Television Encyclopedia

by

STANLEY KEMPNER

Television and Radio Editor, (1943-1946)
RETAILING HOME FURNISHINGS

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Television Encyclopedia

DEDICATION

To my three girls:

VIVIAN, my wife;
PAULETTE, my elder daughter;
LAINE, my younger daughter.

Preface

Heretofore scores of books have been written on television; thousands of articles have appeared in hundreds of periodicals. One radio executive went so far as to state that he had read over 5000 of such in the various consumer and trade newspapers and magazines. However, almost all treated the subject from a specific viewpoint – that of research, manufacturing, production and programming, etc.

To garner all such information which might give the uninformed, the newcomer to the industry, or specialist interested in other phases of the art, meant probing through hundreds of technical, trade and consumer publications, promotional giveaways distributed by the manufacturers, perusal of the thousands of publicity handouts by various companies of talks made by their spokesmen, reading of private reports such as released by the Radio Technical Planning Board, the Federal Communication Commission's voluminous findings and testimony of experts before that august body, and scores of published trade volumes. This would involve a lifetime of reading to the average individual engrossed in other phases of the industry.

This, then, was the work of a specialist. As a working Television Editor, it was my daily job for several years to read almost every word that was written on the video industry. Approximately thirty magazines covering various phases of art passed across my desk weekly. Nearly every publicity release, report, and story concerning the television industry was to be found in my morning mail during that period, (1943-1946).

As a journalist, it became an hourly necessity to check back for specific background information – for the meaning of a phrase or word, for biographical material on people in the industry, etc. This entailed enormous research on the part of the people employed by the Fairchild Publications organization and myself. More time was spent in searching for elusive facts than in writing about them.

I was struck by the lack of coordination of the source material. Checking with the libraries, of broadcasting companies, manufacturers and the public libraries, it became apparent that there was a need for a compilation of this material, which would give the busy executive, director, manufacturer, performer and others interested in the science, a handy source book which would enable them to find key facts in the television field in the shortest time possible. I decided to write such a book. I called it *Television Encyclopedia.*[*]

Whether or not this book becomes an accepted success in terms of sales, royalties, and reputation, it has accomplished its purpose as far as I am concerned. *It had to be written – and I had to write it.* Now that the job is done – for better or worse – I am satisfied. The task is completed – and the evaluation of its compilation is a matter for the critics and readers to decide. This too will grow or diminish with the years. However, as far as I know it is the first of its kind and could be a basis upon which others will build.

January, 1948. S.K.

[*] The reader will note that this book does not follow the usual pattern of arrangement in an encyclopedia. After assaying the material, the editor found it expedient to arrange it in its present form, in order that all of the material would be arranged for easy reference. S.K.

Acknowledgments

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To list the other scores of individuals and record their specific contributions and aid would take up dozens of pages. To each and all, the writer offers heartfelt appreciation in assisting him to make his task that much easier.

Grateful acknowledgment is made to those experts who served as an Editorial Advisory Committee and passed on the respective qualifications of all candidates whose biographies were considered for inclusion in this work. Their expressed desire that they remain anonymous is viewed with regret by the writer. However, it will not be amiss to reveal that they represent outstanding groups and organizations in the television industry and consist of outstanding authorities in the video field.

Those who did more than go out of their way to assist in making this Encyclopedia as comprehensive and accurate as possible include: E. L. "Robby" Robinson, director, electronics publicity, Electronics Department, General Electric Co., Syracuse, N. Y.; C. D. Wagoner, GE publicity, Schenectady, N. Y.; Louise S. Sprague, GE General News Bureau, Schenectady, N. Y.; Paul J. Boxell, director of public relations, and Paul W. Schwehn, Public Relations Department, Farnsworth Television & Radio Corp., Ft. Wayne, Ind.; E. D. Lucas, Jr., public relations, Philco Corp., Philadelphia, Pa.; Harriet Gormley and Laura Tisdale, Eastern publicity, Westinghouse Electric Co.; Earl Minderman, formerly director of information, Federal Communications Commission, Washington, D. C., and Ogden Smith of DuMont Laboratories.

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Lastly, to my devoted wife, Vivian Adele Kempner, who worked at my side, as always, counseling, editing, cutting, pasting and soothing me over the tough spots when I was ready to throw in the sponge, whose guiding hand and spirit made this book an actuality, I say "Thank you, dear!"

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Television Encyclopedia

I

Milestones To Present-day Television

This section is a chronological survey of television's history.

Television, in its fullest sense, is not sight alone but sight plus sound. It follows therefore that video had its beginnings in wireless and radio, which preceded it. To attempt a sharp division without going back to the roots is like building a skyscraper and overlooking the foundations and basement. Writings like *4000 Years of Television* by Richard W. Hubbell trace its sources back to early history, as the title denotes. Other authors contend that television began when Nipkow perfected his spiral perforated disc. Still others look upon John Logie Baird as the "Father of Television"; and the contemporary advocates of electronic systems will battle for the thesis that only with Zworykin's iconoscope and Farnsworth's image dissector was television really born.

But television, like practically every other science, did not come suddenly from nowhere – nor from any one particular laboratory – nor from any brainstorm of any one specific individual. Television grew, idea upon idea, experiment upon experiment, system upon system. Television borrowed from nature – from the amber in the earth, from selenium. It had to lean on the science of optics – of light – yes, even communications methods including sound.

Before there was night, there was day – so with television: before there was sight, there was sound. Step by step through the ages – for days, months, years – men thought, dreamed, and experimented. Even today, the dream of perfection – and ideal color – is still wishful thinking – dreaming – planning and experimenting.

So for encyclopedic completeness, we go back to the beginning of time, when the seed of television was planted, through the period of gestation, the natal agonies, and finally birth, followed by childhood and adolescence. Maturity – full growth as a self-sufficient, self-supporting art – still (at this writing) remains a hope of the future; we can hope that it will be the near future.

600 B.C. – While no exact dates are available the earliest historians mention the phenomena surrounding amber and lodestone as about at this time. In that era, it is chronicled, Thales (640 B.C.) discovered the mysterious sparks that resulted when the latter was rubbed with mineral amber. Today, that process is referred to as "static electricity." For centuries, philosophers sat on their haunches, and talked – and talked – and talked some more – discussing theories, ideas, thoughts. But little was done in the way of experimentation with electricity or magnetism.

1600 – Not until that year, when Dr. William Gilbert, physician to her Majesty, Queen Elizabeth of England, and scientist of note, invented the "electroscope" consisting of a straw which pivoted like a needle, and which indicated the approach of a charged body, did science arouse itself out of its medieval lethargy. He disproved many myths and compiled a list of materials which could be electrified by rubbing. He coined the word "electric" from the Greek root for amber – "electrum." He conceived the earth as a huge magnet, with magnetic poles and a field of magnetic force about it – and thus laid a positive foundation for future scientific discoveries.

1646 – Sir Thomas Browne, English physician and author, performed many experiments with lodestone and magnetism, refuting superstitions by actual trial-and-error accomplishments. He actually attempted to make the first "wireless" by using two compasses with the alphabet written about them (although John Baptista Porta, a predecessor, is credited with the idea). He imagined that if the two needles were magnetized together, then separated, the turning of one to indicate some letter of the alphabet would cause the indicator on the second dial to move to a similar position; thus envisioning a method of communication without any intervening medium. The second compass indicator, however, did not budge from its North-pointing position. However, the idea of communication between people over a distance, up to then a mere idea in the minds of daring thinkers, became a challenge to the inventive minds of scientists of that time.

1672 – Otto von Guericke, German burgomaster of Magdeburg, proved atmospheric pressure. He built an "electric" generating apparatus of a globe of sulphur mounted on an axle and turned by a crank. The globe was rubbed by the dry palm of the hand as it rotated and, after some little friction, the globe was sufficiently electrified to attract particles. This machinery was, of course, a generator only of static electricity, not current electricity now in use. While experimenting with this apparatus, he discovered that the particles after they had been attracted, would in a short time be repelled. At this time, it is known that the particles assumed a like charge to that of the sulphur ball, and when this condition occurred, the particles were repelled because "like charges repel each other." But von Guericke was unaware of the fact that he was laying a foundation for future scientific knowledge.

1676 – Olaus (Ole) Roemer discovered that light travels at a definite fixed speed.

1727 – Cuneus and Pieter van Musschenbroek (Dutch) discovered the principle of the condenser.

1729 – Stephen Gray discovered that electric force could be carried about 1000 feet by means of a hemp thread and thus discovered electrical conduction.

1733 – Charles Francois Du Fay observed that sealing wax when rubbed with cat's fur was electrified but differed from an electrified glass rod. He called one "vitreous" and the other "resinous." Benjamin Franklin later introduced the terms "positive" and "negative" electricity.

1745 – E. G. von Kleist, of Kammin in the Prussian province of Pomerania, invented the ancestor of the modern condenser or what was known later as the "Leyden jar."

Cuneus and Pieter van Musschenbroek, of the University of Leyden in the city of Leyden, Holland, invented the actual so-called Leyden jar, which was able to store up electricity. Van Musschenbroek's discovery was that of the electrostatic condenser principle.

1752 – In June, Benjamin Franklin proved that lightning, and the spark from amber (or from the Leyden jar) were similar. His was the well-known experiment of the kite in the thunderstorm. The kite was tied to one end of a piece of twine, the other end he held in his hand. After the twine had been thoroughly drenched by the rain, it was able to conduct electricity. He drew enough electricity from the highly charged thunder clouds down through the wet string, to put a charge into a Leyden jar. The jar "canned" with electricity was used for a number of other experiments.

1753 – Charles Morrison of Renfrew, Scotland, suggested that electric telegraph should make use of static electricity for the operating energy and the electroscope for the indicating instrument. Morrison's plan made use of one line wire for each character to be transmitted, (26 wires in all,) the transmitting operator electrifying the wire associated with a particular character and the receiving operator knowing the character being sent by the response of a particular electroscope. It was estimated that the messages could be transmitted over such a system at the rate of six words each minute.

1780 – Luigi Galvani discovered the twitching in frog's legs which led to the invention of the voltaic (so-called

— Culver Service

Franklin's experiment, June, 1752

galvanic) electric cell. He called it "animal electricity" and was credited with the discovery of current or galvanic electricity. His discoveries of the role electricity played in the running of the body is considered one of the basic fundamentals of modern scientific knowledge.

1790 — Alessandro Volta invented the voltaic cell.

1800 — William Herschel discovered infra-red rays.

