

## KIER'S 5-BARREL STILL

"A Venerable Industrial Relic"

W. K. CADMAN

PEOPLE of today, completely surrounded by petroleum and enjoying the many services derived from it, may look upon this natural mineral resource as something new. However, the record shows that petroleum, in its various forms, belongs to a group of minerals that have excited the curiosity and the interest of mankind from a time even before the dawn of written human history. In this group are found gold and copper, whose first use antedates the earliest records of civilization; the more common metals, such as iron, tin, and bronze, all known to man prior to 3500 B.C.

Petroleum has been found in many widely separated places throughout the globe. It has appeared in the form of heavy tar or pitch deposited in sedimentary formations or on the surface of the earth, or found flowing from cracks or crevices in rocks, as oil springs or seeps. It has attracted mankind by its smell, its strange oiliness, and by the ease with which it burns.

On the basis of *use*, the long history of petroleum can be logically and conveniently divided into two main periods, namely: the Crude Petroleum Era, and the Refined Petroleum Era. The Crude Petroleum Era includes a segment of time perhaps as long as 8000 years, and is constantly being projected further into the past by research, especially in the field of archeology. On the other hand, the Refined Era, in comparison, is just an infant, whose present age is but five years past the century mark.

### *Early Uses of Petroleum Limited*

Throughout the Crude Petroleum Era, the services of petroleum to mankind were restricted to four general types, namely: as a

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medicine; in the construction arts; as a source of light, and for space and process heating.

As a medicine, petroleum was used as it came out of the ground. Obtained with little effort and at small cost, and requiring little preparation for its use, it was a curative for the ills of both man and beast, when applied internally or externally. It is reported that the Egyptians embalmed their rulers in bitumen as early as 5000 B.C.

In the construction arts, petroleum has a very long record in the service of mankind. In the form of natural asphalt, for many centuries it has been used in the construction of roads, palaces, temples, public buildings; for the waterproofing of ships, cisterns for storing water and grains, and in roofing construction. Some of the earliest objects of art ever found show that bitumen was used in their making. The earliest written account describing the use of petroleum, is the building of Noah's Ark, about 4000 B.C., found in the Bible, in Genesis 6: 14.

In the field of light and heat, petroleum has a very long service record, but not a very imposing one. Try as they may, the ancients never did succeed in devising suitable means for burning petroleum for light and heat. They could not eliminate two very obnoxious products of combustion: a bad odor, and unbearable smoke. As far as is known, the earliest use of petroleum by man is attributed to the pre-Babylonian Sumerians, of the Middle East, who used asphalt for fuel as early as 6000 B.C.<sup>1</sup>

In reviewing the evidence of the record, one can draw a very definite conclusion, to wit: For almost eighty centuries, crude petroleum, because of its chemical and physical characteristics, and because of a lack of suitable *mechanical devices* for its most effective use, was restricted to three simple, basic uses, here given in the order of their importance: (1) In the construction arts—as asphalt; (2) in medicine—as natural petroleum; and (3) in lighting and for space and process heating—as crude petroleum. From experience, man soon learned that natural petroleum was a difficult and obstreperous mineral that did not readily submit to being a servant of mankind. So, after eighty centuries of menial service to the human race, the Crude Petroleum Era came to an inglorious end in the year 1854 A.D. The end of a very old era was brought about by

<sup>1</sup> *Energy Sources—The Wealth of the World*. Eugene Ayers & Chas. A. Scarlott, N. Y., 1952, p. 11.

an event which not only gave birth to a new interest in oil, but it also gave a new look to petroleum and ushered in the golden age of oil—the Refined Petroleum Era.

#### REFINED PETROLEUM ERA—*A New Day for Petroleum*

How did it come, one might ask, that petroleum, after floundering around with menial jobs for almost 8000 years, all of a sudden took a new lease on life, and expanded in importance at a rate and to a degree that has astonished the modern world? For an answer, one must look back into history; and most of the answer is found in the Industrial Revolution of 1774. In short, the New Day for Petroleum was the good fortune of having been born at the right time.

