TimeLine Theatre Company

THE Farnsworth INVENTION

by AARON SORKIN
directed by NICK BOWLING

STUDY GUIDE

prepared by
Maren Robinson, Dramaturg

This Study Guide for *The Farnsworth Invention* was prepared by Maren Robinson and edited by Lara Goetsch for TimeLine Theatre, its patrons and educational outreach.

— STUDY GUIDE —
Table of Contents

Download a PDF of the entire Study Guide at TimeLine's Web site:
http://www.timelinetheatre.com/farnsworth_invention/FarnsworthInvention_StudyGuide.pdf

The Playwright: Aaron Sorkin

Aaron Sorkin was born June 9, 1961, in Scarsdale, N.Y. He graduated with a bachelor of fine arts degree in theater from Syracuse University, N.Y. His plays include: *Removing All Doubt*, *Hidden in this Picture* and *A Few Good Men*, for which he received the Outer Critics Circle Award for Outstanding Playwright and later a Golden Globe nomination for his screenplay of the same title. Other screenplays include *The American President*, *Malice*, *Enemy of the State*, *Excess Baggage*, *The Rock* and *Charlie Wilson's War*. He is perhaps best known for his Emmy-award winning television series *The West Wing*. Other critically acclaimed television series include *Sports Night* and *Studio 60 on the Sunset Strip*. His newest film, *The Social Network*, is scheduled to be released Oct. 1, 2010.

The Farnsworth Invention was first developed at the La Jolla Playhouse in California in 2007. It opened on Broadway later that year at the Music Box Theatre, with Hank Azaria as David Sarnoff and Jimmy Simpson as Philo Farnsworth. It subsequently has been produced at the Alley Theatre in Houston, the Beck Center for the Arts in Lakewood, Ohio, and the Kavinoky Theatre in Buffalo, N.Y.

The History: Sorkin's Artistic License

> "It raises a question, and it also raises a problem, which is that, as I said, my first, if not only, obligation is to entertain. A news organization has a much different responsibility. I might not be telling you the whole story. I might not be telling you a story in a manner that is properly sophisticated. I would hate for anyone to limit the scope of their education on a subject to me. And, frankly, every teacher I've ever had in my life would agree with what I've just said."
> — *Aaron Sorkin, in an interview with Terrence Smith,* Newshour*, PBS, Sept. 27, 2000*

In his interview on the PBS news magazine *Newshour*, Sorkin speaks about the fundamental question that informs many of the plays chosen by TimeLine Theatre: the tension between a good script that gets at the heart of an event emotionally and the history that surrounds an event. It is the prerogative of the playwright to adjust circumstances of history to make a good play that can be performed in a couple hours.

There are numerous places where the story differs from the facts. Sarnoff and his family were not run out of their home by Cossacks, but Sarnoff did see Cossacks beating people in a crowd before he left the country. Various characters have been condensed or assigned different roles than they actually played. And the timeline is often compressed. Farnsworth's light problem is exaggerated. Farnsworth's alcohol consumption became problematic later in his life. Pem was not a smoker. There are many details that Sorkin has altered for the purposes of the play. The most

significant change, for which Sorkin has been criticized, is changing the outcome of the patent trial.

Historically, Farnsworth was awarded priority of invention on his television system patent and RCA paid royalties to Farnsworth. However, the lawsuit took up precious years of the time on his patent, and because his factory converted to making equipment for the government during World War II, Farnsworth had limited time to see the benefit of his patents before their 17-year term ran out.

In spite of these vital differences from the actual history, RCA and Sarnoff did work to prevent Farnsworth from working with competitors and Zworykin visited Farnsworth's lab under false pretenses. Farnsworth was spent by the effort of creating the television, the legal battles and the death of his son, and he suffered a nervous breakdown. Sarnoff did have a "get around Farnsworth team" and he engaged in battles with Armstrong over A.M. and F.M. and later over color television. The struggle for television was certainly still one of an inventor with a small team against a corporation and that struggle is captured by the play.

The People

Philo T. Farnsworth was born Aug. 19, 1906, in a log house without running water in Indian Creek, Utah. He was the first of five children born to Lewis Edwin and Serena Farnsworth. His grandfather and namesake converted to the Church of Jesus Christ of Latter Day Saints (Mormons) and migrated to Utah in 1848. In 1919, the family moved to a ranch near Rigby, Idaho.

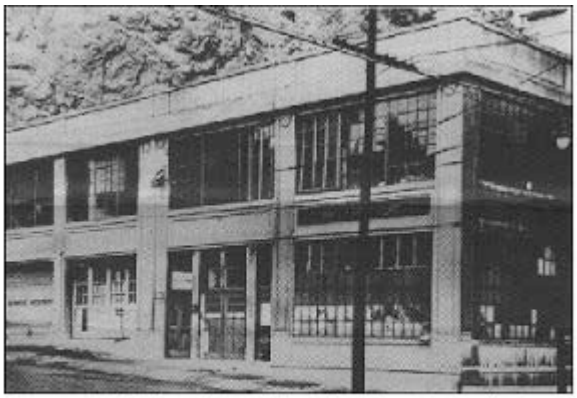
When he was only 14, Farnsworth won a contest in *Science and Invention Magazine* for his invention of the magnetic ignition lock, a device that would be used in cars for years to come. The contest won the young inventor $25, which he used to order his first suit with long trousers from the Sears, Roebuck catalog.

After selling some lambs, he also ordered a violin from the Sears catalog, and he became an accomplished violinist. After a teacher gave him a better violin, he earned extra money on the weekends playing for dances.

He became close friends with his high-school chemistry teacher, Justin Tolman, who gave him supplemental articles and books to read. Farnsworth would confide his early idea for an electronic television to Tolman—an idea he said was in part inspired by looking at the parallel furrows of a plowed potato field.

After his father died from pneumonia in 1924, Farnsworth joined the U.S. Navy to earn money for school. He started going by the name Phil to avoid being teased by his shipmates. Although he passed the Naval Academy tests with the second highest score, he was not suited to Navy life. A Navy chaplain to help him secure his release from the military. He attended Brigham Young University in Provo, Utah, but after a year he did not have enough money to continue. In 1926, he moved to Salt Lake City, where he would work for the Salt Lake City Community Chest and meet his friends and future investors, George Everson and Leslie Gorrell. He moved first to Los Angeles then San Francisco, California where he was set to start working on television in a lab on Green Street.

On May 27, 1926, he married his neighbor and sweetheart Elma "Pem" Gardner. He actually missed his wedding night: After returning the car he had borrowed from Everson to drive them to the hotel, they ended up talking about television late into the night before he returned to the hotel. Pem and her brother Cliff would become vital members of Farnsworth's lab team. On Sept. 7, 1927, Farnsworth would transmit the first electronic image to a screen in a room adjoining his lab.



