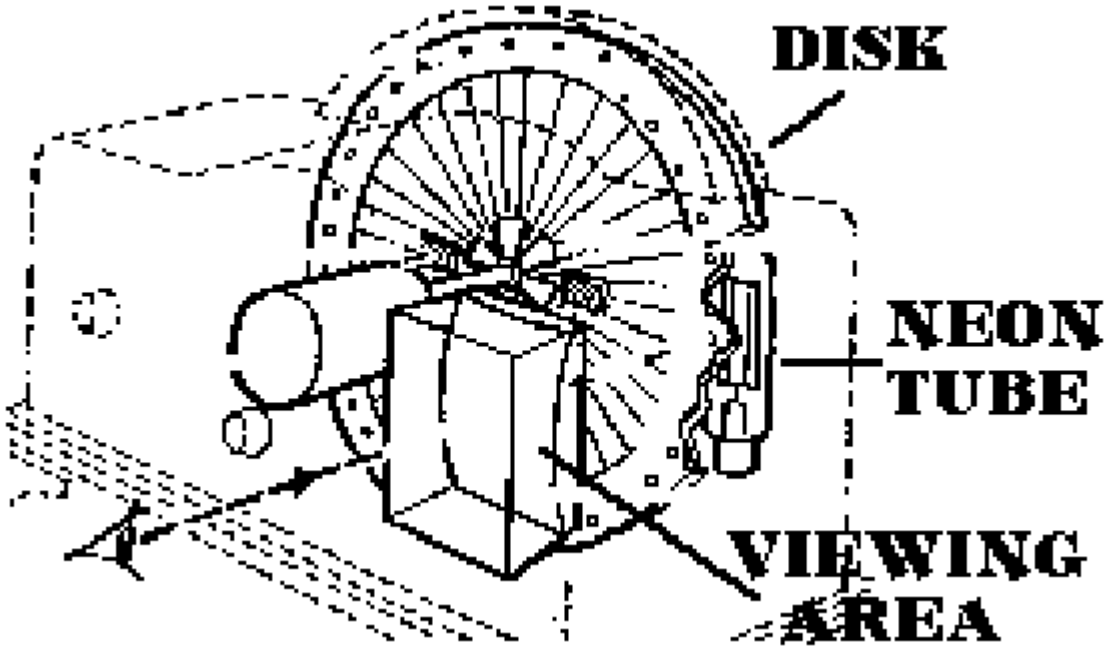
COMMUNICATION USING MEDIA
INSTRUCTOR'S NOTES



BRAD FORTNER

SECTION 1
POINTS FROM THE PAST; HISTORY OF TELEVISION TECHNOLOGY

HISTORY OF TELEVISION

The possibility of vision at a distance had occupied scholars' minds long before the idea of sound broadcasting. Webster's dictionary defines television as "the process of transmitting images by converting light to electrical signals and then back again". Television is constructed of two elements -- video and audio. Video comes from the Latin word "I see" and audio is derived from the Latin word "I hear". Historically, no single person or invention is credited with the development of television.

The modern day television set can be traced back to the discovery of selenium in 1817. Television is based on photoelectric technology. Television's initial developments are linked to pioneering attempts to both improve and send still images down a telegraph wire. In the mid 1800's, sending still images by telegraph wire was an electrochemical process. Yet, the concepts of synchronized scanning and the use photoelectric technology evolved over a fifty year period.

