# 1876

### *Company Evolution*

Thomas A. Edison moves into his new laboratory at Menlo Park, New Jersey. A year earlier he had decided to give up his telegraphic machine manufacturing interests and devote all of his time to invention in a peaceful setting away from the bustle of the city (Newark, New Jersey).

### *Power Generation*

Charles F. Brush constructs his second hand-built dynamo. He successfully demonstrates the development to his employer and sponsor, George W. Stockly, Manager of the Cleveland Telegraph and Supply Company, founded in 1872. The Brush dynamo was one of the first to show that electric power could be put to practical use.

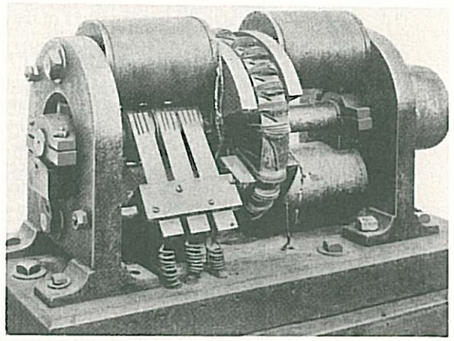
### *Communications*

Alexander Graham Bell demonstrates his telephone at the Philadelphia Centennial.

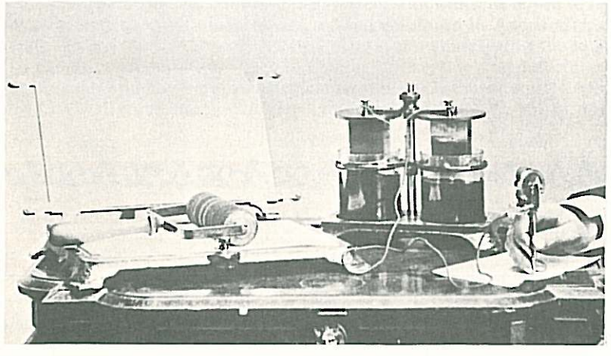
Edison invents the carbon telephone transmitter improving on Bell's earlier telephone which had limited transmission ability. Patent rights to the Edison transmitter were purchased by the American Speaking Telephone Company, a subsidiary of the Western Union Telegraph Company.

Edison patents his mimeograph machine. It consisted of an electric pen that made 8,000 punctures per minute on a sheet of waxed paper which served as the stencil. An inked felt roller transferred the ink supply through the perforated sheet onto the blank sheet below.

The Western Union Telegraph Company completes installation of the Edison quadruplex telegraph system on its lines. The system, which permitted four messages to be sent simultaneously over a single circuit, doubled the capacity of existing wires and revolutionized the telegraphic communications industry.



*Charles Brush's dynamo.*



*Edison's electric pen - the forerunner of the mimeograph.*



## *Charles Francis Brush*
### *1849-1929*

The first important commercial product of the fledgling electrical industry of the 1870's was the arc light, and the pioneer innovator of that product was Charles F. Brush. Not long after graduating from the University of Michigan with a degree in chemistry, Brush opened a consulting office in Cleveland and worked for several years as an analytical chemist. In his spare time he studied electricity and set up a laboratory and workshop at the family estate at Wickliffe, Ohio. Brush believed that if he could make improvements to the basic elements of the arc lighting system, the dynamo and the carbon rods and the rod feeding mechanism, he could displace gas as a means of lighting streets and commercial establishments. It is said that the first arc light dynamo that he designed was driven by a team of horses operating a treadmill. It supplied enough current for one arc lamp generating 10 amperes at about 45 volts. George W. Stockley, vice president of the Cleveland Telegraph Supply Company, and a friend of Brush was also impressed with the potential of arc lighting and agreed to furnish him with facilities, manpower, and funds so that he could expand his work. In 1876 the Telegraph Supply Company became the exclusive outlet for all of Brush's inventions.

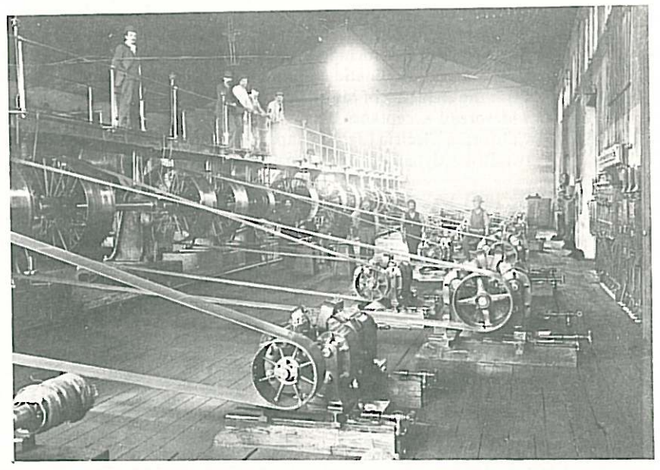
Well publicized tests at the Franklin Institute during the following year demonstrated that the Brush arc light dynamo was the most desirable of those compared, not to mention the fact that a Brush arc lamp was chosen as the standard with which all of the test dynamos were operated.