Farnsworth obtained financial backing from the Crocker bank and the use of 1/2 of the second floor of this warehouse at 202 Green Street, at the foot of Telegraph Hill

First, the team worked at the Crocker Laboratories in San Francisco, since part of their funding came from Crocker Bank. In May 1929, the team incorporated as Farnsworth Television Laboratories but remained in San Francisco. The 1929 stock market crash meant Farnsworth's investors put additional pressure on him to sell or license his electronic television. In 1930, Farnsworth and his employees were hopeful when Vladimir Zworykin, head of research at Westinghouse Electric and Manufacturing Co., visited the lab. The team assumed he was sent to review Farnsworth's television in advance of an offer to buy or license the patents on the television-system. They did not know Zworykin already had agreed to work for RCA under David Sarnoff and that no offer would be forthcoming.

On March 6, 1932, Farnsworth's 18-month-old son, Kenny, was rushed to the hospital with a streptococcal infection of the throat. Without other effective treatments at the time, the doctors performed a tracheotomy to make sure he could breathe, but Kenny died shortly thereafter. It was a devastating loss to the Farnsworths. Farnsworth would start drinking heavily, a problem he would struggle with the rest of his life.

Adding to his duress, less than three months after Kenny's death Farnsworth's attorneys would file a patent-interference lawsuit to try and establish who invented television. RCA countersued challenging Farnsworth's electronic-television patents and claiming they infringed on Zworykin's television-system patents. It was not until July 1935, that the examiner of interferences at the U.S, Patent office would affirm Farnsworth's priority of invention and uphold his patents for electronic television. RCA would enter into a licensing agreement with Farnsworth soon after the ruling.

Throughout the rest of his life Farnsworth continued to make some innovations in television, but he ultimately turned to researching fusion. He was invited to work on the Manhattan Project but, suspecting that he would be helping develop a bomb, he declined.

Farnsworth died of pneumonia on March 11, 1971, in Holladay, Utah; he was 64. At his death, he held over 150 U.S. patents for various inventions.

Utah schoolchildren worked for two years to get a statue of Farnsworth erected in Washington, D.C. as "Father of the Television."

David Sarnoff was born Feb. 2, 1891, in the tiny Russian shtetl of Uzlian, in the province of Minsk. He was the eldest of five children born to Abraham and Leah Sarnoff. His early skill with Yiddish and Hebrew led his maternal grandfather, Rabbi Pritkin, to believe he would make a good rabbi. After his father immigrated to New York City to earn passage for the family, Sarnoff was sent, at age five, to live with a granduncle who was a rabbi in the village of Korme. The only child in the house, he was required to study the Talmud six days a week for the next four years.

By the time Sarnoff was nine, Abraham Sarnoff finally had enough money to bring the family to New York City. As he passed through the capital of Minsk, Sarnoff witnessed Cossacks clashing violently with a crowd of protesters. He later would claim the sight of the Cossacks with their whips trampling the crowds on their horses, "…trampled out of me any lingering feeling I might have had for Russia as my homeland."

Within days after his arrival in America, Sarnoff found work selling Yiddish newspapers. He soon had his own stand and a series of runners, including his younger brothers. Earning money was important to the family, especially since his father's health had been shattered from consumption and the years of menial labor he had done to bring his family to America.

Sarnoff continued his education in school and through supplemental classes, as well as by reading English-language newspapers. He soon spoke a careful English without

a trace of an accent. At the end of eighth grade, his grades were good enough to qualify for one of the high schools, but his father now was bedridden with consumption and would soon die. Sarnoff became the family breadwinner.

In 1906, he went to get a job at the *Herald* but found himself at the offices of the Commercial Cable Co., where he got a job as a messenger boy for $5 a week. He was fired when he asked for time off for the Yom Kippur and Rosh Hashanah holidays. He quickly found a new job as an office boy for American Marconi. When Guglielmo Marconi visited the New York office, Sarnoff introduced himself and offered his services as an errand boy. A rapport grew between Marconi and Sarnoff, and Marconi would use Sarnoff as an assistant whenever he visited. He also allowed him to study the technical files. After his father died, Marconi became Sarnoff's father figure. He moved quickly from errand boy to telegraph operator, and, by the time he was 18, he was the youngest chief operator in the company.

Some of Sarnoff's history at this point gets murky. It was widely reported later in his life that he was the young telegraph operator who stayed at his station for three days to deliver news of the sinking of the RMS Titanic on April 14, 1912, as the news was telegraphed from the RMS Olympic. There are number of holes in the story: Sarnoff was one of several telegraph operators, and his name is only mentioned in a few news articles at the time; plus, his station was one ordered *not* to broadcast at a certain point.

In 1917, he married a beautiful French Jewish émigré, Lizette Hermant. They had three sons. Their 54-year marriage remained the foundation of his life, in spite of occasional philandering.

Sarnoff was successful at moving up the ranks of any company, and when American Marconi was sold to General Electric Co. in 1919 he would become the fledgling Radio Corporation of America's commercial manager.

Much like the Titanic story, Sarnoff claimed to have come up with the idea to broadcast the July 2, 1921, Jack Dempsey-Georges Carpentier boxing match live over the radio—but newspaper accounts at the time do not mention him.

Sarnoff soon became general manager of RCA, and the secret contracts he negotiated with American Telephone and Telegraph Co. were instrumental in the formation of the National Broadcasting Co. in 1926. In 1928, Sarnoff became president of RCA:

Gen. James G. Harbord, then the president, had taken a leave of absence to work on Herbert Hoover's presidential campaign and decided to make his leave permanent.

As president of RCA, Sarnoff would actively pursue television, recruiting Vladimir Zworykin from Westinghouse to head a television research lab at RCA.

During World War II, Sarnoff served as a special communication consultant to Gen. Dwight D. Eisenhower, for which he would be given the rank of brigadier general when Eisenhower became president. Throughout the remainder of his life he preferred to be called General**.**

In addition to his fight with Philo T. Farnsworth over patents and precedent for the electronic television, Sarnoff engaged in similar legal battles over the development and patents for FM radio with inventor Edwin Howard Armstrong. Armstrong would kill himself in 1954; Sarnoff always denied he contributed in any way to Armstrong's suicide.

Sarnoff died in his sleep after suffering a heart attack on Dec. 12, 1971.

Other Players

Edwin Armstrong invented the Regeneration Circuit, which helped amplify radio wave. A.M or Amplified modulation was his creation. He sold the regeneration circuit to RCA for 20% RCA stock. He was involved in a long lawsuit with Sarnoff and ultimately committed suicide in 1954.

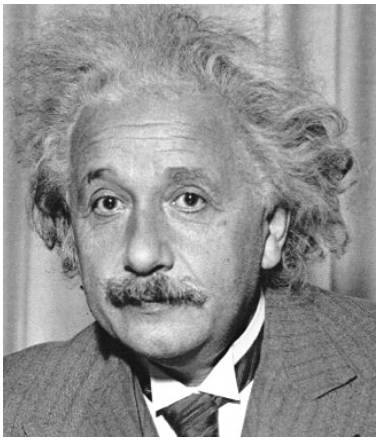
Ernst Alexanderson (GE) (January 25, 1878 – May 14, 1975) Alexanderson was a Swedish American electrical engineer who worked for General electric. He invented the Anderson Amplifier which was a key component in Amplitude Modulation (AM) radio

John Logie Baird (August 13, 1988-June, 14, 1946) Baird was Scottish independent inventor working in London, England. He invented a system of scanning images for television that used a rotating disk with holes in it.

