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A state marker identifies the birthplace of George Westinghouse Jr. At left are the house and original dug well, enclosed and looking like a porch. The house has been placed on the state and national registers of historic places.

I see George Westinghouse as one who captures the essence of an indomitable spirit and human potential – a “pattern of humanity.” – Rosemary Christoff Dolan

***Engineer, Industrialist, Inventor
Was Born In Central Bridge***



Courtesy George Westinghouse Museum, Wilmerding, Pa.

George Westinghouse: A Pattern of Humanity

Rosemary Christoff Dolan

Rosemary Christoff Dolan is a Rochester native and freelance writer and photographer. She has lived in Schoharie County since 1987 and wrote "The Central Bridge Fire Department" in the Schoharie County Historical Review in fall 1997, has published articles and photographs in area newspapers and has won photography awards in the Mario Hirsch-Belmont Park, Visions of Schoharie County and NY FARMS! photo contests.

CENTRAL Bridge residents turned out in force on Saturday, October 5, 1996, to celebrate their most famous son on the eve of the sesquicentennial of his birth. The tribute was organized by Frank Wicks, a professor of mechanical engineering at Union College in Schenectady, and the Central Bridge Civic Association.

Born on October 6, 1846, in a white frame farmhouse in the "old village" of Central Bridge, George Westinghouse Jr. would become one of the greatest engineers, industrialists and inventors of his time.

Between the Civil War and World War I – considered by some to be the most important half century in industrial history – his creative energies and bold new concepts abounded. During his lifetime he received 361 patents on inventions and founded some sixty companies, including Westinghouse Electric and the Westinghouse Air Brake Company.

Acclaimed in his time as the "greatest living engineer,"²⁵ his pioneering work with railroads and electric power systems revolutionized these two industries. Westinghouse was responsible for advancing the manufacture of

25. Frank Wicks, "How George Westinghouse Changed the World," *Mechanical Engineering*, October 1996.

power by devising a way to distribute electricity using alternating current (essentially the transformer). His invention of the air brake in 1869 hastened the growth of railroads at a time when they were starting to have a profound impact on the growth and prosperity of communities across the nation. He also invented the improved car replacer and rerailing frog, to remount the wheels of a derailed car onto the rails; railway signaling devices; interlocking switches; an improved car coupling; and the friction draft gear. His innovations impacted a third industry when he developed a natural gas transmission system.

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The quiet of tiny Central Bridge today belies the colorful history of a once-thriving railroad boom town. As an agricultural and industrial center, Central Bridge was a leading producer of buckwheat flour, the shipping point for milk, and second home of the threshing machine industry.²⁶ At the turn of the century, Peter Enders and W.B. Colyer established the Central Bridge Auto Company, which became one of the largest marketers of Model T Fords in the Northeast.²⁷

The "old village" of Central Bridge is situated at the meeting place of the Cobleskill and Schoharie creeks, along what is now Route 7. Central Bridge derives its name from the Route 7 bridge over the Schoharie Creek, built originally as a covered bridge in 1823.

The advent of the Albany and Susquehanna Railroad (later the Delaware & Hudson), which operated from Albany to Binghamton, transformed the tiny hamlet into a center of commerce. In 1863, the Central Bridge railroad station was built about a mile from the old village. Businesses flocked to the "new village," marking the beginning of phenomenal growth and prosperity that continued well into the twentieth century.²⁸

If some day they say of me that in my work I have contributed something to the welfare and happiness of my fellow men, I shall be satisfied.

—George Westinghouse Jr. Inscription on marker at his birthplace in Central Bridge.

26. "Greatness of the Village is Gone, 'Fixer' Carried on Traditions," *Schoharie County Historical Review*, spring 1979, 22-24. Reprint of an article in the Albany N.Y. *Knickerbocker* 6 July 1936.

27. "McCarthy Ford, Inc.," *Over the Bridge to Yesteryear*. Eccentric Club of Central Bridge, 1978.

28. "How Central Bridge Began," *Over the Bridge to Yesteryear*.

George junior was the eighth of ten children born to George and Emaline Vedder Westinghouse, both of whom came from generations of farmers and mechanics. George's father was a talented inventor in his own right. He built a wheat threshing machine that helped revolutionize American agriculture. According to an article in the Albany *Knickerbocker News* on a July 6, 1936, "Central Bridge was second home of the threshing machine industry, its birthplace having been Minaville, Montgomery County. There dwelt the first builder, George Westinghouse Sr."²⁹ He had moved from Vermont to Central Bridge where he established a plant near Route 7 to manufacture threshing machines and agricultural implements.