When James Watt, of Scotland, brought out his improved steam engine, he started a chain of events in civilized society that later came to be known as the Industrial Revolution. Of the many changes brought about in the social structure of the time, one of the most important was the flow of people from the rural areas to the cities, seeking employment in factories where power and tools were assembled for the better and more efficient production of goods.

One of the earliest and most urgent needs resulting from the crowding into the cities, was for more and better lighting at a lower cost; lights, not only for the factories, but also for the streets and public buildings, as well as for the homes of management and of the workers. It was not long until the animal and vegetable sources of fats and oils, used for illuminating purposes, were taxed to their limits, and this condition brought about a constant increase in the cost of lighting.

To meet the constantly growing demand for light, and at the same time relieve the demand pressure on animal and vegetable fats and oils, gas made from coal was first adopted as the means of getting more light at a lower cost. The plan was suitable for the lighting of streets, factories and public buildings, where limited areas were involved, but not so successful where attempted on wide areas, because every unit using coal gas had to be connected with the central generating plant, and this required a complicated and expensive system of pipes.

#### *The Coal Oil Industry*

To meet the persistent demand for a light that could, with safety

and convenience, be carried from place to place, the industrial chemists of France, England, and the United States resorted to the dry distillation of *coal* as a source of oil for illumination. The product from this process, a *crude oil* called "coal oil," was refined into three principal products: naphtha, lubricating oil, and an illuminating oil that could be burned in lamps of proper construction.

The manufacture of coal oil had its beginning in France, where the famous chemist, M. Selligie, "first introduced the manufacture of a volatile oil from the bituminous schists into France, in the 1840's; and operated also the split coals of Autun."<sup>2</sup> Patents, extending over a period of about fifteen years (1832 to 1845), show that Selligie was a complete master of the coal oil technique. For some reason the efforts of Selligie came to an end, and it was in Scotland, and at a later date, that the real beginning of the coal oil industry took place.

The first patent for the dry distillation of coal in England was granted to James Young, of Glasgow, on October 7, 1850. Young took out a similar patent in the United States, March 23, 1852. In the summer of 1850, Young, E. Meldrem, and E. W. Binney entered into partnership for the purpose of distilling torbanite, or boghead cannel coal, found near Bathgate in Linlithgow, Scotland.<sup>3</sup> In their works at Bathgate, the firm first manufactured naphtha and lubricating oils; paraffin for burning, and solid paraffin were not sold until 1856; and the demand for the solid paraffin only became considerable in 1859.

In the United States, Dr. Abraham Gesner, on June 27, 1854, was issued a patent for the manufacture of an illuminant derived from bituminous shales (Albertite coal), to which he gave the name, "keroselaine," later shortened to "kerosene."<sup>4</sup> During the same year, Dr. Gesner sold his patent to the New York Kerosene Company, and remained in New York to supervise the erection of extensive works for the company. The patent was soon rendered obsolete by the discovery of petroleum on Oil Creek, Pennsylvania, and the copyrighted name, "kerosene," lost its protection when the term became the generic word for all paraffin illuminating oils on

<sup>2</sup> *Production, Technology and Uses of Petroleum and its Products*. S. F. Peckham, Washington, 1884, U. S. Census of 1880 (10th), p. 169.

<sup>3</sup> Young first used petroleum in 1848. Continued to use the oil until the spring was exhausted in 1851. *Dict. of Nat. Biog.* Stephens & Lee, eds. Oxford Press, London, 1922, Vol. XXXI, pp. 1291-93.

<sup>4</sup> *Appleton's Cyclopaedia of Amer. Biog.*, New York, 1895, Vol. II, pp. 632-3.

the market, variously called "carbon oil," and "coal oil," a term wrongly applied to photogenic oils.

By 1854, the rush was on to get in on the ground floor of the new "coal oil" business. Many companies were organized to exploit the many deposits of cannel coal and other bituminous minerals, found in Pennsylvania, Ohio, Kentucky, West Virginia, and other parts of the nation. Coal oil factories along the east coast imported Albertite coal from Canada and the boghead coal from Scotland. By the year 1859, there were between 60 and 70 manufacturers in the United States, engaged in making illuminating oil from bituminous coals and shales. One of the largest factories, the Lucesco Company, on the Allegheny River, in Westmoreland County, Pennsylvania, had a capacity for producing 6000 gallons of *raw* coal oil per day.