Sending Still Images Via Telegraph

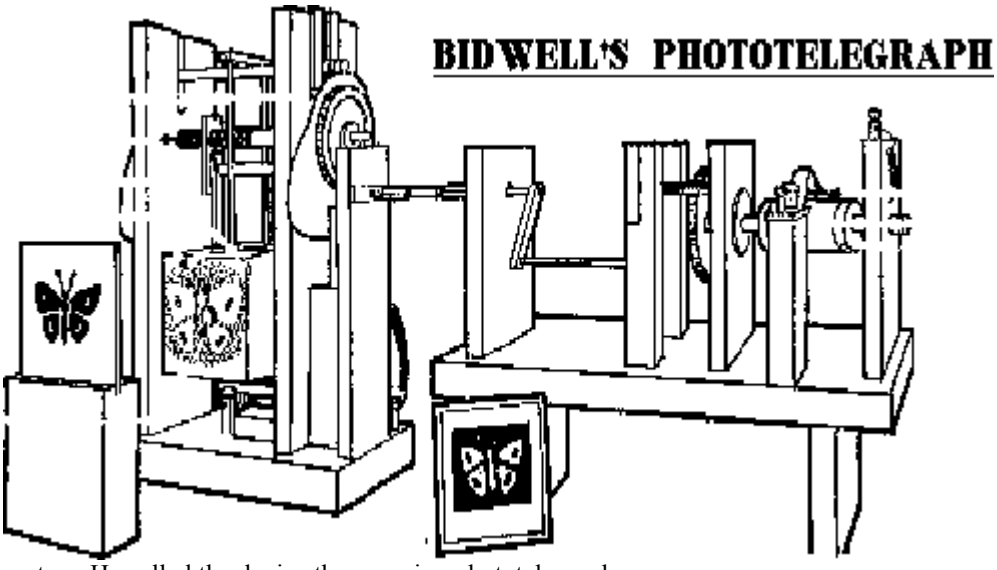
The idea of sending still images via the telegraph traces its roots to1839. At that time Edmond Becquerel, a French physicist interested in the study of light, found that when two pieces of metal were immersed in an electrolyte, an electrical charge developed when one of the pieces was illuminated. Although Becquerel had discovered the electrochemical effects of light he did not offer any practical suggestion for its use.

In 1842, Alexander Bain proposed a facsimile telegraph transmission system based on Becquerel's discovery. Bain proposed that metallic letters of the alphabet could be transmitted chemically. Electrified metal letters could be scanned by a pendulum device and reproduced at the other end of the telegraph wire by a synchronized pendulum contacting a piece of chemical paper. Historians normally associate Bain's idea's with the modern day facsimile (fax) machine. Bain is also credited with the idea of scanning an image, so it can be broken up into small parts for transmission. His invention also drew attention to the need for synchronization between the transmitter and the receiver in order for the transmission system to work.

In 1847, F. Bakewell of Great Britain patented a chemical telegraph. Bakewell improved Bain's proposal by replacing the pendulums with synchronized rotating cylinders. Later, in 1861, Bakewell's system was improved by an Italian priest, Abbe Caselli. Caselli wrapped tin foil around the rotating cylinders and was able to use it to send handwritten messages and photographs.

In 1873, Louis May, a British telegrapher, discovered what we consider today to be the basics of photoconductivity. He found that selenium bars, when exposed to light, were a strong conductor of electricity. He also noted that the conduction of electrical current would vary depending on the amount of light hitting the selenium bars.

The final links between telegraphs and television occurred with M. Senlacq of Ardres, in Northern France in 1878. He proposed that selenium could trace documents. He proposed that the changes in electrical voltage produced by selenium scanning a document, could magnetically control a pencil at the receiving end of the transmission. By 1881, British pioneer Shelford Bidwell successfully transmitted silhouettes using both selenium and a scanning

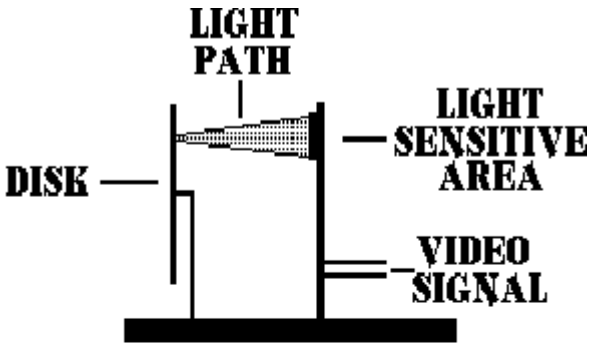


system. He called the device the scanning phototelegraph.