A highlight in George junior's life was when his father built a threshing machine for a local farmer and the whole town turned out to watch it thresh wheat.³⁰ As a horse on a treadmill made the wheels go round, George liked to watch the machinery in the thresher separate the grain for the straw. He liked to tinker with bits of machinery in his father's shop and by the age of seven was already experimenting with making motors and machines. He preferred inventing to attending school and was often truant. His father had little patience with the boy and routinely relegated George's early creations to the scrap heap.

The threshing machine industry became the mainstay of the village and grew rapidly. When Westinghouse was ten, the family moved to Schenectady, thought to be a more advantageous location to set up an agricultural machinery manufacturing plant. The factory was called G. Westinghouse & Co. and was located where the General Electric complex now stands. Here, young George met Stephen Keyes Campbell, who had worked for his father in Central Bridge and who was hired as foreman of the Schenectady plant. It was S.K. Campbell who fostered the boy's inventive bent by encouraging him, and eventually setting up a workshop for him in the loft of the plant, where George worked on his own inventions.

In May of 1860, when George was thirteen, he went to work at his father's shop, earning fifty cents a day. He received periodic raises and by April 1863 he was raised to one dollar twelve and one-half cents a day.³¹ He had the opportunity to work with all types of machinery.

By the age of fifteen he had invented the rotary steam engine, for which he would receive his first patent in 1865 at the age of nineteen. During this period of discovery and experimentation, he cultivated the skills and discipline that were the foundation for the creative genius. He later referred to

29. "Greatness of the Village."

30. "George Westinghouse," *Over the Bridge to Yesteryear*.

31. Henry G. Prout, *A Life of George Westinghouse*, 7.

this experience, coupled with his military service, as his "early greatest capital."³² George Westinghouse may well have been the most productive inventor on record. He continued taking out patents throughout his life, averaging one a month.

When the Civil War broke out he was fourteen and wanted to enlist, along with two of his older brothers, Albert and John. His father permitted the older boys to sign up, but not George. He ran away, but his father promptly brought him back. Two years later he went to war as an enlisted man in the Union army. After serving in the infantry and cavalry, he completed his service as a navy shipboard engineering officer. Albert was killed in action and John returned to establish a mission and night school, and to work with underprivileged children.

Returning home, the eighteen-year-old veteran enrolled in Union College to study engineering but dropped out after just one semester, finding there was little he could learn in the classroom. The dean told him to stop wasting his time and the college's time. He returned to his father's shop, his real academy, where he learned most of what he was to know. That fall, he obtained his first patent. "He was doodling in class and the things he was doodling were for patent applications," said George Westinghouse IV,³³ the inventor's great-grandson.

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In 1866, a train Westinghouse was riding on came to an abrupt halt to avoid colliding with the wreckage of another train. He had the opportunity to examine the wreckage firsthand and recognized the limitations of stopping the train manually. He began to search for a way to stop trains safely and swiftly.

Up to that time, railroad travel had been very unreliable and the casualties from accidents and occupational hazards were estimated to be upwards of 30,000 people a year.³⁴ To stop the train, the brakemen had to respond to the engineer's whistle by jumping from car to car and turning a hand wheel on each car to tighten a chain under the car. This forced brake shoes against the wheels of the car. The stops were unpredictable, stopping short or over-

32. Prout, 5.

33. Susan K. Schmeichel, "Westinghouse Legacy Alive in Wilmerding," Pittsburgh, Pa., *Tribune-Review*, 9 June 2004. http://www.pittsburghlive.com/x/tribune-review/business/s_197942.html, 11 September 2004. George IV, of Atlanta, Georgia, first visited Central Bridge on October 5 1996 as a guest at the sesquicentennial tribute.

34. Wicks.

shooting their mark. This was a dangerous job and those fortunate enough to survive it often lost one or more of their fingers.

Westinghouse experimented with new braking systems, looking for a centralized system that could be operated by the engineer in the locomotive. He came upon the idea of using compressed air, similar to the system used to power rock drills while tunneling, and drew up detailed plans for the air-brake. While working as a sales representative for Anderson & Cook, a steel mill which agreed to produce his re-railing frog, he routinely traveled to Pittsburgh where he attempted to interest his railroad contacts in the air brake.