1802 — Romagnosi, an obscure scientist, found that a copper wire, carrying an electric current, would pick up iron chips, or filings — just as a lodestone would do. But he did nothing with his discovery and, therefore, is not generally credited with it. Thus the fact that an electric current acts like a magnet which is the absolute foundation of the whole electrical system was not credited to its original discoverer.

Thomas Wedgewood cast shadows on chemically treated paper and made crude silhouette pictures. Thus, light from the sun made the first known photograph.

1817 – Baron Jons Jakob Berzelius isolated a new "element" named selenium. The conductivity of this metal was affected by exposure to light. It later became useful as the "eyes of television."

1820 – Hans Christian Oersted discovered the magnetic action of an electric current and published an account of the influence of galvanic current on a magnetic needle (the principle of electro-magnetic induction). When an electric current runs through a wire, it automatically creates a field of magnetic force all around the wire, and it was that magnet which made the needle of a compass move.

André Marie Ampère measured the relationship between electricity and magnetism and developed the ampere, a practical unit of current strength.

1826 – George Simon Ohm discovered the law of electricity which bears his name – Ohm's Law – a standard measurement of resistance to electrical current flow.

1827 – Sir Charles Wheatstone coined the term "microphone" to describe an acoustic device he developed which amplified weak sounds.

Joseph Henry worked out a design for electromagnetics suitable for responding to currents received over telegraph lines. He gave a demonstration in 1827 of an insulated magnet by wrapping the iron core with copper wire that was covered with silk and then passing an electric current through it.

1831 – Michael Faraday formulated the laws of electromagnetic induction and developed the first generator.

1832 – Samuel F. B. Morse, American scientist and inventor, suggested a system of wireless communication employing the earth as a current conducting medium or using the principles of electromagnetic or electrostatic induction. Morse is considered the true inventor of the telegraph.

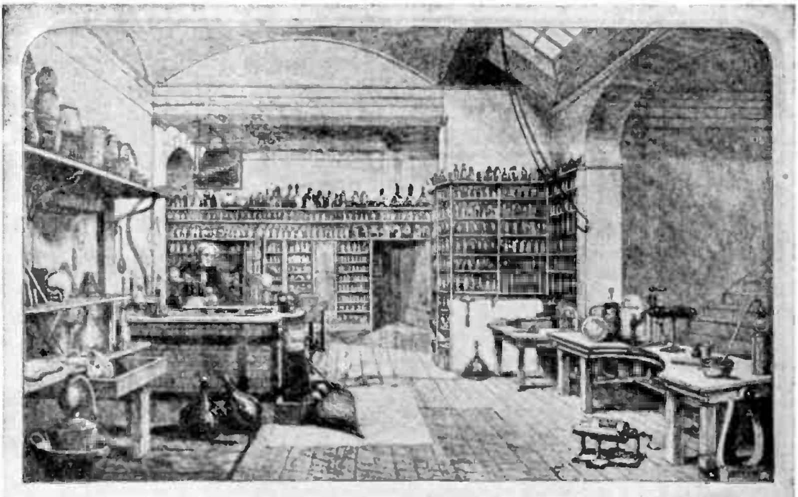
1833 – Karl Friedrich Gauss and Wilhelm Eduard Weber discovered that they could transmit telegraph signals over a line making use of induced currents produced by the motion of a coil of wire surrounding a bar magnet. These are probably the fundamental discoveries upon which our present-day electrical communications systems are based.

William Henry Fox Talbot, in England, discovered the process of photography but did not announce it until 1839 Louis Daguerre announced a similar discovery in January of 1839 but the Talbot type eventually became the more popular. Talbot described his method to the Royal Society in England on Jan. 5, 1839. He called it "photogenic drawing."

1835 – Michael Faraday discovered the principle of electro-optical methods of light control, which is at the basis of the science of television.

1839 – Joseph N. Niepee and Louis Daguerre developed the first practical process of photography.

Alexandré Edmond Becquerel discovered the electro-chemical effect of



– *Culver Service*

Faraday in his laboratory

light, better known as photo-electric effects. In tracing the history of television, it must be remembered that every proposed system of electric vision depends fundamentally upon certain physical changes which are produced by light. If the phenomena known as photo-electricity were non-existent all television would be an impossiblity, and the possibility of television, according to some English scientists, therefore, may be said to date from Becquerel's discovery.

Sir John F. W. Herschel, in England, invented another method of photography and coined the terms "positive" and "negative" and learned how to fix a plate or picture so exposure to additional light would not ruin it.

1840 – John William Draper was the first to take pictures of human likeness by an improvement of Daguerre's process.

1842 – Alexander Bain, Scottish educator, developed a method of facsimile which formed the basis of modern methods for sending photographs.

1844 – Samuel Morse demonstrated the sending of messages at speed over long distances using current from batteries and magnets from current. The process was named "telegraphy."

1845 – Michael Faraday began his

second great period of research in this year and discovered the effect of magnetism on polarized light, and thus discovered a relation between light and electricity.

1846 – Royal E. House patented the first teletype system.

1847 – F. C. Bakewell, an Englishman, proposed the "copying telegraph," employing a mechanism which later was termed "scanning." This invention is considered by Radio Corp. of America's historians as the "earliest date of television beginnings."

1848 – Color photography was introduced as Alexandre Edmond Becquerel reproduced the colors of the spectrum on a daguerreotype plate.

1852 – Sir George Gabriel Stokes discovered the phenomenon of fluorescence which was destined to find a place in television in the late 1930's. The screen on which television images were shown was to be covered with fluorescent paint.

1857 – Heinrich Geissler invented the Geissler vacuum tube.

1859 – Julius Plucker, a German physicist, studied the effects caused by the discharge of electricity through a vacuum. He coined the name "Cathode ray."

1862 – Abbe Caselli transmitted the first picture by electricity when he sent a drawing through a wire from Amiens to Paris, France.

1865 – James Clerk Maxwell produced the first radio magnetic wave by means of an elaborate mathematical formula. His contribution was the theory of electromagnetic waves, in which he showed mathematically that light is an electromagnetic wave and predicted that there must be other electromagnetic waves of different frequencies.

Dr. Mahlon Loomis, an American dentist, conducted experiments and applied for a patent on a method for transmitting and receiving messages whereby the earth's atmosphere was used as one conductor. Uniquely enough, he not only wanted to send messages as mentioned but planned to eliminate the use of batteries or generators, since he was familiar with the fact that the atmosphere is continuously charged with electricity.

1866 – Cyrus Field laid the first Atlantic Cable. Practically instantaneous exchange of intelligence thus became possible between nations.

1870 – Cromwell Fleetwood Varley discovered that sound could be emitted from a condenser.

1871 – The first radio broadcasting patent in the United States was granted to Thomas Alva Edison on Dec. 29. "Signaling between distant points can be carried on by induction without the use of wires connecting such distant points," his application stated. (Patent No. 465,971.)

1872 – The first patent for a system of wireless issued in the United States went to Dr. Mahlon Loomis of Washington, D. C., who in 1865 made a sketch to illustrate how the setting up of "disturbances in the atmosphere would cause electric waves to travel through the atmosphere and ground."

1873 – James Clerk Maxwell published his book, in which he recognized Faraday's ideas and set them down in precise mathematical form. But what was most important, Maxwell stated that "light is really a form of electromagnetic wave" which he had figured out by mathematics. His theory was not proved by actual experiment until Heinrich Hertz did his experiments fourteen years later.

Light-sensitive properties of selenium were discovered by a telegraph operator named May (first name is unknown). This discovery indicated that light values could be converted into equivalent electrical values. May's discovery was first given publicity by Willoughby Smith, an experimenter and May's superior who investigated the matter further and notified the Society of Telegraph Engineers of which he was a member. The first recognized television system appeared two years later – in 1875.

1874 – G. Johnstone Stone, an Englishman, announced the discovery of the "tiniest natural unit of electricity." In 1891, after Heinrich Hertz discovered the "photo-electric" effect, Stone named his "tiniest unit", the electron.

1875 – Professor John Kerr, English scientist, discovered what later was known as the "Kerr Effect." From it developed the Kerr Cell, a device used to control light rays in a number of mechanical television systems of later years.

G. R. Carey, of Boston, Mass., designed what was probably the first television system, imitating the human eye. He proposed a bank of selenium cells and lamps for breaking up pictures and sending the elements over wires.

1876 – Thomas Edison and Elisha Gray patented ideas for transmitting speech. Edison invented the phonograph and wanted to supplement it with a picture machine. He created motion pictures the following year, but the first actual successful demonstration was made in 1889 at his West Orange, N. J., laboratory. The film showed a man sneezing.

Alexander Graham Bell, a teacher of English, discovered the way to change spoken words into electric currents – and send the currents over wires at the speed of 186,000 miles per hour, the same as in the telegraph – and change them back into words at the receiving end – namely, the invention of the telephone.

With the announcement of the speaking telephone by Bell in 1877, the minds of scientists and inventors throughout the world were turned at once to the possibility of sight as well as hearing, at a distance. Tied in with the discovery by May, four years previously, that selenium alters electrical resistance, in presence of light, inventive minds grasped the implications of the two facts. Since light could be used to vary the strength of an electric current, why could not light be recorded electrically at a distance? The number of inventors who conceived the fundamental principles of wired image-transmission is unknown, but there must have been hundreds of them. In 1878, Prof. De Paiva, of Oporto, in Portugal, publicly suggested something of the kind.

1877 – Ayrton and Perry, English scientists, attempted to construct a mosaic with a small number of elements following the structure of the human eye as G. R. Carey tried two years previously.

W. E. Sawyer proposed the use of an oscillating lens where a photo-cell of wide area was scanned by the light received from various points on the scanned scene.

M. Senlecq introduced the "Telectroscope," a television apparatus which used selenium as the operating device.

1878 – Sir William Crookes generated electric discharges in a vacuum and thus discovered cathode-rays, now known as electron beams. He invented the Crookes' tube and demonstrated cathode rays. *(See 1859 Julius Plucker.)*

David Hughes invented the first fully workable microphone.

