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ETHNOLOGY—ENGINEERING

History of Lighting Traced by Science

By Marjorie MacDill

The really important advances in the history of lighting can be quite comfortably squeezed into the last 150 years. Back of that stretch centuries and centuries of fumbling in semi-darkness.

The first torches of which human knowledge has any record are some charred sticks excavated at Vareze, France, which are believed by some archaeologists to date back 100,000 years. Such crude makeshifts as these stand at one end of the scale of the development of light, which has its present culmination in the incandescent lamp of 30,000 watts, used to illuminate the camera postures of the czars and queens of Hollywood.

From little bits of information collected here and there throughout the world for a period of over forty years, Dr. Walter Hough, head curator of anthropology at the U. S. National Museum, has pieced together a panorama of the history of illumination that reaches back from the great white ways of the present into the dark era of paleolithic time.

The Cave Man's Torch

For untold centuries, he says, the torch was the only supplement to the family fire for lighting purposes that man had. When the low-browed Neanderthal had to do an emergency job of fine mending on his spearhead at night in order to be ready for tomorrow's hunt, a blazing pine knot thrust in a crevice in the rock over his head gave the needed illumination. It has even been questioned by some authorities whether fire itself did not have light for its primary purpose rather than heat.

Because of the longer nights, all the higher types of illumination have developed in the temperate zone. Most of the natives of the tropics are still in what might be called the torch and candle stage of culture, Dr. Hough points out, as were all the tribes of North America when Columbus arrived, aside from the Eskimo. For the long sunless winters and the abundance of seal and walrus blubber for fuel brought about among the primitive people of the Far North an early development of the lamp, a manifestation of culture that normally appears rather late in the evolution of a race toward civilization.

Pine was the favorite wood for torches, but almost any natural object, fat with oil or resins, was likely to be turned into a source of light. In the West Indies, a resinous palm was used. In the South Seas nuts from the candlenut tree were strung together and burned to make a light for fishermen to see by at night. In the Marquesas Islands these strings of lights are employed as a rough measurement of time. The candlefish of the Arctic is another example of unusual light fuel. The fish is almost entirely fat, and when it is dried a strip of cypress bark is drawn through it with a wooden needle for a wick. This makes it a sort of hybrid between the torch and the candle. Explorers tell us that it burns steadily

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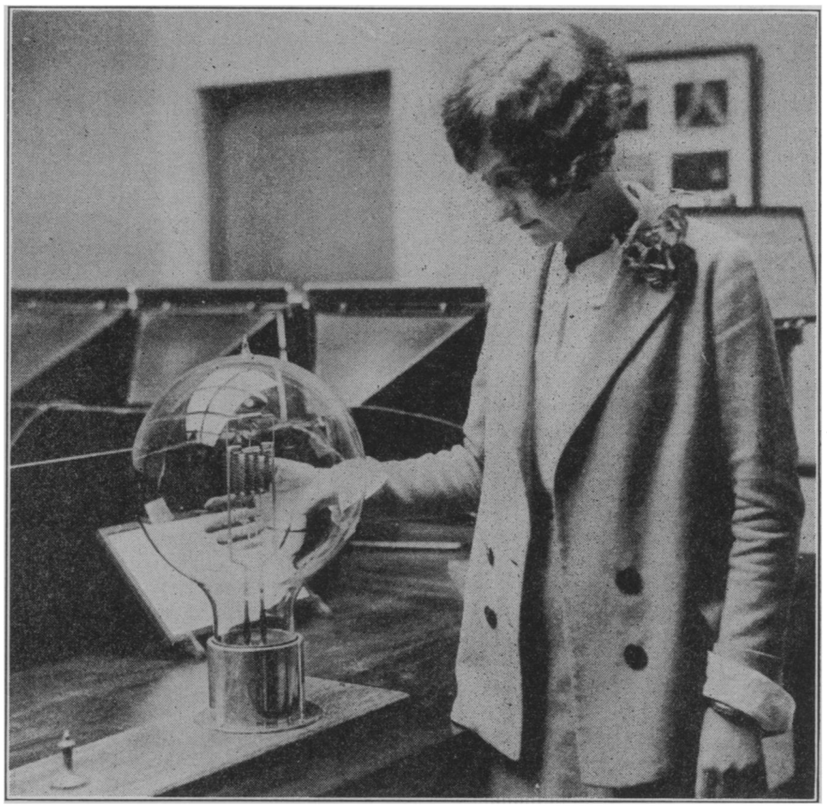