However, his "unsound" invention was not taken seriously and young Westinghouse earned the nickname "Crazy George." No one seemed interested in investing in his enterprise – even his own father turned him down, urging him to seek a more practical way to earn a living.

Finally, Ralph Baggaley, a friend and general manager of a nearby foundry, provided enough capital to build an experimental model by installing the air brake on a locomotive and four cars. Still, railroads were not interested in trying out the air brake. It would be months before W.W. Card, the superintendent of the Steubenville Division of the Panhandle Railroad, decided the idea had merit and persuaded the railroad to stage a test run from Steubenville, Ohio, to Pittsburgh.

As fate would have it, along this same route a team of horses was pulling a wagon across the tracks. The horses reared and the driver fell onto the tracks. The air brake was applied and the train came to a jolting stop. The passengers, who were prominent officials and railroaders invited by Westinghouse, were buffeted about, some sustaining minor bruises. But the air brake had succeeded in stopping the train quickly enough to avoid a collision and the drayman on the tracks lived to tell the story. On April 13, 1869, Westinghouse, while still a resident of Schenectady, received his patent for the air brake. At age twenty-two he went on to form the Westinghouse Air Brake Company at Wilmerding, Pennsylvania, and later, the Westinghouse Electric Company at Pittsburgh.

He continued to work on perfecting the air brake over the next twenty years and received over 100 more patents before making his air brake fail-safe. Within five years of receiving the first patent, 10,000 air brakes had been installed on locomotives and cars. Within ten years, 36,000 cars were equipped with Westinghouse brakes.

During the 1880s, freight trains were growing longer and heavier. He foresaw the mechanical effects of the air brake in its handling of these trains and the need to mitigate the shocks and stresses due to starting and stopping. As trains stopped, the springs between cars were compressed. When

the brakes were released this energy was also released and would push the cars apart with enough force to break the couplings. His invention of the friction draft gear, patented in 1888, was instrumental in helping to dissipate the energy by friction rather than storing it in springs. Some considered this to be his greatest contribution to railroading. In 1888, the Master Car Builder's Association recommended that the air brake be the standard brake for freight trains.

He met Marguerite Erskine Walker on a train and they were married shortly thereafter, on August 8, 1867. Both creative – she was an artist and he an inventor – they remained a devoted couple throughout their forty-six years of marriage and had one child, George III, born in 1884. Westinghouse attributed whatever successes he may have attained in life to his wife. It was said that their love affair lasted a lifetime.

Henry Herman Westinghouse, the youngest of the brothers and a mechanical engineer, was long associated with his brother's air break company. In 1883 Henry invented a high-speed steam engine which became an important factor in the success of the electric power industry. In 1886, the Westinghouse Electric Company was chartered with George Westinghouse being president and H. H. Westinghouse vice president.

George Westinghouse and Thomas Edison (1847-1931) were contemporaries and the two legendary inventors were known for their rivalry. In 1884, Westinghouse decided to delve into the field of electric lighting, an industry dominated at the time by Edison, who was a proponent of direct current. To compete, Westinghouse bought the patents of other inventors and combined them to produce a system of light and power using alternating current.

Renowned for his inventions of the light bulb, phonograph and motion picture camera, Edison had started the first utility system in 1882, providing 110-volt direct current to a select group of people in New York City. Westinghouse redesigned the transformer and in 1886 staged the first U.S. demonstration of the alternating current system at Great Barrington, Massachusetts.

A few months before Edison was due to arrive in Schenectady, where he founded the General Electric Company, Westinghouse established that city's first electric utility, the Westinghouse Illuminating Company.

At the time, a controversy had been brewing as to the safety and usefulness of AC over DC current. In an attempt to discredit Westinghouse, Edison promoted the use of high voltage AC for the execution of criminals by the electric chair. He coined the term "Westinghoused" to mean "electrocuted." Fortunately, the term never caught on.

In 1888, Westinghouse acquired the patent rights for a device that would transform the voltage of AC so that electricity could be carried over long

In order to meet his commitment, Westinghouse needed to devise an emergency lamp as quickly as possible. He owned patent rights to the two-piece Sawyer-Man lamp invented in 1880, which used a stopper. Edison began injunction proceedings to restrain Westinghouse from making the two-piece lamp but the court ruled that it did not infringe on Edison's patent.