1880 – Ayrton and Perry proposed a television system using selenium, which had been conceived some years earlier, and now was published in detail for the first time. *(See, 1877.)*

Maurice Leblanc, French scientist, developed the principle of scanning – the method of viewing successively individual picture elements. A scanning device divided the picture into lines and each line into minute segments. *(See, 1847.)*

Professor John Kerr and Alexander Graham Bell were granted several patents pertaining to television. Kerr's system made use of a multiple of selenium cells. Bell, also, developed his radiophone in which a mica or glass diaphragm covered with a silvered foil was used to reflect a powerful beam of light upon a selenium cell placed in the focus of a silvered reflector. To the selenium cell were connected a pair of telephones and a battery. At the back of the silvered diaphragm was a flexible tube and mouthpiece into which the words were spoken. The sound waves caused the diaphragm to vibrate and sent pulsations of the reflected light upon the selenium cell, thus producing corresponding variations in its resistance and reproducing audible sounds in the telephone.

Marie and Pierre Curie of France, discovered the piezo electric effect which later was applied to hold radio broadcasting stations on their exact waves, thereby cutting down interference.

1881 – Shelford Bidwell, an Englishman, read a paper on the sending of images over a wire and illustrated his lecture by actually transmitting outlines across the wire.

1882 – L. B. Atkinson used an apparatus which utilized a drum fitted with tangential mirrors, each successive mirror being orientated through a small angle so that, as the drum rotated, the area of the image was scanned in a series of lines and projected onto a selenium cell. However, no description of his device was published at the time, and L. Weiller, who in 1889 proposed a similar system of scanning, became generally recognized as the inventor of the mirror drum.

1883 — Thomas A. Edison noted with surprise that a piece of metal, put into one of his electric lamps, would send current through space to the hot lamp filament, but would not receive any current *from* the hot filament. This was the so-called "Edison Effect," which is really the great grand-daddy of radio, as known today.

1884 — Paul Nipkow patented the television scanning disc used in later mechanical video systems. Many scientists begin their history of television with this invention. His disc formed the basis of mechanical television systems until the advent of electronic television in the early 1930's.

1885 — Sir William H. Preece and A. W. Heaviside, both of England, sent signals to each other over a distance of 1000 yards. They used two telegraph lines parallel to each other, with a telephone receiver in the receiving side. The telegraph signals could be heard clearly on the phone receiver, without actual connection between the two, due to what is known as induction, or in common telephone parlance, "cross-talk."

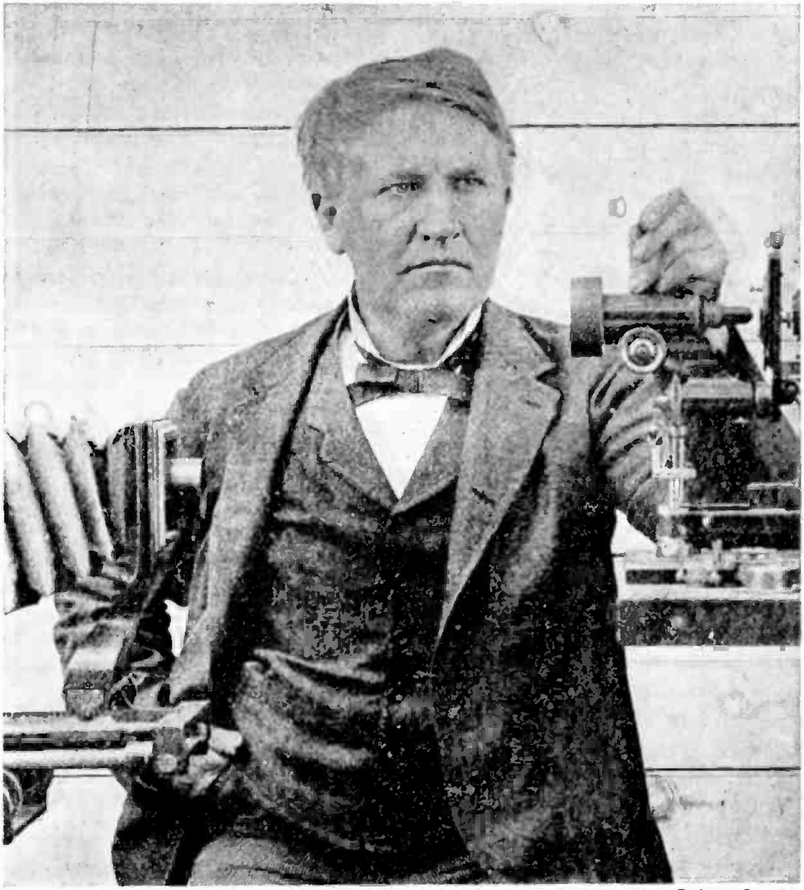
1887 — Heinrich Hertz proved that electromagnetic waves could be sent through space. Later he accidentally discovered the effect of light on electricity, the so-called "photo-electric effect." He actually produced a radio signal — sent it a short distance without wires — and successfully received it at the distant point, thus proving Maxwell's (1865) prediction that electrical energy could be radiated. Hertz passed an electric spark between two brass balls. When the spark passed between the balls at the sending end, a spark passed also at the receiving end. Hertz's experiments started many on the attempt to get similar results at much greater distances. Among them was Marchese Guglielmo Marconi.

Wilhelm Hallwachs, German physicist, discovered that well-insulated and negatively charged bodies lost their charges when illuminated with ultra-violet light. Looking back from today's advances, it can be seen that this was one of the more important beginnings in the evolution of television. But in those days the unusual electrical effects were too insignificant to suggest anything of practical importance. He, thus, was the first to reduce the apparatus essential for demonstrating the photoelectric effect to its essentials.

1888 — Photoelectric cells were built and demonstrated.

1889 — Thomas A. Edison filmed the first motion picture.

L. Weiller, in Europe, devised a system of scanning in which the place of the Nipkow disc was taken by a rotating drum on which a number of mirrors were tilted at different angles. As the drum rotated, the image was scanned in a series of lines and projected on to selenium cell for conversion of light into electricity. Actually,


— *Culver Service*

Edison at work on the motion picture camera, 1889

Weiller, however, was not the first inventor of the mirror drum. An Englishman, L. B. Atkinson, constructed an electrical viewing device using a drum in 1882, but no description of it was ever published, and Weiller is, therefore, generally credited as being the inventor. *(See 1882.)*

Philip Reiss, a German, advanced the theory that light falling upon selenium liberated electrons which aided in conducting the current.

1890 – Elster and Geitel invented the most completely developed photoelectric cell.

Stoletow made the first photoelectric cell, using zinc for the cathode, which required ultra-violet light as an exciting agent.

N. S. Amstutz, an American, sent the first successful picture with halftone over a 25 wire line in 8 minutes.

C. Francis Jenkins, Washington, D. C., inventor, started experimentation to find a new apparatus which Nipkow's disc required to be successful. He began by dropping coins in a slot machine and viewed the unusual animated pictures.

Marcel Brillouin employed a system similar to that of Baird's in which the Nipkow disc was replaced by two parallel discs operating at different speeds.

1891 – Desiré Edouard Branly invented the Branly coherer, a device to detect the Hertzian or radio waves. It was the first detector of wireless waves made.

1892 – A Parisian named Demeney blended voice and pictures in a combination phonograph and magic lantern which he called the "chronophotophone."

1893 – Nikola Tesla, of Serbia, suggested a means of wireless communication which utilized the earth as a conductor and created stational electrical waves on it. He invented the Tesla coil, which, in effect, created high-frequency oscillations of a broad nature–and thus was in actuality a broad wireless transmitter. But, since he made no effort to detect them, allowed the honor of being the first to discover wireless to pass him by. By 1905, he had developed a means of wireless communications from his earlier experiments, but the Marconi system was well entrenched by that time.

Le Pontois combined the practices of Paul Nipkow with those of L. Weiller in a system of television which is important because it was the first attempt to attain synchronism between the transmitting and receiving stations without the use of directly coupled machines.

1894 – Sir Oliver Lodge demonstrated the coherer to the British Association as part of a system for the transmission and reception of electric telegraph messages.

1895 – Marchese Guglielmo Marconi developed the first practical radio system, the wireless telegraph, when he sent and received wireless signals across his father's estate in Italy.

At the Atlantic Cotton Exposition C. Francis Jenkins demonstrated motion pictures. There he developed the idea of sending pictures by wireless.

1896 – Schoffler proposed a system of transmitting television using photographic plates at the transmitter and receiver plus a rotating wheel.

1897 – Sir Joseph Thompson demonstrated the true character of the electron as the smallest particle of the electrical structure of the atom.

Jan van Szcezepanik proposed to

overcome one of the chief difficulties which faced the early experimenters in the time-lag of selenium and its consequent insensitivity to rapid changes of light intensity. He proposed to construct the selenium cell in the form of a ring which was to rotate steadily. By means of a pair of oscillating mirrors the image was to be scanned and projected through an aperture on to a part of the selenium ring. As the ring rotated, it continually exposed a fresh surface to the aperture and thus became capable of responding to higher frequencies. There is little proof, however, that he ever attempted to build this device which scientists claim would have been quite unworkable, as its main principles are founded on technical fallacies.

Although there had been almost a glut of schemes for "seeing by telegraph" during the period from 1875 to 1897, it was gradually recognized that the characteristics of the selenium were unsuitable, and interest in the possibility of distant vision seems to have waned.

1898 – Sir Oliver Lodge, an Englishman, developed the principle of tuning based on the previous work of Michael Pupin, an American.

Karl F. Braun discovered that electrons could be controlled by magnetism and their journey traced on a fluorescent screen.

1900 – Reginald A. Fessenden, an American engineer, flashed the human voice through space for the first time when he transmitted it about a mile at Cob Point, Md. His results were "poor in quality but intelligible," according to the records.

1901 – Marconi transmitted the first radio signal across the Atlantic Ocean from Poldhu, Cornwall, to St. Johns, Newfoundland, on Dec. 11.

Ernest Ruhmer, a German, conducted a number of experiments with the "talking arc light." The vital part of his apparatus was a selenium cell.

Lee de Forest built a wireless apparatus employing the electrolytic detector.

1902 – Professor Arthur Korn, a German, wrapped a photographic negative around a glass cylinder which was then rotated and at the same time moved along its axis so that light from a point source traversed every portion of the negative. The amount of light passing through it on a selenium cell varied with the density of the negative resulting in a variation of the line current transmitted to another station.

Ryan found that a magnetic coil surrounding the neck of the cathode-beam tube had a focusing action upon the electron beam, and that by varying both the position of the coil and the value of the current through it, an exceedingly sharp spot could be obtained upon the fluorescent screen.

1904 – Wilhelm Hallwachs published an account of the preparation of a photo-cell in which the sensitive coating comprised an oxidized layer on a copper surface.

Ribbe perfected a two-way television system using only one channel of communication and also a system for transmitting continuously moving message-bands.

