SECTION D, SOCIAL SCIENCES

The Early American Petroleum Industry: A Scientific Debtor

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The American petroleum industry was born in August of 1859, when Edwin L. Drake drilled and completed the first modern commercial oil well near Titusville in northwestern Pennsylvania. Drake and his financial sponsors were seeking petroleum in response to society's demand for a cheap, efficient illuminant with which to light the darkness of the night. The industry was a child produced by the marriage of science and natural resources. The young industry borrowed, stole and developed technology with which to drill for, produce, refine and transport petroleum products for a widespread and eager market. It was, then, a scientific debtor which owed much to other industries, crafts and scientific disciplines. What it owed and to whom is an interesting study in the technological development of applied science.

American petroleum owed a general debt to the long ago and the far away. A crude but thriving petroleum industry had existed in the Middle East during the earliest eras of recorded time. The Greeks, creators of much that is good in the Western World, failed to transmit the ancients' knowledge of petroleum processing to Roman Europe (Forbes, 1958:VII). They did, however, contribute our present name for crude oil, *petroleum,* Greek for "rock oil," although not until approximately 1,000 A.D. did the word appear in Medieval Latin (Beaton, 1957:2). A considerable scientific debt was owed to obscure or unknown individuals, to ancient and medieval alchemists, to long-dead Moslem merchants of the Middle East as well as to scientists of Renaissance and post-Renaissance Europe, and to many inspired and gifted tinkerers on both sides of the Atlantic.

The American petroleum industry was created in response to the widespread market demand for an efficient illuminant at a price that the average man could afford. Drake's investors wanted to drill for crude oil in 1859 because the substance brought $20.00 per barrel in the market place. Even at that price, kerosene, the illuminant produced from crude petroleum, was markedly cheaper and better than previously used burning oils. At least three factors were important in the development of the market for illuminants which American petroleum exploited: first, the advent and advances of chemistry as a science; second, the development and improvement of lamps and their popular acceptance in the nineteenth century; and third, the creation, development and popular acceptance of the coal gas industry in Europe and the United States prior to 1850.

Modern chemistry was born late in the 18th century as the scientific method was applied to old concepts and unresolved chemical questions. Towering figures with the gift of genius such as Joseph Priestley in England, Carl W. Scheele in Sweden, and Antoine Lavoisier in France did much to establish chemistry as a modern science (Williamson and Daum, 1959:28). The great contribution of the 18th century chemists was their acceptance and use of the concept of the scientific method. This important change, coming as it did in the late 1700's, partially explains why the 18th century produced only modest advances in illuminating practices. However, the knowledge acquired relative to "combustion and the nature of gases is a key to the revolutionary changes in illumination which marked the 19th century." (Williamson and Daum, 1959:28).

Considerable progress was made in the design and construction of oil lamps in the late 18th and early 19th centuries. Until the late 1700's, the vast majority of lamps in use in the North Atlantic area resembled closely the bowl lamps of classical times. With a crude wick of twisted fibers these lamps burned (or almost burned) animal, fish or vegetable oils, sputtering and smoking frightfully in the process (Williamson and Daum, 1959:29).

The first notable improvement in lamp illuminants was whale oil, introduced into Europe by Dutch fishermen around 1650 (Beaton, 1957:7). The accidental discovery in 1712 "of the deep-water haunts of the sperm whale" provided an important new source of whale oil illuminant (Williamson and Daum, 1959:29). American sailors operating from the storied ports of Gloucester, New Bedford and Nantucket became the principal world suppliers of sperm oil as they searched the distant waters of the globe for the valuable mammals. Whale oil, though expensive, constituted a stable supply of good illuminating oil and thus encouraged the invention and development of improved lamps to burn it.

Benjamin Franklin is considered the probable inventor of an improved lamp, widely used in America in late colonial times, which utilized two loosely braided cotton wicks to produce two flames burning close together thus improving the updraft and lamp brightness (Williamson and Daum, 1959:31). An even more advanced lamp was produced in Geneva, Switzerland in 1783 by a physician and chemist, Francois Pierre Argand. The Argand lamp employed a circular tubular wick and a glass chimney for even better updraft and brightness. Quinquet, a French pharmacist and Carcel, a French watchmaker, further improved the Argand burner to make it the pre-eminent lamp of Europe in the early 19th century (Forbes, 1958:182).

In the United States two important advances in lamp illuminants were produced in the 1830's. Isaiah Jennings, in 1830, invented and patented camphene, a volatile substance composed of redistilled spirits of turpentine. Within a decade American lamp manufacturers had adapted the standard whale oil lamp for the burning of camphene. Although camphene stank as it burned and was prone toward lamp explosion, it did produce a brilliant white flame; and because it was much cheaper than whale oil, many Americans accepted the risk and the smell and used the pesky substance. The second improved illuminant was lowly lard. By the late 1830's, soap makers in Cincinnati, using techniques imported from Europe, produced an improved lard oil which rivalled even sperm oil for brightness. The solar lamp was developed to burn the improved lard oil and became the outstanding table lamp of America in the 1850's (Williamson and Daum, 1959:33-36).