### *A Petroleum Renaissance*

While the leading industrial chemists of Europe and the United States—James Young and E. W. Binney of Scotland, Dr. Abraham Gesner of New York, and Samuel Downer, Joshua Merrill, Luther Atwood, and William Atwood of Boston—were concentrating their attention and financial interests on the *manufacture* of coal oil, obtained from the distillation of coal, bituminous shales and schists—all substances that had to be dug out of the ground, an industrialist of Pittsburgh, Pennsylvania, concentrated his attention on *natural* petroleum—a liquid that could be flowed or pumped out of a hole drilled in the ground, as the best source of illuminating and lubricating oils. The industrialist was Samuel Martin Kier, a native of Pennsylvania and a resident of Pittsburgh; a man of many interests which included coal, iron and steel, ceramics, banking, insurance, and transportation.

### *Kier Encounters Petroleum*

Mr. Kier's interest in petroleum came about in a more or less accidental way. In 1841-'42, Mr. Kier, along with his father, Thomas Kier, drilled two wells for salt-brine on a tract of land on the right bank of the Allegheny River, next to the Pennsylvania Canal, about a mile and one-half below the town of Tarentum, Pennsylvania. The two wells, drilled to a depth of 400 feet, got a good supply of brine suitable for the manufacture of salt, at the works erected there. After several years of brine production, petroleum

began to come into the wells in sufficient quantities to interfere with the manufacture of the salt.<sup>5</sup> For a short time the oil was skimmed off the brine, and thrown into the canal near at hand; a practice that was general among the salt manufacturers at Tarentum.

Kier was not the first of the salt men who had trouble with petroleum coming into their brine wells; for years, the salt-well drillers operating west of the Appalachian Mountains were troubled with the oil, to which they gave the name, "devil's tar." Fortunately for posterity, Samuel M. Kier was the *first* salt manufacturer who *did something* about the oil in the salt-wells.

Convinced that natural petroleum was a mineral that had great possibilities for being useful to mankind, in trying to find a use for the oil from his wells, Mr. Kier, about the year 1849, turned to one of the oldest uses for crude petroleum known to history, namely: petroleum used as a medicine.

In competition with the "American Medicinal Oil" of Burksville, Kentucky, whose agents still occupied the field, Kier bottled and sold "Kier's Rock Oil," which, according to his famous bank-note advertising copy, was "Discovered in Boring for Salt Water, 1848, near The Bank of the Allegheny River, in Allegheny County, Penn'a, about four hundred feet below the Earth's Surface"; whose "Wonderful Medicinal Virtues" were "discovered, 1849." From 1849 to 1853, Kier's agents covered the country, selling the medicinal oil in eight ounce bottles, at 50 cents a bottle. Toward the end of 1853, the agents were withdrawn, and further sales of the oil were made through local druggists. In Western Pennsylvania, Kier's medicinal oil was looked upon with great favor as a curative for ills, aches, and itches.

While there may be some question as to the value of the "rock oil" as a medicine, two important things were accomplished by its sale: (1) It kept people informed as to where oil was found and how it was produced, and (2) it maintained a value for the oil at a level which caused men to continue to hunt for it, and to be interested in it. It may be said that Kier's medicinal oil kept alive a flickering light that had almost gone out; it formed the important tie between yesterday and today, in the evolution of petroleum history.

Kier, whose lifelong interest had been in developing the mineral resources of Western Pennsylvania, was not satisfied with using