John Ambrose Fleming developed the two-element (diode) vacuum tube detector.

1905 — Albert Einstein announced the theory of photoelectric effect. His theory was later to become the fundamental principle of the modern television camera. It defined the way in which the camera would turn a picture into electricity. *(See 1887, Hertz.)*

Bernouchi suggested the transmission of electrooptical signals along a light-beam by means of a directly modulated electric arc.

1906 — Rignoux and Fournier D'Albe, French physicists, sent a crude picture over wires.

Lee de Forest invented the three-element vacuum tube with a filament, plate, and grid which was named the audion. This tube made possible the amplification of weak currents and became the heart of radio and television.

Reginald A. Fessenden, of Pittsburgh, Pa., succeeded in sending a voice transmission using a rotating generator that would give a 25-thousand-cycle output — thus eliminating spark frequency system used previously. He had experimented with Bell's telephone and sent voice signals over the Marconi system. The roar of the spark-operated radio wave, however, drowned out all attempts to receive the human voice without wires. He tried increasing the number of sparks sent out, and succeeded by raising the spark frequency to about 10,000 per second. Fessenden then saw that if he could eliminate the spark entirely — change from shock excitation to continuous generation — the problem might be successfully solved. This was finally accomplished with the rotating generator used in Brant Rock, Mass. Thus on Christmas Eve spoken words without wires became a reality.

1907 — Brigadier-General Henry H. Dunwoody and G. W. Pickard developed the first crystal detector. Because of its inexpensiveness, it was to a great extent responsible for increased interest in wireless and radio.

Nicolson proposed a television system with a cathode-ray tube receiver linked with a mirror wheel transmitter adapted for spiral scanning.

A. A. Campbell-Swinton developed the theory of a cathode-ray at both transmitter and receiver.

Boris Rosing translated some of the Campbell-Swinton theories into realities by patenting a television system in which a cathode-ray tube was employed to reconstitute a picture at the receiver.

The first carbon microphone in broadcasting was used by Dr. Lee de Forest in his laboratory at the Parker Building, 19th street and Fourth avenue, New York City. It was of the ordinary telephone variety.

Dr. Arthur Korn sent a picture of President Falliéres of France by wire from Berlin to Paris in 12 minutes.

E. H. Armstrong developed the regeneration principle for receivers and transmitters. *(See 1913, Armstrong.)*

1908 — Adamian suggested the use

of positive-column tubes (or Geissler tubes, as they were then called) to supply the modulated source of light at the receiver.

Eugene Augustin Lauste, American engineer, invented the first talking motion pictures.

1909 – Hans Knudson sent a drawing by radio.

The Andersens suggested a plan for transmitting images in their natural colors.

1910 – A. Elkstrom, Swedish inventor, found he could scan an object by using a strong light beam behind a scanning disc, the so-called "flying spot."

1911 – Boris Rosing evolved a new system of reproduction in which the variations in the picture brightness were produced by varying the speed of travel of the light beam instead of its intensity. This system was later applied to cathode ray tube reproduction and is generally known as "velocity modulation."

A. A. Campbell-Swinton gave comprehensive and workable details of his idea of using the cathode ray tube for a system of electrical transmission. This plan was given in the presidential address to the Rontgen Society in London.

1912 – Gustav E. Hoglund proposed a two-element scanning device comprising slotted discs.

Rescue of 705 people from the sinking S.S. Titanic proved the value of wireless at sea.

De Forest invented the regenerative circuit.

1913 – Elster and Geitel, who invented the photoelectric cell in 1890, had increased the sensitivity of their cells by two orders of magnitude using a sensitive coating of potassium hydride.

Dr. William David Coolidge invented the "hot" cathode ray tube and useful developments in X-ray tubes.

Edwin H. Armstrong sought a patent as the inventor of regeneration, which results in sensitivity when introduced into a receiver. Immediately there began litigation between Armstrong and Lee de Forest who claimed to be the rightful inventor stating that he discovered regeneration with an assistant – Van Etten – in 1912, although they did not bring it out at the time. De Forest produced notebooks to prove that he discovered feedback and the oscillating properties of a tube, and after various court decisions, was finally awarded the patent by the Supreme Court in 1934.

Irving D. Langmuir, physicist in the General Electric Laboratories, discovered a process for creating high vacuums.

1914-19 – Dr. E. F. W. Alexanderson, of General Electric Co., built some of his earlier alternators.

1915 – Marconi predicted future visible telephony as he sailed from New York to Rome.

1916 – Latour expounded the principles of triode amplification. By 1920 the practice of thermionic amplification for speech frequencies was well established.

1919 — On Oct. 17, the Radio Corp. of America was organized and a patent pool of heretofore competing patent interests was effected. On Nov. 20, the assets and business of the Marconi Wireless Telegraph Co. of America were taken over by RCA, and American wireless was in the hands of its own citizenry.

1920 — Regular radio broadcasting began with KDKA, in East Pittsburgh, Pa., covering the Harding-Cox presidential returns. Commercial radio stations were licensed.

Television workers, resuming their interest in video after World War I, found improved materials to work with. De Forest's audion had been improved and around this tube efficient amplifiers had been built. Improvements had been made in the photoelectric cell and research had found far more responsive photo-sensitive elements than selenium.

1921 — Practical horn loudspeakers were developed.

RCA's first radio broadcasting station, WDY, went on the air in December at Aldene, N. J.

1922 — RCA set up a nationwide sales and distribution system and began merchandising radio broadcast receivers and electron tubes for home use.

Superheterodyne demonstrated by inventor E. H. Armstrong.

The first radio broadcast for advertising or commercial purposes was that of the Queensboro Realty Corp. of Jackson Heights, Long Island, N. Y., on Sept. 22 over Station WEAF, the experimental radio station owned and operated by the American Telegraph & Telephone Co.

First colored film in motion pictures shown on Nov. 26, in New York City.

John B. Johnson developed the first low - voltage gas - focused, sealed - off cathode-ray tube.

1923 — Both Charles F. Jenkins of Washington, D. C., and J. L. Baird of London, transmitted silhouettes by wire. Jenkins sent a picture of President Harding by television from Washington to Philadelphia, which was the first practical commercial television demonstration (of photograph) in the U. S. A.

The first radio broadcasting chain was inaugurated on Jan. 3, between WEAF of New York City and WNAC at Boston, Mass. Fifty engineers worked a week to make the event possible. The broadcast lasted three and one-quarter hours from eight o'clock to 11:15.

All previous television had employed mechanical scanning to break pictures into component lines — a requirement for radio transmission — and physical limitations of the mechanical process were retarding television development when Dr. Vladimir K. Zworykin, a Russian - born scientist then employed in the Westinghouse Research Laboratories, applied for a patent on an electronic-beam television pickup. This system eliminated mechanical scanning, making pickup an all-electronic operation and led, after extensive development, to the iconoscope. On Dec. 29, he filed his patent application on the first form of a modern television camera tube, named the "Iconoscope" which became of wide use later. The patent was granted on a system for the "cell storage of light."

At this time no element, in the state of physical knowledge, was lacking for the technical accomplishment of practical, workable television systems. However, the entire video field consisted merely of unconnected, untried proposals, many of which have since become basic in television transmission and reception. The art was ready for a coordination of known facts into one related overall workable system which was soon to come.

Hazeltine announced his invention of the neutrodyne circuit.

1924 — Fournier d'Albe proposed a system of television using a mirror and optical system.

Capt. Richard Ranger transmitted the first facsimile picture from London to New York on Nov. 30.

Dr. V. K. Zworykin demonstrated a crude sort of tube to be used in television without mechanical scanning. *(See 1923.)*

1925 — Heater-type vacuum tubes made possible the first all-electric radio receivers. Dynamic loudspeakers appeared.

Charles F. Jenkins in the U. S. and J. L. Baird in London in April were sending moving silhouette pictures which were outlines only, in black and white, with no detail. *(See, 1923.)*

U. A. Sanabria in Chicago was using similar techniques to transmit television. At the same time Dr. E. F. W. Alexanderson, at the General Electric Laboratories, and Dr. Herbert Ives were conducting experiments with mechanical and electrical scanning systems.

J. L. Baird, in April, transmitted outlines of television at Selfridge's Department Store in Oxford street, London, by wireless.

The first transmission of motion pictures using motion picture film was successfully culminated on June 13, by C. F. Jenkins. The broadcast was sent out by Radio Station NOF, Bellevue, D. C.

On Oct. 25, the first electric phototube was publicly demonstrated.

The first type of "dissector" tube was patented in Germany by Dr. Max Dieckmann and Hell.

1926 — The first television weather map broadcast from a land station to another land station was transmitted from Radio Station NAA, Arlington, Va., on Aug. 18, and received at the Weather Bureau Office in Washington, D. C. The demonstration was arranged by the Jenkins Laboratory of Washington, D. C.

National Broadcasting Co., first great radio network, organized on Nov. 1.

C. F. Jenkins in Washington, demonstrated apparatus which showed far-off moving objects or "shadowgraphs."

J. L. Baird, in England, demonstrated television transmission of half-tone pictures before members of the Royal Institution. On Dec. 30, he demonstrated the vision of objects in total darkness by applying the infrared rays to television. He gave his showing for some 40 members of the Royal Institute in London.

Dr. E. F. W. Alexanderson, General Electric engineer, in St. Louis, demonstrated his development of a mechanical method of television using a multiple light-brush system and new projector.

Warner Bros. gave its first "vitaphone" demonstration.

1927 – The first Federal Radio Commission was appointed. It consisted of Rear Admiral W. H. G. Bullard, John F. Dillon, Judge E. O. Sykes, Dr. O. H. Caldwell and H. A. Bellows.

The American Telephone & Telegraph Co. on April 7, demonstrated the transmission of television over an ordinary long-distance telephone line between Washington, D. C. and New York City, and over a wireless circuit between Whippany, N. J. and N. Y. From the Bell Telephone Laboratory in New York, Walter S. Gifford, president of A. T. & T., spoke to the then Secretary of Commerce, Herbert Hoover. Hoover sat before a screen in Washington and was heard and seen by a group of spectators in the Laboratory. A. T. & T. used a mechanical method of scanning with a 50-line definition.

The American demonstration was followed by J. L. Baird's transmission of images between London and Glasgow, also using ordinary service telephone lines.

– Courtesy American Telephone and Telegraph Company

Mr. Hoover, participating in the famous demonstration of television on April 7, 1927

On April 16, television by radio was demonstrated — both image and sound on the same frequency band by a single transmitter — between Whippany and Bell Telephone Laboratories in New York.

