Celebrating Western Pennsylvania's Engineering Achievements

By Michael G. Bock, P.E., Esq.
President, Engineers' Society of Western Pennsylvania

The following article is a reprint from the February 18, 2005 Engineers' Week supplement to the Pittsburgh Business Times.

Please join me and the other 800 members of the Engineers' Society of Western Pennsylvania (ESWP) in celebrating, during National Engineers Week (February 20 – 26, 2005), the many accomplishments of this region's engineers and the positive impact that engineering has had, and continues to have, on our communities and our daily lives.

Since the founding of ESWP in 1880 — by such local industry stalwarts as Andrew Carnegie, Alfred E. Hunt and George Ferris — our region has seen a continuous succession of engineering accomplishments that have shaped our way of life. Examples of such notable accomplishments include the Smithfield Street Bridge, completed in 1883, and erection of the Frick Building in 1902 and the City-County Building in 1917. The country's first commercial radio transmission, by KDKA, took place from Pittsburgh in 1920.

The 1920's also saw construction of the "Three Sisters"—the Sixth, Seventh and Ninth Street Bridges. In 1932, Pittsburgh's then-tallest building, the Gulf Tower, was completed. The state of the art Pennsylvania Turnpike was completed in 1940. The decade of the 1950's saw completion of the Gateway Center complex, the original Greater Pittsburgh International Airport, and the country's first commercially operated nuclear power plant at Shippingport. Likewise, the late 50's and early 60's saw completion of the Ft. Pitt and Ft. Duquesne Bridges.

Three Rivers Stadium, the U.S. Steel Tower and the fountain in Point State Park were completed in the 1970's. The 80's experienced a boom in commercial building construction, as represented by One Mellon Bank Center, One Oxford Centre, PPG Place, the Dominion Tower and Fifth Avenue Place. During the 1990's, the site of the old LTV Steel plant on the South Side was cleared, environmentally cleaned, and rejuvenated with a variety of dynamic, mixed-use facilities.

> ***"…our region has seen a continuous succession of engineering accomplishments that have shaped our way of life."***

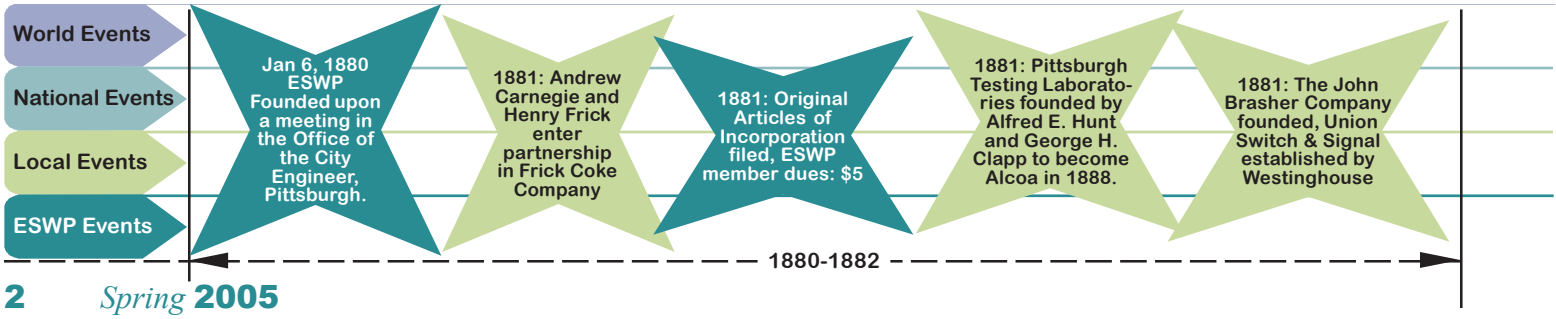
Since the turn of the 21st century, we have seen the development of two state of the art sporting venues, PNC Park and Heinz Field. The world class David L. Lawrence Convention Center lays claim to being the first facility of its nature to be designed and constructed with "green" building features. Last year, the award-winning Braddock Dam was completed—the first inland navigation dam to be constructed "in the wet" through use of innovative float-in technology.

Indeed, our region has cause to celebrate these and many other engineering accomplishments during National Engineers Week. But, for us at ESWP, this week marks only the beginning of our observances. We are very excited about the year 2005 — our 125th anniversary year! To our knowledge, ESWP is the longest continually operating organization of its type in the country. To commemorate this very special anniversary, we are planning a variety of projects and activities in which we are hoping to involve the public at large. We have undertaken a fund-raising campaign to finance these special ventures and are truly grateful for the warm reception afforded our plans by virtually all of the local foundations, organizations, and individuals that we have approached for help. We have assembled a blue ribbon advisory council of local leaders, from both the public and private sectors, who are giving freely of their valuable time, and providing insightful advice and guidance to our efforts.

Our celebration plans include the publishing of a commemorative anniversary book that will chronicle the achievements of Western Pennsylvania's engineers over the past 125 years. Mark your calendars and join us on October 26, 2005 at the Convention Center for a commemorative anniversary dinner. We are pleased and excited to announce that our keynote speaker for the dinner will be the renowned author, historian and Pittsburgh native, David McCullough; and our master of ceremonies for the event will be WQED's documentary wizard, Rick Sebak.

Although the remainder of our anniversary projects will likely extend beyond 2005, our intent is to also produce a commemorative video, install an exhibit at the Heinz Regional History Center, and develop engineering-based educational programs for grade school and high school students at the Carnegie Science Center. We encourage you to check our website (www.eswp.com) in coming months for updates on our various anniversary activities.

Our celebration plans are, admittedly, ambitious. But, with the help and involvement of the community, we look forward to properly commemorating the achievements of Western Pennsylvania's engineers over the last 125 years. Let's kick it off with a memorable celebration during National Engineers Week!



125 Years… And Counting!

A timeline of ESWP and "everyone else"

By David A. Teorsky,
ESWP General Manager

Any organization or company would be pleased to state that they are (at least) 125 years old. It's quite an accomplishment that not many can state. I would venture to say that there have been many more entities that have "came-and-went", versus those who have persevered to achieve their 125th year milestone; the Engineers' Society of Western Pennsylvania (ESWP) is one such entity.

Founded on January 6, 1880 in the Office of the City Engineer, Pittsburg (sic), ESWP has adapted to the many changes since, and is alive and well 125 years later. Much has happened during this time; society has changed dramatically over this period. And from early industrialization to today's high-tech standards, the ESWP has kept pace all along the way.