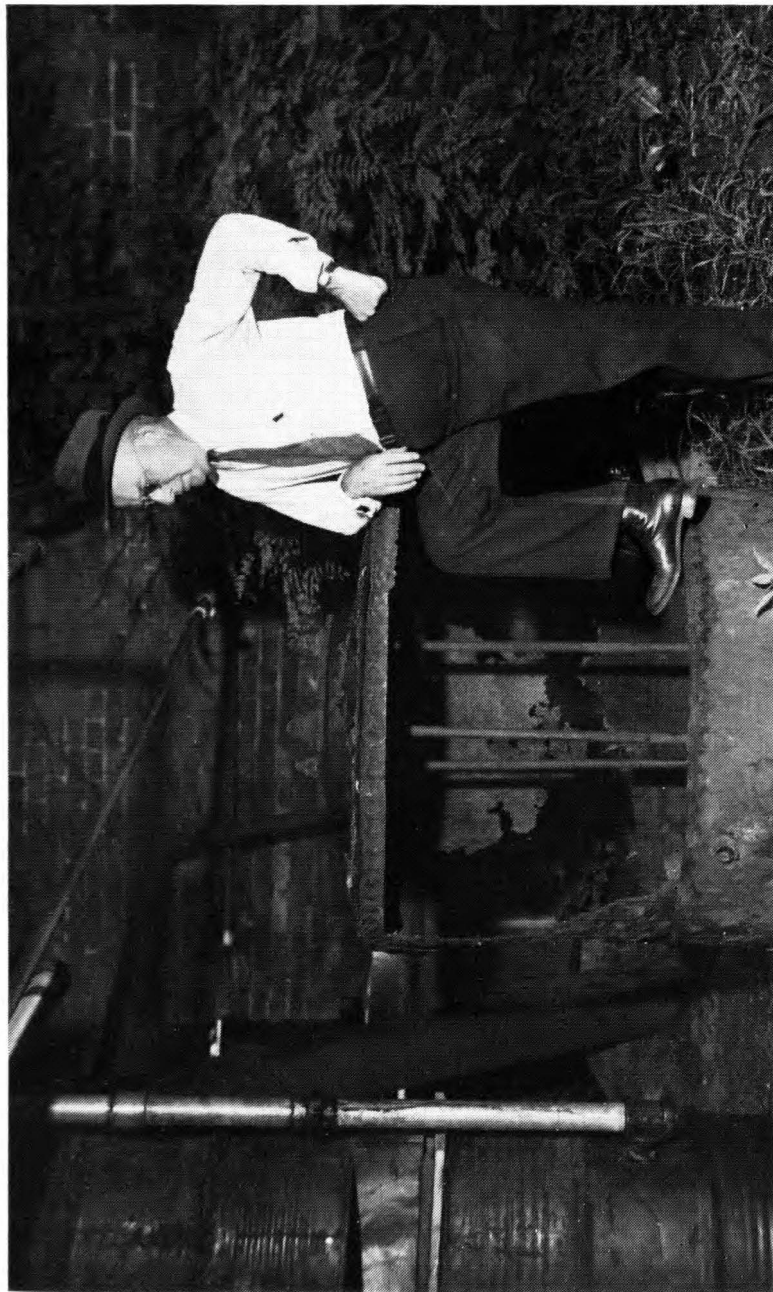
<sup>5</sup> Date fixed as 1845, by Kier's famous bank-note advertising copy.



E. C. Dana copy of an original  
B. L. H. Dana print

**SAMUEL MARTIN KIER (1813-1874)**

Pioneer industrialist and petroleum refiner of Pittsburgh. The father of  
modern petroleum refining.



*Pittsburgh Sun-Telegraph, June 1939*

Kier's 5-Barrel Still, at Salina, Pennsylvania (1939), weathered and worn.  
Person shown: Mr. Whitesell, plant superintendent (deceased).



petroleum only as a medicine; the man had strong convictions that *better uses* could be obtained from petroleum; but they would have to be from petroleum in *some other* form than its natural state.

### *Petroleum Refining Starts*

Driven to further efforts by his strong conviction and belief about petroleum, Kier started experiments in refining petroleum; the object being to obtain an illuminating oil that could be used in lamps with safety and satisfaction. Starting about the year 1850, these experiments were carried on in a cast-iron still of 1½ barrels capacity, made in a local shop in Pittsburgh. The main product from these experiments was called "carbon oil," an illuminating oil for lamps. Other products included naphtha, light oils used by the local cotton mills, and heavier oils used for lubricating the machinery in other Pittsburgh factories. Unlike the manufacturing chemists in the coal oil business, Kier made no attempt to protect the results of his refining experiments with patents.

