IEEE Spectrum

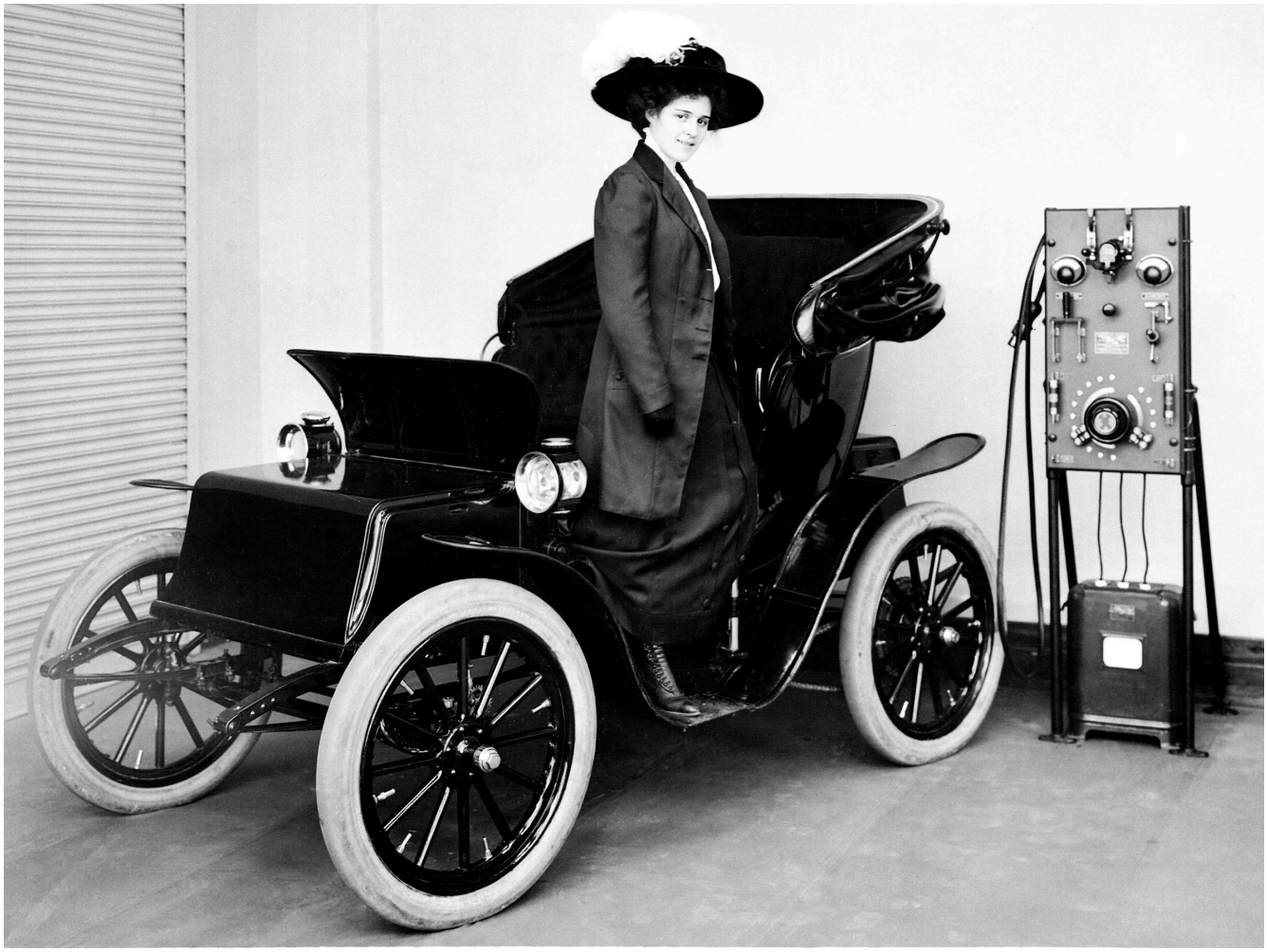
ARTICLE HISTORY OF TECHNOLOGY

When Electric Cars Were for Women › Early carmakers decided women wanted cars that were quiet, clean, and easy to start