Mechanical Television

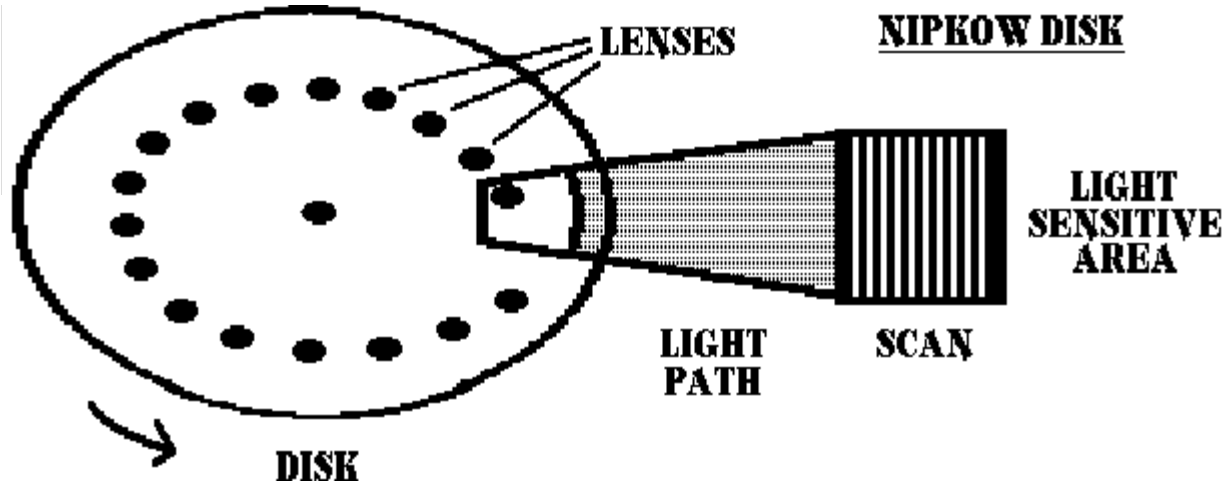
Paul Nipkov

In 1884, university student Paul Nipkow of Germany proposed and patented the world's first electromechanical television system. Nipkow proposed a disc camera, that contained a disc which was perforated. To capture a moving image the disc was rotated before an image and had the effect of dividing the picture into lines. Light sensitive selenium behind the perforated disk would capture the moving image. The camera became known as the Nipkow disk. The Nipkow disk was a mechanical scanning system and became the best known for its time. Nipkow could not build a working system. He could not amplify the electric current created by the selenium to drive a receiver. It was not until 1907 and the development of an amplification tube that serious development in mechanical television would start.



NIPKOW DISK

A Spiral Lens Arrangement On A Spinning Disk Was The Mechanical Scanning System Proposed By Paul Nipkow In 1884. He Also Proposed That Selenium Be Used As The Light Sensitive Material.

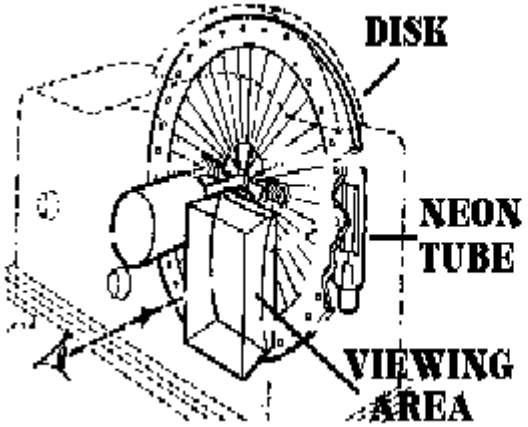


John Logie Baird

John Logie Baird, of Great Britain, has his place in history as one of the champions of the development of mechanical television. Known as an idea-rich inventor, John Logie Baird was said to have had trouble changing a fuses by himself, but had a flair for publicity. Prior to his development efforts at television he had failed at making artificial diamonds and had attempted a cure for hemorrhoids that left him in severe pain for a week.

Despite his history on October 30, 1925, John Logie Baird of London was succesful in transmitting his first picture: the head of a dummy. Looking for publicity he visited the Daily Express newspaper to promote his invention. The news editor was terrified. Later he was quoted by one of his staff as saying:" For God's sake, go down to reception and get rid of a lunatic who's down there. He says he's got a machine for seeing by wireless! Watch him-- he may have a razor on him." In 1928, Baird extended his system by transmitting a signal between London and New York. In 1929 the British Broadcasting Service (BBC) adopted the Baird mechanical system. By 1932 John Logie Baird had developed the first commercially viable television system and had sold 10,000 sets. Baird's electromechanical system consisted of a light sensitive camera behind a rotating disc. It delivered a crude picture consisting of thirty lines at twelve frames per second to a television receiver that displayed an uneven and tiny orange and black image.