THE LATEST ACHIEVEMENT OF THE LAMP MAKER. An electric incandescent lamp using 30,000 watts of power, as compared with the 40 watts of our household lamps. Such lights as these furnish illumination for airplane landing fields and motion picture studios.

INDEX TO THIS ISSUE

Agriculture, 1926 Yearbook of 29
Altruism 31
American Library Association 31
Anniversaries of Science 29
Atoms of Hydrogen Last 25
Atoms, Stars and 29
Aviation Interest Increases 27

Berkowski, Herman 25
Bird Bath, Making of a 19
Bird Photography 20
Bow, New Type of Violin 25
Brief Biology 29

Cable Works as Push Button 25
Cellulose Photo Films 31
Chicago University 27

Darwin, Advice from 29
Darwin, Charles; The Evolution of 29
David, Philippe 31
Davison, Charles 29
Dorsey, George A. 29

Eddington, Arthur Stanley 29
Electric Cable, New 25
English Royal Society 31
Evolution of Charles Darwin 29

Family Shaken, Ideas of 27
Ferenczi, Sandor 21
Fishes Stranded 25
Flood Leaves Fishes Dry 25
Founders of Seismology 29
Freud Still Active 21

Gramet, Charles 29

Hedrick, Earle R. 25
Home Economics Association, American 27
Hough, Walter 17
Hull, Callie 29
Hydrogen Atoms Last 25

Illumination, History of 17
Inbreeding, Studies Human 21
Inventions and Patents 29

Jordan, David Starr 31

Kaplan, Joseph 25
Kessell, M. H. 29

Lamp Evolution of the 23
Larrett, Denham 29
Leach, G. C. 25
Lighting, History of 17

Marine Hospital Service authorized 31
Mathematics, The Story of 29
Miller, Dayton Clarence 21
Medsger, Oliver Perry 20
Mencken, H. L. 26

Nagy, Oscar 25
Nature Ramblings 27
Nature Study 19
Norfolk Island Inhabitants 21

Pacific Weather Favorable 27
Patents, Inventions and 29
Perkin, Sir William Henry 31
Photo Films, Cellulose 31
Photography of Birds 20
Physics 29
Psychoanalysis and Freud 21

Race Mixture, Studies 21
Religion, Scientific 31
Royal Society Granted Charter 31
Running Records, New Times for 25

Scientific Societies 29
Scientific Religion 31
Seismology, The Founders of 29
Shapiro, Harry L. 21
Societies, Handbook of Scientific and Technical 29
Sparrow-Hawk 27
Springs of Human Action 29
Squire, Lorene 20
Stars and Atoms 29
Story of Mathematics 29
Street, Elwood 26

Thomson, Mehran K. 29

Violin Bow, New Type of 25

Weather, Pacific, Favorable 27
West, Clarence J. 29
Wright, Milton 29

Science News-Letter, July 9, 1927

History of Lighting

(*Continued from page* 17)

and furnishes a good light to read by when inserted in a holder made of a cleft stick. Even today the natives of the Orkney Islands use the very oily body of the bird known to sailors as the stormy petrel in the same way. They insert a wick in the bird's beak and it burns merrily, though smoking, making a useful extempore torch that borders on the abstract principle of the lamp, for the body of the dead bird acts as a reservoir for the fat that the burning wick melts down.