By the time the Dred Scott decision and the Lincoln-Douglas debates were history, a parlor lamp was no longer a status symbol in the United States as it had been when Andrew Jackson sat in the White House. Several different types and models of lamps furnished an ever-growing number of Americans with lamp light as affluence and nocturnal activities increased. These lamps varied from the modest solar and camphene lamps to expensive, imported Carcel lamps and elegant Astral lamps. Many lamps boasted ornately patterned and decorated glass, a result of the introduction of mechanical glass pressing in 1826 (Williamson and Daum, 1959:30-36).

The development and growing use of modern oil lamps coincided with the advent and rise of the coal gas industry (Forbes, 1958:182). Europe took the lead in experiments with gas-producing substances but the United States did not lag behind in the industrial and commercial use of gas. A Belgian chemist, Van Helmont, had invented the Western word for "gas" in 1609 (Clark, 1963:5) and the inflammable properties of various gases had been known by chemists during the 17th and 18th centuries. In search

of sources for the production of inflammable gas, a number of Europeans tested various materials. When the process of dry distillation with low to moderate temperature was applied to substances such as wood, peat, coal and shales, a number of distillates and new chemicals were found which could be used as illuminants in addition to the gas manufactured. A host of researchers between 1780 and 1840 produced paraffin wax and other illuminants and led other scientists to the investigation of oil shales as sources of gas and illuminants through dry distillation (Forbes, 1958: 182). While producing these invaluable secondary products, the gas industry on both sides of the Atlantic introduced more and more people, in the first half of the 19th century, to the practice and habit of nocturnal illumination.

The Western gas industry originated in London. There in 1807, Frederich Albert Winsor, a German, succeeded in manufacturing coal gas and transporting it through pipes fashioned of sheet lead to light Pall Mall, the first city street in the world to be gas lighted. In 1813 The London and Westminster Gas Light and Coke Company, with a charter from the British Parliament, succeeded in gas lighting the entire length of Westminster Bridge in London without mishap (Clark, 1963:12-13). Thereafter the British took the lead in inventing and developing devices and processes upon which the coal gas industry was based.

In the United States, gas operations proceeded apace in the early 19th century. David Melville, of Newport, Rhode Island, in 1813, received a patent from the Federal government for a practical coal gas process. Baltimore in 1817 was the first city in the New World to have one of its streets gas lighted. Philadelphia in 1816 boasted the first interior commercial use of gas in America with the installation of gas lights in its fashionable New Theatre (Clark, 1963:13-14). In New York City, a gas company, using first whale oil and later rosin oil, began operations in 1823. Meanwhile, Fredonia, New York, a small town near the southern shore of Lake Erie, in 1821, was the proud possessor of the first system using natural gas to light an American city (Wilson, 1946:27-29).

Gas companies proliferated steadily among cities in the United States during the period from 1820 to 1852 despite the adverse financial effects of the Panic of 1837. Boston began using gas in 1829, New Orleans in 1832, Pittsburgh in 1835, St. Louis in 1847, Washington, D. C., in 1848, Chicago in 1850 and San Francisco in 1852. The popular acceptance of gas as a source of light is exemplified by the interesting statistic that by 1852, gas lights actually outnumbered oil lamps in New York City (Clark, 1963:16-23).

As a result of the scientific knowledge gained from the various processes by which inflammable gas was manufactured from coal, some chemists began to experiment with certain oil-bearing shale from which coal oil—similar in content to kerosene—could be extracted by dry distillation. James Young, a Scottish chemist, received a British patent in 1850 and another in 1852 from the United States for a process for the extraction and "manufacture of paraffin and an intermediate crude oil" from "a variety of oil bearing shale." (Beaton, 1957:8). Approximately two dozen American firms licensed Young's process in the 1850's and began producing coal oil, an efficient and economical lamp oil.

The similarity between the oil extracted from oil-bearing shale and petroleum found in oil seeps and floating on streams in western New York, Pennsylvania and Virginia suggested the possibility that petroleum was a ready source of a commercial burning oil. Professor Benjamin Silliman, Jr., of Yale University in 1855 rendered a tantalizing report on the characteristics and economic prospects of distilled petroleum as a source of illuminating oil to some businessmen who had retained him for the purpose of examining a specimen of petroleum. Encouraged by the Silliman report, they sent Edwin Drake to drill for petroleum at Titusville

and were thus privy to the birth of a new industry. They and the industry they helped to create were scientific debtors to all that had gone before.

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