BAIRD'S TELEVISION RECEIVER



Using A Magnifier And A Neon Tube, Baird's Mechanical Television Set Could Reproduce Television Signals By Using A Built In Spinning Disk Synchronized To The Transmission Disk.

North America And Mechanical Television

Experiments in mechanical television began in North America in the early 1920's. Ernst Alexanderson of General Electric began transmitting silhouettes from his laboratory to his home in Schenectady, New York.

Charles Francis Jenkins

While Baird promoted and developed mechanical television in Britain, Charles Francis Jenkins promoted it in North America. A lone tinkerer from Dayton, Ohio, Jenkins created "radio vision" and performed his first transmission, from Anacosta, Virginia to Washington in 1925. Described as a multitube radio set with a special picture receiving attachment, by 1928, Jenkins had managed to sell several thousand sets at a cost that varied between $85 and $135. The device, consisting of and electric motor and prismatic rings, managed to produce a cloudy 40 line image on a six-inch square mirror. Jenkins also opened and operated North America's first television station, W3XK in Wheaton, Maryland.

Canada And Mechanical Television

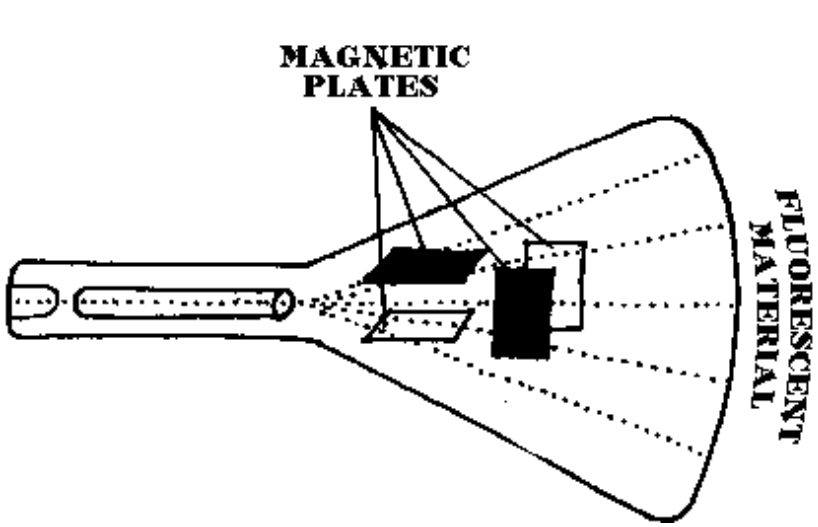
The French Canadian pioneer radio station, CKAC, in Montreal, began experimenting with the mechanical television in 1926. Operated by La Presse, it started by experimenting with a Baird disc camera and a Jenkins drum scanner. Originally, they transmitted pictures over a wire link. In 1931, the station purchased a television transmission system manufactured by a Chicago company and Canadian broadcasting began. The system used a three spiral, 45 line disc camera. The picture was transmitted separately from the sound with the voice portion broadcast on a standard radio station. The picture was transmitted on the shortwave band using 500 watts of power. Historically broadcasting began in Canada on July 20, 1931. It went out to an estimated 20 viewers originating from a studio that used four 20 watt red lightbulbs to illuminate the talent. Using the call letters CKAC, Mariette Mineau, a violinist, her sister Francoise, singer Violet Gridley, Douglas Reid and artist Edward Picard would be credited with being Canada's first television performing artists. Working as a technician on the historic broadcast was J. Alphonse Ouimet, who would later become president of the CBC. The La Presse studio would broadcast twice a week through 1932, once a week during 1933 and then sporadically thereafter.