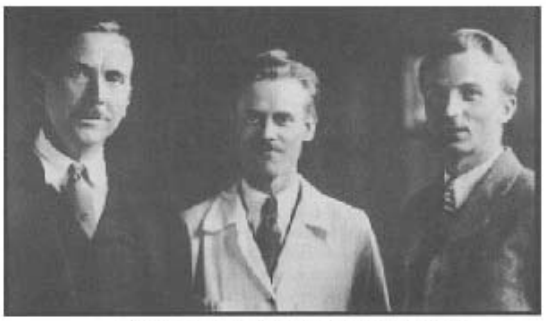
Ferdinand Braun (6 June 1850 – 20 April 1918) German inventor, Braun, was the inventor of the Cathode Ray Tube. He shares the 1909 Nobel Prize in Physics with Guglielmo Marconi.

William H. Crocker (1861-1937) President of Crocker National Bank. His father, Charles Crocker had earned his money building the Central Pacific Railroad. Interested in both arts and science he was known to finance many projects and charities.

Lee De Forest (1873-1961) Inventor of the Audion Tube. He sold his patent to AT&T when he was strapped for cash. He attended Harvard and worked at Western Electric for a time but mostly worked as an independent inventor. He also worked on synchronizing sound for motion pictures for which he received an honorary Oscar in 1959.



Albert Einstein (March 14, 1879 – April 18, 1955) a ground breaking German physicist. While Einstein was perhaps best known for his Theory of Relativity, it is his work on the Photo Electric Effect which was mentioned as the reason for his 1921 Nobel Prize and is relevant to the development of television. In 1905 Einstein he published, "On a Heuristic Viewpoint Concerning the Production and Transformation of Light" about the photoelectric effect. It refers to the emission of electrons from matter, most often metals, in response to electromagnetic radiation or light (or photons).



Everson, Farnsworth, & Gorrell, ca 1926

George Everson was one of Farnsworth's bosses when he worked at the Salt Lake Community Trust. With his partner Lesley Gorrell he would be one of the first investors in Farnsworth's system of television and work to find investors to provided financing for the lab throughout Farnsworth's work.

Douglas Fairbanks (May 23, 1883 - December 12, 1939) Fairbanks was a prolific American actor and producer known for silent films like *The Thief of Bagdad*, *The Mark of Zorro* and *Robin Hood*. He married fellow silent film star Mary Pickford in 1920 and the pair were considered Hollywood royalty. With Pickford, Charlie Chaplin and D.W. Griffin, he created United Artists in 1919 to have their own studio and have artistic control over their films and a share of the profits.

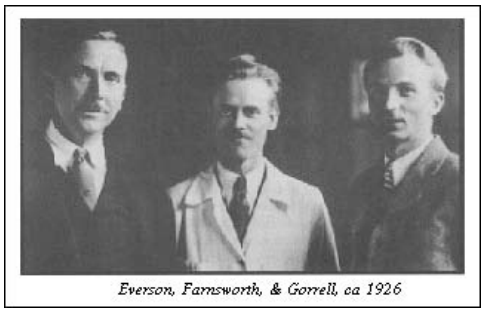
Elma "Pem" Gardner Farnsworth (February 25, 1908 - April 27, 2006) Pem Gardner was born in Jensen, Utah, and met Farnsworth in 1922 when his family moved to Provo, Utah, and their families became neighbors. After her marriage to Philo Farnsworth on May 27, 1926, she moved with him to California and would be an integral part of his lab. She typed his notes and trained herself to do technical drafting so she could record various devices invented in the lab. She was the first person to appear on a cathode ray tube receiver by a transmission in her husband's lab. After his death she would work to reclaim his reputation as creator of television.

Agnes Farnsworth Agnes Farnsworth was a friend of Pem Gardner and introduced her classmate Pem to her brother Philo. She was maid of honor at their wedding. She joined them in California and shared a house with them to save money while they worked in the lab.

Cliff Gardner was Pem's older brother and would remain close with Pem and Philo throughout his life. When they left for the lab in California he went with them to help set up the lab. He taught himself how to blow glass to make variations on the vacuum tubes they were testing in the lab.

Walter Gifford — AT&T VP of Finance and on RCA Board. In 1925 he became the president of AT&T. He was well known for not hiring women, blacks, Jews or ethnic minorities or immigrants. Harry Warner of Warner Brothers was the man who asked, "Give me the name of one Jew who works for your company" when talking to an AT&T executive.

Leslie Gorrell — Unlike his partner at the Salt Lake City Community Chest, Leslie Gorrell had studied engineering and became a strong advocate of Farnsworth and early investor. Because of his background in engineering he would often take a hands-on role in the lab as well.



Everson, Farnsworth, & Gorrell, ca 1926

General James G. Harbord (March 21, 1866 – August 20, 1947) served as General Pershing's Chief of Staff during World War I for which he was promoted to Brigadier General. Was appointed RCA president in 1923 a role he held until 1928 when he took a leave to work on Herbert Hoover's presidential Campaign but he remained Chairman of the Board of RCA.

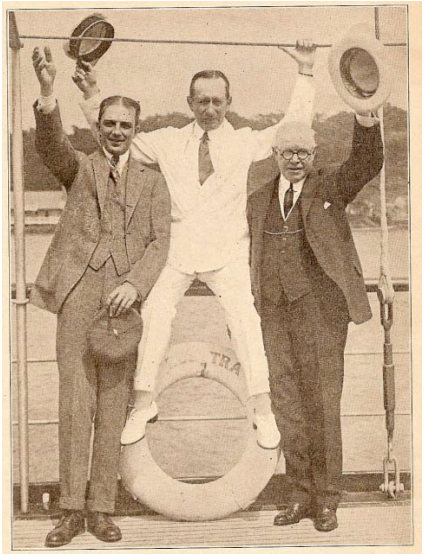
Harlan Honn was an engineer already working at Crocker labs. When the Crocker investors were considering investing in Farnsworth's television system, they asked Honn to review the plans and see if he thought they would be viable for ultimate commercial development.

Herbert Ives (July 21, 1882- November 13, 1952) his Ph.D. at Johns Hopkins and worked for AT&T's on telephotography, a predecessor to the fax machine. He also worked on their television system for AT&T, particularly their long distance transmission system. During World War II he worked on night vision goggles for the U.S. Military.

Charles Francis Jenkins (August 22, 1867 – June 6, 1934) was an independent U.S. inventor working on a television system that relied on mechanical scanning. His work was similar to that of John Logie Baird in England. He demonstrated mechanical television on June 13, 1925. He called the rough silhouettes he transmitted "shadowgraphs." He helped found the Society of Motion Picture Engineers.