The Columbia Broadcasting System went on the air with a basic network of 16 stations.

On June 11, pictures were radioed from London and Hawaii to the Massachusetts Institute of Technology dinner in New York by means of an improved Ranger system. (In this demonstration, a stream of hot air driven through a small muzzle moved to and fro across a special paper treated with nickel.)

On Oct. 17, Marconi prophesied before the Institute of Radio Engineers that short waves were destined to play a vital role in radio and television development in the future.

Single-dial tuning was featured on radio receivers.

The 50-line quality of television pictures that year did not produce satisfactory images. Even 240-line pictures were unsatisfactory. (Not until Zworykin's iconoscope was developed were images satisfactory. But this did not come until 1933.)

1928 — WGY, General Electric Radio station in Schenectady, N. Y., became the pioneer U. S. television station in May with a regular schedule—three afternoons a week.

Jenkins Laboratories, Washington, D. C., on July 2, inaugurated the first regular broadcast of radiomovies. Silhouettes only were transmitted initially.

In August, General Electric Co. televised the first remote pickup, of the then Governor of New York, Alfred E. Smith, making his acceptance speech at the inaugural ceremony in the state capital—Albany.

Radio Corp. of America established W2XBS, New York television station.

On September 11, the first television drama was telecast from WGY's studio in Schenectady, N. Y. The drama was entitled, *The Queen's Messenger*.

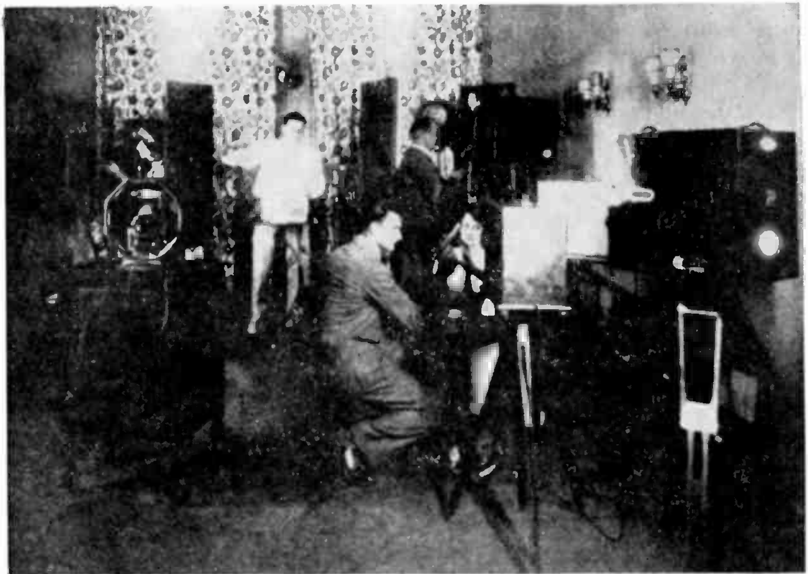
RCA established its New York television laboratory, coordinating television development work with the General Electric and Westinghouse companies.

J. L. Baird sent the first trans-Atlantic television picture and demonstrated the first crude systems of color and stereoscopic television. He also demonstrated that television could be accomplished by daylight.

Philo T. Farnsworth, in October developed a new kind of television receiver which used a cathode ray tube and later developed a type of cathode ray camera which was called the "image dissector" using the "image dissector" tube.

Bell Telephone Laboratories demonstrated television using ordinary daylight instead of artificial light to illuminate the subject before the transmitter. J. L. Baird had already accomplished this feat but used a lens disc instead of a Nipkow disc. Bell engineers used a Nipkow disc but instead of using beam scanning they employed what was designated as "direct scanning."

Dr. E. F. W. Alexanderson dem-



— *Courtesy General Electric*

"The Queen's Messenger"

onstrated in his home the first television system for transmission to the home.

Gardner of Los Angeles developed a scanning device which caused a light spot to move in the field of view with a minimum of movement.

Dr. V. K. Zworykin's patent on the iconoscope was granted.

1929 – Dr. V. K. Zworykin demonstrated an all-electronic television receiver using a special cathode ray tube which he called the Kinescope (a picture tube), on Nov. 18, before the Institute of Radio Engineers at Rochester, N. Y.

First theatre television demonstration given at Schenectady, N. Y., using system developed by Dr. E. F. W. Alexanderson.

Application was filed for original Espenschied-Affel patent on the coaxial cable used as a wide band long distance transmitting medium. Application mentioned that one objective was the use of such conductor for television transmission.

First public demonstration of color television was made at Bell Telephone Laboratories, New York.

British Broadcasting Co. on Sept. 30 began an experimental television service throughout England through 2LO, using the Baird system, with 30 lines, 12½ frames per second, and a frequency of some 5 to 10 kc., which lasted until 1936.

Dr. A. Karolus, a German, developed an electrochemical light (or "shutter" in television) so that more powerful illumination could be used.

1930 — Television on 6 x 8-foot screen was shown by RCA at RKO-Proctor's, 58th Street Theatre in New York City on Jan. 16.

Dual transmission—speech and sight simultaneously—were sent over separate lines through the British Broadcasting Co.'s control room at Savoy Hill to Brookman Park, where they were radiated on the separate wavelengths, and thence on to the center of London, England. The program had originated in the studio of Baird Television Co. in Longacre and conducted to BBC's control room. This was on March 31.

Two-way wire television on which speakers at the end of a 3-mile telephone wire line saw each other as they conversed, was demonstrated by the Bell Telephone Laboratories on April 9. The system consisted, in brief, of a duplicated disc arrangement, with two scanning discs—one for transmission and one for reception—with a neon lamp and bank of photoelectric cells at the end of the circuit.

In April, U. A. Sanabria showed television images on a two-foot screen in his Chicago laboratory.

Television projected on a 6 x 7 foot screen before a theatre audience, for the first time, on May 22 at Proctor's Theatre in Schenectady, N. Y. by Dr. E. F. W. Alexanderson of the General Electric Company's laboratories. The action, originated in the General Electric laboratories, was shown by use of a giant scanning disc on the screen.

In June announcements were made for the proposed construction of Radio City in New York to cost approximately $250 million.

M. von Ardenne, a German, began research on cathode-ray systems for the reconstruction of television images, and was later the first to produce results comparable to those of mechanical reconstituting processes.

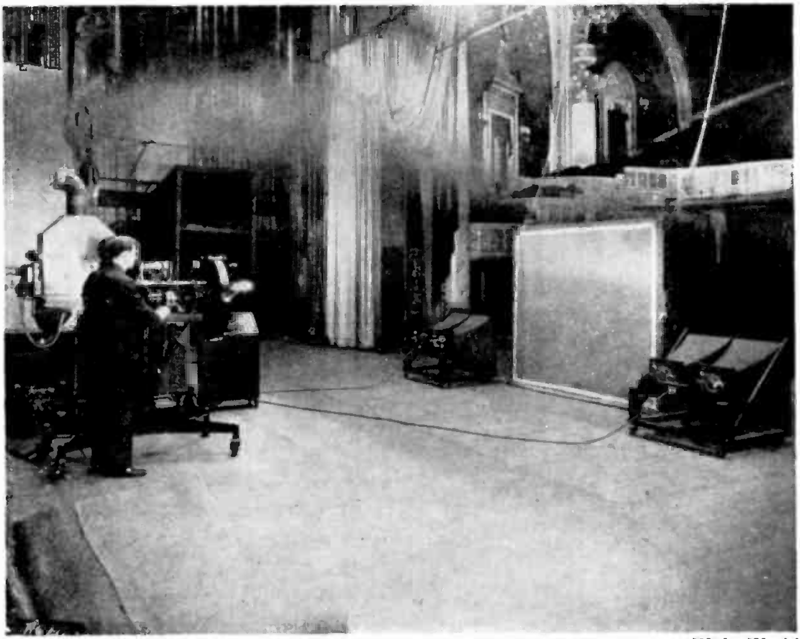
John Hays Hammond, Jr., on June 10, described his patent for a television eye on airplanes that enabled pilots to "see" through fog and darkness and thus make safe landings.

RCA television research laboratories were established at Camden, N. J.

The first radio broadcast of a voice around the world was accomplished in one-eighth of a second on June 30 by a series of radio relays. C. D. Wagoner spoke into the shortwave microphones from W2XAD, Schenectady, N. Y. His voice was carried to Holland, to Java, to Australia, across the Pacific Ocean to North America and back again to Schenectady.

Dr. V. K. Zworykin joined the RCA laboratory staff.

On July 28, in England, television and tele-talkies were included in the public program of a theatre for the first time—at the London Coliseum for a period of two weeks. This was followed by similar demonstrations at the Scala Theatre in Berlin, Germany; The Olympia Cinema in Paris, France; and the Röda Kvarn Cinema in



— *Wide World*

Dr. Alexanderson showing television images to theatre audience, May 22, 1930

Stockholm, Sweden. (Films were transmitted from a studio and reproduced on a multi-cellular lamp screen on the stage using Baird's process.)

National Broadcasting Co. began operating W2XBS, pioneer experimental station in New York on July 30.

On July 31, another advance had been made in England when, on the roof of the Baird Co. in Longacre, Baird showed images of great brilliance on a screen 2 x 5 feet.

In Berlin an experimenter saw the face of Prof. August Karolus, of Leipzig, on a television screen, although the savant was at that moment being televised in Schenectady, N. Y. This was one of the first remarkable distance records achieved in that period.

P. T. Farnsworth on Dec. 14, informed the Federal Radio Commission that he had succeeded in narrowing the wave band required for television to 6000 cycles width.

French patents on a system of television synchronism were granted to

Rene Barthelemy referring to a new type of direct current motor used without brushes.

All television demonstrations outside the laboratories in 1930 used mechanical cameras with moving parts—Nipkow discs in one form or another. None produced a good enough image to make television practical at that time.

1931 – Dr. E. F. W. Alexanderson of General Electric Co. sent a picture—a rectangular design—all the way from Schenectady, N. Y. to Australia and back again in about an eighth of a second—and the design was recognizable when it completed its round-trip.

Dr. V. K. Zworykin in conjunction with R. R. Law, demonstrated a projection tube which was again shown in 1937 at a meeting of the Institute of Radio Engineers in New York. (Too bulky for home use, it cast an image of 8 x 10 feet).

