the crown block. [11] This characterization of the oil well as a fountain of plenty coincided with Americans' desire to see the country as the source of unlimited wealth. For a number of complex reasons, this image of the oil bonanza, like the earlier discovery of gold in the West, had a strong appeal in a highly competitive society. It served to reassure people that most, if not all, would ultimately be rewarded in the struggle. Newspaper accounts of new strikes invariably focused on the dramatic instances of wells flowing hundreds of even thousands of barrels per day. The result of such publicity obscured the fact that the overwhelming majority of oil produced from the earliest days of the industry was pumped out of the ground. Novice oil producers were quickly, and sometimes painfully, relieved of this misconception. Even wells which began as gushers were eventually put on the pump as the gas which forced out the oil exhausted itself. The prospects of a continuous return on a fixed initial investment vanished as oil operators were faced with the additional costs of production. Whereas during the initial period of flowing wells, a small operator could drill several wells by movinghis steam engine from one rig to the next, pumping meant that each well required its own engine and boiler. Faced with falling prices for his output, the operator then had to weigh the costs of such production against the value of his output.

As production outstripped refining and handling capacity in the mid-1860's, the price of crude oil continued to fall, and oil producers sought ways to cut the costs of production on pumping wells. Initial attempts involved the use of natural gas instead of coal to fire boilers. In the Pennsylvania fields, some operators began using larger boilers to provide steam to several pumps. In the early seventies, a number of applications were developed using a single engine to pump a number of wells. [12] These systems enabled a single operator to supervise the production of as many as forty wells. Together with the oil pipeline, this type of multiple power transmission drastically reduced the demand for labor in developed oil fields and many oil towns which had boomed during the initial stages of development became "ghost towns" by former standards. Pithole, Pennsylvania, one of the more meteoric boom towns, grew as a result of initial strikes in the spring of 1864. On May 24, 1865, a town plan was drawn up and the first lots offered for sale. By September, Pithole's population numbered approximately 15,000 and daily output of crude reached 6,000 barrels. Intense development quickly led to exhaustion of the gas pressure in the pool and meant that many wells became pumpers.

By December, some 341 wells had been shut down. New discoveries in other fields coupled with a general depression in 1866 forced down the price of crude oil. By November of 1867, Pithole's daily production had fallen below 2,000 barrels and the town's population dropped to less than 3,000. In June of 1868, new strikes were reported at Shamburg and Pleasantville and the general exodus left Pithole deserted. [13] Subsequent production from the Pithole field was pumped by a few men tending multiple well hookups. This basic pattern, duplicated many times during the subsequent history of the industry, is reflected in the survival of the Volcano operations.

The pumping phase of production in the Volcano field began in the mid 1870's and continues to the present; its longevity is due to a combination of economic and technological factors. Although the output of these shallow wells was not great (about one barrel per day per well), the superior lubricating quality of the oil assured producers a relatively constant market for over a hundred years. [14] A parafin-base oil with a high specific gravity (48^{o}), it required relatively little refining (steaming out until fully settled) to make it suitable for both cold and hot bearings. Volcano oil, marketed under the names of Globe, Penninsular, Grant, Hills Dale, Mount Farm, White Oak, and Zero Oil, gained international recognition. Zero Oil was still being sold in the late 1940s as a high-grade lubricating oil. [15] While illuminating oils and fuel for the internal combustion engine were subject to the vagaries of a mass market, the highly specialized lubricating oils were in steady demand. All signs indicate the organizers of the Volcanic Oil and Coal Company were fully aware of the nature of the Volcanic oils in 1864.