Guglielmo Marconi (April 25, 1874 – July 20, 1937) The son of an Italian country gentleman, Marconi studied in a lab in his father's country estate and succeeding in transmitting a radio signal over a mile and a half. He took his invention to England where he continued his studies and was granted a patent for radio telegraphy. He founded British and American Marconi and succeeded in transmitting a radio signal across the Atlantic Ocean. He was awarded the Nobel Prize in physics in 1909 for his contributions to radio telegraphy.

Donald Lippincott was an engineer as well as an attorney. He filed Farnsworth's first patent applications in 1926-1927. He would become Farnsworth's lifelong friend.



Edward Nally – (1859-1953) (Pictured on right with Young, at left and Marconi, center on Marconi's yacht) He first served as vice president and General Manger of American Marconi. He was named President of RCA when it was formed out of American Marconi. He was president from 1919-1923.

Mary Pickford (April 8, 1892-May 29, 1979)
The child of actors, Pickford, born Gladys Marie Smith, appeared on stage as a child. She made the transition to silent films and became one of America's first film sweethearts. By the age of 20 she had appeared in 176 films. Because of the grueling schedule and abuses of the early film industry she moved into producing and writing and helped found United Artists. She was a savvy businesswoman and helped found the Academy of Motion Picture Arts and Sciences. She married Douglas Fairbanks Sr. after a messy divorce from a previous husband. She received an Oscar for lifetime achievement in 1976.

Lizette Hermont Sarnoff married Sarnoff after closely supervised courtship. She was Jewish and French and Sarnoff was proud of her accent and elegance. She was smart and caught her husband in attempts at infidelities confronted him on them and he abandoned the infidelities. She had three sons with Sarnoff and was active in numerous charities. Pictured far right May 19, 1947 at a parade event for "Tribute to Women Week" fundraising event for New York Infirmary.

a

Justin Tolman taught Philo T. Farnsworth chemistry in Rigby, Idaho. He was impressed with Farnsworth's skill and quick apprehension and spent many hours talking to Farnsworth and giving him additional books to read. When Farnsworth revealed to him an idea for an electronic television Tolman saved the sketch. The sketch would become key evidence in Farnsworth's later patent hearing and Tolman was a star witness.

Owen Young – (October 27, 1874 - July 11, 1962) Young became president of GE in 1922. He became the First Chairman of RCA after helping arrange General Electric's purchase of American Marconi and its transformation into RCA. He held the position from 1919-1929. He was named Time "Man of the Year" on January 6, 1930.

Television: The Business

Patents: The United States government issues a patent when an inventor submits an invention that is shown to be substantially different from other similar inventions that have been issued patents. There are three fundamental statutory requirements that an invention must embody before a patent will be granted: utility, novelty and non-obviousness. That is, a patent must be for an item that is useful, unique or different from its predecessors and so different from previous inventions that it would not have been obvious even to experts in the field. To receive a patent an inventor must submit drawings and explanations of the invention (along with the required fees). Experts in the patent office review the paperwork to determine if it meets the legal standards for a new patent.

Priority of invention: Under U.S. patent law, a patent may be issued only to the "original and first inventor," which means that inventors working separately on the same invention have at times had a race to file a patent first. If an inventor is granted a patent or priority of invention on a patent, the inventor can bar others from making, using or selling the invention. However, once a patent is issued, the inventor only has 17 years before the patent expires and the invention becomes public.

Patent pools: Through David Sarnoff, RCA began amassing key patents on parts related to radio and television. Sarnoff sold and swapped stock in RCA for patents and created a so-called "patent pool," which later would be investigated as an illegal monopoly. RCA stock, or simply radio as the traders called it, was a hot commodity on the stock market, and so corporations were willing to trade for stock even though RCA kept a controlling share.

Licensing patents: After striving to compete with other radio makers who were using patented parts illegally, RCA instituted a licensing program by which radio makers would pay a licensing fee to RCA for the use of the patents on each radio they made. Intimidated by the threat of lawsuits, most radio makers paid the licensing fee, further enriching RCA. Many of these licensees later would be part of the government's anti-monopoly case against RCA
The media corporations

The Radio Corporation of America Patent Pool

The alphabet soup of corporations involved in the early development of television can be confusing, just as the relationships of parent companies and media conglomerates is confusing today.

In order to acquire key patents for radio and television, then Commercial Manager of RCA, David Sarnoff orchestrated the trade of stock to other companies in exchange for key patents and cross licensing agreements, creating a patent pool. These

companies thus had an interest in seeing RCA succeed but RCA always maintained a controlling share of the stock. In 1932, an anti-monopoly suit against RCA would break up the patent pool. The U.S. Justice Department ordered General Electric and Westinghouse to sell their stock in RCA. By this time Sarnoff was president of RCA which was no longer financially tied to other companies.

Edison General Electric Co. (GE) was founded by inventor Thomas Edison. After a congressional mandate, GE was asked to incorporate a company to purchase American Marconi. GE remained the principal shareholder of RCA until 1932 when it divested RCA stock after it was found it to be a monopoly. General Electric reacquired RCA in June 1986.

Radio Corporation of America (RCA) was created by GE in October, 1919 to acquire American Marconi, which it did on November 20, 1919. The U.S. Congress was concerned about a foreign corporation owning the wireless telegraph systems. Sarnoff, who was commercial manager at American Marconi, retained that role at RCA.

American Marconi was the American branch of British Marconi; the company founded Guglielmo Marconi, an Italian innovator who helped develop the wireless telegraph. It was sold to RCA on November 20, 1919 after the U.S. government decided that a foreign company should not control radio telegraphy.

American Telephone and Telegraph (AT&T) was founded by Alexander Graham Bell. In 1920, RCA gave AT&T 10% of its stock to acquire the patent to the audion tube and other key patents. President of AT&T, Walter Gifford, was known for refusing to hire Jews, minorities and immigrants. After Sarnoff became President of RCA he clashed with Gifford and AT&T would sell all its RCA stock in 1924.

National Broadcasting Company (NBC) was launched by RCA on November 15, 1926. Sarnoff created the company after acquiring the New York broadcast station WEAF for 1 million dollars. This allowed NBC to enter the broadcast market as well as do research and development on radio and television.

Westinghouse Electric and Manufacturing Co., known for making household appliances, set up the world's first broadcasting station, KDKA, in Pittsburgh in 1920. The company also owned several key patents from inventor Edwin Howard Armstrong, including his regeneration circuit, which amplified signal strength for long-range transmissions. In 1920, RCA gave Westinghouse 20% of RCA stock to obtain exclusive rights to the patents.

In 1929, RCA bought **Victor Talking Machines Company**, complete with the company's trademark dog Nipper and the recording label, to prevent it from entering the radio-manufacturing market and becoming a competitor. As he had from the beginning, Sarnoff, now RCA's executive vice president, offered RCA stock to clinch the deal.

Other Players in Early Radio and Television

American Broadcasting Company (ABC) In 1946, the Federal Communication Commission (FCC) was convinced RCA had a monopoly on broadcasting and ordered the company to divest half its holdings. RCA kept its NBC Red network and sold its Blue network for $8 million. The network was renamed ABC and became a competitor of NBC.