Caesium photoelectric cells that "see red" were introduced on Jan. 11, by the Bell Telephone Laboratories to clarify the television images.

In April, U. A. Sanabria demonstrated television on a two-foot screen in his Chicago laboratory. He used a "lens disc," which was a solid aluminum wheel with 45 lenses sunk into it. A zipping daub of light caused by the disc revolving at a high speed flooded the screen with light. Sanabria tinted some of the faces by using a neon-mercury gas in a special lamp.

The first actual street scene was transmitted by television on May 8 in England. Heretofore the bulk of transmission had been confined to studio subjects; and although television by daylight had been demonstrated as early as June 1928, sufficient progress had not been made with the apparatus to enable scenes from everyday life to be transmitted in ordinary daylight.

The Radio Manufacturers Association of America set up a tentative set of standards for orderly progressions in television.

Empire State Building, world's highest skyscraper located in New York City, was selected in June as site for RCA-NBC television transmitter and aerial site for ultra-short wave experiments using both mechanical and electrical scanners. Operation began Oct. 30.

The English Derby was televised on June 3 by John L. Baird at Epsom Downs, England.

In June, a demonstration of projection television was given by the Gramaphone Co. in London at the Exhibition of the Physical and Optical Society; motion picture films were transmitted by a multi-channel process and reproduced by means of a Kerr cell and mirror-drum device on a translucent screen.

J. L. Baird demonstrated the directly-modulated arc for big-screen projection to the British Association meeting in London, in the section devoted to Mechanical Aids to Learning.

Early in the year RCA Victor made practical tests on cathode ray television system in New York City which continued through the first half of 1932 using 120 line scanning, with picture repetition frequency of 24 per second.

The Columbia Broadcasting System put its experimental television station W2XAB, on the air on July 21.

U. A. Sanabria on Sept. 24, demonstrated television on a 10-foot screen at the Radio-Electrical World's Fair in New York.

In October, again on a 10-foot screen, 1700 spectators viewed television at the Broadway Theatre. A wire link was used between the Theatre Guild Playhouse and the televiser.

Don Lee Radio Broadcasting Company opened experimental station W6XAO, in Los Angeles.

The first photograph of a large group of people, taken in darkness with a short exposure, was made in the Kodak Research Laboratories, Rochester, N. Y., on Oct. 7. The subject of the picture was a group of about 50 executives and research men who were visiting. The photo was taken with one second's exposure apparently in total darkness. Actually the room was flooded with invisible infrared radiation, and a new photographic emulsion sensitive to these rays was used. (The image orthicon camera developed by RCA was to use a similar principle in 1946).

In November, television images from the city of Chicago were picked up at Ottuma, Ia., a distance of 250 miles.

Again in November, Dr. E. F. W. Alexanderson sent television across his laboratory in Schenectady, N. Y., on a beam of light instead of a radio wave or wire.

In this year there were but three systems of scanning existent in America which employed the simple scanning disc. They were the 48-line system of Jenkins & Radio Pictures; the 60-line image employed by RCA, and NBC; and the 45-line multiple arrangement of Sanabria used by Western Television. The RCA and NBC images were scanned at the rate of 20 pictures per second. In the Sanabria system, the image was scanned three times for each rotation of the disc. The scanning was not complete in each instance, as the lines were separated by twice their width in each scanning operation.

1932 – C. Francis Jenkins outlined a new television principle concerning images described as 3600 times brighter than previously shown. The picture appeared on a sensitized emulsion of "an animated lantern slide". Incoming signals quickly changed the surface from opaque to clear, equivalent to light and shade, thereby "painting" an ever-changing pattern, corresponding to the scene at the transmitter.

On April 7, Marconi announced successful tests with the ultra-short waves and reported he expected to see his family via the radiophone in the near future.

RCA initiated field tests with 120-line, all-electronic television on May 25 at Camden, with signals relayed by radio from New York through Arney's Mount, N. J.

The American Radio Manufacturers' Association created a television committee which among other things considered and adopted standards of scanning as follows: (1) Scanning from left to right and from top to bottom; (2) A scanning speed of 15 pictures per second; (3) The use of 48 line standard; a secondary standard of 60 lines was created in order to permit more detail in an image for more advanced research workers. No adherence to these standards, however, was required by the committee.

Leading television developers on the American scene included the Jenkins Television Corp.; Bell Telephone Laboratories; Dr. E. F. W. Alexanderson of the General Electric Co.; Dr. V. K. Zworykin, RCA; and Philo T. Farnsworth of the Television Laboratories, Inc., San Francisco. In England, up to 1932, there had been but one outstanding television experimenter—J. L. Baird of Baird Television, Ltd. Outside of Baird's process used in the British Broadcasting System's transmission, the only other source of television in 1932 in Europe was from Germany, which used horizontal scanning as against Baird's vertical scanning. Therefore, the reception of the German transmission was difficult. Once the image was picked up, it was necessary for the viewer to bend his head sideways at an angle of 90 degrees in order to recognize or attempt recognition of the image. Thus, conflicting standards resulted in confusion for the Germans who also used a disc with a different number of holes, making it difficult—if not impossible—to pick up their transmissions on a Baird receiver.

In France, experimental television broadcasts were maintained by the Television Baird-Nathan Co., an affiliate of the John L. Baird Co., using mechanical scanning system.

The British Broadcasting Co. installed television equipment designed by Baird Television, Ltd., for regular transmissions from their studio at Langham Place.

RCA built a transmitter to operate on a frequency above 40,000 kc. as a result of a mechanical system used in Camden, N. J., laboratories—the receiving portion of which used a cathode ray tube system. The transmitter used a mechanical system of scanning which at that time was believed to be the highest level obtainable in any system. This was the first full-scale television broadcast transmitter for relatively high definition images and provided tests which showed inadequacy and limitations of a mechanical system of television.

Television was first used in a national political campaign.

The first ultra-short wave transmission of television in England was sent out by the Baird Co.

1933 — The RCA laboratories had been conducting experimental television broadcasts, using a low definition system which gave a picture of 120-line definition. RCA also put Zworykin's iconoscope camera and kinescope receiver into use. With the advent of the iconoscope, which employed electrical scanning, it was raised to 240 lines.

In March, the Marconi Co. published a description of their commercial television apparatus for the transmission of pictures of live pickups.

On April 6 a demonstration of high-definition television using cathode-ray tubes at the receiver was shown by Baird in England, with 120 lines and 25 pictures per second being used.

In June the first mirror-drum television was placed on the English market.

(Well-known experimenters in television at this time included U. A. Sanabria, H. S. Baird (no relation to J. L. Baird of England), Dr. H. E. Ives of the A. T. & T. Associated Companies, Dr. E. F. W. Alexanderson, Dr. Alfred N. Goldsmith of RCA. In Germany: Dr. A. Karolus of Telefunken, and Drs. Hudec and Kirchstein.)

BBC, using the Baird process, sent out 120-line pictures on an experimental basis.

Fernsehen A. G. in Berlin at the Radio Exhibition demonstrated the "intermediate film" process for outdoor television transmission, or for large-screen projection with a short time delay.

1934 — L. H. Bedford and O. S. Puckle invented a television system based on velocity modulation.

RCA's electrical scanning system utilizing the iconoscope employed 343 lines interlaced with a frame frequency of 30 per second and a field frequency of 60 per second. This system, started in 1933 and more highly developed in 1934 employed a synchronizing generator which was entirely electrical and employed no moving parts. This marked another of the major evolutionary steps in the progress of developing a television system.

The Baird Co. in England, demonstrated intermediate film process for outdoor television transmission or for large-screen projection with a short time, and also, the high-speed intercalated system for instantaneous television transmission or projection.

1935 — On Jan. 31, the Television Committee appointed by the British Postmaster General recommended that the BBC take over official television service in England to start in the London area. It was stated that both Baird Television, Ltd., and Marconi-E.M.I. Television Co., Ltd., be given the opportunity to supply, subject to conditions, the necessary equipment for the operation of their respective systems at the London station.

Large-scale television field tests inaugurated in New York with regular program transmission to receivers located in viewers' homes.

Scanning became interlaced as distinguished from progressive.

In France, where a Baird mechanical system had been in use since 1932—the transmission standards were raised to 60 lines of definition in the picture. A new station was opened in the Eiffel Tower with a mechanical scanning system improved to 180 lines of definition.

Baird Co. and the Electrical and Musical Industries in England experimented with 240 and 405-strip transmissions respectively.

In April, Farnsworth Television Co. of Philadelphia signed agreements to interchange patents with the Fernseh Co. of Germany.

On May 7, David Sarnoff, RCA president, announced his firm would spend a million dollars on a series of experimental television test broadcasts from RCA's new transmitter atop the Empire State Building in New York City.

On Nov. 6, Major Edwin H. Armstrong announced his principle of Frequency Modulation (FM). He had taken a principle of radio transmission, long known but undeveloped, and perfected a new system of transmitting radio waves. It eliminated static and opened the way for true high fidelity broadcasting. (FM became the sound for television in 1941.)

1936 – Television outdoor pickups demonstrated by RCA at Camden, N. J., on 6-meter wave across a distance of a mile, on April 24.

June 10 was the service date of first Bell System coaxial cable provided for television use. Cable was 1.5 miles long (from NBC studio in New York to transmitter at Empire State Building).

All electronic field tests of RCA began June 29, from ultra-short-wave transmitter in Empire State Building, New York City, and aerial on the pinnacle releasing 343-line picture at the rate of 30 complete pictures per second.

Radio manufacturers saw television demonstrated by RCA on July 7, with radio artists and films used to entertain.

Cathode ray television began to spread beyond the laboratories of its inventors.

The Columbia Broadcasting System in New York City ordered an all-cathode ray television system from RCA which was installed in the tower of New York's Chrysler Building with studios in the Grand Central Terminal Building on Vanderbilt avenue and 42nd street.

Television arrived in England and Germany about 1936, from the viewpoint of the scientist and engineer.

In Los Angeles, the Don Lee Broadcasting System began public television demonstrations with cathode ray tube equipment.

Philco Radio & Television Corp. began demonstrating its cathode ray system in Philadelphia.

A. T. & T. began laying coaxial cable between Philadelphia and New York, which proved successful.

BBC in November, officially opened its London Alexandria Palace television station, transmitting a 405-line picture. (From then on the British television service was continuous until the outbreak of World War II.)

1937–RCA, on May 12, announced development of an electron projection "gun" which made possible television pictures on an 8 x 10-foot screen.

