

# The History of Electricity

Early cave people probably recognized the force of electricity when lightning struck. They might also have noticed the way amber attracts light objects, or the way certain fishes, such as the electric eel, stun their prey.

## Discovering Static Electricity

Around 600 BCE, in Greece, a mathematician named Thales discovered that amber rubbed with animal fur attracted light objects. Even though other people may have noticed this before, Thales was the first to record his findings. We don't have his writings, but from other people's reports of his work we can guess at his experiments. We think that Thales noticed static electricity from polishing amber with a piece of wool or fur. After rubbing the amber, which created a static electric charge, other light objects such as straw or feathers stuck to the amber. At this time, magnetism was confused with static electricity.

Later, other experimenters discovered that other substances, such as diamonds, also attracted light objects the same way amber did. These substances are called insulators. They also discovered that other substances, such as copper, silver, and gold, did not attract anything, no matter how long the object was rubbed and no matter how light or heavy the other object was. These are called conductors because they let electricity flow through them.

## Direction and Magnetism

About 300 years after Thales, a Chinese general named Huang-ti was supposed to be the first to use a lodestone as a compass. He might have had a polished piece of lodestone on a piece of wood so polished the stone could easily have turned to always point north. Another version of the story suggests that Huang-ti had a lodestone in a floating bowl. The lodestone would force the bowl to turn with it to face north. Chinese military commanders during the Han dynasty (206 B.C.E. to 220 C.E.) used compasses.



Compasses were used by generals and magicians (who had to find the right places for temples or burial sites) for hundreds of years before they were used on ships. Lodestones were not used for ship navigation until the 1200s, when Chinese navigators began to use a ship's compass.

Many doctors during the time of Queen Elizabeth I of England (the late 16th century) were interested in magnetism. They thought magnets might have healing powers for the human body. William Gilbert invented a lightweight tool called a *versorium* that looked like a compass but didn't use a magnetized needle. The pointer was balanced and would spin in reaction to magnetic attraction even if there wasn't enough force to lift a light object. Nowadays we use a modern version of the versorium called the electroscope to study atomic particles. Gilbert also made up the term *electricity*. He called objects that attracted his versorium *electrics* and those that didn't attract the tool *nonelectrics*.

## New Inventions and Discoveries

In 1660, a German experimenter named Otto Von Guericke built the first electric generating machine. He showed that electricity could be transmitted by using a wet string to conduct electricity several feet.

In the early 1700s, several Englishmen published works that described interesting experiments with electricity. One, Francis Hauksbee, removed air from a glass globe and made the globe

rotate while rubbing it with a wool cloth. The globe gave off such a bright light that Hauksbee could read large letters in a dark room. When it got hotter, it attracted light objects from a greater distance. Another experimenter, Stephen Gray, discovered conductivity. Gray found that an electric could transmit electricity through another body. He found that even water could be electrified. Charles Du Fay, in Paris, performed many experiments based on Gray's work. He came to the conclusion that everything and everybody contained electricity, which we know is correct. The only thing he didn't include, strangely enough, was *lightning!*

During the 18th century everyone was fascinated by electricity. Demonstrations of static electric generators were attractions at popular lectures. A mathematics teacher in Holland, Pieter Van Musschenbroek, invented a storage jar, called a Leyden jar, that showed that electricity could be stored for future use. Modern capacitors are based on the Leyden jar, and are used in radios, televisions, computers, and the flash for a camera.



Ben Franklin conducted his famous kite experiment in 1752. As a storm was about to break, Franklin flew a kite with a stiff wire pointing up that was attached to the top of the kite. He attached a metal key to the other end of the string, and let it hang close to a Leyden jar. Rain moistened the string, which began to conduct electricity. Sparks jumped from the key to the jar until the jar could not handle any more charges. Although there wasn't any lightning yet, there was enough electricity in the air for Franklin to prove that electricity and lightning were the same thing. Franklin also proved that pointed rods conduct electricity better than balls do. He invented lightning rods and sold them throughout colonial America.

In Italy, in the late 1700s and early 1800s, two professors made some interesting discoveries. Luigi Galvani discovered that a dead frog's muscles twitched when it was placed near an electrical machine. He conducted experiments to try to explain why a dead frog appeared to jump. Galvani thought the frog's nerves contained the electricity. Alessandro Volta was interested in Galvani's experiments but thought the electricity came from the metals, such as the steel knife or the metal table. Volta is best known for inventing the voltaic pile, now called an electric cell or battery, in 1800. He had made a stack of disks of zinc, acid- or salt-soaked paper, and copper. This was the first way to store and control the release of dynamic electricity. Volta did not know why his electric cell worked. The volt is named after Volta.

While others concentrated on generating electricity, Charles de Coulomb was the first person to measure the amount of electricity and magnetism generated in a circuit. We still call the unit of electrical charge a coulomb in his honor.

During the first half of the 19th century, Michael Faraday conducted experiments in England on electricity and magnetism. His work led to modern inventions such as the motor, generator, transformer, telegraph, and telephone. Faraday also created words we still used, including electrode, anode, cathode, and ion. He experimented with induction and discovered a way to generate a lot of electricity at once. We use his principle of electromagnetic induction for generating electricity today in electric utility plants. But, back then, Faraday was just interested in finding out why things behaved the way they did so he did not put his findings to any practical use.

Many other scientists in the first half of the 1800s contributed a lot to our modern uses of electricity. They include Andre Ampere, of France, who contributed to the measurement of electric current and who experimented with electromagnetism. Joseph Henry, an American, worked with electromagnetic induction, as did Faraday. Henry's, Faraday's, and Ampere's work all contributed to the development of the telegraph. Karl Gauss created a set of units to measure

the amount of magnetic induction. The unit is called a *gauss*. We *degauss* or demagnetize our computer monitors so that residual magnetism doesn't spoil the image. Georg Ohm, a German, discovered the relationship among voltage, current and resistance in a circuit using direct current. The relationship is called Ohm's Law.

### **Modern Light and Power**

Thomas Alva Edison was an American inventor in the second half of the 19th century. He is best known for his invention of incandescent light bulbs in 1879. He experimented for a year to find the best material for a filament so the bulb would burn brighter and last longer. Edison wanted to bring light into every home and factory. He directed the operation of the first central commercial incandescent electric generating station in the country. It provided electricity to one square mile in New York City in 1882. The first day it operated only 52 customers wanted electricity. Edison's generating station used only direct current (DC) because he thought that alternating current (AC) was dangerous.



One of Edison's employees, Nikola Tesla, was an inventor from Croatia. Tesla wanted to develop an alternating current induction motor but Edison opposed it. Tesla set up his own laboratory and announced his invention in 1888. George Westinghouse hired Tesla to sell AC transmission, using Tesla's induction motor, across America. Everyone but Edison agreed that AC was superior to DC. Even Edison's own company, Edison Electric company--now called General Electric--switched to AC. All our electric motors today, such as fans, air conditioners, and refrigerators, run on principles set out by Tesla. Tesla also set the standard for the frequency of the transmission current, or the number of cycles per second. Today we still operate at 60 hertz.