Candles Came Late

Candles proper belong to a relatively high stage of culture, according to Dr. Hough. Countless centuries passed before the mind of man was able to cope with the complex idea of making an illuminant by inserting a wick in a mass of solid fat. It was well on in the Bronze Age, about 4000 years ago before candles finally appeared. Keeping a combustible fat solid enough to support a wick involves the important factor of temperature. This in turn drags in the elements of climate and altitude. One does not look for candles in a country where all the fats available either from domestic animals or wax-yielding trees or insects, melt immediately down into oil. An imaginary "oil and butter" line has been drawn around Europe above which fixed fats occur and below which oils prevail. Below this line, in Italy, the lamp which used oil for fuel developed early. The manufacture of lamps and the oil to supply them was an industry of sizable proportions, while the banquets of Teutonic chieftains were still lighted with smoky flambeaux. The Romans did use a candle, however, but it was made of wax with wicks of papyrus or rushes dipped in pitch. Wax melts at a considerably higher point than tallow and consequently has a more widespread use in warm countries.

Candles may be divided into two

(*Continued on page* 23)

News-Letter Features

Born over four years ago of the demand and interest of those individuals who had caught a glimpse of *Science Service's* news reports to newspapers, the Science News-Letter has since proved interesting to laymen, scientists, students, teachers and children.

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History of Lighting

(*Continued from page* 18)

classes. The first is the taper, which is made of cord or wick covered with wax, forming a flexible length coiled up in a vessel or around a support. The second is the rigid candle, with which we are all familiar. Though unknown to most of the present generation, the taper coiled into fanciful shapes at a comparatively recent date was still used to light backwoods dances in remote sections of the mountains in Virginia and Tennessee, says Dr. Hough.

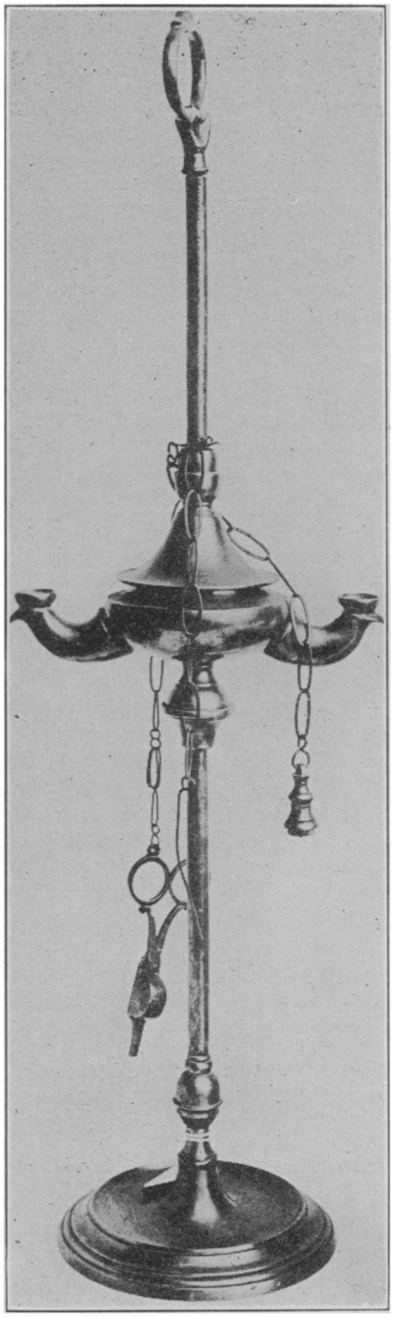
Tallow candle dipping and molding were home industries in early American households, and in spite of being superseded from the point of view of efficiency, pink teas, interior decorators and tenants of would-be studios keep the commercial industry of candle-making still on its feet. It is probably bolstered up also by the present vogue for antique candlesticks, snuffers and all the accessories of grandmother's time, on which craftsmen of the period lavished their attention.