Columbia Broadcasting System (CBS) By 1928, William S. Paley and his family, which had made a fortune in cigars, was a broadcast competitor of NBC. The family had the controlling share in Columbia Phonograph Company and bought the operation rights for a chain of radio stations so they could get their musical selections on the air since NBC was playing RCA Victor musical recordings.

Philadelphia Storage Battery Company, or Philco, was one of the more prominent radio set makers that was using RCA's patents illegally until Sarnoff came up with the idea of having radio makers pay a licensing fee to RCA for every radio produced. For a time Farnsworth partnered with Philco until RCA, ever-nervous about competition in developing television, applied pressure on Philco to drop Farnsworth or RCA would rescind patent licenses Philco used in building their radios. Philco would later file suit against RCA for interfering in their ability to do business.

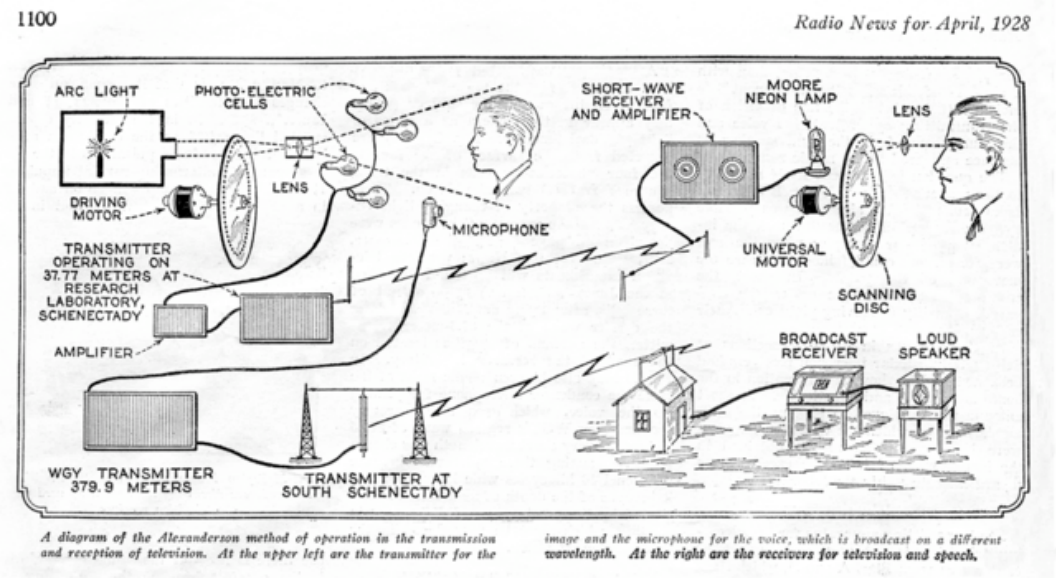
Zenith Radio Co. This Chicago-based electronics company was making radios and illegally using parts for which RCA held the patents until RCA created its licensing plan to have other manufacturers pay for the use of RCA-held patents. Zenith would also be a competitor in the Television set market.

Television: The Science

The idea of a television was not a new idea, and many scientists contributed the necessary steps to what would be essential for its development, starting with Albert Einstein's work on the photoelectric effect, which refers to the emission of electrons from matter, most often metals, in response to electromagnetic radiation or light in the form of photos.

Early mechanical moving pictures like the zoetrope and film relied on many separate still images that flickered past, giving the illusion of movement when viewed by the human eye and processed by the brain.

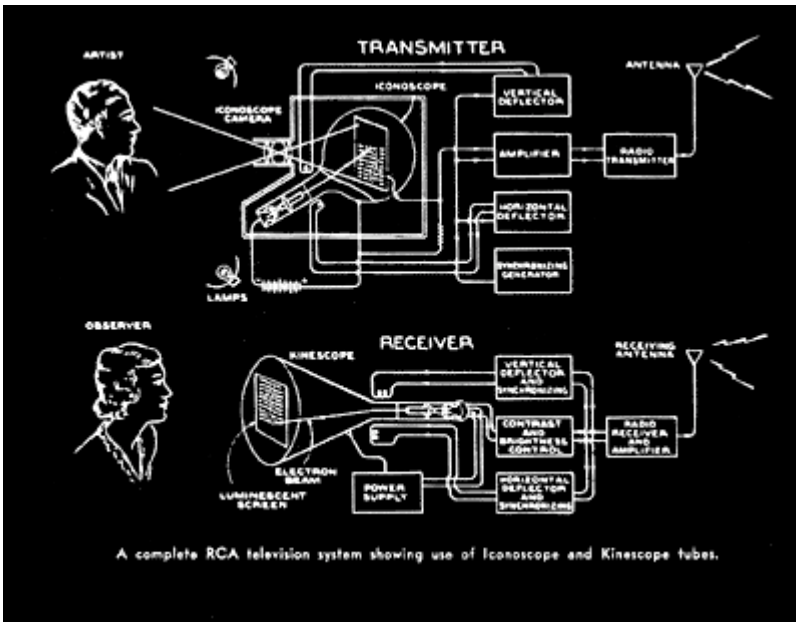
All early attempts at designing a television relied on a mechanical method of dissecting movement into a series of images. This was generally achieved by means of a perforated spinning disk.



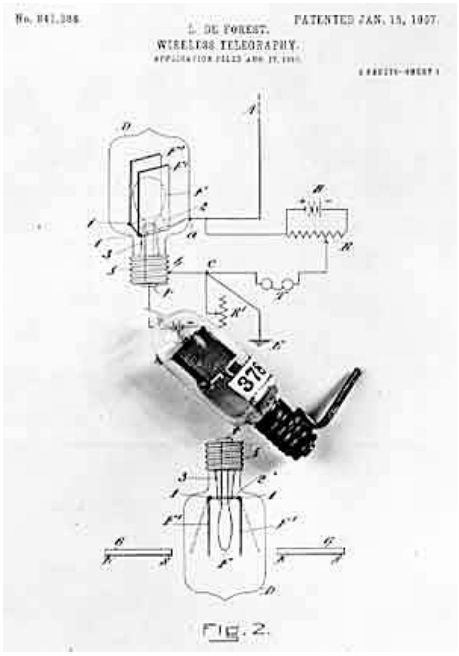
Farnsworth's innovation was to realize that the nature of light and photosensitive material might be used to create an electronic television that did not rely on a spinning disk.

Farnsworth theorized that light bouncing off a moving person could then be received and turned into electrical impulses. Then the electrical impulses could be transmitted just like radio or telephone signals and reconverted back into an image when the electrons hit a photosensitive material in a series of rows that the eye would register as a moving image. This solved the problem of speed that had plagued the mechanical approach because images would be transmitted at the speed of light through the same technology that allowed the transmission of radio.