Unlike many of the speculators drawn to the oil regions, the Volcanic principals were experienced.* William C. Stiles and Robert Gratz had engaged in the manufacture of gas meters and were undoubtedly familiar

* Stiles' relative, Lewis Cooper, also a stockholder, was a Philadelphia broker who dealt in coal and oil securities. Like Gratz, Cooper was also a principal in the Pennsylvania Gas Coal Company. [18] Finally, William Hacker was directly involved in the oil fields of western Pennsylvania as secretary and treasurer of the Bennehoff Farm and Cherry Tree Run Oil Company near Oil Creek. [19] In October of 1863, Stiles, the managing partner of Volcanic, had taken an inspection trip through the Pennsylvania fields to familiarize himself with production methods and investigate the prospects for investment. [20]

with the process of manufacturing gas from coal. [16] Gratz was also president of the Pennsylvania Gas Coal Company and was probably aware of distillation methods current in the coal oil industry as well. [17] Johnson N. Damden, with the benefit of his four years experience in the Burning Springs field was the architect of the company's early refining and marketing policies. Realizing that successful operations depended on getting a useable product to consumers, Damden organized a refinery in Parkersburg to process the Volcano crude oil. J. N. Damden and Company (later Camden Consolidated Oil Company) soon became a leading distributor of lubricating oils in the United States. [21] by 1867, Stiles and Camden were marketing the refinery's output in Philadelphia and Baltimore. [22]

The Volcano System of Endless-Wire Power Transmission

While the physical structure of the Volcano pumping apparatus was patterned after the cable-tool drilling rigs of the salt industry, the use of endless-wire transmission was derived from a different source. At first glance, the West oil rig appears to be a rustic mechanical anomaly, but it was initially the product of a sophisticated approach to long-distance power transmission.

The endless-wire cable system was first used in Europe in 1850, where it was called "telodynamic transmission" by its inventor, M. G. Hirn. [23]* The most impressive installations were in France and Switzerland where the endless-wire was used to transmit large water powers (up to 8,000 horsepower by 1872). [24] Since falls and rapids were usually located in rocky gorges at some distance from convenient factory locations, the endless-wire rope provided a cheap and efficient alternative to the construction of long power canals and dams.** One source estimated the number of endless-wire rope installations in Europe at over 800 by 1867. Its efficiency was far greater than either belting or shafting and, prior to the invention of the small electric motor and improved electrical transmission, wire rope was the premier method of long-distance power transmission.

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* Hirn, an engineer in Mulhausen, Switzerland, originally used a riveted steel band, 2-1/2" wide. He found that wind resistance and excessive wear at the rivets made this unacceptable and quickly adopted wire cable in its place.

** The most impressive of these European applications was that built in the early 1860s (1862-66) by D. H. Ziegler of the Swiss firm of J. Rieter and Company. Ziegler used wire rope to carry 600 horsepower from several turbines located on one bank of the Rhine to the factories of Schaffhausen on the other side. The distance over which the power was transmitted was 3370 feet. By 1872, Ziegler was at work on a project at Bellegarde, France, to transmit over 8,000 horsepower in the same fashion.

The foremost proponent of endless-wire rope transmission in the United States was the firm of John A. Roebling's Sons of Trenton, New Jersey. In addition to being the most important builders of wire-cable suspension bridges, the Roeblings were the largest, most skilled manufacturers of the wire calbe. John A. Roebling was a native of Germany and his sons had extensive contact with the Continent and with engineering developments there. When Hirn and others demonstrated the efficiency of endless-wire rope transmission, the Roeblings were quick to advocate its adoption here. Following Hirn's 1850 success, Roebling installed an endless-wire transmis ion at his Trenton works. There, a 7000-foot cable was used to power a 3500-foot wire ropewalk.* (See photocopy of patent drawing, WV-9-24). [25] With an eye toward expanding the firm's potential market, Washington A. Roebling published a pamphlet explaining the system in 1869. [26] The pamphlet included a table of horsepower, cable size, and the corresponding size and speed of the caryying sheaves. The 1874 edition of this pamphlet included a number of testimonials from satisfied customers and a list of 75 additional installations using Roebling cable. Several of the testimonials indicate the system had been in use in some areas as early as 1867.