That the experiments were fruitful is attested by an event that took place at Pittsburgh, Pennsylvania, in the year 1854. With medicinal oil sales on the decline, and faced with an unexpected increase in oil production from the salt-wells at Tarentum—especially from a well owned and operated by Charles Lockhart, of Pittsburgh, and a Mr. Kip, of Tarentum, late in 1853, Kier decided that the time had come to go into refining petroleum on a commercial scale.

### *First Commercial Petroleum Refinery*

In 1854, at Pittsburgh, Pennsylvania, on Seventh Avenue just east of the old Pennsylvania Canal near Grant Street, Samuel M. Kier established the first successful commercial petroleum refinery in the western hemisphere, if not in the modern world.<sup>6</sup> On a scale

<sup>6</sup> The literature contains fragmentary reports of early attempts at refining petroleum: In Japan, in 1613; the Near East, in 1735; Galicia, in 1810; and in the Caucasus, in 1823. All of these ventures had one experience in common: that of being born too soon. They all died early, and were not revived.

However, many people, most of them contemporaries of S. M. Kier, made valuable contributions to the evolution of modern *petroleum* refining. To mention the most important, they are: James Young and E. W. Binney, of Scotland; James M. Williams, of Canada; and Abraham Gesner, of Canada and the United States. In this evolutionary development, the United States is represented by Professors Dixie Crosby and O. P. Hubbard, of Dartmouth College; Professor Benj. Silliman, Jr., of Yale; Professor S. F. Peckham, Dr. Thomas Antisell, and Professor Jas. Curtis Booth, of Philadelphia. The industrial chemists were—Samuel Downer, Jr., Luther Atwood, Joshua Merrill, and William Atwood, all of the Boston area.

adequate to meet the demands of the trade, and in competition with "coal oil" produced from local coal and shales, Kier produced his "carbon oil," burned in a lamp of Mr. Kier's invention, devised to stimulate the sale of his new lamp oil.

At long last, after almost eighty centuries, the problem of refining petroleum on a commercial scale was solved; at long last, through the relatively simple process of distillation, petroleum was unshackled from its three or four simple tasks of the Crude Petroleum Era, and was freed to move into the broader field of the hundreds of uses of the oil in the Refined Petroleum Era of today. To personalize a substance, "Pete Roleum" was a bum until he became refined. And it was Samuel M. Kier who refined him. Kier, by the process of refining petroleum by distillation, showed how to transform an obstreperous mineral of yesterday, into the miracle mineral of today.

### *Dawn of the Petroleum Industry*

When Colonel E. L. Drake brought in his famous well on Oil Creek, in Venango County, Pennsylvania, August 28, 1859, it was to Samuel M. Kier, at Pittsburgh, that Drake turned as the main outlet for his new-found oil. In a contract with Drake, dated November 14, 1859, Kier agreed to take Drake's oil in an amount "not to Exceed One thousand gallons per week . . . at Sixty (60) cents per gallon delivered in Pittsburgh or Allegheny City."<sup>7</sup> Between S. M. Kier's commercial petroleum refinery at Pittsburgh, and E. L. Drake's well on Oil Creek,—the well that dramatized the fact that commercial quantities of petroleum could be found in a hole drilled into the ground, the "coal oil" boys, who had to *dig* their oil out of the ground with a shovel, were completely routed by the "petroleum oil" boys, who *flowed* or *pumped* their oil out of the ground.

### *Kier's 5-Barrel Refinery*

For several years, Kier carried on his medicinal oil business and his oil refining experiments at 363 Liberty Street, Pittsburgh, this address being the head office of Samuel M. Kier's numerous enterprises including coal, iron and steel, ceramics, transportation, etc. As the Kier operation in petroleum increased in volume, an

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<sup>7</sup> Copy of contract sent to W. K. Cadman, Sept. 23, 1953, by Mrs. Wm. M. McKee, widow of the late Samuel M. Kier, II.