RCA's Television system circa 1939:



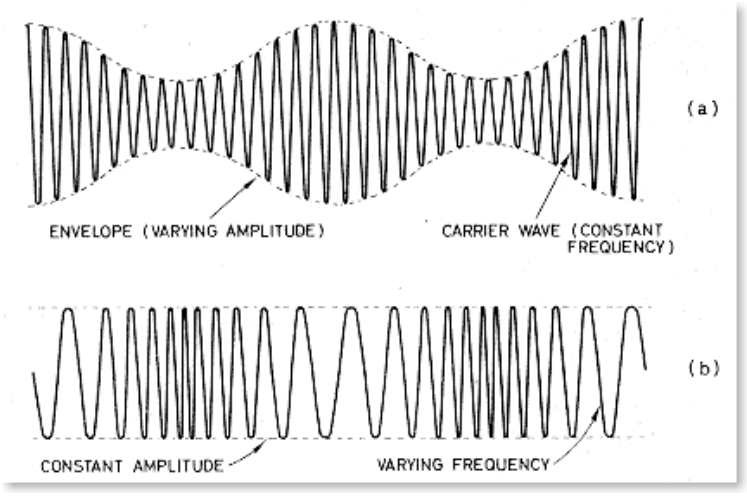
Audion Tube – (Audion Triode Tube) was invented by Lee De Forest who sold the patent to AT&T when he was strapped for cash. It is an amplifying vacuum tube and the forerunner of his improved Audion Triode Tube or the Triode. The Triode could convert radio frequency to audio frequency. The entire device was in a vacuum tube with an anode (filament) at one and a cathode (plate) at the other. De Forest's innovation was to add a small electrified grid between the cathode and the anode allowing it to receive and amplify radio signals. The original audion design did not have the grid and the play and many inventors at the time seem to use Audion and Triode interchangeably since the insertion of the grid was also De Forest's innovation. However it was other inventors, like Armstrong who figured out how to increase the amplification. At left De Forest's Original Patent Diagrams of the Audion Tube.



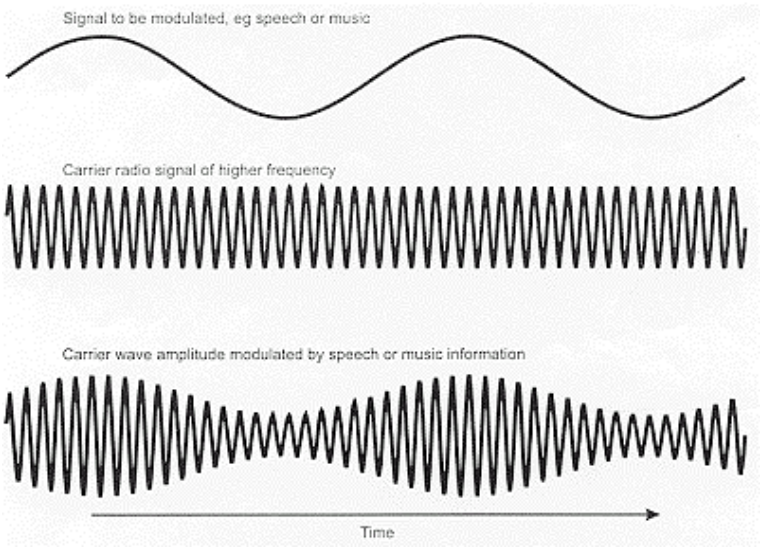
The Regeneration Circuit — Invented by Edwin Howard Armstrong who sold to RCA for $200,000 and 60,000 shares in RCA stock. The regeneration circuit used the triode audion tube to amplify a radio signal so it could travel greater distances. Armstrong's regeneration circuit fed the input signal into the circuit again and again amplifying it and creating greater signal strength

Frequency Modulation (FM) Edwin Armstrong invented frequency modulation which is a method of varying a signal wave to transmit sounds in a way that more closely approximated the voice or sounds being transmitted. Frequency Modulation varies the frequency of the waves rather than the amplitude (as in AM) to create distinctions.

The diagram below shows AM (a) and PM (b):



Amplitude Modulation (AM) Amplitude Modulation originally used to produce more realistic sound as transmitted by radio waves. The radio wavelengths sent out were directly related to the sounds made by the speaker so that when they were decoded on the other end of a transmission the sound closely imitated the sound of the original speaker.



Anode — An anode is an electrode (electrical conductor) through which an electrical current flows. In a cathode ray tube the anodes are positively charged and serve to help control the cathode ray (stream of electrons).

Cathode — A cathode is an electrode (electrical conductor) through which an electrical current flows. In a cathode ray tube the stream is of negatively charged electrons.

Cathode Ray Tube (CRT) The cathode ray tube was the picture tube in any television until they were replaced by LCD screens. The tube is a vacuum tube (a sealed glass tube from which all air has been removed) At one end a cathode releases a stream of electrons when the electrons strike the phosphorescent surface on the other end of the tube a series of images is produced. The interior anodes and deflection coils are designed to help regulate (providing better control) the flow of electrons to create a beam that could move across the screen and a better picture. This is the receiving end of a television system.

Farnsworth holds the image dissector (at left) and a cathode ray tube (at right) that served as the image receiver in his television system.

Image dissector — The camera and transmitting side of a television system. Like other cameras it receives the light that bounces off the subject and in a light detecting device like a phototube that is coated with a photosensitive material (matter that is sensitive to light and will release electrons in response to being exposed to light) When the light hits the photosensitive material electrons are released and converted into an electronic signal that can be amplified and transmitted to a distant location.

Photoelectric Effect – First written about by Albert Einstein and the discovery of which was the reason for his 1921 Nobel Prize, photo electric effect refers to any substance sensitive to giving off electrons when exposed to light.

Phosphorescence is a type photoluminescence (where a substance can absorb photons and reemit them generally at a different wavelength). Phosphorescent materials reemit photos at a slower rate (thus storing the energy briefly) than other photoluminescent materials which may emit them at the same rate like florescence.

Photons are discrete packet (or quanta) of light (or electromagnetic energy). Photons are always in motion and in a vacuum they move at the constant speed of light.

Electrons all matter is made up of atoms which are electrically charged particles. An atom has a nucleus made up of positively charged protons and neutral neutrons and the negatively charged electrons are in a cloud surrounding the nucleus. Certain elements have electrons that are only weakly tied to the atom and may be prone to be emitted from the atom.

Timeline of Selected Events: Television, Farnsworth and Sarnoff

January 6, 1884 Paul Nikow applies for a patent on an image-scanning system using a perforated disk, which was a mechanical method of television.

1888 Henrich Hertz demonstrates that one can create electromagnetic radiation or radio waves.

February 27, 1891 David Sarnoff is born in Uzlian, Russia.

1896 Guglielmo Marconi applies for a patent on a system of transmission and reception of radio telegraphy using electric waves.

1897 Carl Braun perfects the cathode-ray tube, a vacuum tube with a gun that shoots electrons at one end and a fluorescent screen (a screen coated with photosensitive material that releases light when hit by the electrons) at the other end.

1900 Sarnoff immigrates to America.

December 17, 1902 Marconi successfully transmits a wireless telegraph message across the Atlantic Ocean.

1905 Albert Einstein writes "On a Heuristic Viewpoint Concerning the Production and Transformation of Light," about the photoelectric effect, for which he would receive the Nobel Prize in 1921. It refers to the emission of electrons from matter, most often metals, in response to electromagnetic radiation or light in the form of photos. It is a discovery that will make television possible.