In preparation for the Society's 125th anniversary year, I have gained a new respect for the contributions and participation that ESWP has made to Western Pennsylvania, and beyond. Reading from the volumes of the ESWP's early proceedings, you can literally see the city of Pittsburgh "grow up". Early ESWP members — names like Andrew Carnegie, John Brashear, George Ferris, John Roebling — were making their mark on the world, which helped Pittsburgh grow into an industrial and corporate powerhouse. Public health and safety, transportation systems, roads, bridges, tunnels and highways, heavy industry, mining, natural resources, design and construction are but a few topics recorded in the minutes of the ESWP earliest meetings. And Society members weren't on the sidelines; they were doers who were intimately involved with some of the weightiest responsibilities of the day. Still to this day, ESWP members are involved in projects around the world, representing companies large and small — or working independently — to continue the spirit displayed by those giants of yesteryear.

And it wasn't ESWP that made these dreams become realities, it was the effort and brilliance of those engineers and architects and other members that allowed ESWP to claim involvement in the growth of the past 125 years. It is the members who made (and continue to make) the Society what it is; not the other way around.

To help place the ESWP into perspective with other events from around the world, and around the block, please note a special feature in this issue of *Pittsburgh Engineer* magazine. Running along the footer of each page, you can follow a continuous timeline that traces the events of the world, nation, local society and *your* Society from it's inception in 1880 through today. I hope that you enjoy some of the correlation between the layers of the timeline, and appreciate the continuity that ESWP has maintained while the world has changed so radically. And, yes, I am sure that many readers will know of events that don't appear in the timeline — it was truly both a pleasure and a challenge to arrive at this version — fear not, a full version in greater detail will be forthcoming in the new book commissioned by the Board of Directors that recounts the Society's first 125 years, due out in early 2006. (By the way, did you know that ESWP published the book "Pittsburgh" in 1930 to commemorate the 50th anniversary?)

The work contributed to date was thanks to the work of many hard-working volunteers, who did much of the digging into ESWP's archives and elsewhere to help identify the items considered for the timeline and upcoming yet-to-be-titled book. A special thanks to George Tannehill, Chuck Tabone, David Donahue, Jim Dwyer, Kevin Schuman, Glenn Baggley, Al Ackenheil, Rich Rice and Harold Hall for your thoughts and efforts. If you would like to join the effort, or have suggestions for additional items, please forward them to ESWP.

I hope that you enjoy reading along as much as we did researching, writing and learning about the early days of ESWP.

1882: ESWP Member Edwin Thatcher presents technical paper on the Slide Rule

1883: Smithfield St. Bridge completed. Designed by Gustav Lindenthal, a founding member of ESWP, who became New York City's commissioner of bridges.

1883: Brooklyn Bridge opens

1884: First Pittsburgh meeting of the American Society of Mechnical Engineers

1884: Seventh Street Bridge designed by Gustav Lindenthal erected.

1885: Washington Monument dedicated in Nations Capital

1882-1885

EDITORIAL COMMENT

Pittsburgh is a City of "Firsts"

By Dave Crawley
"KD Country" Reporter
KDKA-TV

Pittsburgh is a city of "Firsts". From mass produced aluminum, to the Westinghouse Air Brake, to the Lawrence Welk bubble machine — the City of Steel turns to its engineers for innovation. Another Pittsburgh "First" occurred 125 years ago, in the office of the City Engineer. Those who gathered in that room to form the Engineers' Society of Western Pennsylvania had no way of knowing the best was yet to come.

Did anyone foresee the shaving of the "hump", the engineering marvel that transformed Grant's Hill into the level cobblestones of Grant Street? Could they know that the experimental robots of George Westinghouse were precursors of a Robotics department at a University named for steel magnate Andrew Carnegie? As Walter C. Kidney notes in an article that follows, engineers have keep this city "on the move."

While looking to the future, you have not abandoned the past. The creations of Pittsburgh's greatest inventor are preserved in a Wilmerding mansion. I toured the George Westinghouse Museum in my role as Feature Reporter for KDKA-TV… and was pleased to see the inclusion of yet another First. KDKA radio began as 8XK, its signal emanating from the garage of Westinghouse employee Frank Conrad. An engineer, of course.

Steel makers built Pittsburgh. But engineers have kept it running.

Meet Our Featured Guest Speaker…
at the ESWP 125th Anniversary Banquet

David McCullough, author of the forthcoming 1776, is twice winner of the National Book Award and twice winner of the Pulitzer Prize. He has been called a "master of the art of narrative history." His books have been praised for their exceptional narrative sweep, their scholarship and insight into American life, and for their literary distinction. His John Adams, one of the most acclaimed American biographies ever published, hit the *New York Times* bestseller list at number one and remained on the list for more than a year. To date more than two million copies have been sold.

His new book, 1776, to be published in May, tells the intensely human story of those who marched with George Washington in the fateful year of the Declaration of Independence.

Gordon Wood, writing in the *New York Review of Books*, said of John Adams, "By far the best biography of Adams ever written… McCullough's special gift as an artist is his ability to recreate past human beings in all their fullness and all their humanity."

Edwin Yoder, in *The Washington Post*, wrote, "If nations appointed historians laureate, David McCullough would surely be ours."

In the words of the citation accompanying his honorary degree from Yale, "As an historian, he paints with words, giving us pictures of the American people that live, breath, and above all, confront the fundamental issues of courage, achievement, and moral character."

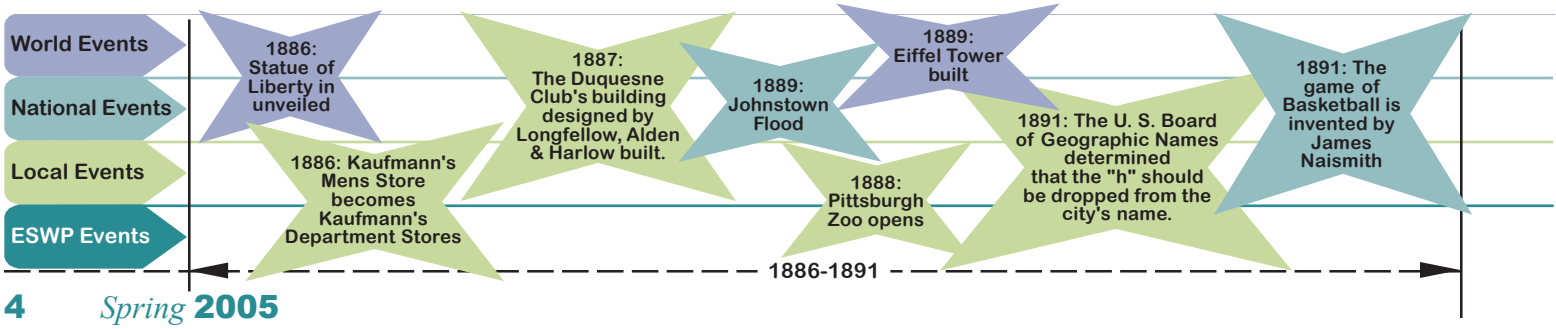
His books include The Johnstown Flood, The Great Bridge, The Path between the Seas, Mornings on Horseback, Brave Companions, and Truman. As may be said of few writers, none of his books has ever been out of print.