While working to improve the efficiency and reliability of the dynamo, Brush used his chemical expertise to improve the composition of the carbon electrodes. He searched for a source of carbon that would contain a lower level of impurities than the illuminating gas coke then in use. He found such a source at a Standard Oil Company oil distillation plant within a mile of his Cleveland workshop. The new material produced a more steady light and extended the life of the arc carbons. By copper plating the carbons he improved the electrical contact with their holders and decreased the circuit resistance. Other innovations include the double-carbon lamp which could give light for up to sixteen hours without attention, an automatic constant current regulator and a simple and reliable carbon feed mechanism. With the elements of his system far superior to those offered by the competition, Brush arc lights found widespread acceptance across the country. In 1879 Brush was able to promote the formation of the California Electric Light Company of San Francisco, the first electric central station in the world. It had two Brush dynamos supplying a total of twenty-two arc lamps.

By 1880 over 5000 Brush arc lights and dynamos were in operation, and represented over 80 percent of all arc lights in use at the time. The Telegraph Supply Company became the Brush Electric Company and again expanded to meet demand. By 1890, 20,000,000 arc carbons were produced annually.

In 1889, a law suit led to the loss of Brush's patent protection on certain key elements of arc-lighting systems. The need for additional capital and technological developments by the competition induced Brush Electric to accept an acquisition proposal from the Thomson-Houston Company. Brush retired from the manufacturing portion of the business and devoted his time to experiments in his private laboratory. The flow of inventions continued to be prolific up to the time of his death in 1929. One of his last notable deeds was the establishment of the Brush Foundation for population study and the betterment of humanity.


*A Brush arc lamp and arc lamps in the Brill Brothers Store in New York City.*



*A Brush dynamo room in South America*



# 1877

### *Lighting*

Edison increases his Menlo Park staff and begins his incandescent lamp experiments. At the same time, he starts development of what he envisions as a complete electric lighting system.

Brush is granted patents on his copper-coated carbons for arc lamps and the first open-coil arc dynamo.

The Cleveland Telegraph Supply Company receives the sole right to manufacture Brush's dynamos and arc lamps. After several months of testing, the Franklin Institute of Philadelphia decides to purchase a Brush dynamo, citing it as one of the most efficient and the best engineered of its type.

### *Electricity*

Elihu Thomson, Assistant Professor of Chemistry at the Central High School in Philadelphia, demonstrates that by passing sufficient current through a coil of German silver it can be used as a heating element. Two years earlier, he demonstrated the production of "electric waves" and the ability to detect them. In 1887, Heinrich Hertz demonstrated electromagnetic waves, and in 1895, Marconi put them to practical use in the first wireless transmission of messages.

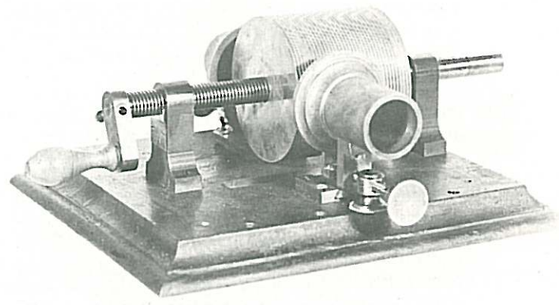
*Elihu Thomson*

### *Communications*

Edison invents the phonograph. A grooved cylinder, covered with tin foil, was turned by hand with a stylus attached to a diaphragm resting against it on either side. The tin foil recorded the vibrations of the diaphragm which were caused by the voice. When the stylus was returned to its original position and the cylinder was rotated again, the original vibrations were reproduced with the sound playing through the diaphragm on the other side.

*Edison's original tin foil phonograph played the first recorded words of its inventor:*

*Mary had a little lamb,*
*Its fleece was white as snow,*
*And everywhere that Mary went*
*The lamb was sure to go.*



# *Elihu Thomson*
## *1853-1937*

Two days after the death of Elihu Thomson on March 13, 1937, the River Works News of the General Electric Company plant at Lynn, Massachusetts published a special four page edition carrying tributes to him from around the world. Reprinted below is a portion of General Electric's final tribute to one of its founders.