Television on 3 x 4 foot screen was shown by RCA to the Society of Motion Picture Engineers on Oct. 14.

Images were transmitted from the Empire State Building on 34th street to Radio City, 46-47 street, both in New York City.

441-line pictures were demonstrated by the Philco Corp. in a 3-mile test across Philadelphia.

The television band was widened in the radio spectrum.

In England, the Marconi-E.M.I. apparatus and picture standard was given the "green light" as against the Baird system over BBC.

Coronation procession of King George VI was telecast over 7500 square miles to an estimated audience of 50,000.

Bell Telephone Laboratories used coaxial cable successfully transmitted visual images for 240-line television pictures from New York to Philadelphia. Frequency band width of about 800,000 cycles was employed.

A 441-line picture was obtained on iconoscope installed at Paris television station for Paris Exhibition.

Mobile television vans operated by the National Broadcasting Co. and Radio Corp. of America appeared on Dec. 12 in the streets of New York for the first time.

1938 – Equipment for CBS television station completed.

BBC television transmitter used on ultra high frequency waves to detect airplanes approaching shores of England although they were many miles away (radar). The signals from BBC's transmitter would strike the approaching plane and be reflected back to the ground.

Television images from London, on ultra short waves, picked up on Long Island, but badly distorted.

In January, Baird again demonstrated color television from the Crystal Palace to the Dominion Theatre, London, England, ten miles away, on a screen 12 x 9 feet. Although far from perfect, in full color, the demonstration heralded another milestone in progress.

On Oct. 28, RCA announced that a public television program service would be inaugurated and commercial receiving sets offered to the public in April, 1939.

The Radio Manufacturers Association revised their standards to permit a broader television band. This was obtained by the use of a single sideband image within the same total emitted frequency band as had been occupied by the previous standard.

1939 – Standard telephone cable pairs used successfully as local pick-up channel for television broadcast of six-day bicycle race at Madison Square Garden, New York City, on May 20.

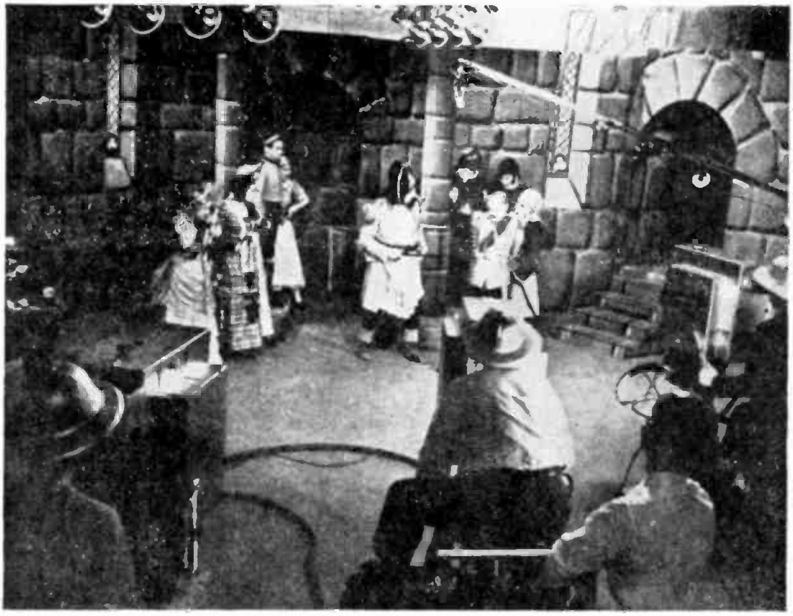
RCA and NBC introduced television on April 30, as a service to the public, at opening ceremonies of New York World's Fair, featuring President Roosevelt as first Chief Executive to be seen by fully developed television.

On June 7, the improved television "eye" camera named the "Orthicon", was demonstrated by RCA.

On June 10, first long-distance reception of high-definition television was established via the General Electric television transmitter W2XB in the Helderberg Mountains, 129 miles north of New York City, showed King George and Queen Elizabeth touring New York World's Fair.

Pirates of Penzance, the first musical production telecast in NBC's regular television service was presented on June 20.

In July the Bell Telephone Labora-



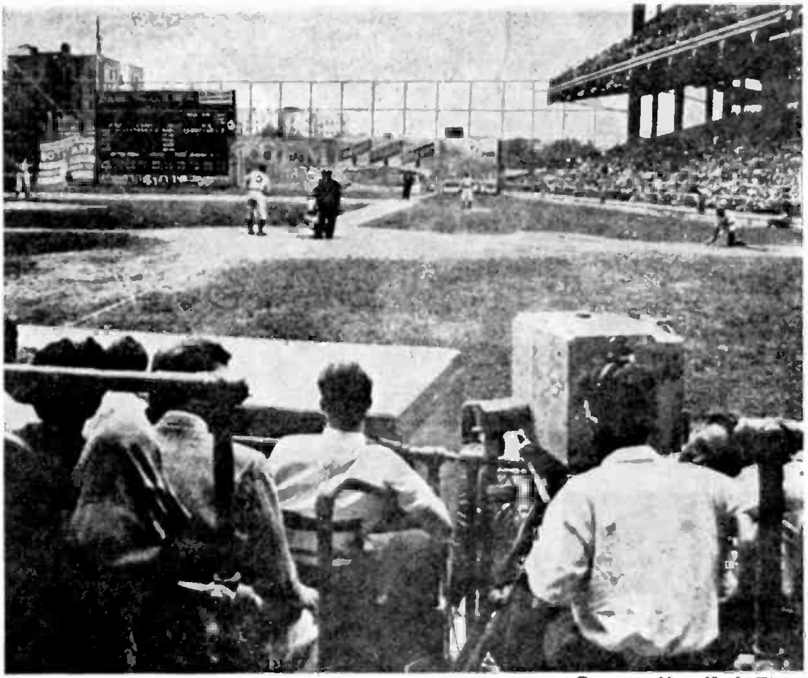
"The Pirates of Penzance"

tories successfully demonstrated television in colors. Like Baird, they utilized the principles used in three-color photography but their method of applying these principles differed. Instead of using a triple spiral scanning disc with each spiral of holes covered with appropriate filters and one communication channel, as Baird did, the Bell technicians used their usual 50-hole scanning disc, beam scanning, three sets of photoelectric cells, and filters, and three communication channels, one for each color.

Bloomingdale's, New York department store, televised a millinery fashion show from an improvised studio on the 6th floor to send television images to the third floor. First to demonstrate intra-store "jeep" system publicly.

RCA and Farnsworth jeep television units demonstrate video in more than 100 department stores from Maine to the Pacific Northwest.

A successful experimental demonstration was held at the Israel Zion Hospital, Brooklyn, N. Y., in the spring. Seventy-six doctors, internes, and nurses sat in an auditorium in one building and via television watched a staff surgeon perform a



— *Courtesy New York Times*

First telecasting of a major league baseball game. Dodgers vs. Reds, August 26, 1939

delicate operation in the operating pavilion located in another building. This was hailed as the beginning of a new method in the teaching of difficult surgical techniques. Approximately 100 New York University students participated in the broadcasting of a biology lecture. The director of research set up a high power microscope with regulation camera attachments sufficiently large to allow two television cameras to work direct on broadcasting smears. Instead of using 100 microscopes for the students, they used one television receiver with which to make their observations.

The first major league baseball and first college football games were telecast. (Brooklyn Dodgers vs. Cincinnati Reds at Ebbets Field on Aug. 26 and Fordham University vs. Waynesburg College in New York on Sept. 30). The Derby at Epsom Derby, one of the most famous horse races in the world, was telecast.

A receiver in an airplane over

Washington picked up a telecast from the NBC station in New York 200 miles away on Sept. 17.

Roy and John Kent of Chelmsford, England, assigned to RCA a system enabling pilots to make blind landings in fog or darkness. On the landing field two transmitters, one for television and one for short-wave radio which were synchronized, were to be installed. On the plane were corresponding receivers also synchronized. In heavy weather the field sends approaching planes all necessary information such as name of field, wind velocity and approximate visibility. On the pilot's own receiver he could see a picture of the field and ascertain the necessary gliding angle to land his plane in safety.

Outbreak of war stopped all commercial television activities in Europe.

(Television was used on aerial torpedoes and pilotless television torpedo planes plus other military uses in World War II.)

CBS announced the development of a television film scanner by Dr. Peter Goldmark, chief television engineer, which transmitted motion pictures without distortion or loss of definition.

1940 — In the first official television network broadcast, on Feb. 1, members of the FCC at Schenectady, N. Y., witnessed pictures telecast from NBC in New York which were received directly and then rebroadcast through GE's automatic relay station and television transmitter WRGB across the Capital District area.

RCA on Feb. 6 demonstrated for the Federal Communications Commission a television receiver which produced pictures in color by electronic and optical means employing no moving mechanism.

Philco Corp., at Philadelphia, demonstrated television pictures of 605 lines on horizontally polarized waves, 24 frames per picture, and reception on a loop antenna inside the receiver.

The Federal Communications Commission authorized "limited commercial" operation, and later suspended its authorization.

New York City, on March 6, was televised from the air for the first time by an airplane equipped with a portable television receiver.

Television pictures on a 4½ x 6-foot screen were demonstrated by RCA at the annual stockholders meeting in Radio City on May 7.

Coaxial cable was used for the first time in television program service by NBC in televising the Republican National Convention at Philadelphia and transmitting scenes over a New York station.

The Zenith Television Corp. began regular program service in Chicago on an electronic system, early in the year.

FM broadcasting began.

The Chicago Democratic Convention was filmed and rushed to New York by airplane and then telecast by NBC.

CBS' first actual color television on Aug. 28 of 16 mm. Kodachrome film. On Nov. 12, Dr. Goldmark announced that direct pick-up of color television had been achieved. He spoke to the joint fall meeting of the Institute of Radio Engineers and Radio Manufacturers Association at Rochester, N. Y. This was the first public indication that CBS's theories on direct pickup — known for some time, had been verified.

The Bell System using 441-line television employing a frequency band of about 2,700,000 cycles transmitted over coaxial cable from New York to Philadelphia and return, a distance of nearly 200 miles. Demonstrations of such transmission were subsequently given before the National Television Systems Committee (Nov. 8, 1940) and before the Institute of Radio Engineers, N. Y. C. (Jan. 1941).

The DuMont studios took mobile transmitters on Army field maneuvers.

Lee De Forest was at work on a pilotless "television torpedo plane."

1941 — First public showing of direct pickup of color television demonstrated to both the press and members of the Institute of Radio Engineers on Jan. 9.