It was November of 1928 when television visionary David Sarnoff of RCA announced "The Dawning Age of Sight by Radio". His pronouncement was based on the mechanical systems pioneered by Jenkins and Alexanderson. But in 1929, he met Vladimir K. Zworykin, who had fled Russia ten years earlier and had plans for an electronic system for television. Sarnoff would later hire him from Westinghouse and Zworykin would develop electronic television becoming RCA's greatest engineer

Electronic Television

Cathode Ray Tube

The modern television system would evolve from developments associated with electronic television. Electronic television is based on the development of the cathode ray tube, which is the picture tube found in modern television sets. First identified in 1859 by Julius Plucker, a German mathematician and physicist, it would take until 1878 whenWilliam Crookes, a British chemist, would confirm the existence of cathode rays by building a tube that displayed them. Later , English physicist Ambrose Flemming, working with Crookes tube, would discover that cathode rays could be deflected and focused. This was accomplished by wrapping the tube with wire (creating a magnetic field) and passing an electric current through it. In 1897, German physicist Karl Braun developed the first cathode ray oscilloscope. Braun illuminated the cathode rays by placing fluorescent materials at the end of the tube. Braun built the oscilloscope to demonstrate how cathode rays could controlled a magnetic field. As time passed these developments would be applied to the scanning system for todays television.



CATHODE RAY TUBE

In 1897, Karl Braun Invented The Cathode Ray Tube. It Uses Magnetic Feilds To Control The Cathode Rays. Braun Placed Fluorescent Materials On The Front Of The Tube So Control Of The Cathode Rays Could Be Observed. The Cathode Ray Tube Would Become A Key Component In Electronic Television.

Amplification Tubes

Another important development in electronic television was the arrival of the amplification tube. Tubes performing various functions would become the building blocks of the electronic system. Based on modifications to the common household lightbulb, (the same type pioneered by Thomas Edison), tubes were soon created that had the ability to turn on and off current (Flemming Valve 1904), amplify electronic signals (De Forest Triode 1906), and transmit radio waves (Armstrong Regenerative Circuit 1912).

World Wide Development

The development of electronic television was not limited to one single group or country. Research and pioneering efforts are credited to various inventors.

Philo T. Farnsworth

In 1922, American Philo T. Farnsworth, who was then a 15-year-old Idaho farm boy born in a log cabin, described to his friends and teachers how an electronic TV system might work. Later in 1927, he would transmit his first TV image based on his system.

Kenjito Takayanagi

The Japanese say the honour of the first working electronic television system goes to Kenjito Takayanagi of Tokyo. On Christmas Day, 1926, he used a cathode-ray tube to transmit an image of Japanese writing. Japan now honours Mr. Takayanagi, who was a slow learner in school, as the inventor of TV.

Vladimir Zworykin

The person most often associated as the father of television is Vladimir Zworykin. Teamed with David Sarnoff at RCA, Zworykin would lead the development of electronic television. Zworykin was cursed with living in interesting times, born in Russia in 1889, he studied at the St. Petersburg Institute of Technology. He was eventually hired by one of his instructors, Boris Rosing, who was seeking ways of extending mans vision. By 1907 Rosing had developed a television system which employed a mechanical disc system as a camera and a glass tube (cathode ray tube) as a receiver. The system was primitive but it was more electronic than mechanical. With the Russian Revolution, Rosing went into exile and died. Zworykin carried on his work.

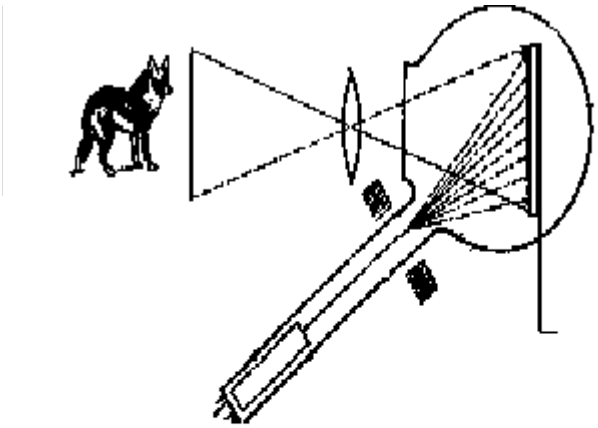
With the outbreak of World War I, Zworykin decided to leave Russia for the United States. Zworykin found work with Westinghouse. Based on their pioneering efforts in radio, he tried to convince them to do research in television. Turning down an offer from Warner Brothers, Zworykin worked nights, fashioning his own crude television system. In 1923, Zworykin demonstrated his system before officials at Westinghouse and applied for a patent. All future television systems would be based on Zworykin's 1923 patent.