Mr. McCullough is as well twice winner of the prestigious Francis Parkman Prize. For his work overall he has been honored by the National Book Foundation Distinguished Contribution to American Letters Award, the National Humanities Medal, and the New York Public Library's Literary Lion Award. He is past president of the Society of American Historians. He has been elected to the American Academy of Arts and Sciences. He has received 31 honorary degrees.

In a crowded, productive career, Mr. McCullough has been an editor, essayist, teacher, lecturer, and familiar presence on public television — as host of *Smithsonian World*, *The American Experience*, and narrator of numerous documentaries including *The Civil War* and *Napoleon*. His is also the narrator's voice in Seabiscuit.

A gifted speaker, Mr. McCullough has lectured in all parts of the country and abroad, as well as at the White House. He is also one of the few private citizens to speak before a joint session of Congress.

Born in Pittsburgh, Mr. McCullough was educated there and at Yale, where he was graduated with honors in English literature. He is an avid reader, traveler, and has enjoyed a lifelong interest in art and architecture. He is as well a landscape painter. Mr. McCullough lives in West Tisbury, Massachusetts with his wife Rosalee Barnes McCullough. They have five children and seventeen grandchildren.



Moving Experiences

By Walter C. Kidney
Pittsburgh History & Landmarks Foundation

The local engineering past has offered occasional colorful instances of ponderous objects shifted from place to place, for reasons more or less practical. Here are a few.

At times, a whole massive building has moved. Around 1921, Second Avenue downtown was being widened into the Boulevard of the Allies, and among other things the eight-story building of the Joseph Woodwell Company had to yield its place at Second and Wood. Rather than being demolished, it was moved forty feet. The John Eichleay, Jr. Company, which claimed that between 1875 and 1925 it had moved 10,000 buildings, undertook the Woodwell move in a day and a half, surrounding sidewalks included. Eichleay publicity said that "Throughout the operation, sewer, water, gas, light, and telephone services were maintained. The elevators ran, and steam warmed the building's radiators." Outside, crowds stood in awe as the building visibly moved, but inside, the Woodwell staff went serenely about its business.

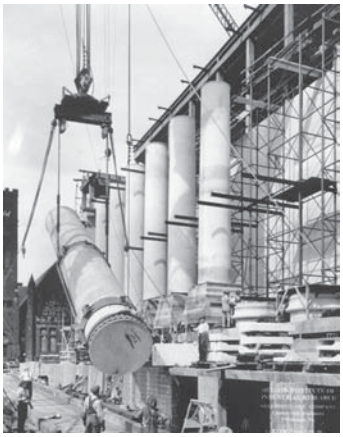
The Joseph Woodwell Company Building

The Allegheny County Morgue now stands on Fourth Avenue just east of Ross, but when it was completed in 1902 it stood a hundred yards uphill on Diamond Street (now Forbes Avenue) and Gala Way. People know it as a Richardson Romanesque building faced in massive, vigorously-textured stones, designed to go visually with the Jail and Courthouse across Diamond. The City-County Building had been added to the group in 1917, and in 1929 the County Office Building was planned for the corner land that the Morgue shared with the 1840-period South School. What to do with this public building due to be ousted, still useful albeit lugubrious in style and function? It was decided to move it to its present site: a ponderous operation involving massive timberwork and steel rails; a 32-foot move along Diamond, and then the ticklish 265-foot downhill move to the new foundation. At times the brittle Morgue had to be lifted, every inch of it to the same height at the same moment, and this part of the operation approached the fantastic: for a hundred men from a Balkan tribe — specialists in the Old Country, apparently, in moving buildings — manned a hundred screw jacks that they gave quarter-turns every time a whistle sounded until the Morgue was twenty feet in the air. The whole operation took about three months, but the sad business within went on without interruption.

The Allegheny County Morgue

> ***"…the brittle Morgue had to be lifted, every inch of it to the same height at the same moment,…"***

There was once a sort of distinctive Mellon style in the expenditure of money, at least for architecture, that was remarkably lavish, cool, and unflinching. Through this, Washington D.C. received the National Gallery, and Pittsburgh the Mellon Bank (with the Ionic banking room we remember); the East Liberty Presbyterian Church; and the Mellon Institute of Industrial Research. In the last, the Mellon Institute — a successor to a much more modest building on the Pitt Campus — either the architects, Janssen & Cocken, or the Mellons decided on a bold gesture in the form of a giant Classical order. Across Bellefield Avenue, the Gothic Cathedral of Learning, 535 feet high, was rising on land donated by Andrew Mellon, and a deliberate act of visual rivalry might seem unlikely. And yet: in 1937, a colonnade of 62 unfluted Ionic columns, with 36-foot monolithic shafts of limestone, was erected — purely for swank, with no practical purpose. These shafts were quarried in Indiana; turned there on giant lathes; shipped by rail to East Liberty; hauled to the construction site over streets that had to be specially reinforced in places; raised in slings; and lowered, bottom first, onto preset bases where precisely-set blocks of ice melted under the increasing pressure as the positions of the shafts were adjusted. Afterwards, the capitals and the entablature were lowered to complete the Ionic order.



The Mellon Institue of Industrial Research

1892: Carnegie Steel Works locks out employees in labor dispute at Homestead

1892: Alfred E. Hunt, co-founder of Alcoa, elected ESWP President. ESWP Chemical Section founded

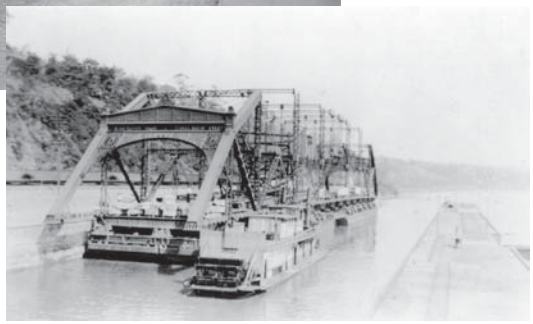
1893: Chicago's Worlds Fair, introduction of Ferris Wheel created by ESWP member George Ferris

1893: Member Dues increased to $7.