Although no direct link has been found between the Roeblings and the original Volcanic Company installation, it is almost certain this was the source of Stiles' idea to use the endless-wire to pump the Volcano wells. Local legend has it that Stiles got the idea from seeing a similar application in his native Philadelphia. This is entirely possible, since Roebling's 1874 testimonials did include one from a Philadelphia source, and the wide geographical distribution of the 1874 installations suggests extensive efforts were made to advertise the system. [28] Although there is no documentation on the early Volcano installations, Roebling cable was used exclusively in recent years. [29] Then, too, the fact that Stiles and his associates never patented the system would seem to indicate their awareness of Roebling's precedents. What Stiles did was to take a system which was fast becoming the prinicpal means of long distance power transmission and adapt it to his needs. The high cost of pumping wells with individual steam engines, the falling price of oil, and the ever-present danger of fire due to the large number of boilers in the oil field made endless-wire transmission very attractive. Of the number of systems devised during the 1870s to pump several wells from a single power source, the endless-wire was the most advanced from an engineering standpoint. Developed in Europe and promoted here by the Roeblings, the system had benefitted from the analysis of some of the best engineering minds of the period. The West Oil Company endless-wire installation is probably the only remaining example of a system, which, in 1870, seemed to be the solution to long-distance power transmission.

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* Roebling's use of the endless-wire allowed him to integrate the operation of several components which were widely separated in space. This enabled him to maintain a constant tension on the strands and resulted in a superior product with uniform strength.

Although W. C. Stiles did not invent the endless-wire transmission, the Volcano version is quite different from the one advanced by the Roeblings. The system John Roebling installed to power his wire rope machine employed cast iron sheaves (the wheels which carried the cable). [30] To increase the friction between sheave and cable, the perimenter of the former was deeply grooved and filled with either wood or leather inserts set on end, perpendicular to the circumference. The Volcano system, as evidenced by the West Oil Company rig minimized the use of rion, using the local hardwoods instead. All the transmission sheaves were composed of hardwood segments set perpendicular to the circumference. The segments were held in place by nailed side panels and the only metal was in the cast-iron axle flange. (See Typical Wooden Wheel, HAER drawings, Sheet 5 of 5). Each well originally had a wheel, 8 feet in diameter, connected by a crank to the walking beam which pumped the well. (While Roebling's original installation used only rotary motion, Stiles had to convert this to linear motion). This drive or "counter" wheel was augmented by one or two "angle" wheels, five feet in diameter, which had several functions. (See Drilling and Pumping Equipment, HAER drawings, Sheet 4 of 5, also WV-9-25). The principal purpose of the angle wheel was to bend the cable around the drive sheave so that friction was sufficient to turn it without slipping. The angle wheel was also an ingenious way of changing the direction of the cable from well to well. In Roebling's pamphlet of 1869, directional change was achieved by bevel gearing and a second loop of cable. Stiles' use of angle wheels with a common tangent to the drive sheave meant that only one wire instead of two ran from station to station. Finally, the angle wheels were used to adjust the tension on the cable. One of the problems of endless-wire systems systems was the expansion and contraction of the wire caused by temperature changes. In warm weather, the longer wire caused slipping and excessive wear, while excessive tension during cold weather could snap the wire or pull the sheaves out of line. Hence, the angle wheels were set in a sliding sash frame which allowed the operator to adjust them in accordance with changes in the cable length. (See Drilling and Pumping Equipment, HAER Drawings. Sheet 3 of 5, also WV-9-26) The sliding frame was also a convenient mechanism for slackening the tension when it was necessary to remove the cable or to replace it after repairs.

The Volcano system for delivering power from the engine to the endless-wire was also an ingenious adaptation of earlier technology. Because of variations in the demand for power on the parts of the line, the Volcano system had to be more flexible than Roebling's and other more permanent installations. Power transmitted by belting from a friction clutch and band wheel on the drive shaft of the engine to a countershaft located in the center of the powerhouse (See Engine House, HAER Drawings. Sheet 2 of 5, also WV-9-27, WV-9-28.) Belting from two band wheels on the countershaft conveyed power to the large wooden transmission wheels. (WV-9-29) Each transmission wheel had a grooved portion, 8 feet in diameter, on either side to carry a cable loop (WV-9-30). By changing the size of the countershaft wheels and the transmission wheels, the distribution of power could be adjusted to meet different demands. In the West installation, the northern transmission wheel (left) is 17 feet in diameter, while the other wheel measures approximately 12 feet (see elevation in Engine House, HAER Drawings. Sheet 2 of 5, also WV-9-29, WV-9-31). The counter wheel corresponding to the large wheel is 4 feet, 2 inches in diameter, while the smaller transmission wheel is driven by one of 3 feet, 5 inches. Hence, the power delivered to the larger wheel is 22% greater than that to the smaller one. Due to its larger diameter, the 17 foot wheel revolves 16% more slowly than the 12 foot wheel, delivering fewer strokes per minute at each well. Hence, the large wheel deliveres more power, but at a slower speed than does the smaller wheel.