Zworykin describes his 1923 demonstration as "scarcely impressive". Westinghouse officials were not prepared to base an investment in television on such a flimsy system. The companys suggestion was that Zworykin devote his time to more practical endeavours. Undeterred, Zworykin continued in his off hours to perfect his system. He was so persistent that the laboratory guard was instructed to send him home a 2:00 in the morning if the lights of the laboratory were still on. During this time,. Zworykin managed to develop a more sophisticated picture tube called the kinescope, which serves as the basis of the television display tubes in use today.

In 1929, Vladimir Zworykin invented the all electric camera tube. Zworykin called his tube the iconoscope (literally "a viewer of icons"). He demonstrated both the iconoscope and kinescope to the Institute of Radio Engineers. Zworykin's all electronic television system demonstrated the limitations of the mechanical television system. In attendance was David Sarnoff who eventually hired Zworykin to develop his television system for RCA.

Under Sarnoff's watchful eye, Zworykin continued to develop the electronic system. When Zworykin started at RCA his system was scanning 50 lines. Experimental broadcasts started in 1930 first using a mechanical camera transmitting at 120 lines. By 1933 a complete electronic system was being employed with a resolution of 240 lines. Zworykin had originally told Sarnoff it would cost $200,000.00 to develop a television system, the final cost was estimated to cost RCA about $50,000,000.00 .

Zworykin was not alone. By 1934 two British electronic firms, EMI and Marconi, created an all-electronic television system. They used the Orthicon camera tube invented by an American company, RCA. This electronic system was officially adopted by the BBC in 1936. It consisted of 405 scanning lines, changing at twenty five frames per second.



ZWORYKIN'S ALL ELECTRIC CAMERA TUBE

By 1929, The All Electric Camera Tube Had Been Developed By Vladimir Zworykin. This Development Was A Key Component In The Advancement Of Electronic Television

North American Television

Three years later in 1939, broadcasting started in the United States. The National Broadcasting Company (NBC) started regularly scheduled broadcasts to only 400 sets in the New York area. These initial broadcasts employed a scanning system of 340 lines at thirty frames per second. In 1941, the American Federal Communications Authority (FCC) set the standards for broadcast television. Called EIA (Electronic Industries Association standard), the system contained 525 lines changing at thirty frames per second. With the start of World War II, television production stopped in the U.S.

At the end of the war, there was a two year delay in the development of television as the Federal Communications Authority considered colour television systems. In 1947, all proposals for colour television were rejected. Black and white sets, based on the EIA standard were manufactured in great quantity. Coupled with the post war economic boom, the sales of television sets soared. From just 7000 receiving sets in the United States at the start of 1946 to 10,000,000 sets by 1950.

It took until 1954 for the National Television System Committee (NTSC) to set the standard for colour broadcast television. They settled on a system that was compatible with existing black and white TV sets. Colour was achieved by inserting the colour information inside the black and white signal. Japan adopted the NTSC system in 1960, but it wasn't until 1967 that the USSR and France adopted the SECAM system (Systeme Electronice Coleur Avec Memoire) that features less colour distortion than our NTSC system along with 625 lines at 25 frames per second.

By 1970, television had become the primary information and entertainment medium in the United States. Americans led the world in owning television receivers, having almost 93 million of the world's 271 million sets. Canadians ranked fifth in 1970 with almost 8 million sets, behind the U.K. with 17 million sets, Japan with 24 million sets and the U.S.S.R. with 28 million sets. Today, it is estimated that there are 605 million television sets worldwide. There are 15 variations of broadcasting standards, centering around NTSC, SECAM, PAL and HDTV.

CHRONOLOGY OF TELEVISION TECHNOLOGY

1817 - Swedish Baron Jons Berzelius isolates the element selenium.

1839 - Edmond Becquerel discovers the electrochemical effects of light.

1842 - Alexander Bain proposes facsimile telegraph transmission that scans metal letters and reproduces image by contact with chemical paper. Synchronized scanning is part of proposed transmission system.