1853 — 1937

GENERAL ELECTRIC

RIVER WORKS NEWS

1853 — 1937

Vol. 4 MONDAY, MARCH 15, 1937 Special

# Final Tribute Is Paid Prof. Thomson

## Genius Won High Honors In Lifetime

**Elihu Thomson Was Only Scientist Who Received Great Britain's Three Most Notable Medals**

Elihu Thomson, teacher, engineer, inventor, scientist, pioneer in the electrical field, and benefactor of humanity, received many government, scientific, and academic honors as well as numerous medals and prizes during his lifetime of service.

No other scientist in the world received the unique distinction given Professor Thomson when he was awarded the three most notable medals of Great Britain. In 1910 he was the recipient of the Hughes medal, bestowed by the Royal Society. He was honored by the award of the Lord Kelvin medal, given by all technical and engineering bodies of England with the concurrence of leading engineering societies of America, in 1924. The Faraday medal was presented to him in 1927 by the Institution of Electrical Engineers of England in commemoration of the founding of the Institution.

Professor Thomson was decorated by France in 1889 with the red rosette of the Legion of Honor. He was a chevalier and an officer of this distinguished body.

**Awarded Many Medals**

Twice Professor Thomson received the John Scott Legacy medal and premium of the Franklin Institute. He was awarded the Rumford medal of the American Academy of Arts and Sciences in 1902, the first Edison medal of the American Institute of Electrical Engineers in 1910 the Elliot Cresson gold medal of the Franklin Institute in 1912, the John Fritz medal given by the four principal American engineering societies in 1916, the Franklin medal of the Franklin Institute in 1925, the Grand Prix at the Paris expositions of 1899 and 1900.

On his 82nd birthday, March 29, 1935, Professor Thomson was awarded the medal of honor of the Verein Deutscher Ingenieure of Germany. Up to that time, the late Calvin W. Rice was the only other American on whom this medal, of what is considered the oldest and largest engineering society in the world, had been conferred.

Although he never attended a college, Elihu Thomson held the following honorary academic de-

Continued on Page 2, Column 3

## ENTIRE WORLD MOURNS HIS DEATH

*Professor Elihu Thomson*

## President Swope And Other G. E. Officials Pay Professor Tribute

*(From his office in New York, President Gerard Swope of the General Electric Company sent the following telegram to Mrs. Elihu Thomson last Saturday morning.)*

After our conversation of Thursday, you know how deep is my feeling and the feeling of 60,000 General Electric employees in the loss of dear Professor Thomson. His contributions were of the greatest value to the General Electric Company and the industry and his life was an inspiration to his associates and will long remain a tradition in the General Electric Company.

Very cordially,

GERARD SWOPE

### Established Tradition

"General Electric's earliest products were, for the most part, the offspring of Professor Thomson's brain. He was a true scientist and by example and precept established the tradition of scientific research in the General Electric Company. I feel the loss of a great and good friend."

DR. W. D. COOLIDGE

### All-round Scientist

"Chemists knew him as an expert in their field just as electrical engineers recognized him as preeminent in their field and mechanical engineers as the leader in theirs. Astronomers also knew he was one of their group. He was an all-round scientist. In his death I feel a great personal loss."

DR. W. R. WHITNEY

## Famed Inventor Helped Found General Electric

**One Of Most Far-sighted Inventors, Elihu Thomson Held Over 700 American Patents, Third Largest Number Held By Any Man, And Was Considered One Of The "Big Four" Of Electricity In America**

Officials and employees of the Lynn Works join with leaders of industry, science and government today in paying a final tribute to Professor Elihu Thomson, world famous scientist and inventor, at funeral services held this afternoon at the First Unitarian church in Lynn.

While the simple but impressive service is in progress at the church, several thousand workers in the two Lynn plants of the company will pause from work for a minute of silent tribute to the last surviving founder of General Electric Company. Meanwhile, messages of sympathy continue to arrive with tributes to the noted scientist who passed away peacefully at his Swampscott home Saturday morning after a long illness. Had the Professor lived, he would have celebrated his 84th birthday March 29.

At an early age, Professor Thomson's inventive genius asserted itself. When he was only 11 years old, he constructed the first crude friction electric machine using a wine bottle for a cylinder. Throughout the 73 years following this invention, he devoted his life to mechanical, electrical, and optical experiments and inventions for which he received the third largest number of patents ever granted to any man.

## Funeral Today For Professor Thomson

Funeral services for Professor Thomson who died Saturday morning at his home in Swampscott, will be held at 2:30 o'clock this afternoon at the First Unitarian church of Lynn. Reverend Dr. Cloyd Valentine, pastor of the church, will conduct the service assisted by Reverend Doctor William Wallace Rose, pastor of the First Universalist church. Burial will be at the Pine Grove cemetery in Lynn.

