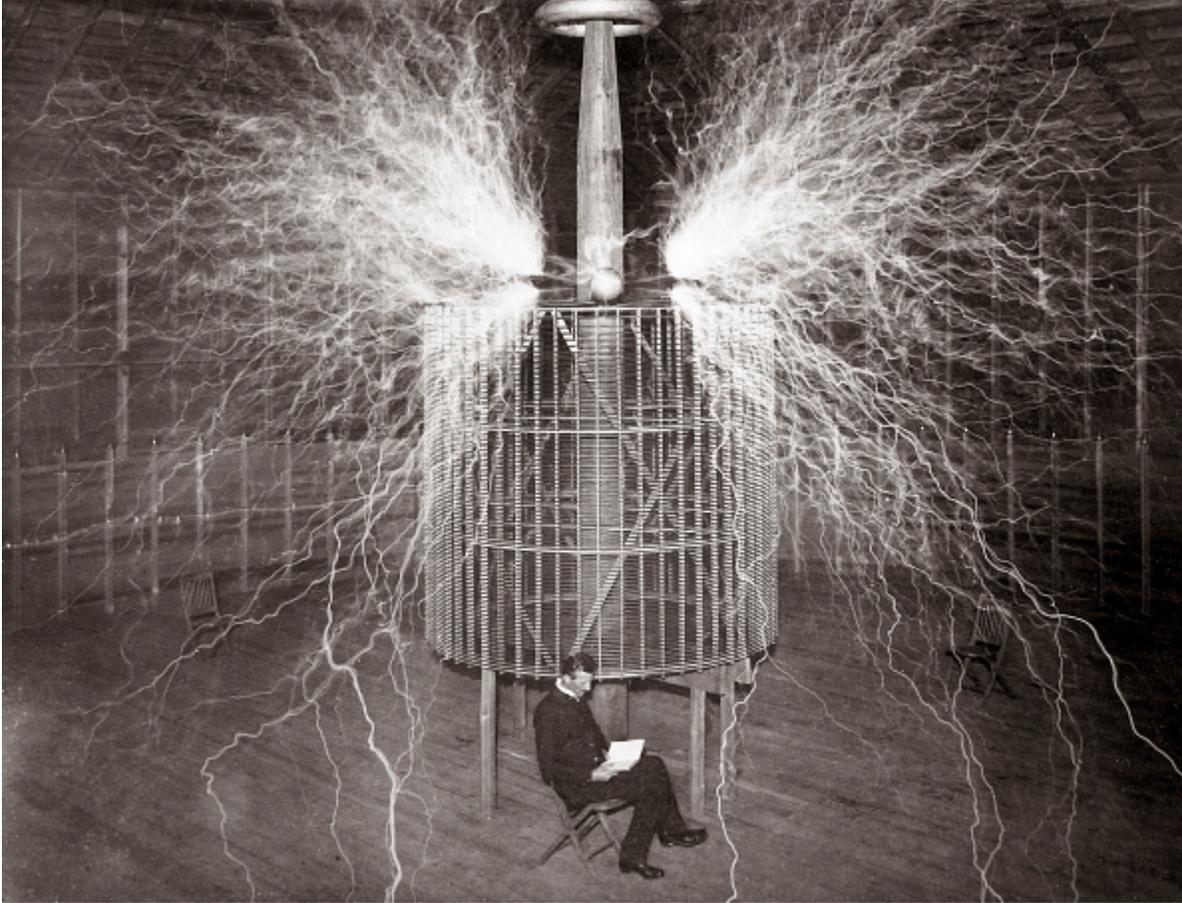


Light bulbs, electricity, and the 'Current War'

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Thomas Edison might be credited with inventing the first practical light bulb, but he did not have a way of keeping the lights on across the country. As it turns out, transporting electricity is a lot more challenging than just harnessing it.

If it were not for George Westinghouse and Nikola Tesla, the country might have remained in the dark for a lot longer.

George Westinghouse was the inventor of the railroad air bike, and Nikola Tesla was a visionary engineer from Serbia. In the late 1880s, the three pitted themselves against one another in a quest to determine which was the superior technology for electricity transmission.

Tesla had an eidetic memory, which meant that he could “work” on his inventions in his mind. This helped him create accurate and intricate 3D objects mentally before he needed to illustrate them.

As a result, Tesla was able to build prototypes using just a few drawings. This ability meant that he was able to work more quickly than both Westinghouse and Edison.

"He really worked out his inventions in his imagination," said Bernard Carlson, author of *Tesla: Inventor of the Electrical Age*.

Competition breeds innovation

All three -- Tesla, Edison, and Westinghouse -- knew that the next phase of human evolution would hinge on the use of electricity. But the three had very different ideas on how to make that happen.

This trifecta of a rivalry is the premise of the film, *The Current War* (2017). While Edison is hard at work promoting the use of direct current (DC), Westinghouse contends that alternating current (AC) is the only way to get electricity to the masses.

For Edison and Westinghouse, the division between AC and DC was clear. However, for the rest of us who do not live in a world regulated with physics knowledge, it is not.