BY ALLISON MARSH

31 OCT 2026

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When automobiles were still a novelty, electric cars vied with those powered by steam and internal combustion. MISCI—MUSEUM OF INNOVATION AND SCIENCE

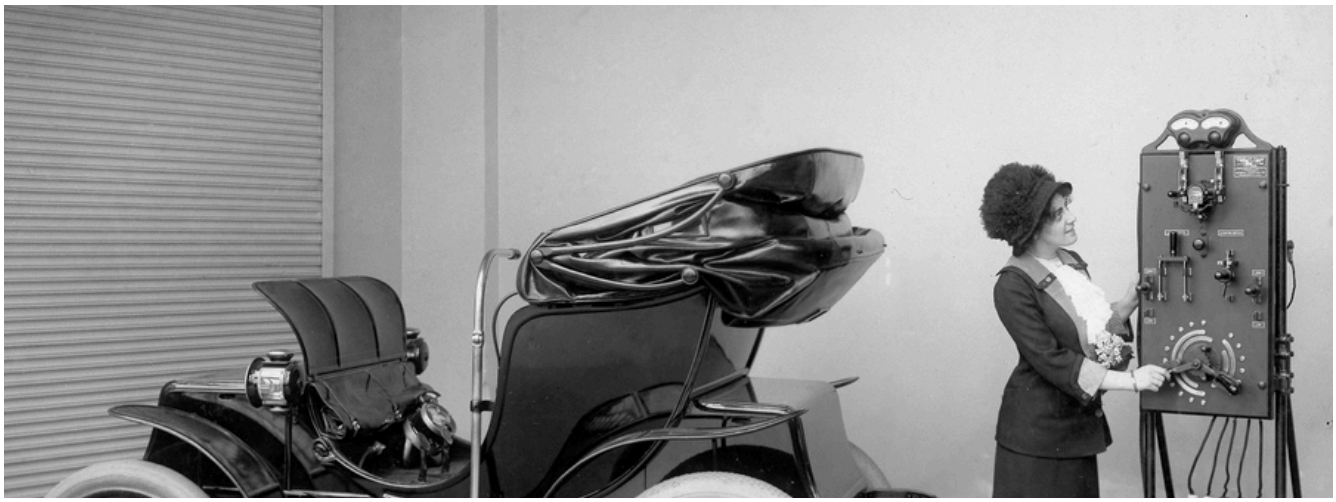
AT THE TURN OF THE LAST CENTURY, THE automobile industry was still new and evolving rapidly. In 1898, there were about 50 carmakers in the United States. A decade later, that number had increased fivefold. In 1901, the companies produced 7,000 vehicles. By 1910, production had reached 181,000.