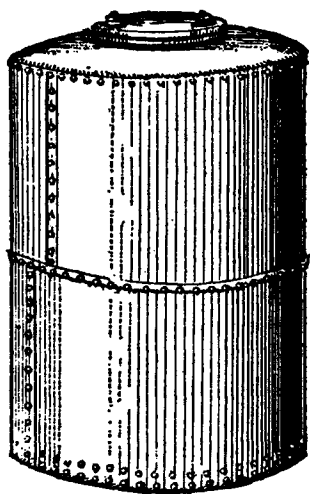
effort was made to locate his oil house as near as possible to the terminal depot of the Pennsylvania Canal, at the corner of Seventh Avenue and Grant Street. The reason for this is found in the fact that for a time, at least, salt and his supply of petroleum came from the salt-wells at Tarentum, via Kier's line of boats operating over the canal between Pittsburgh and Philadelphia.

In the summer of 1853, after leasing a tract of land from the Denny Estate, the oil operations were moved from 363 Liberty Street, to a location on Seventh Avenue, east of the canal, and just across the street from the Canal Terminal Depot.

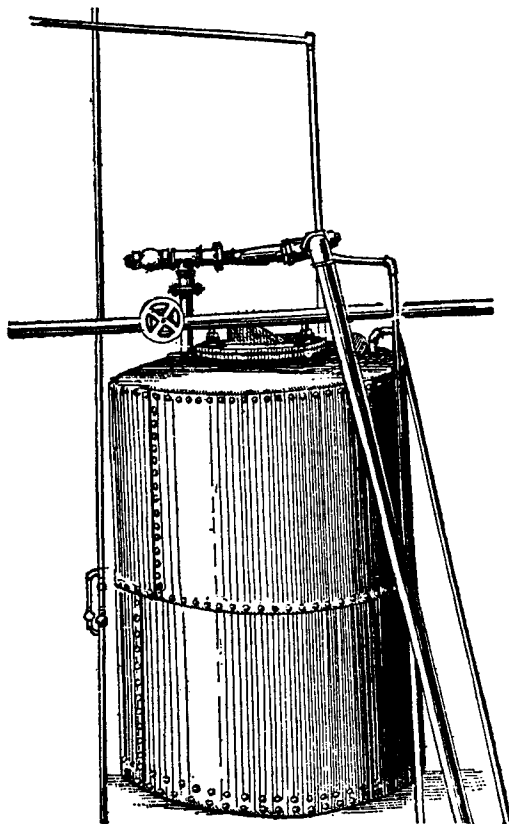
At this new location, bottling oil for medicine and the experiments in oil refining continued until 1854, the year Mr. Kier got his 5-barrel commercial petroleum refinery into operation. In S. F. Peckham's *Report on Petroleum* is found the only detailed description of the Kier refinery known to exist. Quoting from a letter published in the Bradford (Pa.) *Era*, July 4, 1881, and written by someone calling himself "Old Salt Well," "In the year 1854 a small refinery was built at the corner of Grant street and Seventh avenue, Pittsburgh, point of the old canal outlet into the Monongahela river and the same locality of the present railroad tunnel. It was there the first carbon oil was refined for illuminating purposes. The still did not have a capacity exceeding five barrels. It occupied a one-story building, in size 12 by 24 feet. In the spring of 1855 I purchased a gallon of the oil, had it placed in a stone jug, and took it home for the purpose of illumination. The kind of lamp in which the oil was used was the same as what was then employed for a substance called burning fluid. The lamp had from one to five small tubes, and was made of Britannia or pewter. To trim the lamps, cotton-wick was drawn into the tubes, perfectly tight, and the wick was cut down close until it ceased smoking, and then the lamp was nearly as perfect as any lamp of the period. Each one of the tubes produced a light equal to about two candles."<sup>8</sup> The refinery continued operating at the Seventh Avenue location until the year 1861, when, because of a city ordinance passed in May of that year, Mr. Kier moved his plant to Lawrenceville, a district then outside of the city limits. The 5-barrel refinery moved to "the bank of the Allegheny river at Ewalt Street, now known as 43rd street."<sup>9</sup>

<sup>8</sup> Peckham's *Report on Petroleum*, p. 159.

<sup>9</sup> Geo. S. Davison, in *Spirit of Pittsburgh*, Pittsburgh, 1927, p. 93.



Kier's old Still, capacity 5 bbls.,  
height 4 ft. 8 in., diameter 3 ft.  
 $7\frac{1}{2}$  in., circumference 11 ft. 2 1 in.