The [US Department of Energy explains](#) it like this: "Direct current runs continuously in a single direction, like a battery or fuel cell. Alternating current reverses direction a certain number of times per second and can be converted into different voltages using a transformer."

To put it another way, the difference is in the direction in which electrons flow. DC electrons flow in a single direction -- forward. AC electrons switch directions — sometimes going forward and sometimes going backward.

DC voltage cannot travel very far before it begins to lose its energy. That means that if we were living in Edison's DC world, we would have large coal-operated plants every few miles.

[Jill Jonnes](#), author of *Empires of Light: Edison, Tesla, Westinghouse, and the Race to Electrify the World*, explains: "The brilliance of AC was that you could send it long distances, bring the voltage down via another transformer station, and distribute it as needed out into the surroundings."

The use of a motor in DC systems was progressive, and the business potential for the design of electric motors was huge. Edison inherently knew that the motor would be the driving force in future technology.

His challenge was in creating that machine.

For his part, Tesla wanted to create an AC-powered motor. He tried to get Edison on board for this design several times, most notably when he worked for Edison in 1884.



American inventor Thomas Edison (1847 to 1931) conducting an experiment in his laboratory, circa 1910. (FPG/Archive Photos via Getty Images).

Tesla left after six months of employment when it became apparent that Edison was only interested in developing DC technology.

Tesla's ideas were often more disruptive to the status quo of the times. Often considered impractical, there was not a large market demand for Tesla's products.

In many ways, this casts him as a futurist, the kind of forward-thinking for whom we owe much of the credit of today's world.

Tesla spent years working on a system designed to transmit moving pictures, voices wirelessly, and images -- the early precursors of television, radio, and wireless communication.

"Our entire mass communication system is based on Tesla's system," said Marc Seifer, author of *Wizard: The Life and Times of Nikola Tesla*.

Historians suggest that Edison's fixation with DC current might have clouded his judgment. He became convinced that AC was more dangerous than DC since it operated on higher currents.

'Practical' uses for electricity

Edison famously wrote of AC designs, "Westinghouse will kill a customer within six months after he puts in a system of any size."

In 1887, Alfred Southwick approached Edison asking for alternatives to the then-standard capital punishment of hanging. Southwick was a member of a commission established by New York State to explore alternatives after a string of the hangings were not effective.

For his part, Edison was reluctant to respond. As a lifetime opposed to the death penalty, Edison did not want to have his name associated with the commission.

Nevertheless, he did see the opportunity to discredit both Tesla and Westinghouse.

He recommends to Southwick that AC devices "manufactured principally" by Westinghouse be the "best appliance" for carrying out capital punishment sentences.

Edison then teamed with Westinghouse-opponent Harold Brown to find the appropriate amount of voltage that would be needed to kill a human. In his experiments, Brown determined a dog could survive 1000 volts of DC but would be killed by just less than 300 volts of AC.

During a press conference, Brown, bolstered by his success in the lab, electrocuted a 76-pound dog named Dash.

Brown was awarded the commission contract and with Edison's help, designed the first electric chair using AC generators.

On Aug. 6, 1890, Edison and Brown tested the first electric chair. At the Auburn State Prison in New York, William Kemmler, who was convicted of killing his wife, was electrocuted with a 17-second jolt of 1300 volts of AC electricity.

He did not die, however.

Then, he was given a charge of 2000 volts, and four minutes later, the body caught fire — with officials declaring him legally dead.

Edison believed this incident would quash Westinghouse and Tesla's inroads with the spreading of electricity across the country. On the contrary, it was not enough to do that at all.

Showing off

Tesla demonstrated his AC motor in 1888. Westinghouse then purchased Tesla's patents so Tesla could solve the issue of how to commercialize the motor.

"Once Tesla solved the problem of creating a motor that could operate using AC, then it was clearly the superior technology," said Jonnes.

The bid to electrify the country was won by Westinghouse's company at the Chicago World's Fair in 1893. The same year, Westinghouse's company signed a contract to install AC generators in Niagara Falls.

Tesla's design worked well, and in 1895, the first hydroelectric power plant launched there.

Tesla's forward-thinking approach to technology is the backbone of current era power and communication systems. Most of his inventions have been lost to history, even though his preliminary work has had such an impact on modern life.

One of the biggest distinctions between Tesla and Edison is that Edison had money to spare. Tesla was destitute when he died, in part because his benefactor JP Morgan stopped funding his experiments.

Edison, meanwhile, was able to continue buying up other people's patented inventions, which is one of the reasons why history remembers Edison so fondly but draws a blank about Tesla. It's only been recently with Elon Musk's introduction of electric cars has Tesla's name began to receive the recognition it deserves.

The Current War aims to correct some of that by telling the story of how the country was electrified. In doing so, it will shed light on the Race of the Currents and how the US went from candlelight to fully lit in such a short amount of time.

Tesla knew that AC would be the best for powering electric motors along with an array of household appliances. When we think about great inventors, we need to begin thinking about both Tesla and Westinghouse as helping to bring light and electricity to the country.

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