1895: Andrew Carnegie endows his first free public library

1892-1895

The former St. Clair Street Bridge…



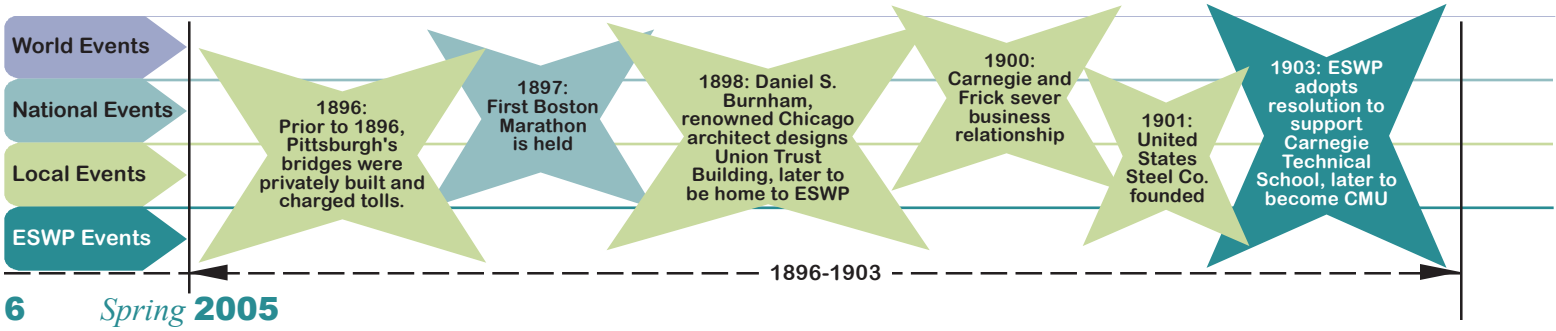
Became the new Neville Island Bridge

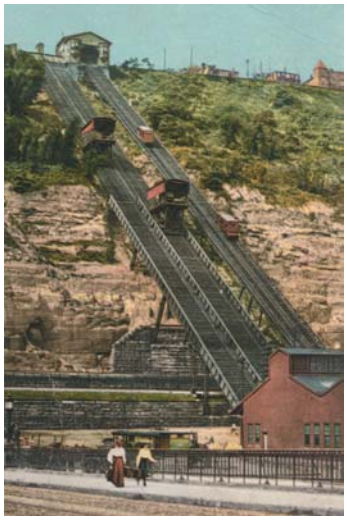
A bridge has crossed the Allegheny River at St. Clair Street—which we call Sixth Street—since 1819. The first was a wooden covered bridge, the second a suspension bridge by John Roebling of Brooklyn Bridge fame, The third came in 1892: a work by Theodore Cooper, built to withstand the loads imposed by electric trolleys. This last involved two camel-back spans of 440 feet each.

The time for yet another Sixth Street Bridge came in the mid-1920s, when navigational clearance requirements led to the replacement of existing Sixth, Seventh, and Ninth Street Bridges by the handsome trio we now have. In 1927, Cooper's trusses came down, to begin a new existence on the back channel between Neville Island and Coraopolis. *The Bridges of Pittsburgh,* White and Bernewitz' 1928 classic, says that the 12-mile river journey of the bridge's two spans, each 1600 tons, and their re-erection at Neville Island resulted in an economy of $300,000. To slip under the bridges crossing downriver, the trusses' upper chords were temporarily reduced. The masonry central pier and abutments were demolished while the spans rested on temporary steel frames. The spans were lowered 18 feet onto four lashed-together coal barges per span, using a complicated assembly of pairs of steel suspension straps and hydraulic jacks that lowered the straps as water bled from their cylinders. The lowering process took 14 hours. The trusses passed the Emsworth lock "easily," and at Neville Island the temporary steel frames, straps, and jacks were used to raise the trusses 32 feet. The whole process took 140 days. The reconstructed bridge stood until 1994, when its steel was deemed too brittle for safety.

Now, here is an example of something *meant* to move, but that moved almost in spite of itself. Around 1890, Pittsburgh had three cable-car companies, the best-known of them the Pittsburgh Traction Company, which connected the Triangle with East Liberty via Fifth and Highland Avenues. In the horsecar days before 1888, this trip took nearly two hours in good weather. The cable car accomplished the trip in forty minutes, hauled along by three cables in successive eastbound-westbound loops, the westernmost cable going eight miles an hour, the others twelve. There were drawbacks, though, to this obvious improvement. The cables themselves were the major part of the total load; more than half the energy from the powerhouses was spent on simply moving them. They could wear or fray, and had to be repaired or replaced at times, shutting down the system. The capital investment in underground construction was high. And changes of gradient and tight curves were real challenges. The ascent of Soho Curve, shown

The Fifth Avenue Trolley - Soho Curve



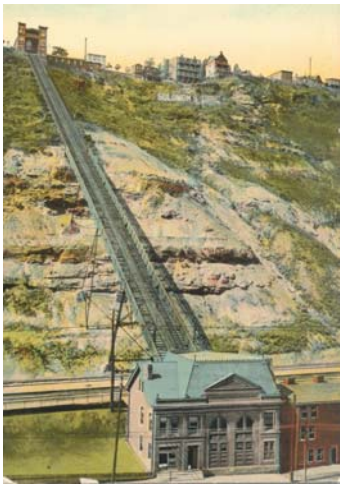


The Monongahela Incline

here, involved a four-percent gradient over a half-mile, with one curve of 350-foot radius, one of 250 feet, and another of 350 feet. Easing the cable around this tight, complicated curve required 290 subterranean pulleys, closely spaced. The picture shows the cover plates in the pavement, not much more than a yard apart. (For the orientation of modern Pittsburghers: St. Agnes' Church stands about where the upper part of the curve winds out of sight, and Carlow University is at the top of the rise these days, where the castle-like Ursuline Convent stands in the photograph).

To Pittsburghers, inclines—funiculars, as others call them—may seem less bizarre, affairs of a few hundred feet rather than miles, but it is remarkable to reflect, even so, that we once had about twenty of them for the transport of pedestrians and vehicles, and others to lower coal from mines near the top of Mount Washington. The coal inclines appear on a map of 1852 and probably started operations long before, powered by gravity. It was not until 1870, though, that the Monongahela Incline initiated a passenger service up Coal Hill (Mount Washington) to the eastern end of High Street (Grandview Avenue), sparing pedestrians at last a winding road climb of nearly 400 feet. This picture shows the Incline after 1883, when a broad-gauge vehicular incline was built just to its east. This added incline was demolished in 1935, when electric power replaced steam. As we see it today, the Mon Incline has a lower station of the 1900s, a much-altered and enlarged upper station of the 1870s, and track structure and cars of recent years.

Our other surviving incline, a mile westward, is the Duquesne (or Duquesne Heights) Incline, begun in 1877. This is notable, in its upper station, for displaying the drive machinery, with its wooden-toothed gear wheels. Here, the cars are genuine antiques, with bodies of 1889 by the Philadelphia streetcar builder Brill.



The Duquesne Incline

1903: Wright Brothers first flight

1903: Pittsburgh Pirates play in first "World Series" losing to Boston Americans 5 games to 3.

