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# HENRY ELLIS WARREN

*A Biographical Memoir*



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Henry S. Warren

## HENRY ELLIS WARREN

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CERTAIN HISTORIANS have described the successive eras of mankind's residence upon earth in reference to the type of device he used to tell time. If this system of computation is considered, then a Massachusetts man, Henry Ellis Warren, must be given credit for inaugurating a new era. It was he who first developed a practical and accurate electric time-piece, which he proceeded to manufacture under the name of "Telechron," a word he coined meaning "time from afar." For over thirty years he headed the company which he had founded, with its plant at Ashland, Massachusetts. Motivated to the end by the creative spirit of the inventor, he perfected many other devices which are of significant value in our complex civilization, but he will be remembered best as "The Father of Electric Time."

The founder of the Warren family in England was William de Varenne, whose name was taken from his father's fortress. This was situated on the Varenne River in Normandy, and gave its name to that part of the country.

He came to England with William the Conqueror, and is first mentioned at the Battle of Hastings in 1066. He was an able and trusted lieutenant through the early days of fighting, and later in the occupation of the country. He was richly rewarded with lands. He gave much to

churches and built several very good priories. He is said to have married the stepdaughter of the Conqueror, Gundrada. His name became William Warren in England. He was Earl of Warren and also of Surrey. His descendants have been prominent in English history.

The founder of Henry Warren's branch of the family in this country was Arthur Warren. Nothing is known of him until about 1635 when he must have come from England. By 1638 he had settled in Weymouth, Massachusetts. He was married there in that year to Mary —. He lived there through 1651, when his land holdings were mentioned. He died in 1658 or 1659. He was evidently a substantial citizen.

Henry Ellis Warren was born in Boston, Massachusetts, on May 21, 1872, the son of Henry Warren and Adelaide Louisa (Ellis) Warren. Two years later, in 1874, a sister was born, named Louise. In 1880, when he was eight years old, the family moved to Newton Centre, a pleasant suburb eight miles southwest of Boston. The inventor later credited much of his ability to his grandfather, Rowland Ellis, who lived with them. Mr. Ellis had been a leader in Boston affairs, and a member of the legislature. His family had been neighbors and friends of Paul Revere. Mr. Ellis possessed considerable mechanical ability and taught the boy the proper use of tools.

Henry showed ingenuity as a child. He had a few chickens in his yard. He contrived a way to feed them without going out to their little house in the early morning. He pressed a button by his bed which tipped over a bucket of feed.

He also re-fitted his mother's sewing machine to run by electricity. The boy developed a range of technical interests, and became an expert photographer in his early teens.

In 1884, at the age of twelve, he entered the Allen School in West Newton, which had been founded by Horace Mann. It was then headed by Nathaniel Allen and his brother. They were remarkable men, leaders in the progressive movements of the day. The school had an unusual record for bringing out the ability of its scholars. Henry lived at his home three miles away. He rode back and forth on his bicycle.

In 1884 a great sorrow came to the household. His sister Louise died from scarlet fever at the age of ten. She was a very bright, lovable girl. There were no other children in the family.

His father was a woolen merchant who travelled in the middle west, a very friendly man whose interests were in business. His mother was a lovable homemaker. They adored him and gratified his wishes. He installed a little experimental laboratory in his home. Here he spent many happy hours. A fondness for playing with timekeeping mechanisms became an obsession with him.

In 1889 Henry finished his work at the Allen School.

In July 1890, at the age of eighteen, he made a walking trip with a companion into Vermont and New Hampshire. They paid their way by taking photographs of

fine homes and selling copies to the owners. They developed their negatives in the brooks as they went along. The old-fashioned camera equipment with glass plates made a heavy load when added to their clothing, but they enjoyed the experience, and earned as much money as they needed.

He especially liked to wander at random through northern New England with a bicycle. He was venturesome and daring. One day he came to Lake Champlain at dusk. He wished to go across and spend the night, but there was no human being or habitation in sight. He saw an old boat at a wharf, balanced his bicycle on the boat and started to paddle across the lake. By the time he reached the middle the boat was leaking badly, and seemed about to sink. With great difficulty he barely succeeded in reaching the shore. In later years he went with a saddle-horse. Mt. Monadnock in southwestern New Hampshire became his favorite spot for recreation throughout his life.