There are several possible reasons for the differences in the rate and distribution of power to the two transmission wheels of the West rig. The difference in the number of revolutions - and, hence, the strokes per minute - is accounted for by the fact that the wells on those loops were closer to the center of the principal oil-bearing formation, the Volcano-Burning Springs Anticline. This geological feature was a belt of uplifted rock, a mil and a half wide, running generally north and south (see Cover Sheet. HAER Drawings. Sheet 1 of 5). As distance increased east and west of this belt, the wells were found to contain more water. Since the rate of flow in the oil bearing strata was the same throughout, the peripheral wells were pumped faster to exahust both the oil and the water during the same time it took to exhaust the wells with only oil. The wells on the smaller transmission wheel of the West rig were located on the eastern fringe of the anticline. [32] The 22% differential in the distribution of power to the two wheels was due either to a difference in the number of wells on each transmission or to a difference in the depth of the wells. There is a constant column of fluid between the valve at the bottom of the well and the surface of the land. Since the weight of this column is greater in a deeper well, correspondingly greater force is required to lift this column in a deep well than in a shallow one. The other possibility-and probably a better guess-is simply that there were fewer wells on the smaller wheel because it was farther from the center of the anticline. Since the fringe of the oil-bearing strata yielded less oil per unit output of energy, it is likely that these plats were less intensively drilled. Unfortunately, these loops have been dismantled and no records have been found to indicate which wells were originally on the system. If the depth and number of these wells had been the same as on the northern loops, the higher rate of pumping would have required more power instead of less.

There appears to be a number of reasons behind Stile's choice of endless-wire transmission over other techniques being advanced during the 1870's. Unlike other systems, the endless-wire was free of patents and required no royalty payment for its use. [33] The fourth edition of Roebling's pamphlet, published in 1874, made a point of mentioning that the system was unencumbered by such nuisances. The endless-wire also had distinct advantages in terms of economy of installation and efficiency of operation. The cost of the cable, in 1869, was 1/18th of the cost of belting. Compared to belting or shafting, it required fewer intermediate stations and, hence, fewer wheels and bearings. During operation, this meant that power loss from friction was far less. [34] Roebling estimated that friction losses in an endless wire system amounted to approximately 10 percent per mile.

The system, as installed by Stiles, reduced first costs even more by utilizing local materials. While Roebling and his European contemporaries used iron wheels whose grooves were filled with leather or rubber, Stiles used wooden wheels made on the site. Essential iron fittings were made locally by the C. M. Zones foundry in Volcano.* The West Oil Company machine shop had all the necessary woodworking machines to keep the system in repair, including a table saw, planer, bench lathe, jigsaw, drill press, and wheel lathe (See Machine Shop, HAER Drawings. Sheet 4 & 5 of 5, photos WV-9- , WV-9- , WV-9- .) A small forge and anvil enabled West to make minor repairs to drilling and pumping tools and made the company virtually self-sufficient.

The endless-wire also provided a convenient source of power at each well which could be used for purposes other than pumping. Each well had two sets of tubing, a 6-inch casing cemented into place to keep the walls from collapsing, and a 2-inch pipe inside which served as the barrel of the pump. The 2-inch tubing was subject to corrosion and had to be pulled out periodically and replaced. To harness the power of the endless-wire for "pulling the well," a loop of hemp rope was run from a second groove (5-feet in diameter) on the side of the counter wheel to a groove on the bull sheel (WV-9-). The bull wheel and its shaft up over a pulley in the crown block and back down to the derrick floor, where it was attached to the tubing by a pair of sliding clamps. The operator then tightened the coils on the shaft, and the bull wheel, acting as a winch, drew the pipe from the well. [35] In difficult terrain, like that at Volcano, the convenience of a power source at each well to perform this task was an added incentive to the adoption of endless-wire transmission. It did away with the necessity of maintaining access roads to each well and of having a specialized, portable source of power.