1905: First "nicklelodeon" is opened in Pittsburgh

1905: Einstein's Theory of Relativity

1908: Henry Ford introduces the Model T

1909: Forbes Field built — the first baseball stadium in the U.S.A.

1903-1910

A Century of Engineering

By: James H. Garrett,
Patricia Laughlin,
and Chriss Swaney,
Carnegie Mellon University

The Charter Class of 1905 at the Carnegie Technical Schools founded by industralist Andrew Carnegie

Andrew Carnegie understood the importance of education and its ability to improve the lives of the working class. Carnegie, the son of a master weaver in Dunfermline, Scotland saw his boyhood paradise torn asunder when his father's skills were rendered obsolete by the power loom. He emigrated to Pittsburgh at age 12. Quick-witted, shrewd and resilient, he survived a Dickensian adolescence to become one of the Gilded Age's wealthiest industrialists.

"Put all your eggs in one basket," Carnegie once advised, "and then watch that basket." For him, that basket brimmed with steel. Fiercely competitive, obsessed with innovation and efficiency – he would unhesitatingly scrap a relatively new plant to erect a more modern one. Carnegie imported the Bessemer forced-air steel process to America. Such innovation permitted him to reduce the price of rails – the product that initially drove the industry – from $160 a ton in 1875 to $17 by 1900. His steel furnished the growth of America's burgeoning towns and factories. His philanthropy built the Carnegie Technical Schools.

The 120 members of the charter class of 1905 at the Carnegie Technical Schools enrolled in programs of study leading to three-year diplomas in the fields of architectural practice, chemical engineering practice, civil engineering practice, electrical engineering practice, mechanical engineering practice, and metallurgical engineering practice. (Those disciplines would map directly into the engineering disciplines a century later in the engineering college.)

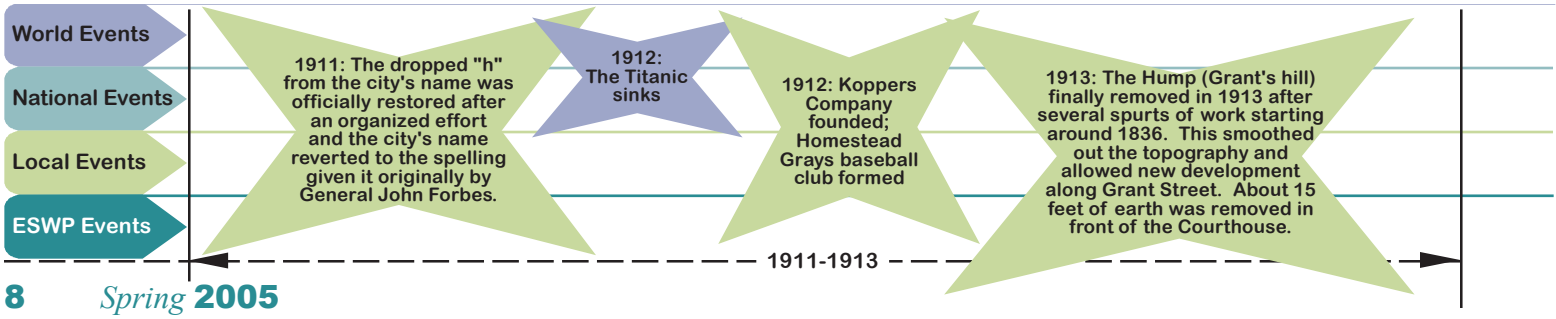
In 1912, the technical schools became a four-year degree-granting institution offering bachelor's and master's degrees and in 1922, the School of Applied Science was recognized as the College of Engineering, (Carnegie Tech). The early engineering curriculum was characterized as hands-on technical training in courses taught by faculty who were often practitioners. By 1928 engineering students faced a daunting array of technical course requirements that crowded out classes in science, humanities and social science. Carnegie Tech was training technologists rather than educating engineers, and by 1929 engineers who were so narrowly trained often failed to find employment outside their fields.

Early on, concern arose in the college about the process by which students became engineers. Carnegie Tech President Robert Doherty, having observed engineers while employed at General Electric, felt that colleges and universities were failing students by not educating them in problem-solving skills. His "Carnegie Plan for Professional Education" emphasized an understanding of the fundamentals of science and engineering, creative problem solving, and an appreciation of the humanities. As a result, new courses in humanities and social leadership were added to the engineering curriculum. Engineers were educated to develop creative and analytical abilities.

> ***"…(The Carnegie Plan) emphasized the need for engineering students to possess problem-solving skills in the context of larger social issues and to understand the impact of technology on society."***

As historian Edwin Fenton states, "To achieve his goals, Doherty divided the curriculum into two stems: the scientific stem and the humanistic–social. The scientific stem would teach problem solving by laying a foundation in fundamental scientific courses… The humanistic-social stem would give students social knowledge… Doherty argued that this curriculum should educate students to become engineers, not to train them to be engineers."

The Carnegie Plan was significant not just because it emphasized problem solving, but because it emphasized the need for engineering students to possess problem-solving skills in the context of larger social issues and to understand the impact of technology on society. In 1940, all first-year students at Tech were required to take a common curriculum that included humanities courses. By 1945, Tech faculty were writing papers on the new curriculum and their assessment of its impact, and in 1948, faculty volunteered to evaluate their



Engineering students during the spring of 1959 surveying a portion of the campus off Frew Street near where the university now features Hunt Library.

strengths and weaknesses in the classroom by having students fill out rating sheets, a precursor of present day course evaluations.

After World War II, the economy surged and technology advanced, creating a need for engineers. The college of engineering experienced growth in its research and enrollments during this period. In the 1950's, computing first entered the engineering curriculum. In 1958, the Computing Center pioneered a course in programming for first year students, and within two years, half of the firstyear engineering and science students were taking computing courses. Nearly 50 years later it is hard to imagine engineering before computer and information systems like the Internet. (Carnegie Mellon was one of the original sites that comprised the first electronic network, which preceded the Internet.)

The College of Engineering is recognized worldwide for its robust interdisciplinary culture, evident in its academic objectives and especially in research endeavors. Engineering's interdisciplinary culture took root back in 1923, when the Metals Lab opened. In this lab, physics and chemistry were applied to metallurgical research. The lab was supported by industry and foundations and provided fellowships for graduate students. Decades later in 1967, Mellon Institute, the prototype of private applied research institutes in this country, merged with Tech to become Carnegie Mellon University. The purpose of this union was to develop a greater partnership between industry and science in the hope that academic research results could be shared with the public.

"Being an engineering student at Carnegie Mellon means being part of a century-old tradition–a tradition that combines a technical and liberal education," said Pradeep K. Khosla, dean of Carnegie Mellon's College of Engineering. "Our students experience a broad mix of engineering challenges via project classes and student research projects."