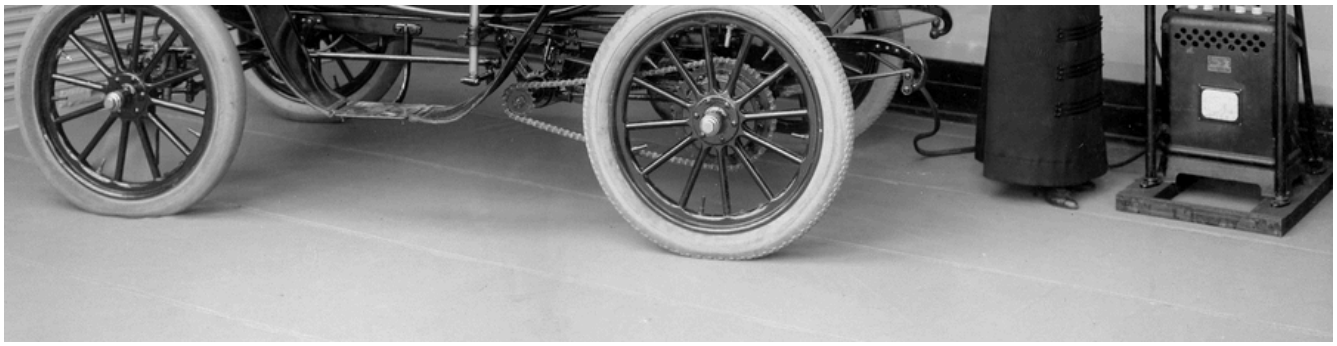
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For several decades, electric cars vied with those powered by steam and internal combustion, and nobody was sure which technology would come out on top. Steam had the legacy of locomotive technology behind it but came with a risk of fire. Steam-powered vehicles could also become exceedingly hot, depending on the placement of the boiler and the steam piping. Both gasoline and electric cars faced logistical challenges: How far could you travel without refueling or charging? You could always throw an extra can of gasoline in the back of the car, but charging a battery involved more planning. The infrastructure for long-distance travel was not yet in place.

Before the invention of the electric starter in 1911, gasoline-powered engines had to be started with a hand crank; once running, they were loud and emitted noxious fumes. Fully electric vehicles, by contrast, were easy to start; you just turned on the main battery switch, often with a key, and there was no foul exhaust to deal with.

Electric carmakers looking for a way to differentiate their products decided that these attributes made their vehicles perfect for women. (Electric cars were also marketed to doctors so that they could make house calls in the middle of the night without waking the neighbors.) General Electric, which made car chargers based on mercury-arc rectifiers, was so captivated by the idea of women driving electric cars that the company created a series of advertisements featuring stylishly dressed women plugging in their cars and posing with their charging stations.





In ads for its electric car chargers, General Electric featured women using the equipment. MISCI—MUSEUM OF INNOVATION AND SCIENCE

A young woman named Fannie Goodnow was an early EV adopter. She owned a 1908 Bailey Victoria Phaeton, an open two-seater that really did look like a horseless carriage, and she used a GE mercury-arc rectifier to charge it.

Who Invented the Mercury-Arc Rectifier?



Electrical engineer Peter Cooper Hewitt invented the mercury vapor lamp, which became the basis for the mercury-arc rectifier used in car-charging

car charging
systems.
BETTMANN/GETTY IMAGES

Electrical engineer Peter Cooper Hewitt is generally credited with the invention of the mercury-arc rectifier. During the first decade of the 20th century, Hewitt received several U.S. patents for electric lamps and other apparatus for transmitting and using electric currents. U.S. patents 968,896 and 1,163,706, granted to Percy H. Thomas, advanced Hewitt's designs. Thomas was chief electrician for the Cooper Hewitt Electric Co., which Hewitt had cofounded with George Westinghouse to manufacture and sell his lamps.

The mercury-arc rectifier functioned as a diode. In a car charger like the one Fannie Goodnow used, it converted alternating current from the power grid into direct current needed to charge the car's battery. A small amount of liquid mercury contained in a glass tube would vaporize and glow as electricity passed through it. Coupled with the carbon anodes, the vapor allowed current to flow in only one direction. This unit took about 12 hours to charge a drained battery.

A Carriage Maker Pivots to Electric Cars

I couldn't find any records as to why Fannie Goodnow opted for an electric car. But as a well-to-do woman living in the Boston area, she had more than a half dozen automobile producers to

area, she had more than a half dozen automobile producers to choose from. The one she chose was S.R. Bailey & Co. of Amesbury, Mass.