1847 - F. Bakewell improves facsimile by creating rotating scanning drums.

1859 - German mathematician and physicist Julius Plucker experiments with invisible cathode rays.

1861 - Italian priest, Abbe Caselli, uses tin foil on facsimile to transmit handwriting and pictures.

MAY 1873 - British scientists, Willoughby Mith and Joseph May noted that the electrical conductivity of the element selenium changes when light falls on it. This property, called photoconductivity, is used in camera tubes.

1878 - M. Senlacq proposes the use of selenium in facsimile machines to transmit paper documents

1878 - Sir William Crookes develops a tube that confirms the existence of cathode rays.

1881 - British pioneer Shelford Bidwell demonstrates his scanning phototelegraph that establishes both scanning and the use of selenium in transmitting still pictures.

1884 - German scientist Paul Gottlieb Nipkow patented a device for scene analyzation that consisted of a rapidly rotating disk placed between a scene and a light sensitive selenium element. It became known as the Nipkow disk. Although this was a mechanical design (not in use today), it was the first television scanning system, outlining the principle of scanning a moving image. If the Nipkow disk was turned fast enough, it theoretically created a scanning system capable of showing a moving picture. It is believed a working model was never built by Nipkow himself. It would take the development of the amplification tube before the Nipkov Disc would become practical.

1888 - German physicist Wilhelm Hallwachs noted that certain substances emit electrons when exposed to light. Hallwachs demonstrated the possibility of using photoelectric cells in cameras. This property called photoemission was applied in the creation of image orthicon tubes allowing the creation of the electronic television camera.

1897 - German Karl Braun invents the Cathode Ray Tube (CRT).

1904 - First colour television system is proposed based on the principle of scanning three primary colours.

1907 - American engineer Lee De Forest invented the triode electron tube. This made amplification of video signals created by photoconductivity and photoemission possible.

1907 - English inventor A.A. Campbell-Swinton and Russian Boris Rosing independently suggested using a cathode ray to reproduce the television picture on a phosphorous coated screen. This suggested that the electronic scanning system used in the CRT could replace the mechanical Nipkow disk.

1911 - English inventor A.A. Campbell-Swinton proposed an electronic scanning system using a charge-collecting screen and an electron gun to neutralize the charge to create a varying current. The electronic scanning system used in the CRT could then be adapted as an electronic scanning system to replace the mechanical Nipkow disk.

1923 thru 1926 - American Charles F. Jenkins developed a working television system based on the Nipkow disk. In England, Scottish engineer John L. Baird demonstrated a working television system that was based on the Nipkow disk, with improved resolution. The Baird system used infrared rays and could take pictures in the dark. Both systems produced a small crude orange and black recognizable image.

1923 - Westinghouse, General Electric, RCA, and AT&T entered into television research.

1923 - Vladamir K. Zworykin, a Russian immigrant to the United States, patented the "iconoscope" an electronic camera tube based on A.A. Campbell-Swinton's proposal of 1911.