While many employees of the two Lynn Works will attend the funeral as representatives of the numerous departments and organizations, all will pause in their work at 2:30 o'clock and observe a minute of quiet in respect to Professor Thomson. The plant whistles will blow to signal this pause of respect for the last surviving founder of the General Electric Company.

When word of the Professor's death was received, flags at all works and offices of the Company were lowered to half-mast where they will remain until after the funeral this afternon.

All Lynn Works employees will be represented at the services this afternoon when representatives of the engineering and manufacturing

Continued on Page 3

Professor Thomson was born in Manchester, England, on March 29, 1853, the son of Daniel and Mary Rhodes Thomson. When he was five, the family came to the United States, settling in Philadelphia, where he was educated in the public and at Central High school.

Making unusually rapid progress in his studies, Elihu Thomson was ready for high school at 11 and had to wait two years before he could enter. Instead of playing with other boys during this time, he spent his spare time making electrical and mechanical experiments.

Graduating from high school at the age of 18, he became an instructor, his students being boys his own age or older. His work was so outstanding that he was made an assistant professor at 20 and a professor at 23.

During these years his chief interest was in the field of electricity. Outside of his school work he gave a series of lectures at the Franklin Institute in Philadelphia, where he held audiences spellbound with his electrical experiments. It was here that he demonstrated his first dynamo in 1876.

Professor Thomson made two friends during his ten years at Central High who were destined to play an important part in his later life. Edwin J. Houston, the first of these, later assisted Thom-

Continued on Page 4, Column 1





## Final Tribute Paid

Continued from Page 1

son in forming the Thomson-Houston Electric Company. The second was Edwin Wilbur Rice, Jr., who was associated with the Thomson-Houston Company in its early years and later became president and honorary chairman of General Electric Company.

**Perfected Separator**

Working with Houston while they were both teaching in Central High, Professor Thomson perfected his machine for the continuous separation of substances of different densities. This machine was immediately recognised and soon put to general use in separating cream from milk in creameries.

Another early experiment which was successfully demonstrated in 1875 was the transmission of wireless waves to a distance through walls, solid floors and space. Because of other work and interests Elihu Thomson did not follow this lead which was later developed by others to our present radio and wireless transmission systems.

**Important Inventions**

Professor Thomson showed his first bi-phase dynamo in 1878 and his second in 1879. These were important because the first contained characteristics essential in modern generators while the second was the basis for the Thomson-Houston are lighting system which only recently gave way to more modern methods of lighting.

In 1880, Professor Thomson gave up teaching and went to New Britain, Connecticut, as electrician for the American Electric Company and two years later, in 1882, organized the Thomson-Houston Company to take over his business.

**Thomson Electric Meter**

A year later the work was moved to Lynn where it grew to cover all branches of the electrical industry through Elihu Thomson's inventions and genius. Invention of the Thomson electric meter and electric welding contributed to this growth.

With the merger of the Thomson Houston Company and the Edison Electric Company to form the General Electric Company in 1892, Professor Thomson was made head of the Lynn Works' research laboratories which soon became world famous as the Thomson Research laboratory.

**Continued His Research**

As General Electric grew and become the leader in the electrical industry, Professor Thomson continued his research and inventions, winning world-wide fame. Important discoveries which contributed to his greatness and the Company's growth during this period were the principle of dynamic repulsion between primary and secondary coils, the development of a full capacity electric locomotive, his method to control electric cars and trains, and the Thomson-Houston street railway system which was adopted throughout the world.

Other inventions made by Professor Thomson include many of the safety devices now compulsory in the distribution of alternating current power, and forms of lightning arresters which made possible great savings to power systems by eliminating damage from lightning.

**Made Many Contributions**

Professor Thomson made many contributions too numerous to mention to the electrical industry as well as along other lines during the busy years. He invented the first stereoscopic methods in X-ray photography; a uniflow engine, a steam engine of very high efficiency, and a steam engine for automobiles, one of which he used in his own car for many years. His electric meter proved the forerunner of over 30 millions of these instruments now in use by industry as well as in private homes.

His alternating current repulsion motor was probably his most important single contribution to industry. Over 1,000,000 of these are now in operation.

**Astronomy His Hobby**

Through Elihu Thomson's long life, astronomy was his hobby. At his home in Swampscott he built an observatory equipped with two telescopes which he designed and built in his own laboratory. He spent many enjoyable hours of leisure time there studying the stars.