This early electric car charger used a mercury-arc rectifier to convert AC to DC. HERITAGE MUSEUMS & GARDENS

According to Galen Handy, who maintains the Early Electric Vehicles website, Samuel Robinson Bailey started in the carriage and sleigh business as a teenager, winning a best-in-show prize at a carriage exhibition in Portland, Maine, in 1855. Bailey developed a reputation as an inventor and designed processes to streamline the manufacture of his vehicles. He went into business for himself in 1882. Just over a decade later, one of Bailey's carriages won a gold medal at the 1893 World's Columbian Exposition in Chicago.

Bailey's son Edwin attended the exposition, where he likely

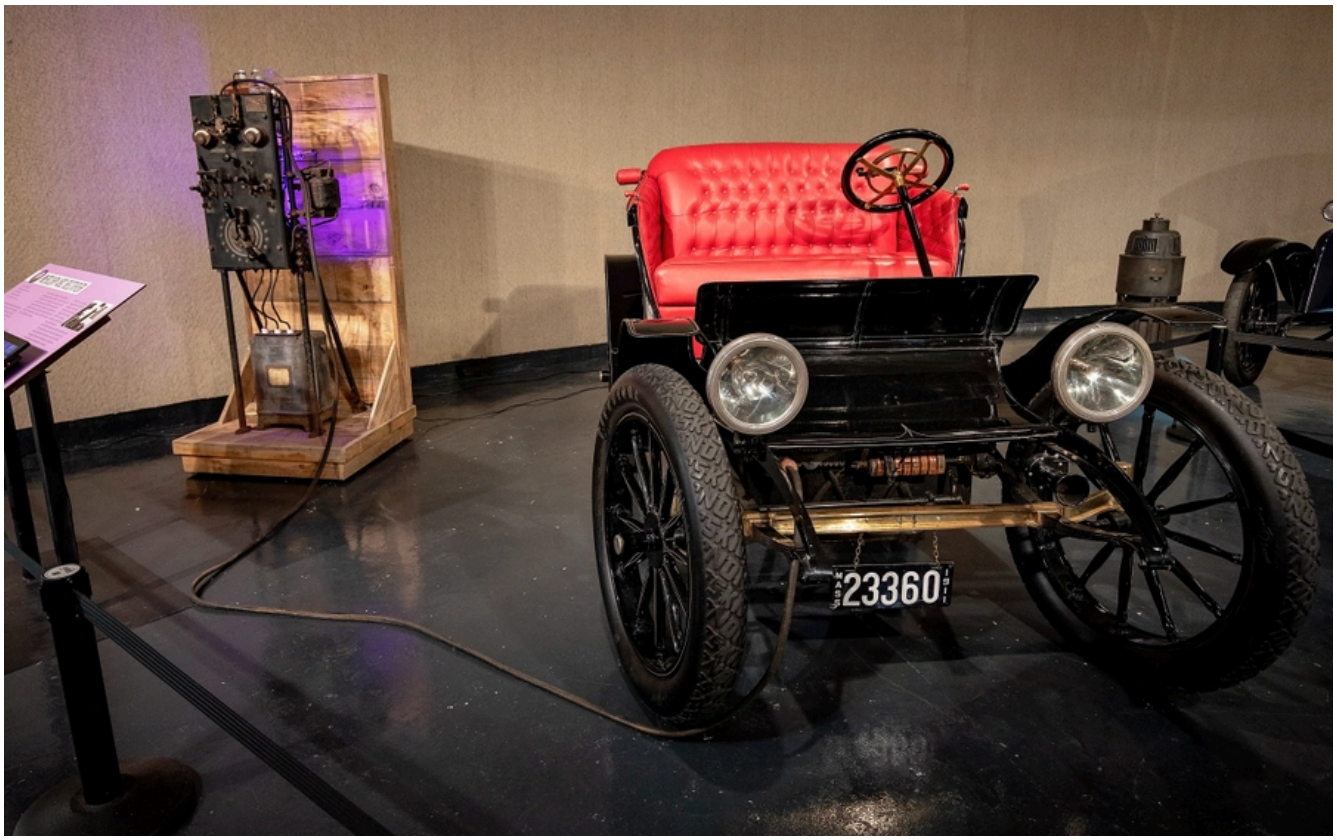
Bailey's son Edwin attended the exposition, where he likely would have seen a vision of the future: the Morrison electric wagon. This six-passenger, battery-powered vehicle ferried visitors and VIPs around the fairgrounds. It wasn't long before automobiles began eating into the carriage business. In December 1906, with the carriage industry collapsing, S.R. Bailey & Co. announced it was getting into electric vehicles.