In 1990, the College of Engineering evaluated its undergraduate curriculum, recognizing that as the world becomes at once smaller and more complex, demands are placed on engineers to meet the increasing needs of society. Engineers enter a profession that cuts across international cultures and markets. Important questions that helped shape the new curriculum included what kind of education allows engineers to contribute to the advancement of technology, while deriving personal career rewards; what kind of undergraduate education would provide the best background for graduates who wish to enter other professions, such as medicine, business or law?

Faculty recognized that it is impossible to teach everything about each discipline, and with the pace of technological innovation, stu-

Carnegie Mellon civil engineering students work to complete a concrete canoe for competition at the 2004 American Society of Civil Engineers' concrete Canoe competition.

> ***"…with the pace of technological innovation, students must be prepared to become life-long learners."***

1913: Panama Canal opened

1913: Ford introduces assembly line production of automobiles

WWI 1914-1918

1919: Andrew Carnegie dies but not before trying to mend his relationship with Frick, which provoked the famous "Tell Mr. Carnegie that I will meet him in hell, where we are both going" response. Although each owned Fifth Ave. mansions in New York City, Carnegie died without ever seeing Frick again after their 1900 split .

1920: KDKA's First radio broadcast

1913-1920

dents must be prepared to become life-long learners. A new, more flexible curriculum was designed which increases breadth of knowledge while reducing class overloads and yet imparts students with skills that foster self education.

A priority of the new curriculum was to introduce students to engineering in their first semester at Carnegie Mellon. Each discipline developed an Introduction to Engineering course that is offered with a science or math co-requisite. In the intro courses, lectures on fundamentals and theories are combined with hands-on engineering projects. True to the Carnegie Plan, engineering students had 20% of their courses in the humanities and 80% in engineering, math and science. In the revamped curriculum 65-70% of a student's courses are engineering, math and science related, leaving room to pursue other interests, or double majors or minors, many outside of engineering.

Two double majors within engineering are Engineering and Public Policy (EPP) and Biomedical Engineering (BME). These programs are integrated into traditional majors in such a manner that students can graduate in 4 years with majors in related but distinct fields. Students in these programs have career interests that transcend traditional engineering. Many BME undergraduates are interested in medical-related careers, while EPP students explore technology-based policy options in government, foundations or other non-profit organizations.

An Event Not to be Missed:

The ESWP 125th Anniversary Banquet

WEDNESDAY,

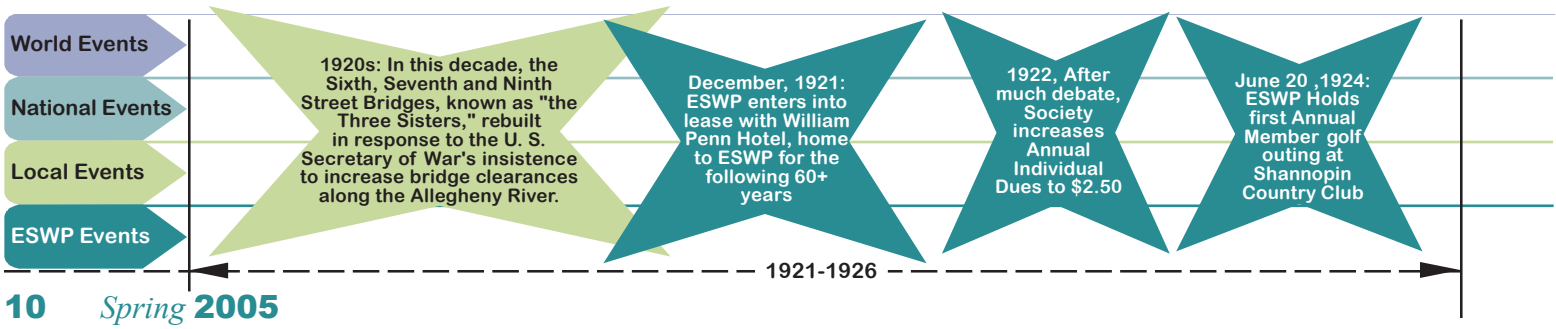
OCTOBER 26, 2005

at the

David L. Lawrence Convention Center

Master of Ceremonies: Rick Sebak, WQED

Guest Speaker: David McCullough, Author-Historian



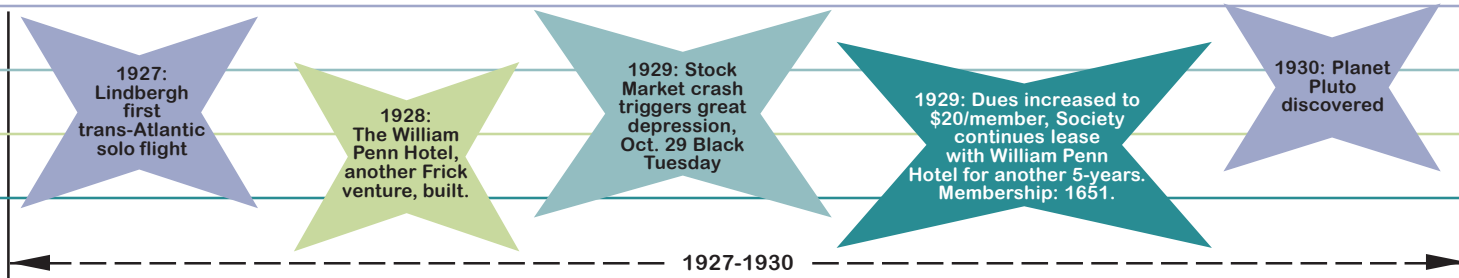
Engineering continues to organize interdisciplinary teams to tackle challenging research into new processes, materials and technologies through dozens of research centers. The Institute for Complex Engineered Systems (ICES), for example, delves into research involving multiple disciplines and technologies. ICES initiated a number of interdisciplinary design courses that bring together faculty and students from all of engineering, other colleges, and industrial sponsors to explore engineering product design projects.

The Biomedical Imaging Center was recently founded to advance the development of advanced computer systems that assist in the interpretation and analysis of biomedical images. This center involves faculty and graduate students from Biomedical Engineering, Electrical and Computer Engineering, Computer Science and Biology.

A final example, the Information Networking Institute (INI) began as an interdisciplinary program of the computer science, engineering and the management schools to conduct research and to provide a master's degree in information networking. Close ties with industrial sponsors drove the original research and educational program. Today, the INI offers a master's program on campus, and via distance learning opportunities, also awards degrees in Greece. Next year, the program will expand to include Japan and Korea. As the challenges of society and technology become more global, engineers will be needed to innovate and manage technology overseas and in virtual locations.