August 19, 1906 Philo T. Farnsworth is born in a log cabin in Indian Creek, Utah.

April 14, 1912 The sinking of the RMS Titanic is reported over wireless telegraph by the RMS Olympic. Sarnoff claims to have been the wireless operator listening that night.

July 4, 1917 Lizette Hermant and Sarnoff marry at a Bronx synagogue.

November 20, 1919 American Marconi—the American branch of British Marconi, the company founded by Guglielmo Marconi— is sold to the Radio Corporation of America. RCA had been created by General Electric Co. in October of that year after a congressional mandate amid fears about having a foreign corporation controlling American radio telegraphy.

July 2, 1921 The Jack Dempsey-Georges Carpentier boxing match airs live over broadcast radio. Later, Sarnoff claims the publicity stunt, which increases the demand for radios, was his idea.

February 21, 1922 Farnsworth sketches his idea for a television for his high-school chemistry teacher Justin Tolman, who saves the sketch.

1922 Sarnoff becomes Vice-President and General Manager of RCA.

1923 RCA appoints former "Rough Rider" Gen. James G. Hubbard as president.

December 29, 1923 Vladimir Zworykin files for a patent for his television system.

1924 Farnsworth's father dies; Farnsworth joins the U.S. Navy to earn money for college, but leaves a few months later.

1924 AT&T sells all its RCA stock.

1925 Walter Gifford becomes president of AT&T.

1925 Scottish inventor John Logie Baird transmits recognizable human features by means of a mechanical television

1926 Farnsworth works at the Salt Lake City Community Chest, a charity fundraiser, for George Everson and Leslie Gorrell, who become his friends and future investors

May 27, 1926 Farnsworth and Elma "Pem" Gardner are married in Provo, Utah.

November 15, 1926 The party for the newly formed National Broadcasting Company (the former WEAF radio station RCA purchased for $1 million) is broadcast live from the Waldorf Astoria Hotel in New York City.

1927 The movie *The Jazz Singer* is released, starring Al Jolson. It is the first feature film with synchronized sound and picture.

January 7, 1927 Farnsworth applies for a patent for his electronic television system.

April 7, 1927 American Telephone and Telegraph (AT&T) invites newspapers to witness then Secretary of State Herbert Hoover deliver a brief televised message that will be sent over telephone lines.

September 7, 1927 Farnsworth transmits the first electronic image to a screen in a room adjoining his lab on Green Street in San Francisco, CA.

1928 Harbord takes a leave of absence from RCA to work on Herbert Hoover's presidential campaign; Sarnoff becomes acting President of RCA.

March 17, 1929 Farnsworth and his partners in San Francisco incorporate as Television Laboratories, Inc.

September 23, 1929 Pem Farnsworth gives birth to their first son, Philo Taylor Farnsworth III.

October 29, 1929 The stock market crashes, and financial panic grips the United States at the start of what would become known as the Great Depression.

1930 Sarnoff becomes President of RCA.

1930 Mary Pickford and Douglas Fairbanks, as owners of United Artists, visit the Farnsworth lab to see television, but it doesn't work because of a disconnected cord.

August 26, 1930 Farnsworth is granted a patent for the electronic television system.

January 15, 1931 The Farnsworth's second child is born: Kenneth "Kenny" Gardner Farnsworth.

October 18, 1931 Thomas Alva Edison dies.

March 6, 1932 Kenny Farnsworth dies after an emergency tracheotomy to treat a streptococcal infection.

1932 Farnsworth brings a patent-interference suit against RCA. RCA countersues, claiming Farnsworth's 1930 patent is infringing on Zworykin's December 29, 1923 patent for a television system.

1932 GE and Westinghouse are ordered to divest itself of all RCA stock, to end an illegal monopoly. RCA is required to license patents to competitors

1933 The U.S. Prohibition on the sale of alcohol is lifted.

October 5, 1935 The Farnsworth's third son, Russell Seymour Farnsworth is born. He is called "Skeezix," after a popular cartoon character.

July 1935 The examiner of interferences at the U.S, Patent office affirms Farnsworth's priority of invention, and his patents for electronic television are upheld.

1936 Sarnoff enters into a cross-licensing agreement for Farnsworth's patents.

1936 Kálmán Tihanyi, a Hungarian physicist, describes the principles of a plasma television

1936 BBC London starts broadcasting for television.

1946 Three major broadcast stations are available, NBC, CBS and ABC.

1947 *Howdy Doody* and *Meet the Press* debut on NBC.

September 4, 1948 The Farnsworth's fourth son, Kent, is born.

1948 Cable broadcasting begins in rural Oregon and Pennsylvania, where local cable companies capture over-the-air signals and retransmit them to households that had difficulty receiving signals via antennas. The major networks are unhappy with what they view as theft of their programming and work to block the expansion of cable television.

1951 The first color television is introduced in the United States.

1960 70 million viewers watch the televised presidential debates between Sen. John Kennedy and Vice President Richard Nixon. Radio listeners believe Nixon won the debate, but television viewers believe Kennedy won. The televised debates usher in an era in how political candidates are perceived

1962 NASA scientists broadcast images of themselves to scientists in England via satellite, paving the way for satellite television.

July 20, 1969 The Apollo 11 lunar landing is broadcast on television.

March 11, 1971 Farnsworth dies of pneumonia in Holladay, Utah, at age 64. At his death he holds over 150 U.S. patents for various inventions.

December 12, 1971 David Sarnoff dies in his sleep of a heart attack, at age 80.

1972 The White House-initiated *Cable Television Report and Order* loosens restrictions on cable television's expansion into new markets, paving the way for cable television's growth in the 1980s and 1990s.

1975 Sony introduces the Betamax video recorder.

1975 Home Box Office (HBO) uses a satellite to broadcast programs to local cable television providers.

1976 VHS videocassette recorders are introduced to the market, ultimately putting Betamax out of business.

April 8, 1979 40.2 million households watch the final episode of *All in the Family*.

1980 Ted Turner founds the Cable News Network.

1981 Walter Cronkite retires from regular television reporting.

1986 Live television coverage of U.S. Senate proceedings begins**.**

1990 Channel capacity is expanded, and the 54-channel system becomes common.

1996 The Digital Video Disk (DVD) is introduced to the market.

1998 Digital Video Recorders are released in the U.S.

1998 High-definition televisions become commercially available in the U.S.

May 6, 2004 52.5 million households watch the final episode of *Friends*

June 12, 2009 Deadline for the conversion of all U.S. televisions to a digital signal.