Thomas Edison Designed a Bad Battery

Bailey's first model, the Victoria Phaeton, used an Edison alkaline battery. Thomas Edison had been working on a lighter, more reliable, and more powerful battery for the auto industry since the 1890s, and announced the achievement with great fanfare in 1903. Unfortunately for Bailey and other carmakers who deployed it, the battery leaked and wouldn't hold a charge. Edison was forced to go back to the drawing board. By 1910, he had a better battery in production, but by then his friend Henry Ford had introduced the Model T, setting the stage for the internal combustion engine to take over the market.

While Edison toiled to improve his tech, Bailey pivoted to a battery from the Gould Storage Battery Co. of Depew, N.Y. Gould also supplied batteries for railroads, utilities, subways, elevators, and farms. Goodnow's Victoria Phaeton used a 30-cell lead-acid battery housed in a wooden box that was suspended under the chassis. The standard battery had a range of 64 to 80 kilometers;

chassis. The standard battery had a range of 64 to 80 kilometers, a larger battery with 50 percent more capacity was available for an upcharge. With the standard battery, the Victoria Phaeton cost US $2,000 (about $73,000 today, or about the list price of an upscale EV like the Audi Q8 or BMW i5).

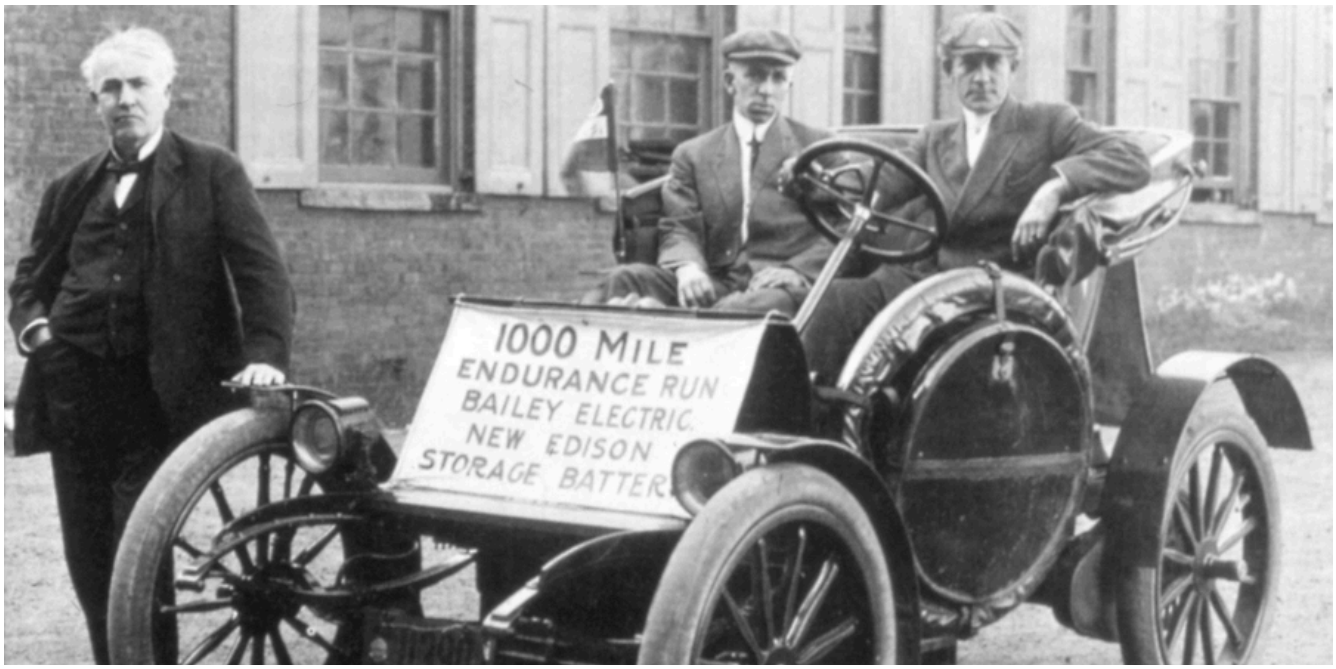


Fannie Goodnow's electric car charger now resides at the Heritage Museums & Gardens in Sandwich, Mass. But her 1908 Bailey Victoria Phaeton has been lost to history. Shown here is a 1911 version of that model. SARAH THORNINGTON/HERITAGE MUSEUMS & GARDENS

Goodnow installed a mercury-arc rectifier charging station in the barn adjacent to her parents' summer home in Hull, Mass. Bill Lillie of Vintage Electric Cars notes that the charging plug was of an unusual design. This is, of course, one of the banes of any

an unusual design. This is, of course, one of the banes of any early adopter: nonstandardized plugs and cables. The Electric Vehicle Association of America, which formed in 1910, tried to put forward a standard so that electric vehicles could be charged at any charging station. (Modern EV owners can no doubt relate.) But savvy electric car owners knew to carry spare plug adapters and cables when traveling.