Toward the close of his life, Professor Thomson devoted much effort to the construction of a 200-inch fused quartz mirror for the world's largest telescope planned for the Mt. Wilson observatory. While it was eventually decided to use a glass mirror, he had already secured patents on a process for making quartz mirrors which will be of great value in future work along this line.

While Professo. Thomson first lived in Lynn, he later moved to Swampscott, where he lived at the estate on Monument avenue until his death. Not confining his interests to science and invention, he took a part in town affairs which won the devotion and respect of Swampscott people. He aided many civic interests in Greater Lynn which included giving the land for Swampscott's public library and serving that institution for many years as a trustee.

**Received Many Honors**

Professor Thomson was also closely associated with scientists at Harvard and M. I. T. He lectured at various colleges and later became a faculty member at Tech, and acting president of that institution from 1920 to 1922.

Elhihu Thomson has been honored throughout the world by government recognition and by leading scientific societies and universities who have conferred on him numerous medals, honors, and degrees. Dr. Karl T. Compton, president of Massachusetts Institute of Technology, has said of him, "More than any man now living, or in fact, more than any man in history, it seems to me that Professor Thomson has combined in a most remarkable way the constructive powers of the inventor, the thoroughness and soundness of the man of science, and the kindly balance of the ideal philosopher, teacher, and friend. Because of these qualities he is held in equally high esteem by engineers and in the most highbrow academic circles. He has always shunned publicity, and because of this, his achievements have not been highly advertised or made common objects of front-page newspaper publicity."

**Married Clarissa Hovey**

On May 1, 1884, Professor Thomson married Mary I. Peck of New Britain, Connecticut. They had four sons, the late Captain Stuart Thomson, who died of war injuries in 1919, Roland D. Thomson of Schenectady, N. Y., Malcolm Thomson of Swampscott who is a welding engineer in the Works Fabricating department, and Donald T. Thomson of Rye, New York. Mrs. Thomson died in 1916, and on January 4, 1924, Professor Thomson married Miss Clarissa Hovey, the daughter of Theodore Hovey of Boston, who survives him.

## PROFESSOR THOMSON AT WORK IN HIS STUDY AT HOME

**Until the last few months of his life, Professor Elihu Thomson spent much time working in the study of his Swampscott home. Taken on his 80th birthday, this picture shows him reading some of the large number of congratulatory letters which came to him from all parts of the world on that occasion.**

### *THOMSON LIKED FRIENDLY TITLE OF PROFESSOR*

Although Elihu Thomson held doctors' degrees conferred by the world's leading colleges and universities, he always preferred to have his friends address him as "Professor", the title given him over 60 years ago by the Philadelphia Central High School. He liked this title because to him, it was more endearing and friendly than "Doctor".

## Thomson Was "General" To A Small Boy

**Charles A. Coffin Selected Late Professor As One Most Worthy Of Title "General" Electric**

The late Professor Thomson received many formal honors during his lifetime, but the only military rank he held was in the heart of a small boy whose own engineering career was later cut off in action at St. Mihiel. That was a general's rank, and how it came about was revealed in a letter from the boy's father, Ira Walton Henry, a New York consulting engineer.

Henry took a short "Expert" course here under Professor Thomson in 1887 and was later sent to a New York City power station as an electrical engineer.

Years later, he stopped in Schenectady with his wife and five-year old son. The boy had spent the previous day at an army review and was still much impressed by his introduction to Generals Merritt and Greeley. Without his father's knowledge he expressed a desire to meet "General" Electric in the hearing of Charles A. Coffin, then president of the company. With some ceremony, the latter presented him to Professor Thomson as the one most worthy of that title.

Later young Henry studied engineering at Harvard and always spoke of the famous Professor to his fellow students and instructors as "General" Electric.

## Genius Is Lauded By J. A. McManus

*(As Professor Thomson's secretary for the past 34 years, John A. McManus has been privileged to know him intimately during this long period and is, therefore, well qualified to know his unusual abilities.)*

The death of Professor Thomson marks the passing of the last of the great pioneers in the electrical industry in America. But, Professor Thomson was more than this, and time will enhance his stature in the firmanent of the great. His colossal attributes of genius are too little known to the lay world for immediate appraisal by it, but his fellow scientists and engineers have appraised them in superlative terms on many occasions. I have been closely associated with Professor Thomson since his prime of life in an intimate and delightful relationship, and privileged to observe first-hand his great tolerance, his kindly sympathy, his eager desire to pass along to others the wealth of his information, and his love for and interest in youth. These were among his outstanding qualities. I am naturally deeply grieved by a loss which, to me, is irreparable.

JOHN A. McMANUS.