Same Still now in use as a  
Gasometer at Kier Bros.  
Brick Works, Salina, Pa.

**Earliest picture (1898) of Kier's 5-Barrel Still, doing separator service at the Kier Fire Brick Company plant at Salina, Pennsylvania.  
(Drawings and captions reproduced from the original)**

Here the refinery continued to operate almost up to the time of Mr. Kier's death, in 1874.

#### KIER'S STILL, "A VENERABLE INDUSTRIAL RELIC"

With the passing of Samuel M. Kier, who died at his residence in Pittsburgh, October 6, 1874, the trail of the 5-barrel-still grows dim. The first mention of the still's whereabouts was reported by the "Old Salt Well," cited above. In his letter he said: "In the year 1876 or 1877 the still that was employed in this immense refinery

was displayed at the exposition in Allegheny city, and was labeled as the first still ever used to refine petroleum."<sup>10</sup> The next published reference to the still is found in Warner's *History of Allegheny County, Pa.*, 1889 which says: "The original wrought-iron still for refining petroleum is preserved by his sons as a valuable relic."<sup>11</sup> Again the trail is lost until 1898, when in the Derrick's *Hand Book of Petroleum*, two pen and ink drawings show the still doing gas-separation service at a gas well in the plant of the Kier Fire Brick Company at Salina, Pennsylvania. This is perhaps the first published picture of the Kier still, *intact*.<sup>12</sup>

Twenty-five years were to pass before the Kier still again appears in print. In 1923, while in the Pittsburgh area, Mr. Frank T. Lauinger, president of the company publishing the *Oil & Gas Journal*, made a journey to the Kier Fire Brick Company plant at Salina, and learned that the 5-barrel-still was still doing gas separator service at the works. As a result of this visit, Mr. Lauinger published an article in the *Oil & Gas Journal* of December 6, 1923, entitled, "A Venerable Relic of the Oil Industry." The still was found to be intact at the time of this visit. Two photographs of the still were used as illustrations for the article. These are the earliest *photographs* of the still, known to exist.

In 1939, this writer, while visiting in Pittsburgh, took the time to make a trip to Salina, to see if the old still could be re-discovered. It was found at its old location; but found in a condition much the worse for the wear. Between 1923 and 1939, the old pot had been taken off gas separation service, and was standing unused. Yes, standing idle, and fast succumbing to the ravages of time and weathering. At the rate the process of disintegration was progressing, and considering the environment it was in, it was obvious that the time was not far off when this piece of industrial equipment, which played so great a part in the evolution of the petroleum industry, would be nothing but a pile of rust.

In the fall of 1939, thanks to the active and effective interest of Mr. Floyd L. Greene, late president of the General Refractories Company of Philadelphia, the Kier 5-barrel still was delivered to the Pennsylvania State University, to be placed in the Museum of the College of Mineral Industries. Today, the relic of the modern

10 Peckham's *Report on Petroleum*, pp. 159-60.

11 Warner's *History of Allegheny County, Pa.*, 1889, Pt. II, p. 535.

12 Derrick's *Hand-Book of Petroleum*, 1898, Vol. 1, p. 952.

petroleum refining industry is on public exhibition at the E. L. Drake Memorial, at Titusville, Pennsylvania.

It would be difficult to overestimate the importance of distillation in the history of petroleum; and the still is the heart of that vital process. Just as a glass prism separates a beam of sunlight into its component colors, so does a still separate a stream of petroleum into oils of many varieties and uses. Liberated by the still, petroleum has been able to meet, in a manner that astonishes the world, the ever increasing demands of the Industrial Revolution; many of the demands themselves were created by the refined petroleum itself.

In a literal sense, the history of petroleum flowed through the still of Samuel M. Kier; it was with this 5-barrel pot that a pioneer industrialist of Pittsburgh demonstrated to the world that natural petroleum could be successfully refined on a commercial scale.

In view of the part the still played in the evolution of the modern petroleum refining industry, surely S. M. Kier's 5-barrel still deserves the title given to it by Frank T. Lauinger, who called it "A Venerable Relic of the Oil Industry."