In the autumn of 1890 Mr. Warren entered Massachusetts Institute of Technology in Boston. The course he took there was Electrical Engineering.

He continued to live at his home in Newton Centre. The church he attended there was the Unitarian, and when the pastor urged its members to form a Young People's Society, Henry Warren and Homer Loring volunteered to do this. The two young men were second cousins and intimate friends. The Society was named the Hale Union, after Edward Everett Hale. It became very active. The first president was Homer Loring. After a year or two Henry Warren was made president. The secretary from

the first was Miss Edith Smith. Her association with him in the activities of the Hale Union resulted in a friendship which led to their marriage in 1907.

In 1894 Henry Warren was graduated from the Massachusetts Institute of Technology with the degree, Bachelor of Science.

The first of his patented inventions dates from about this period. A friend, George Whipple, who was an expert in the purification of water, pointed out to him the need for an instrument to take temperatures in inaccessible places. In May 1895 a patent for an electrical thermometer called the "Thermophone" was issued to Whipple and Warren. It came into wide use, was installed in the Capitol at Washington, and at Derwentwater Reservoir in England.

In 1897 Henry Warren began his career as an electrical engineer with the Saginaw Valley Traction Co. in Michigan. Following bankruptcy this company had been acquired by a Boston syndicate. One member of the latter was the father of Homer Loring. The syndicate asked Henry Warren and Homer Loring to go out to Michigan and try to rehabilitate the company.

Homer Loring greatly increased traffic on the electric cars by building an amusement park at the end of the line. Henry Warren, in his capacity as engineer, found a way of using the excess steam generated by the plant to work large salt deposits in the area. The steam was conducted underground, and the salt in liquid state was forced up. During blizzards he ran the electric cars himself in the night. By 1902 the company was in excellent condition, and the two young men returned home.

Henry Warren made his first venture in real estate at this time. He bought eleven acres of desirable land near his home, which was in a good residential district of Newton Centre. He built five houses on a street which passed at one side of the property. Then he made several roads. The chief one was named Westminster Road, after his father's birthplace in Westminster, Massachusetts, a town near Gardner. Then he sold the remaining land to others, who finished the development with good houses.

In 1902 Henry Warren accepted a position as superintendent and engineer with the Lombard Governor Co. of Boston. This firm had been founded by Nathaniel Lombard to manufacture a waterwheel governor which he had invented. He was a pioneer in the work. The company had a good business, but the owner wished to sell. It was bought by the same syndicate which had purchased the Saginaw Valley Traction Co. Homer Loring was made president of the Lombard Company. After Henry Warren joined the organization he invented and developed an electric governor for waterwheels. At that time the company's plant was at Roxbury Crossing in Boston. The young engineer urged them to find a suitable water supply for testing purposes. He searched the area within a twenty-five mile radius of Boston, and made careful tests. He finally selected Ashland, which had the best waterpower, and an excellent situation at the headwaters of the Sudbury River. Some buildings were available. Ashland was twenty-five miles west of Boston, and three miles west of Framingham, Massachusetts. It had previously been a thriving industrial town, but the mills had closed, and it was in

economic doldrums. There were over one hundred empty houses.

The Lombard Governor Co. was moved there in 1904. Its coming brought new prosperity to the town. During the next ten years more than 3,000 of these improved speed regulators were installed in the principal water power plants of the United States and many other countries. During World War I important products for carrying on the war were manufactured. These included hydraulic lathes and special high pressure valves for Muscle Shoals development. During this period other industries moved to Ashland as well.

Through 1904 Henry Warren continued to live at his home in Newton Centre eighteen miles away. He rode back and forth on his saddle-horse. After a while he boarded in Ashland until his marriage in 1907. Then he came to live on a farm there. This farm was on a hill and overlooked a beautiful lake, as well as the white houses and church spire of the town. The woods around the lake offered attractive walks and bridle paths which he enjoyed very much.