Andrew Carnegie's philanthropy, rooted in part from his recognition of the limitations of narrow training, enabled the rise of an internationally prominent university, where engineers are educated to be innovative and creative as they pursue a variety of careers. Throughout the College of Engineering the mission is clear and consistent: develop and implement the fundamental and essential elements of an enduring education and identify and solve the most challenging technological problems for the enrichment of humankind.

This work relies heavily on *Carnegie Mellon 1900-2000 A Centennial History*, written by Edwin Fenton, published by Carnegie Mellon University Press.

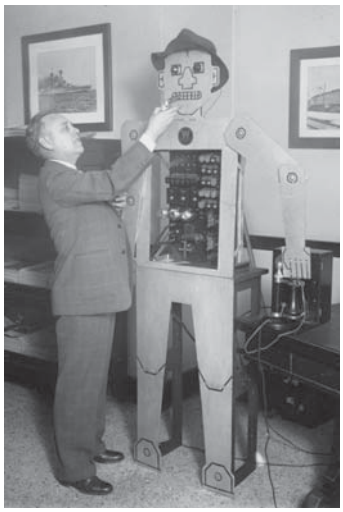


Early Westinghouse Robots Were Fascinating Characters

By Ed Reis
Executive Director
The Westinghouse Museum

The year was 1927. A Westinghouse Electric & Manufacturing Co. employee, with a twinkle in his eye, gazed at a piece of equipment that the company manufactured and sold — a Televox.

This piece of equipment could accept a telephone call by lifting the telephone receiver. It could then control a few simple processes by operating some switches, depending on the signals that were received. The employee decided to add a head, arms, body and legs to the piece of equipment — and in doing so created the first Westinghouse robot. He decided to keep the same name, so the robot was named Televox. Televox could utter a few primordial buzzes and grunts and could wave his arms a bit. Later, to give him more humanlike skills, a cigar was occasionally placed in his mouth and lighted. Although speechless when first created, Televox later learned to say two simple sentences.



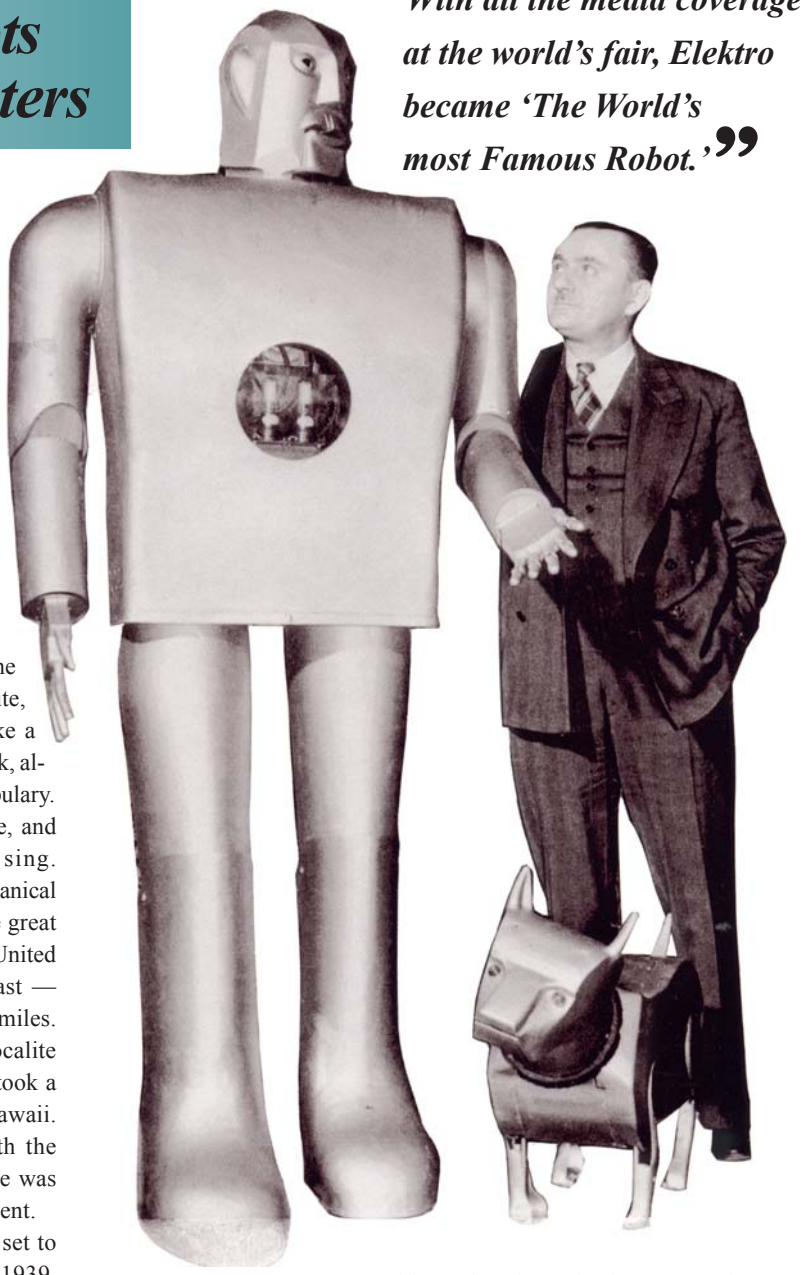
Televox (1927) was the first Westinghouse robot.

Five years later, Westinghouse engineer Joseph Barnett created another robot. This tall and stately character was named Willie Vocalite. Willie had additional humanlike skills; he could sit down, stand up, salute, fire a gun and… well, smoke a cigarette. He could even speak, although he had a limited vocabulary.

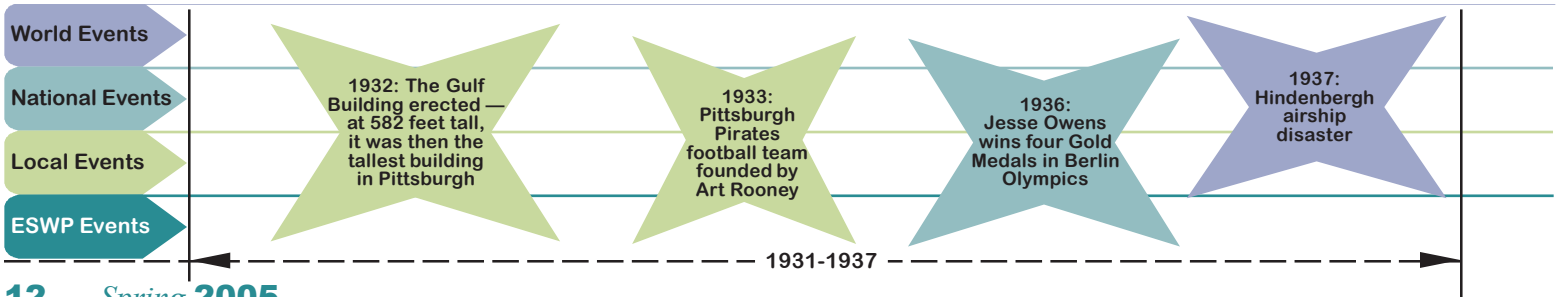
His skills grew over time, and later he even learned to sing. Among Westinghouse's mechanical men, Willie Vocalite was the great traveler. His tours across the United States — from coast to coast — covered more than 100,000 miles. In fact, one time, Willie Vocalite even took a vacation — he took a steamship all the way to Hawaii. People were fascinated with the robot's performances, and he was well received wherever he went.