When Edison's improved battery was finally available, Bailey began using it in the Victoria Phaeton and then went on a publicity blitz. In September 1910, the carmaker sponsored a round-trip tour from New York to Boston, with a side trip up New Hampshire's Mount Washington, totaling about 1,600 km. Sadly, the "This Car Climbed Mt. Washington" bumper sticker hadn't yet become popular.





Thomas Edison supplied the batteries for an electric car made by S.R. Bailey & Co., which then went on a publicity road trip from New York to Boston. MISCI—MUSEUM OF INNOVATION AND SCIENCE

Although Thomas Edison posed for a photo with the new Bailey Victoria Phaeton that featured his new battery, he himself chose a Detroit Electric Victoria for his own use. (Edison was known to be a terrible driver, so someone else likely chauffeured him around.)

Unable to compete against the rising tide of Model Ts, S.R. Bailey sold its factory in 1915, having produced about 500 to 600 electric vehicles.

Although the vehicle Fannie Goodnow chose turned out to be just a blip in automotive history, I like to imagine her driving about town in a beautiful car that embodied all the quirks of early adoption. I hope her friends didn't make fun of her for investing in electric just before internal combustion took off. I hope she didn't get stranded without the proper charging cable. I do not know what happened to her or her Victoria Phaeton, but her charging station remained in situ until 2022, when it was donated to the Heritage Museums & Gardens in Sandwich, Mass.

Now it stands ready to tell stories of technological change and adoption that continue to resonate today.

Part of a continuing series looking at historical artifacts that embrace the boundless potential of technology.

An abridged version of this article appears in the November 2026 print issue.

References

For a detailed history of the development of the mercury-arc rectifier (or valve), see Deepak Tiku's article in the March/April 2014 issue of *IEEE Power & Energy Magazine.*

Harry Cooke Cushing Jr., a fellow of the American Institute of Electrical Engineers, wrote (and updated regularly over a number of years) *The Electric Vehicle Hand-Book,* which gave general instructions for the care and storage of batteries, including how to charge them with a mercury arc rectifier. Discussion of the mercury-arc rectifier begins on page 156 of the 10th edition, published in 1922. (The American Institute of Electrical Engineers is one of the predecessor organizations of the IEEE.)