Evolution of the Lamp

The first lamps were crudely hollowed-out stone saucers or sea shells, extemporaneously made into oil containers. Sometimes the skull of an animal was pressed into service to hold the illuminating grease. The next step was to elaborate a lip on the edge of the rude saucer to hold the wick. This eventually developed into a projecting spout, through which the wick was inserted. A handle and a cover for the oil reservoir followed in due course after widely separated intervals of time, as the different races struggled to make light for themselves through the long non-inventive period in man's history.

Millions of lamps, however, of this simple construction were manufactured of terra cotta and bronze during the Graeco-Roman era. Designed in accordance with the artistic taste of this classic period, many of them are objects of great beauty. The use of the Roman lamp became widespread throughout the whole Mediterranean region around 300 B. C., and formed the basis of one of the greatest developments in the history of illumination. Rome achieved a stage of prosperity at that time, according to the Roman naturalist Pliny, that assured an excess in the oil supply that had previously all been needed for food and permitted its use for fuel. Better agricultural skill brought about greater yields of grain and olives, while Roman engineers improved the olive mills and presses until they extracted the maximum of oil from the grist. They could be used, and often were, for other sources of oil than olives, such as nuts and seeds.

In the tomb of Tut-Ankh-Amen were several examples of the float lamp, an interesting type of illumination that saw widespread use at different times during antiquity. The wick, instead of being anchored to the side of the lamp, floated on a bit of cork on oil, which in turn floated on the surface of a bowl of water. The light naturally was very feeble, but would last a long time, burning a minimum of fuel. On account of the water the fire hazard was small, so that it was propably used in places such as corners in dark stairways, where only a small amount of illumination was needed all the time. They were burned before altars in many countries and made an ideal night light in sick rooms. The National Museum collection contains a beautiful chandelier of hanging float lamps of intricate metal work that came originally from Morocco.



THE ITALIAN LUCERNA, the most beautiful lamp ever designed. It stands midway between the lamp of antiquity and the gravity pressure lamps of the nineteenth century.

Gravity Pressure Lamps

"The link in the chain of lamps from the Roman period to the period of enlightened invention is the Italian lucerna, the most beautiful and graceful lamp ever designed," says Dr. Hough. "The lucerna is made of bronze, brass, or terra cotta, and consists of a reservoir with from two to four spouts and an upright stem with a base on which the perforated reservoir can be raised or lowered. When the reservoir is full there is a slight gravity head on the oil, not conclusively intentional, but which might suggest an improvement to an observing mind.

"There follow in this apparent line lamps patently designed to furnish oil to the wick under gravity pressure. These slanting long spout lamps in brass and copper were in use in Belgium, France and other countries of northern Europe. Many were brought by immigrants to the New World. In the beginning complexities of researches ushering in the inventive period, many experiments were carried on by men whose minds belonged to a new age. The needs for more light were stressed by growing cities, navigation, commerce, occupations and the vast ramifications of social intercourse. By this time the prospect of remuneration was added stimulus to invention.

"The effective lamp required the services of chemistry, physics, mechanics, the industrial arts and sciences, and only by their progress was it possible to transform the greese cup, which our ancestors thought the last word in lighting, into an efficient illuminating apparatus. About 1780, tubular wicks furnished complete aeration and the burner was given draught by openings under the flame, a principle long before incorporated in the stove. The draught was brought up through the burner, aerating both sides

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History of Lighting

(*Continued from page 23*)

of the flame and doing away with the center of incombustion."

The Swiss engineer Argand is to be given credit for the advanced lamp, according to Dr. Hough, his particular contributions being the perfected burners and an increased draft by the addition of the cylindrical chimney. Lamps like this, however, were articles of luxury and affected the slowly developing lighting appliances of the people but little. George Washington possessed several lamps of the Argand type, but there were only a few scattered through the houses of the wealthy in America at the end of the eighteenth century.