## *Frank Julian Sprague*
### *1857-1934*

*"In the roster of men who have been the foremost energizers of electrical invention and industry will be found the name of Frank J. Sprague"*
*T.C. Martin, S.L. Coles*

One of the pioneers in electric railway transportation started his career at sea as a graduate of the U.S. Naval Academy and an ensign in the U.S. Navy. In 1877 he was assigned to duty off the coast of China on the USS Richmond during President Grant's Far Eastern tour. On his return, he worked at the Brooklyn Navy Yard and Stevens Institute making plans for the introduction of incandescent electric lamps on U.S. Navy vessels. His investigations caused him to be so enthusiastic about Thomas Edison's work that he resigned from the Navy to join Edison at Menlo Park. His interest focused on the design of electric motors and the possibilities for their use on electric railways. In 1884, he organized the Sprague Electric Railway and Motor Company. Almost immediately the company was offered a contract to build an electric street railway at Richmond, Virginia. It consisted of 40 cars propelled by 80 motors, a complete overhead system and a central power plant. This constituted the first sizable commercial electric road in the world. It was followed by 110 Sprague-built railways before his company merged with the Edison General Electric Company in 1890.

Sprague's interests included vertical as well as horizontal transportation. In 1886 the first 220-volt Sprague motor was installed in a building in Boston for the purpose of running a freight elevator. In 1892, the Sprague Electric Elevator Company was formed and was a spawning ground for his numerous inventions in the area of remote control and other equipment for elevator operation. The development of control circuits found its most widespread use in Sprague's "Multiple Unit" system of train control, which permitted the assembly of any desired number of cars into a train, with control over the train made possible with each car's motor and controller from any point in the train. The invention, first installed on the South Side Elevated in Chicago in 1897, paved the way for the construction of electrically powered elevated roads and subways throughout the world. General Electric's President Charles Coffin negotiated with Sprague to acquire the multiple unit patent and, in 1903, the Sprague Electric Company was acquired. Sprague's first large task was the electrification of Grand Central Terminal and the replacement of the old steam locomotives with General Electric locomotives coupled together by means of the multiple unit system.

Although Sprague's varied interests led him to the formation of a number of independent businesses including the Sprague Development Corporation and the Sprague Safety Control and Signal Corporation, he remained for many years, a consultant to the General Electric Company.



# 1883

### *Company Evolution*

The Thomson-Houston Company, a reorganization of the American Electric Company, is formed by a group of Massachusetts shoe manufacturers headed by Charles A. Coffin. Its operations are later moved to Lynn, Massachusetts.

The Bentley-Knight Electric Railway Company is formed through the aid of the Brush Electric Company in Cleveland, Ohio.

### *Lighting*

Thomson patents the magnetic blowout for the protection of arc lighting circuits from current surges.

San Francisco makes its first use of electric street lighting with the Brush system.

The first night baseball game is played in Fort Wayne, Indiana, using seventeen arc lights of 4,000 candlepower each.

The first photograph ever made using incandescent lamps is taken at Menlo Park, New Jersey.

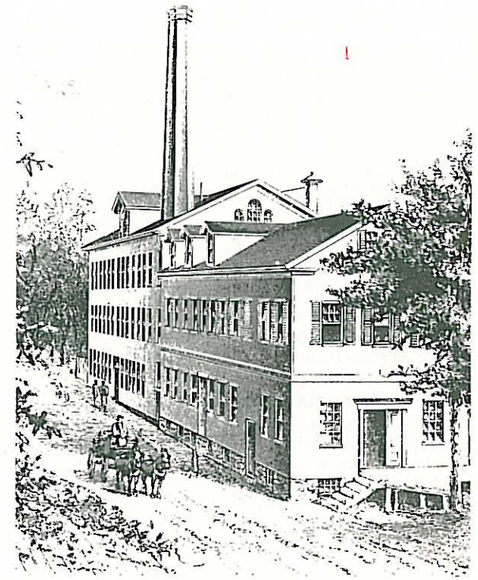
### *Electricity*

Edison discovers that electric current can flow through an evacuated space from a filament to a plate in an incandescent bulb. This phenomenon, later called the "Edison Effect", was patented by him and became the forerunner of electronics.

The first central station to use Edison's three-wire system begins operation at Sunbury, Pennsylvania. The Edison Electric Light Company inaugurates the first underground three-wire system at Brockton, Massachusetts.