He fitted up a machine shop in a good barn on the farm. One of the first troubles he had was to find satisfactory gears. He developed a new way of making gears which were much better than those on the market. He found a good demand for these, and organized the Warren Gear Works to make and sell them.

Another of his inventions was a clock which ran on batteries. In 1912 the Warren Clock Co. was organized to produce these. It was incorporated in 1914. Homer Loring was a stockholder and a director. Before 1915 the Clock Co. was moved from the hill down into the center

of the town. Space was rented from the Lombard Governor Co. These clocks however were found to be impractical because the batteries deteriorated. Some of their features were later incorporated into other clocks.

This work with clocks opened his eyes to the need for some new way of time-keeping on a large scale. He had a vision,—a vast network of electric clocks, a time service which would be available to every socket on every power line. He realized that alternating current would have to be used.

For many years individual scientists and companies which made electrical devices had been earnestly trying to develop a small self-starting synchronous motor which would run on alternating current, one which would be suitable to operate clocks and instruments. Their efforts had been in vain. Henry Warren, after more than ten years of experiment, produced such a motor in 1916. It was of a radically different type from all those in the other attempts. It would run on alternating current and could carry the load of a gear train and clock hands with ease.

The General Electric Company were especially interested, and wished to share the project. In 1917 they were allowed to buy a half interest in the Clock Co. Henry Warren continued as president. This arrangement was very successful. General Electric could use Telechron motors in clocks of their own and also in their instruments. Other manufacturers of clocks and instruments were licensed to do the same.

In 1920 his growing interest in the development of the electric clock led him to resign from the Lombard Governor Co.

A valuable record of Mr. Warren's

early work with electric time is given in a published interview from the Boston Herald in 1936.

In the inventor's own words:

This first crude motor was connected by tiny gears to the hands of a clock which had a small dial. Then followed weeks of observation to determine the behavior of this clock, which was connected continuously to the Boston Edison system. It was off as much as ten to fifteen minutes per day.

One day, after verifying my records, I telephoned the Edison power station and said as tactfully as I could that the frequency at that time was in error approximately half a cycle. I was politely told that according to their instruments it was correct. Then I suggested that the standards must be in error, which probably made the operator at the other end of the wire think I was foolish. Nevertheless, this unusual message from a stranger was taken seriously and I learned later that the meters at the power station were rechecked with laboratory standards.

The experiments in measuring continued at Ashland for many weeks. At the same time development work on the motor was rushed until there had been built four or five clocks that looked as though they could operate for a long time. My apparatus and experiments were rechecked very carefully at the Edison laboratory under the direction of R. S. Hale, in charge of research and laboratories, a man of clear vision and progressive ideas, to whom I feel much indebted.

After some months the way was made clear by him for an experimental demonstration, at the L Street power station at Boston, of a regulating instrument I had designed and built. This instrument was intended to eliminate errors in frequency of the current which had so far prevented my clocks from keeping time. It was named the Warren Master Clock.

I never dreamed, continues Mr. Warren's interview, that they would make any use of it (the master clock) until there had been time to regulate it and observe its behavior. However, the men at the switchboard were curious to try regulating by the new kind of indicator.

Before any of us realized what had happened the great Edison system began sending out accurately timed alternations. That was on October 23, 1916, and from that day to this (20 years) the same service has never been interrupted except for a few minutes by reason of accidents.

. . . there was a tremendous outside interest in the new idea. Representatives of other big power companies came to consult with me at Ashland and soon the master clocks were controlling the frequency of current which was flowing into a million homes.

Regulation of the pulse was the final step in opening the way for practical domestic use of electric clocks. They soon went on the market, and within a decade had revolutionized timekeeping. Mr. Warren's invention, the Warren Master Clock, was the foundation upon which a thriving industry has grown. It was estimated that by the mid-1920's Telechron clocks were in use by twenty million people.