A great world's fair was set to open in New York City in 1939, and plans were underway for Westinghouse to be represented. Barnett went to work and created a new robot for the event. The robot was named Elektro the Moto-Man. Elektro was quite impressive and a real attention-getter. He stood out in a crowd; he was 7 feet tall and weighed 280 pounds. Elektro was also quite talented; he could talk and had a vocabulary of 77 words. He could also walk, move his head, arms and fingers, count on his fingers, distinguish colors and… well, smoke cigarettes. Throngs of people attended the daily appearances as Elektro performed in the Westinghouse Building. With all the media coverage at the world's fair, Elektro became "The World's most Famous Robot." The 1939 New York World's Fair closed in the fall of that year, but it had been so successful that it was decided to reopen it in 1940 for a second year. Barnett went to work again and created still another Westinghouse

> ***"With all the media coverage at the world's fair, Elektro became 'The World's most Famous Robot.'"***

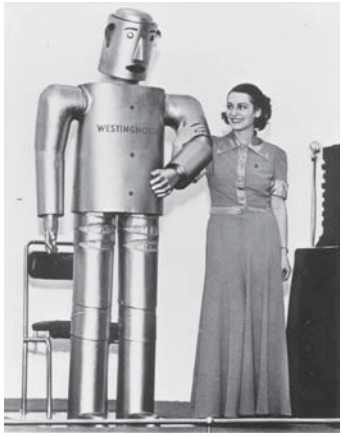


Elektro and Sparko stand with creator Joseph Barnett.



Elektro and Sparko perform in the Westinghouse building at the 1939-40 New York World's Fair

robot. But this was no ordinary robot. This robot was different — one without human skills. This robot was a *dog*. He was named Sparko the Moto-Dog. Sparko weight 65 pounds and was a smart dog that could perform many tricks. In addition to walking alongside Elektro, he could sit, stand, wag his tail and even bark. He could perform all these tricks on command from Elecktro. Elektro would say "sit", and Sparko would sit. Elektro would say, "bark," and Sparko would bark. Sparko's responses to Elektro's commands added a fascinating twist to the popular performance.



Willie Vocalite (1932) had humanlike skills.

All good things must come to an end, and so it was with the world's fair. A cartoon appeared in The New Yorker the day after the fair closed. There were no words accompanying the cartoon, only a sense of sadness at seeing Elektro and Sparko walking away into the sunset.

Ed Reis is the executive director of the George Westinghouse Museum in Wilmerding and a Pittsburgh free-lance writer for the Tribune-Review. This article was reprinted with permission of the Pittsburgh Tribune-Review.

A 45-minute program and slide presentation on "The Westinghouse Robots" is available to groups and organizations. Ed Reis, the executive director of the George Westinghouse Museum in Wilmerding, narrates the program on Westinghouse robots from the 1920s-1940s. A donation is requested to help support the museum, which is totally staffed by volunteers.

For information, contact Reis at 412-655-2447 orejreis@aol.com.

1939: Buhl Planetarium founded

1939: Germany invades Poland

1940: Pittsburgh Pirates renamed as the "Steelers"

1940: ESWP initiates International Water Conference

1940: Michael Baker Jr. starts firm

1938-1940

Early Lamps by Westinghouse

By Ed Reis
Executive Director,
George Westinghouse Museum

Early Westinghouse incandescent lamp

> ***"Thomas Edison had sued George Westinghouse and other manufacturers of incandescent lamps for patent infringement…"***

Thomas Edison invented and demonstrated the incandescent lamp in the year 1879. George Westinghouse also had an early interest in the area of electricity. The early work on electricity that he did was done at the Union Switch & Signal Company. He had started Union Switch & Signal in the year 1881. Recent research using old documents located in the George Westinghouse Museum archives reveals that this interest in electricity resulted in George Westinghouse having a fully operational incandescent lamp manufacturing department located at the Lawrenceville, Pennsylvania works of the Union Switch & Signal Company in the year 1884. It turns out that this incandescent lamp manufacturing department was set up by the great Westinghouse engineer William Stanley. Stanley was also the engineer that did the early work on the Westinghouse alternating current transformer. William Stanley also did the work that made the demonstration of alternating current illumination of the town of Great Barrington, Massachusetts possible in 1886. George Westinghouse also started the Westinghouse Electric Company in the year 1886. This is a most interesting discovery as the George Westinghouse biographies that exist and other written accounts indicate that George Westinghouse's first foray into the area of incandescent lamps was with the Westinghouse two-piece, all-glass stopper lamp that was used to illuminate the Chicago World's Fair (Columbian Exposition) in the year 1893. It is most interesting to now know that George Westinghouse was manufacturing incandescent lamps at the Union Switch & Signal Company a full nine years before the Chicago World's Fair of 1893. Thomas Edison had sued George Westinghouse and other manufacturers of incandescent lamps for patent infringement so George Westinghouse was concerned that if the courts upheld the lawsuit by Edison that he could run into serious problems with his contract to illuminate the Chicago World's Fair of 1893. Therefore he acquired another incandescent lamp manufacturer named Sawyer-Mann. George Westinghouse strongly believed that the new Westinghouse stopper lamp, which was based on the Sawyer-Mann patent, would definitely hold up to the scrutiny of the courts as it was a lamp that did not have a vacuum. All the other incandescent lamps of that period of time, including Edison's patented lamp, were produced with a vacuum and were sealed against leakage. The screw type base that is used on our light bulb today was the type originally used by Edison. Westinghouse based lamps over time came in four varieties. A single pin push-in base. That is, one just had to simply push the lamp into the socket and pull the lamp to take if out of the socket. Westinghouse also had a two-pin incandescent lamp that he invented in 1894. One pushed this lamp into the socket and turned it clockwise 90 degrees. To remove one turned the lamp 90 degrees in a counter-clockwise fashion. The all-glass Westinghouse stopper lamp was of this variety. Westinghouse also manufactured a two pin brass based lamp. The last type was when Westinghouse adopted the screw type base which became the standard for incandescent lamps in the early 1900's. Interestingly florescent lamps today still use the Westinghouse created two pin system.