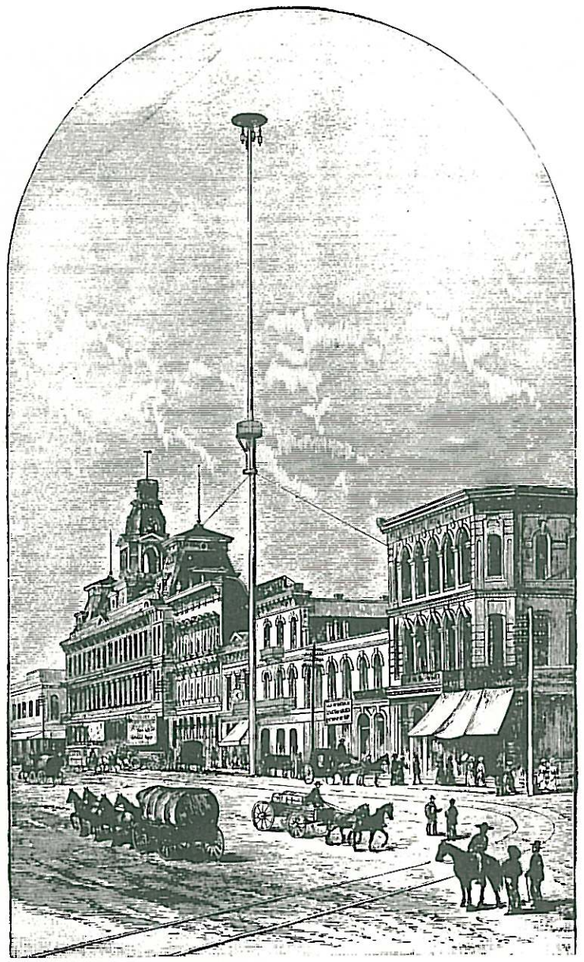
### *Transportation*

The first elevated electric railway in the United States is operated at the Chicago Railway Exposition by the Electric Railway Company.



*American Electric Company, New Britain, Connecticut — forerunner of the Thomson-Houston Company.*

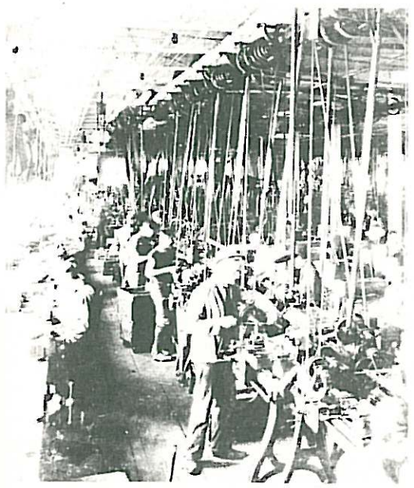
*The first incandescent lamp photo, Menlo Park.*



*The Brush Electric Company arc lighting system for the Los Angeles, California light tower.*



# 1885



*The Thomson-Houston Company's manufacturing machine shop at Lynn, Massachusetts.*

### *Company Evolution*

The Van Depoele Electric Light Company is merged into the Van Depoele Electric Manufacturing Company.

### *Lighting*

Thomson devises the use of the grounded secondary for transformers. This development provided a means for coping with the possibly dangerous effects of insulation breakdown in a transformer and, in so doing, gave impetus to the use of AC distribution systems.

Thomson develops a DC dynamo for incandescent lamps.

Thomson adopts the magnetic blowout as a lightning arrester for the protection of arc lighting and other circuits. The principle of the magnetic blowout has since been employed in the design of modern high-current switching devices.

The Statue of Liberty is floodlighted by the use of arc lights from the Fort Wayne Electric Company.

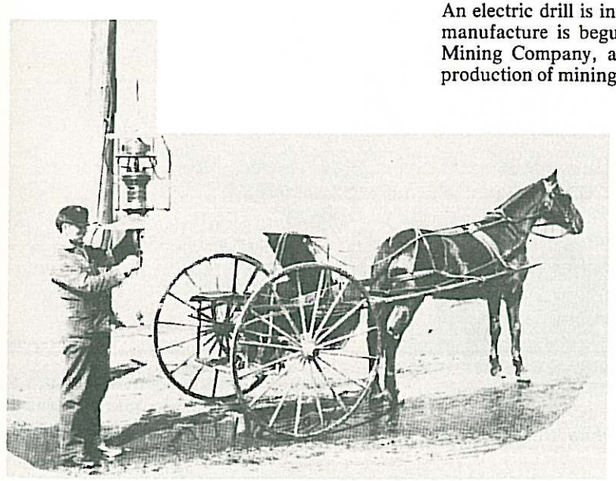
The Thomson-Houston Company begins to manufacture incandescent lamps at Lynn, Massachusetts.

Dr. Edward Weston develops the hydrocarbon flashing process for making uniform carbon lamp filaments.