To produce the lamps by deadline, Westinghouse invented a more efficient vacuum pump, organized a glass factory, and designed new machines for grinding the globe and glass stopper. He produced more than 250,000 lamps needed to light the fair, which remained open for six months.

When the Columbian Exposition opened in Chicago on May 1, 1893, the Westinghouse exhibit was one of the few large exhibits ready for operation. In a dramatic demonstration, Westinghouse provided the greatest display of incandescent lighting to that time.³⁶ It introduced the public to the advantages of alternating current over direct current and ended the "battle of the currents." Alternating current was here to stay.

This success was followed by the Niagara Falls hydroelectric project in 1896. Using three polyphase generators, Westinghouse harnessed a total of 15,000 horsepower from Niagara Falls and transmitted the power twenty-five miles away to Buffalo. This demonstrated the practicality of the alternating current transmission system. A tribute came from Nikola Tesla himself, the inventor whose patents Westinghouse had acquired: "George Westinghouse was, in my opinion, the only man who could take my AC system under the circumstances then existing and win the battle against prejudice and money power. He was one of the world's true noblemen of whom Americans may well be proud, and to whom humanity owes an immense debt of gratitude."³⁷

On the occasion of the centennial celebration of Westinghouse Electric Corporation in 1986, chairman Douglas Danforth proclaimed, "It was indeed the magic of the alternating current system – or 'Westinghouse current' as it was called in its early days – which made possible the major developments resulting from the dawn of the Age of Electricity in America."³⁸

IN his time, Westinghouse was respected for his honor and integrity. He was bestowed honorary doctorate degrees from Union College and Königliche Technische Hochschule in Berlin, and declined several others. He received the Grashof Medal, perhaps the highest engineering honor in Germany, and engineering honors in the United States: the John Fritz Medal

36. *Centennial Review*.

37. *Centennial Review*.

38. *Centennial Review*.

and, ironically, the Edison Medal named for his long-time rival. He was an honorary member of the American Association for the Advancement of Science and the American Society of Mechanical Engineers, in which he served a term as president.

Following the Equitable Life Assurance Society insurance crisis of 1905, three individuals of high moral character were selected to serve on a panel of trustees, to restore public confidence. In a press cable going to Europe, the panelists were announced as Grover Cleveland, former president of the United States; Morgan J. O'Brien, justice of the New York State Supreme Court; and George Westinghouse. He needed no further introduction.³⁹

Charles A. Ruch, a co-founder and volunteer historian at the Westinghouse Museum from 1987 to 1998, attributed the inventor's great success to his ability to turn an idea into an enterprise. One of the strengths of Westinghouse Electric was an open-minded policy toward the inventions of others. They always gave credit to the inventor by incorporating his name with the article he had invented.

At his peak, 1893 to 1907, Westinghouse was considered to be the largest⁴⁰ private employer in industrial history, with 50,000 employees from coast to coast. In sharp contrast to most employers of the day, when ruthless exploitation of workers was the norm, Westinghouse was known for his kindness and fairness. In 1871 he was the first to offer half-day Saturday holidays, in the Pittsburgh area if not the entire United States. It was the precursor to the five-day work week. In 1907, he created a relief department to protect employees against loss of earnings in case of disability and provided widow's benefits to the survivors of deceased employees. In 1908, he established a pension plan and in 1913 he provided paid vacations for workers. He also provided an in-plant hospital for workers and their families. At Wilmerding, Pennsylvania, he founded a planned community for Westinghouse employees featuring a swimming pool, bowling alley, dance hall, restaurant and library.⁴¹

George Westinghouse Jr. died on March 12, 1914, and his wife, Marguerite, just three months later. They are buried in Arlington National Cemetery in Washington, D.C.

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In the audience at the 1996 sesquicentennial was Dr. Lorraine Davis, current owner of the home in which George Westinghouse Jr. was born. Flanked by locust trees, the 1800 clapboard structure stands on 1.8 acres

39. Prout, 17-18.

40. Prout, 18; Wicks, 75.

41. Prout, 294-300; *Centennial Review*.

George Westinghouse Virtual Museum. George Westinghouse Museum Foundation.
<http://www.georgewestinghouse.com/museum.html>, 11 September 2004.

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