Television by the Numbers

THEN

— **20,000** — television sets in service in New York City in 1938[1]
— **$100,000** — the amount of money inventor, Vladimir Zworykin, told RCA president, David Sarnoff it would take for him to get a working television[2]
— **$50 million** — the amount RCA would pay to get a working television[2]
— **1.5 million** television sets in the United States in 1950[1]
— **15 million** television sets in the United States in 1951[1]
— **85 million** television sets in the United States in 1960[1]
— **73 million people**, nearly 40 percent of the U.S. population, watch The Beatles perform on *The Ed Sullivan Show* on February 9, 1964[3]
— **230 million** television sets throughout the world in 1970[1]
— **36.38 million** American households watch the finale of the mini-series *Roots* on January 30, 1977[4]
— **28** national networks in 1980[5]
— **105.9 million** American households watch the final episode of *M*A*S*H* on February 28, 1983[4]
— **$13 billion:** the amount Time Inc. spends to acquire Warner Communications Inc. in 1989, creating the world's largest entertainment group[1]
— **79** national networks in 1990[5]

NOW

— **7** world media conglomerates control most television stations in 2001[6]
— **98** percent: the approximate number of American homes with televisions in 2009[7]
— **151:** the average number of hours of television an American watches per month in 2009[7]
— **8.5:** the average number of hours Americans spend in front of a screen per day (television, computer, cell phone) in 2009[8]
— **29 percent:** the number of American homes with digital video recorders in 2008[9]
— **11 million:** the number of Americans who watch mobile videos in 2009[7]
— **31 percent** of Internet usage occurs while Americans are watching television in 2009[7]
— **$30 billion:** the estimated amount of the 2009 deal for Comcast Corp. to buy NBC Universal from General Electric Co.[10]

---

[1] Grun, Bernard *The Timetables of History* 3rd Ed.
[2] " Big Dream Small Screen" American Experience, PBS 1997
http://www.pbs.org/wgbh/amex/technology/bigdream/bigdreamts.html
[3] "Beatles on the Air" February 6, 2004, NPR On the Media
http://www.onthemedia.org/yore/transcripts/transcripts_020604_mania.html
[4] http://television.aol.com/feature/may-sweeps/photos-quizzes/most-watched-finales
[5] http://www.museum.tv/eotvsection.php?entrycode=unitedstatesc
[6] PBS Frontline "The Merchants of Cool" http://www.pbs.org/wgbh/pages/frontline/shows/cool/giants/
[7] CNN February 24, 2009 Taylor Gandossy "TV viewing at 'all time high' Nielsen Reports"
http://www.cnn.com/2009/SHOWBIZ/TV/02/24/us.video.nielsen/
[8] "8 Hours a Day Spent on Screens, Study finds" New York Times March 26, 2009 Brian Stelter
http://www.nytimes.com/2009/03/27/business/media/27adco.html
[9] 2009 Nielsen Report "Television Internet and Mobile Usage in the U.S.
http://i.cdn.turner.com/cnn/2009/images/02/24/screen.press.b.pdf

[10] "GE Makes it Official: NBC will go to Comcast" New York Times December 3, 2009 Tim Arango
http://www.nytimes.com/2009/12/04/business/media/04nbc.html

The Response to Television

"It is with a feeling of humbleness that I come to this moment of announcing the birth in this country of a new art so important in its implications that it is bound to affect all society. Television is an art, which shines like a torch of hope to a troubled world. It is a creative force which we must learn to utilize for the benefit of mankind. ... now ladies and gentlemen, we add sight to sound."
— *David Sarnoff, unveiling RCA's television at the 1939 World's Fair in New York City*

"This instrument can teach, it can illuminate, it can even inspire, but it can do so only to the extent that humans are determined to use it to those ends. Otherwise, it is merely wires and lights in a box."
— *Edward R. Murrow, radio and television journalist*

"Seeing a murder on television ... can help work off one's antagonisms. And if you haven't any antagonisms, the commercials will give you some." — *Alfred Hitchcock, film and television director*

"If it weren't for Philo T. Farnsworth, inventor of television, we'd still be eating frozen radio dinners."
— *Johnny Carson, comedian and host of The Tonight Show*

"I can think of nothing more boring for the American people than to have to sit in their living rooms for a whole half hour looking at my face on their television screens." — *President Dwight D. Eisenhower*

"One of the few good things about modern times: If you die horribly on television, you will not have died in vain. You will have entertained us." — *Kurt Vonnegut,* In these Times*, "Cold Turkey," May 10, 2004*

"This idea it's monstrous, absolutely monstrous."
— *Response of patent attorney Richard Lyon on hearing Philo T. Farnsworth's idea for television*

"Like any father of an eight-year-old, he thinks there are too darned many cowboy movies at the dinner hour. ... Dr. Farnsworth has just as much trouble as you or I in guarding against TV becoming a monster, devouring all of the time that should be set aside for reading and conversation."
— *Fort Wayne* News Sentinel*,* "What Does Farnsworth Think of 'Baby'? Inventor of TV Says Too Many Cowboy Movies," *March 21, 1957, Ernest E. Williams*

Discussion Questions

About the Play

— Sorkin changes significant historical details in the play? What is gained by these changes? What might be lost by changing historical details?

— The play is called *The Farnsworth Invention* and yet much of the play is also about David Sarnoff. Why call the play *The Farnsworth Invention*?

— Both Sarnoff and Farnsworth seem able to step into a scene and step out of it and comment on the play. What does their commentary add to the play? Why do you think the play allows individuals who never met to confront each other? What do we gain by seeing these two men tell each other's stories?

— There is some irony in creating a play about television rather than a television program about television. What advantages does theater as a form have for telling this story?

About the Production

— The set in this play offers a channel of space for the actors to move in with audience on either side. How does the ability to see the audience opposite you change your experience of the play? How does the space change when the scenes focus on Farnsworth as opposed to the times when it focuses on Sarnoff?

— Sarnoff opens the play by talking about light. Lighting is key to the play as are projections. How do the lighting and projections reinforce the ideas of the play?

— Most actors play more than one role in the play. How do the costumes help distinguish the characters?

About the History

— Farnsworth invented many of the key elements of the electronic television and yet most people have not heard his name. Why do you think he has been overlooked by history?

— Farnsworth and Sarnoff both offer competing models of someone trying to achieve the "American Dream" what value is there in seeing their competing methods?

— The current economic crisis has many critical of corporations. What lessons might be learned from the past behavior of corporations?

— No one involved with the invention of the television fully appreciated the impact it would have on the world. What new inventions might change the way humans interact and think about the world?

Additional Resources

Books

- *The Last Lone Inventor: A Tale of Genius, Deceit and the Birth of Television* – Evan I. Schwartz
- *Distant Vision: Romance and Discovery of an Invisible Frontier* – Elma G. Gardner
- *The Story of Television, the Life of Philo T. Farnsworth* – George Everson
- *The History of Television, 1880 to 1941* – Albert Abrahamson
- *The General: David Sarnoff and the Rise of the Communication Industry* – Kenneth Bilby
- *Television: A Struggle for Power* – Frank C. Waldrop and Joseph Borkin
- *The First Principles of Television* – A. Dinsdale
- *Tube: The Invention of Television* – David E. Fisher and Marshall Jon Fisher
- *Philo T. Farnsworth: The Father of Television* – Donald G. Godfrey
- *Acceptance and Dedication of the Statue of Philo T. Farnsworth* – House Document 101-188

Documentaries

- *Television Window to the World*, The History Channel
- *Big Dream Small Screen: The Story Behind Television*, PBS, *American Experience*