This standardization of average frequency—obtained by the power companies through the use of the Warren Master Clock—proved of immeasurable value both to power producers and consumers in the following ways:

- (1) By improving the service furnished to manufacturing companies, ensuring more uniform speed of motor-driven machinery and, as a general result, assuring better product quality.
- (2) By facilitating interconnection with other power companies which have correspondingly standardized their frequency.
- (3) By enabling power companies to use synchronous motor movements in their maximum demand meters and graphic recorders, thereby obtaining more accurate and better synchronized records at lower cost of maintenance.

Many important instruments were in almost inaccessible places, and had to be wound by hand every day.

In 1926 the name of the organization was changed to Warren Telechron Co. Soon a very good factory was constructed in Ashland with the help of the General Electric Co. It was started in 1927, built in sections, and finished in 1937. In 1936 another factory building in the town was purchased. Since he was primarily interested in research and invention Henry Warren was less concerned with actual manufacturing. He sold his interest in the Telechron Company to the General Electric, who acquired full ownership in 1943. Mr. Warren's relations with the General Electric Company during the twenty-six years of association had been very cordial. He had served as consulting engineer to General Electric from 1919 to 1940.

Soon the company occupied three additional factories in Worcester, which is twenty miles west of Ashland. The management remained in Ashland. In 1946 the name of the company was changed to Telechron, Inc. In 1951 this corporation was merged with the General Electric and became "The Clock and Timer Division of the General Electric Co."

In 1947 Mr. Warren was honored by the Associated Electric Companies of America in a nation-wide radio broadcast from the great Civic Auditorium at Worcester. This celebrated the 30th birthday of the Telechron electric clock. There were 176 companies who united to give the program, which included a fine concert.

It was said there, "We at Telechron now employ about 3400 people and occupy about 12 acres of floor space. More than one-third of the total employees and floor space are located right here in Worcester. Production of electric clocks and synchronous timing motors runs into

millions. This is a great and thriving industry. It is estimated that over 95% of the electric lines in the United States, and most of those elsewhere, are controlled by Warren Master Clocks."

The president of the Worcester County Electric Co. told how easily the responsibility for control of time through the large network power transmission system along the Atlantic coast was being shifted back and forth from one big power company to another, often at a great distance. This could be done in an instant without the slightest difficulty, for an hour, a day, or more. It resulted in great convenience and economy. On the previous Wednesday the New England Power Co. system at Millbury had shifted control six times.

An important national authority said that "Next to Edison's electric light, Mr. Warren's clock will be most universally remembered."

During the years since he came to live in Ashland he had bought some pieces of land and sold much of it. One, purchased about 1932, was a tract of approximately seventeen acres, which seemed suitable for a residence development. It had a good location on a hillside, and adjoined a highway. It offered a pleasing view of the village, the sunset, and woods with brilliant foliage. There were some fine large trees on it. He made three streets, one of which was named Warren Road. He sold generous lots to people who built good houses. The name given to the development was "Ashland Heights."

In 1937 when the owner of Lombard Governor Company died and it was for sale, Mr. Warren purchased the company. The name was changed to the Lombard Governor Corporation. Mr. Warren man-



aged the company and served as president until his death.

He turned the organization back to the field of governors and the task of retooling for national defense. In 1941 ground was broken for a new building to adjoin the factory. It was completed early in 1942. This was built and equipped by the Navy Department with the best facilities. The building and equipment were later purchased by the company. There were about 750 employees at that time. In 1943 the Lombard Governor Corporation was the first in this locality to receive the Army-Navy "E" for outstanding performance in war work during World War II.

The Lombard Governor organization had produced the first efficient hydraulic speed governor, the first hydraulically operated relief valve, and various special devices to facilitate power plant operation. The company did make very precise surface and angle plates, parts of small steam turbines, universal milling machines. At the present it is doing very precise sub-contract machine work, together with chain saws and large plastic molding machines. The chain saws have been shipped all over the world.

One of Mr. Warren's many inventions was a time standard. This would operate a motor which was used to rotate a telescope so that the latter could follow a certain star. This device was installed on the great 200 inch telescope at Mt. Palomar in California and also on most of the other large telescopes in the country. The control consoles incorporating these devices, which are used in the U. S. Naval Observatory at Flagstaff, Arizona, were of Mr. Warren's design and produced by the Lombard Governor Corporation.