1923 - Philo T. Farnsworth (13 years old) developed an electronic camera tube, similar tube to Zworykin's named the "kinescope".
1926 - Canadian experiments with mechanical television start in Montreal.
1927 - First long distance television broadcast from Washington to New York performed by AT&T.
1928 - John L. Baird demonstrates a colour television system using a modified Nipkow disk.
1928 - American inventor E. F. W. Alexanderson demonstrates the first home television receiver in Schenectady, New York. It consisted of a 3" screen and delivered a poor and unsteady picture. On May 28, 1928 the first television station WGY began broadcasting in Schenectady. Sets were built and distributed by General Electric in Schenectady.
1929 - John L. Baird starts transmissions using BBC radio towers in off hours.
1929 - Zworykin demonstrates the all electronic television camera and receiver.
1930 - American Philo Farnsworth patents electronic television.
1930 - NBC is granted an experimental broadcast licence.
1931 - Television broadcasting starts in Canada by CKAC of Montreal.
1933 - 33 Radio Stations Are Broadcasting In Canada.
605 Radio Stations Are Broadcasting In United States.
8 Radio Stations Are Broadcasting In Newfoundland.
1935 - Germany begins world's first public broadcasting service.
1935 - RCA pledges millions of dollars towards the development of TV.
1936 - Public broadcasting begins in England.
1936 - Germany broadcasts Olympic Games.
1939 - RCA displays TVs at World's Fair.
1940 - American Peter Goldmark introduces a refined colour television system in New York City.
1941 - NBC and CBS are granted commercial broadcast licences.
1941 - United States adopts a 525 line black and white system as the standard for broadcasting.
1941 - A total of 400 television receivers had been sold in the United States.
1945 - There are an estimated 10,000 television sets in the US.
1946 - 6,500 television receivers are sold in the United States.
1947 - World Series (Baseball) is broadcasted, attracting an audience in excess of four million in the United States.
1948 - CBS announces development of colour television system.
1949 - NBC announces development of colour television system.
1951 - Television broadcasting in colour began and ended in United States using the Peter Goldmark colour system that was not compatible with the 525 line black and white standard.
1952 - CBC is licensed in Montreal and Toronto.
1952 - Television sets in American homes pass the 22 million mark.
1953 - Half the homes in the United States have television sets.
1953 - NTSC television standard is adopted in the United States allowing for colour television that is compatible with existing black and white TV sets.
1954 - Commercial colour broadcasting begins in United States using the NTSC standards.
1955 - Videotape is introduced.
1959 - CBC linked by microwave from Victoria to St. Johns.
1960 - Television sets in American homes pass the 60 million mark.
1961 - CTV receives television broadcast licence.
1962 - Telestar 1 satellite launched, thus opening doors for television satellite transmission and allowing intercontinental transmission when in proper position.
1962 - Television sets in American homes pass the 70 million mark.
1965 - Commercial satellite Early Bird launched in fixed orbit allowing continuous intercontinental transmission.
1965 - With only two exceptions, NBC announces all prime time programmes to be in colour.
1966 - Colour television tests were conducted in Canada.
1967 - Canadian colour television standards are set and colour transmission begins.
1969 - Apollo 11 moonwalk is transmitted and broadcast live from the moon.
1974 - 97% of American homes have at least one TV set and it is on at least five hours per day.
1984 - Stereo television authorized.
1987 - CBC shoots the world's first large scale commercial HDTV production, "Chasing Rainbows".
1990 - 1446 television stations broadcasting in United States.

Summary

The possibility of vision at a distance had occupied scholars minds long before the idea of sound broadcasting. Historically, no single person or invention is credited with the development of television. The modern day television set can be traced back to the discovery of light sensitive selenium in 1817.

Alexander Bain, normally associated with the fax machine, is also credited with the idea of scanning an image, so it can be broken up into small parts for transmission.

In 1884, Paul Nipkow of Germany proposed the world's first electromechanical television system. Using selenium as the basis of his camera it became known as the Nipkow disk. The Nipkow disk was a mechanical scanning system and became the best known for its time. By 1932 John Logie Baird, of Great Britain, championed mechanical television and had developed the first commercially viable television system.

The French Canadian pioneer radio station, CKAC, in Montreal, began experimenting with the mechanical television in 1926. Broadcasting began in Canada on July 20, 1931 to an estimated 20 viewers. Mariette Mineau, a violinist, her sister Francoise, singer Violet Gridley, Douglas Reid and artist Edward Picard are credited with being Canada's first television performing artists. Working as a technician was J. Alphonse Ouimet, who would later become president of the CBC.

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In 1929, Vladimir Zworykin of Westinghouse invented the all electric camera tube. When coupled with the cathode ray tube, electronic television quickly demonstrated the limitations of mechanical television. In 1939, broadcasting started in the United States. The National Broadcasting Company (NBC) started regularly scheduled broadcasts to only 400 sets in the New York area.

In 1941, the American Federal Communications Authority (FCC) set the standards for broadcast television. Called NTSC, the system contained 525 lines changing at thirty frames per second. It took until 1954 for the National Television System Committee (NTSC) to set the standard for colour broadcast television. They settled on a system that was compatible with existing black and white TV sets. Colour was achieved by inserting the colour information inside the black and white signal. Today, it is estimated that there are 605 million television sets worldwide. There are 15 variations of broadcasting standards, centering around NTSC, SECAM, PAL and HDTV.

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