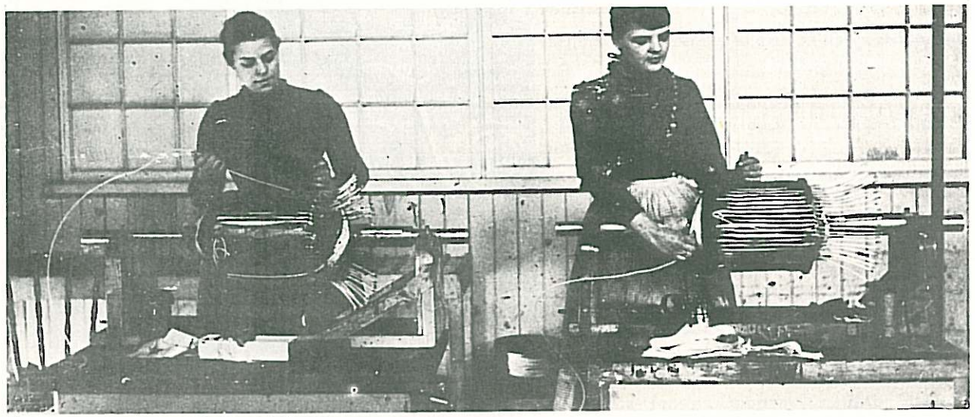
### *Industrial Products*

Weston patents a magnetic drag-type speedometer — an early automobile speedometer.

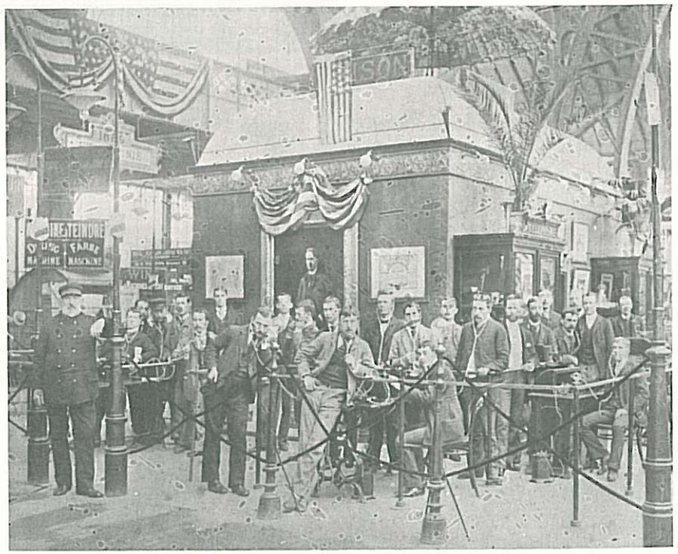
An electric drill is invented by Charles J. Van Depoele, and its manufacture is begun by the Thomson-Van Depoele Electric Mining Company, a subsidiary of Thomson-Houston for the production of mining equipment.



*Servicing an arc lamp in Hartford, Connecticut.*



*Streetcar armature winders at the Schenectady Works, late 1880's.*



*A display of Edison telephones and phonographs attracted over 30,000 people at the Paris Exposition this year.*



*Charles P. Steinmetz—in Yonkers, New York after his arrival in the United States.*

*Soldering wattmeter housings at Lynn, Massachusetts.*

# 1889

### *Company Evolution*

The Edison General Electric Company is formed by consolidating the Edison Electric Light Company, the Edison Lamp Company, the Edison Machine Works and Bergmann & Company.

The Edison United Manufacturing Company becomes the United Edison Manufacturing Company and is acquired by the Edison General Electric Company.

The Sprague Electric Railway and Motor Company is absorbed by the Edison General Electric Company.

The Thomson-Houston Company buys the Brush Electric Company, although the Brush Company continues as a separate organization.

The Bentley-Knight Electric Railway Company merges with the Thomson-Houston Company.

Charles Proteus Steinmetz (1865-1923) of Germany arrives in the United States and starts work in Yonkers, New York, as a $12-a-week electrical draftsman for Eickemeyer and Osterheld.

### *Transportation*

The first official commercial run of an electrified street railway is made on the Beacon Street-Brookline Division in Boston along 13 miles of track powered by the Sprague Company.

### *Lighting*

The Paris Exposition is the first to be kept open successfully during the evening with the extended use of electric lighting. More than 10,000 incandescent lamps, ranging from 4 to 50 candlepower, were used for lighting purposes.

### *Power Transmission*

The first alternating-current power transmission system to be installed in the United States is placed in operation between Portland and Willamette Falls, Oregon — a distance of 13 miles.

### *Electricity*

Thomson invents the integrating wattmeter. This meter was the forerunner of the watt-hour meter used almost universally for the automatic measurement of power utilization by electric utility consumers.