Petroleum, Gas and Electricity

By the time of the Civil War, the use of petroleum had become general, and two-tube lamps mounted with ventilated burners with a flat wick and glass chimneys became common. At the Philadelphia Centennial Exhibition, in 1876, a lamp was exhibited with a tubular woven wick with center ventilation and a glass tubular chimney that had an expanded air chamber at the base. This was the beginning of a long line of lamps that achieved the highest illuminating results from petroleum. The rather quaint little hand lamps with flat wicks were relegated to the cellar or the attic by the advent of befrosted crystal fringed circular burners, that presided in dignity over many a parlor from the secure enthronement of mother's best center table. They are vanished now into the limbo of the whatnot and the tidy but the antique hounds have rescued the small hand lamp from oblivion. Any that escaped being thrown out on the trash pile during the housecleaning orgies of orderly great aunts, not infrequently bring from $2 to $10 apiece in Ye Olde Dominion Antique Shoppe and its hosts of competitors.

The economic utilization of gas is quite clear cut, unlike so much of the history of cultural development. In 1732 a man named Murdock, in England, experimented with the production of gas from various substances and finally lighted his own house with coal gas. In 1797 he lighted the Soho manufactory at Birmingham with the same fuel, while in 1803 the Lyceum Theater in London and a cotton factory in Manchester were also lighted with it. From these early pioneers there was rapid progress. Gas was first used in the United States in Baltimore in 1821, thereby beating New York by a half dozen years, that metropolis not putting it in until 1827.

The early experiments with electricity in the nineteenth century led up to the production of the incandescent lamp by Thomas Edison in 1879, which brought electric light into the home. From that time forth the progress of electricity in lighting has been steadily forward. Where it will stop, there is no means of foretelling.

Baku Centers of Fire Worship

The first recorded use of natural gas took place in a Parsee fire temple near Baku in the seventh century. This part of the Caucasus, toward which the faces of the oil interests are at present set, was the center of the fire worship of the Magi. The natural gas was discovered when a well became dry and the owner threw down a piece of lighted tow in order to see the bottom. The mouth of the well immediately burst into flame and continued to burn until a few years ago. A temple was built over the ever-burning well, which was attended by priests as late as the last century. Ironically enough it is protected, or was until a quite recent date, from destruction by an oil company, exponents of a more modern worship of the Great God Gasoline.

According to Marco Polo, the great mediaeval traveler, the natives burned naptha for light around this region in the thirteenth century. In general, however, mineral sources of light were not utilized till modern times. Fish oil was used more extensively for lamps than animal fats because it stayed liquid in cold climates. Small fish were used first for this purpose, and then as man became more inventive and aggressive, he went after the larger ones. The great whaling industry developed in response to a demand for a better supply of oil, and the introduction of petroleum is probably the only thing that saved the great cetaceans from extinction.

Ever-Burning Light

"A vast amount of myth and pseudoscience have accumulated around the idea of a perpetual lamp that would burn indefinitely without replenishment," Dr. Hough declares. "Earnest search was made by the alchemists and even more modern chemists for such a desirable illuminant. Stories were prevalent of finding such lamps in tombs, attributing to a past age knowledge of this mysterious fuel. Ever-burning lamps in shrines and temples abound in history, analogous to the sacred fire kept burning by the vestal virgins of Rome. There is a record of a light in Townley Chapel, in England, said to have burned for over a thousand years."

The custom of lighting the dead with candles or a lamp, says the well-known ethnologist, is widespread among many races, the general underlying idea being to help light the way along the unknown path of another world. For in a sense light was thought to have the magic power to penetrate the mysterious veil of death.

Science News-Letter, July 9, 1927

MEMORANDUM

This blank space serves a dual purpose. It allows you to clip out the article on the reverse of this page without destroying any other article. It can also be used for notes and the recording of your own observations.