It is the combination of efficiency and self-sufficiency that accounts for the longevity of the Volcano endless-wire transmission. In 1895, when Michael West received his first lease from the Volcanic Oil and Coal Company, endless-wire transmission had no serious competitor. Electric transmission and small durable electric motors which would pump later oil fields had not yet been developed.** The endless-wire was excellent as a system for transmitting power from a moderately-sized central engine

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* Many of the parts have foundry marks on them.

** An 1883 study put the efficiency of electric transmission over a distance of 300 feet at 69 percent compared to 96 percent for wire rope. The only other competitors, hydraulic and pneumatic transmission, had a very low efficiency. [36]

to widely separate but small applications. William Stiles' adaptation made it less expensive and allowed Volcano producers to offset the low prices for crude. The system needed little supervision and could be operated by one man. In 1972, George West, then 87 years old, was still operating the system as he had for over 75 years although old age prevented him from pulling the wells and replacing the tubing. When the tubing of a well became corroded and leaked water, the well was simply taken off the system and abandoned. Over the eyars, West was able to keep the system in repair with a minimum of capital investment. During the winter, when the wells could not be pumped, he spent his time making the wooden transmission wheels and other spare parts and in overhauling the machinery. Aside from engine parts and the cable itself, there was little need for outside capital expenditures since timber was cut on the site. The diminishing size of his operation and yield was offset by his own diminishing needs. As a result, he kept alive a visible reminder of the complex history of an industry which has developed into one of the most critical and technically sophisticated sectors of American technological growth.

FOOTNOTES

1. Harold F. Williamson and A. R. Daum, The American Petroleum Industry: The Age of Illumination, 1859-1899, Vol. 1 (Evanston, 1959) pp. 1-81.

2. Eugene E. Thoenen, History of the Oil and Gas Industry in West Virginia (Charleston, W. Va., 1964) pp. 11-14.

3. Ibid, pp. 19, 23.

4. Ibid, p. 21.

5. Festus Summers, Johnson Newlon Camden, A Study in Individualism (New York, 1937) p. 60.

6. Wood County Clerk, Deed Books Vol. 22, p. 472 (June 22, 1864); Ritchie County Clerk, Deed Books Vol. 7, p. 338. Hereafter cited as Wood or Ritchie County Deeds, Vol. and page.

7. Wood County Deeds, Vol. 23, p. 519.

8. Summers, pp. 115-117.

9. Thoenen, pp. 66, 74.

10. Ibid, p. 169.

11. Daum & Williamson, p. 113.

12. Oil and Gas Journal, Centennial Issue (1959) pp. C-27-D11. Hereafter cited as Oil and Gas Jour.

13. Daum & Williamson, pp. 120-129; William C. Darrah, Pithole: The Vanished City (Gettysburg, 1972).

14. Interview with Walter Tait, former employee of Power Oil Company, Volcano, W. Va., July 1972. Hereafter cited as Tait, July 1972.

15. Hope Natural Gas Company, The Beacon, Vol. II, no. 3 (June, 1948) p. 4.

16. McElroy's Philadelphia City Directory for 1863 (Philadelphia, 1863) p. 299. Hereafter cited as McElroy's (year).

17. McElroy's (1865).

Footnotes, cont'd.

18. McElroy's Directory (1866) p. 93; (1867) pp. 196-197; Gopsill's Philadelphia City Directory for 1869 (Philadelphia, 1869) p. 378; Gopsill's (1870) p. 1698.

19. McElroy's (1867) p. 375.

20. H. E. Matheny Loan Collection. W. C. Stiles, Jr.'s Account Book, 1863, Archives and Manuscript Division, West Virginia University Library, Morgantown, West Virginia [no page].