In 1938 he became a founder of Fenwal,

Inc., a company which made temperature controls. He was instrumental in having it located in Ashland. He was a stockholder and director until 1946.

In 1943 he installed an experimental shop in a house on the farm. Here he did research work of many kinds. During World War II he employed fourteen men there who gave valuable service. He found great satisfaction in doing all types of experiments and spent many hours working there alone. During this period one of his inventions was a self-starting synchronous motor which would run without oil. A number of clocks with these motors have been operating successfully for years. At the age of eighty-four he was still very active and vigorous. He had been granted 135 United States patents during his lifetime. His latest one was issued on September 10, 1957.

In 1935 Mr. Warren received the John Price Wetherill Medal from the Franklin Institute for his invention of the Telechron motor. Shortly afterwards he was awarded the Lammé Medal for "meritorious achievement in the development of electrical appliances for machines" conferred by the American Institute of Electrical Engineers. He was a Fellow and life member of the American Institute of Electrical Engineers.

In 1950 Rutgers University conferred on him the honorary degree, Doctor of Science. His citation read in part:

As an engineer whose inventive genius has been documented through the granting of scores of patents by our own and by foreign governments; as the inventor of the synchronous electric clock making possible the interconnection of vast electric power systems; as an industrialist whose initiative and organizational skill have created a great and thriving industry; as a humanitarian whose influence for

good has been felt in many fields; you enter today the honorary fellowship of the University with the grateful appreciation of your friends and admirers everywhere.

Writing was among Mr. Warren's achievements and he contributed many articles to engineering publications. He sometimes lectured on his work before Massachusetts Institute of Technology and scientific societies, including the American Institute of Electrical Engineers. He had a good voice and enjoyed public speaking. He made radio addresses, one with Lowell Thomas. He had many friends, far and near, who showed their devotion as long as he lived.

In 1933 some graduates of Wellesley College decided to find a way of utilizing the facilities of the college during the summer. They developed a project called "The Summer Institute for Social Progress at Wellesley." This brought together a choice group of intelligent people from many walks of life. They came from all over the United States and other countries. They heard lectures by experts and discussed the problems of our civilization. Henry Warren contributed to this project. He was chairman of the Institute from 1938 to 1947, then vice chairman until his death. There were many free scholarships for young students, who found great inspiration there.

Mr. Warren served in public office. From 1907 to 1909 he was chairman of the Ashland Selectmen. He urged the townspeople to install a public water system. This was done. He was chairman of the Water Commissioners from 1910 to 1917. Chairman of the Town Forest Committee from 1937, he was largely responsible for the establishment of the Ashland Town Forest.

After serving from 1936 as trustee of the Middlesex County Extension Service in Agriculture and Home Economics he was elected president in 1945 and served through 1953.

He was trustee of the Algonquin Council of Boy Scouts and endowed it with a substantial scholarship fund. In recognition of his long interest in Scouting he was awarded the Silver Beaver. He was trustee of the Salvation Army, also of Framingham Union Hospital, and director of the New England Forestry Foundation. He gave to many philanthropies and was especially interested in scholarships for colleges. He established a scholarship fund at Ashland High School.

Politically Mr. Warren classified himself as a "Progressive Republican."

He was deeply interested in rural life. At the time of his marriage he rented half of a double house on a farm with thirty acres of land. Later he bought the house and forty-five acres more land. In time he added two more adjoining farms making the total 175 acres. He greatly improved the land and had a fine herd of pure-bred cows. He took much pleasure in the farm. He also owned about 300 acres of land in the town, some of which was being developed for very good residences.

He was fond of athletic activities outdoors, tennis, skiing, mountain climbing, swimming. He and Mrs. Warren enjoyed walking and riding on horseback through the countryside.

She was formerly Miss Edith B. Smith of Newton Centre. She was married to Henry Warren on January 19, 1907. Her father, Herbert Newell Smith, was a native of Providence, Rhode Island. Her mother, Emma (Dean) Smith, was born



*Edith T. B. Warren*