21. Summers, p. 118.

22. McElroy's (1867) p. 1093.

23. William C. Unwin, Elements of Machine Design, 4th ed. (New York, 1882) pp. 342-366; Washington A. Roebling, The Transmission of Power by Wire Rope (New York, 1869) p. 6; Albert W. Stahl, The Transmission of Power by Wire Rope, 2nd ed. (New York, 1884) p. 11.

24. Stahl, p. 135; "Bellegard," The Engineer, Vol. XXXVII (1874) p. 195.

25. U. S. Patent Office. Patent no. 11,973 (Nov. 21, 1854) Plate 3. Hereafter cited as Patent 11,973.

26. Roebling, Transmission....

27. Roebling, 4th ed. (1874) p. 30; The Roeblings also listed three Canadian customers and one in Bolivia. The applications varied from cotton gins to stone quarries.

28. Ibid, pp. 33-35.

29. Telephone conversation with Walter Tait, Jan. 5, 1976. Hereafter cited as Tait, Jan., 1976.

30. Patent 11,973, Plate 3.

31. Roebling (1869) p. 14. At a later date, these grooves were sometimes filled with tarred jute fibers for the sake of economy.

32. Tait, Jan. 5, 1976; U. S. Geological Survey. Pleasant Wood and Ritchie County Geological Report (Charleston, 1910).

33. Oil and Gas Jour., pp. D8, D9.

34. Roebling, 1st ed., p. 9.

35. Tait, Jan., 1976.

36. **Stahl, p. 123.**

BIBLIOGRAPHY

Darrah, William C. Pithole: The Vanished City. Gettysburg: , 1972.

Gopsill's Philadelphia City Directory for 1869. Philadelphia:

Hope Natural Gas Company. The Beacon, Vol. II, no. 3 (June, 1948).

McElroy's Philadelphia City Directory for 1863. Philadelphia: E. C. & J. Biddle & Co., 1863, also volume 1864-1867.

Morgantown, West Virginia. H. E. Matheny Loan Collection. Archives and Manuscript Division, West Virginia University Library. Account Book of W. C. Stiles, Jr., 1863.

Mamford, John K. Outspinning the Spider; the Story of Wire and Wire Rope. New York: Robert Stillson Co., 1921.

Ritchie County Clerk. Deed Books. Harrisville, W. Va.

Roebling, Washington A. The Transmission of Power by Wire Rope. New York: D. Van Nostrand Co., 1869.

Schuyler, Hamilton. The Roeblings. Princeton: Princeton University Press, 1931.

Shattock, C. H. "Coal and Oil in West Virginia" Report of the Commissioner of Agriculture for 1863. Washington: G.P.O., 1863.

Stahl, Albert W. The Tranmission of Power By Wire Rope, 2nd ed. New York: D. Van Nostrandm 1884.

Summers, Festus. Johnson Newlon Camden, A Study in Individualism. New York: G. P. Putnam's Sons, 1937.

Tait, Walter. Interview, July, 1972.

Thoenen, Eugene. History of the Oil and Gas Industry in West Virginia. Charleston, W. Va.: Education Foundation, Inc., 1964.

United States Commissioners to the Paris Exposition of 1867. Report Washington: G.P.O. 1868.

Unwin, William C. Elements of Machine Design, 4th ed. New York: D. Appleton & Co., 1882.

West, Geroge. Taped interview with George West, July 1972.

Whiteshot, Charles A. The Oil Well Driller. Mannington, W. Va.: N. P., 1905.

Williamson, Harold F. and A. R. Daum. The American Petroleum Industry: The Age of Illumination, 1859-1899. Vol. I. Evanston: Northwestern University Press, 1

Wood County Clerk. Deed Books. Parkersburg, W. Va.

Historic American Engineering Record

West Oil Co.: Endless Wire Pumping Station HAER WV-9
Petroleum
Ritchie Co.
West Virginia

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WVA,
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REDUCED 8" x 10" DRAWINGS