Demonstrating television progress to the FCC, RCA exhibited the projection-type home television receiver featuring a screen 13½ x 18-inches.—Television pictures including a prize-fight from Madison Square Garden and a baseball game at Ebbets Field, Brooklyn, were projected on a 15 x 20-foot screen in the New Yorker Theatre.—Scenes at Camp Upton, Long Island, were automatically relayed by radio to New York establishing a record as the first remote pick-ups handled by radio relay stations. (Jan. 24).

Facsimile multiplexed with frequency modulation sound broadcast.

Color television pictures in motion were put on the air by NBC in the first telecast by mechanical means from a television receiver on Feb. 20.

On May 12, 441-line television with an effective band width of 2,700,000 cycles was transmitted over coaxial cables for a distance of about 800 miles by looping the coaxial units in the Stevens Point, Wisconsin-Minneapolis cable.

RCA-NBC made successful tests with first projection-type color television receiver on May 1, using mechanical methods.

The Federal Communications Commission authorized commercial television on May 2, effective July 1.

NBC's television station WNBT became the first commercially licensed transmitter to go on the air on July 1.

(Commercial operation of television began on July 1, on a minimum schedule of 15 hours a week.)

RCA large-screen television demonstration for motion picture distributors and press at New Yorker Theatre featured the world's middleweight championship bout at Madison Square Garden.

Patent granted to Dr. Alfred N. Goldsmith for an airplane detection device. The pilot was able to see his airbase on the screen and as he came closer the picture grew larger.

All sound broadcasting used in television went on Frequency Modulation from Amplitude Modulation which had operated heretofore.

Television broadcasting channels were shifted—FM replaced television on the lowest channel—44 to 50 megacycles.

J. L. Baird demonstrated color and stereoscopic television in England.

The standard television picture was raised from 441 lines to 525 by the Federal Communications Commission.

CBS presented first television newscast, and went on air Dec. 7 to cover news from Pearl Harbor.

1942 – On April 17, the Defense Communications Board recommended that there be no further construction of radio or television transmitters and stations.

World War II equipment requirements curtailed most television activities in the United States.

On May 12, the FCC changed minimum broadcasting per week from 15 hours to 4 hours.

First mass education by television initiated by RCA-NBC in training thousands of air-raid wardens in the New York area on Oct. 25.

CBS telecast a course in Red Cross instruction and sold war bonds by television.

The Orthicon camera, an RCA development, was given a more sensitive "eye" that saw under normal lighting conditions without necessity of brilliant lamps as in prewar television. Experimental "screens" were enlarged and the texture of the pictures made finer.

1943 – NBC televised major sports and other events at Madison Square Garden for wounded servicemen in television-equipped hospitals in the New York area on Oct. 25.

W6XYZ, Paramount Station in Hollywood, Cal., televised a regular course in Civilian Defense Training.

Scophony Corp. of America granted two basic patents for large-screen television.

A three-color television system was patented by Dr. E. F. W. Alexanderson of General Electric.

Dr. Palmer Craig of the University of Florida announced a new theoretical system of broadcasting television over standard radio channels.

The Radio Technical Planning Board (RTPB) was organized.

Radar and its uses as a detection and range-finding apparatus were first revealed to the public.

1944 – Television Broadcasters Association, Inc., (TBA), was organized in January and held its first annual national conference in December in New York.

NBC on March 1 announced plans for a nationwide television network, possibly to be completed by 1950.

Telecine 16 mm. film was first used in April.

Controversy in the television industry, arising out of the Federal Communication Commission's allocations hearings in Washington, centered around whether television should remain "downstairs" or go "upstairs" in the spectrum. Most of the spectrum difficulties were settled with the FCC's preliminary allocations report which took cognizance of both groups in that commercial television was allowed to remain practically where it was in the lower spectrum with provision made in the higher spectrum for experimental television in color and higher definition monochrome images.

Production problems were one of the major video topics of the year. Two schools of thought on programming aired their views. One advocated the use of films in the majority of telecasts for the future; the other argued for "live" programs based principally on sporting and news events.

Plans for a $2,000,000 trial of short-wave radio relays for intercity television and telephone relays were announced by the American Telephone & Telegraph Co.

The Columbia Broadcasting Co. on April 27 called for the scrapping of all prewar equipment and receivers "starting from scratch" in the higher frequencies which would provide "not only better pictures, but larger pictures and entire programs in full color." RCA, NBC, TBA, Philco, and other industry concerns dissented and declared existing black-and-white television was technically perfect and ready for immediate consumption by the viewing public.

RKO Television Productions, Inc., subsidiary of RKO, was organized in May. This subsidiary of the first film company to enter video film production was formed to produce news and entertainment shorts exclusively for television.

Two hours of live television programs were presented on Friday, May 5, by CBS, at the reopening of Station WCBW, now, WCBS-TV, New York, as a first step in developing modern productions and perfecting studio technique for future television.

CBS, on May 23, announced it had placed an order for the first ultra-high frequency television transmitter from General Electric for installation in the Chrysler Tower, New York. The transmitter, when installed, was intended to broadcast "high fidelity television pictures," containing about "twice as many tiny picture elements as the present (525) standards prescribe, and should also make possible transmission of high fidelity pictures in full color," according to CBS spokesmen.

RCA and NBC demonstrated intra-store or department-store television to a group of AMC (Associated Merchandising Corp.) representatives on May 31.

First television network, linking NBC in New York, GE in Schenectady, and Philco in Philadelphia, went into operation.

The Republican and Democratic National Conventions were televised via film.

Election returns were given over television in several cities.

A television seminar was held by the Radio Executives Club during the summer under the direction of Murray Grabhorn, then REC president, and Richard Hubbell, producer and writer as coordinator.

DuMont opened new WABD studios. "The Boys From Boise," a two hour musical comedy, was feature at the opening and represented tele vision's most ambitious programming in New York up to that date (July 13).

WRGB, GE's Schenectady station, received the American Television Society's award for outstanding contribution to the art of television programming.

Allen B. DuMont, president of the Allen B. DuMont Laboratories, Inc., received the ATS plaque for the "best contribution to television" during the year.

NBC University of the Air, and University Extension of Columbia University New York, in collaboration, inaugurated a television course which was recognized for credit toward a degree.

Edward R. Murrow, chief of CBS European Staff, in his regular weekly broadcast from London on Sunday, Nov. 5, confirmed reports that great strides had been made in France in the development of wide-band, high-frequency television.

Rene Barthelemy, French television authority, in a press interview with CBS correspondent, Charles Collingwood, in Paris, told of successful experiments with 1000 line screen (December).

WKY, Oklahoma City, Okla., NBC affiliate, used television to sell bonds during the Sixth War Loan drive on a tour of 19 Oklahoma cities.

1945 — A plan for using airplanes cruising in the stratosphere for transmission of tele and FM was revealed by Westinghouse and the Glenn L. Martin Co.

Long distance transmission was further advanced when the Bell System announced that at least 1,500 miles of coaxial cable would be laid by the year's end.

Successful transmission of all-color, high frequency television across the New York skyline was announced by Paul Kesten, then CBS vice-president.

First major intra-store tele demonstration, undertaken by RCA-Victor in Gimbel's Philadelphia store, proved successful.

Coaxial cable between New York and Washington will be turned over to telecasters for experimental use after Jan. 1, the Bell System announced.

FCC allocated seven channels to New York, and established an operating minimum of 28 hours weekly, generally following industry recommendations.

All RCA tele patents are made generally available to manufacturers under terms and conditions of the company's standard licensing agreements.

AT&T applied to FCC for licenses to construct a microwave relay chain between Milwaukee and Chicago, to be ready for field tests by 1947.

Regularly broadcast network television was begun linking New York, Philadelphia and Schenectady.

A national tele web was the goal of the Raytheon Manufacturing Co. when the firm applied to the FCC for microwave relay stations.

Canada organized a Radio Technical Planning Board.

RCA on March 15 demonstrated a projection-type television home receiver featuring a screen approximately 18 x 24 inches.

DuMont showed a 20-inch direct-view screen for home use.

Federal Communications Commission announced FM and frequency allocations for peacetime expansion.

A new multiple-relay television network linking Washington, D. C., and Philadelphia, Pa., was developed by Philco.

V-E day, V-J day, Navy Day and many other important occasions covered by leading television stations, with NBC staying on the air 14 consecutive hours during V-E day presentations.

Films of the Japanese signing surrender documents on board U.S.S. Missouri were telecast by WNBT Station, NBC-owned, in New York on Sept. 9.

RCA Image Orthicon tube of supersensitivity was introduced as the solution to major problems in illumination of television programs and outdoor pickups on Oct. 15. Scenes could be picked up by the light of a match, infra-red rays, and/or candlelight (thus eliminating need for expensive lighting in studios), pick-ups of outdoor activities and sporting events during twilight, etc.

DuMont started construction of world's largest television studios at the John Wanamaker Auditorium in the New York store.

Greatly improved black-and-white television pictures and color television in three dimensions featuring live talent were demonstrated to the press at RCA's Princeton, N. J., laboratories on Dec. 13. The color system was mechanical; the black-and-white, all-electronic. David Sarnoff declared all-electronic color television in the ultra-high frequencies was still five years away.

William Still, television's pioneer amateur, built his own television station W2XJT at Jamaica, Long Island, N. Y.

1946 – January – First hearings on applications for commercial television stations since the end of World War II were conducted by the Federal Communications Commission. Hearings were for the four available channels in the nation's capital. Applicants included Bamberger Broadcasting Service, Inc.; Capital Broadcasting Co.; Allen B. DuMont Laboratories, Inc.; Evening Star Broadcasting Co.; National Broadcasting Co.; and Philco Radio & Television Corp.

RCA announced a television picture tube of greater brightness resulting in a gain of about 50 per cent in the light efficiency of relatively low voltage cathode-ray television tubes by coating the back of the luminous surface of the kinescope, or picture tube, with a layer of metal 2 to 8 millionths of an inch thick. Described by D. W. Epstein and Louis Pensak of RCA Laboratories before winter convention of the Institute of Radio Engineers in New York (Jan. 24). At the same time the new RCA television camera tube, the Image Orthicon, was described at the IRE meeting. The tube, it was pointed out, was the third in a series of three television camera tubes which had been developed at the RCA Laboratories. The first, the Iconoscope, proved most effective in picking up images at high levels of illumination; the second, the Orthicon, was superior at medium light levels, but was adversely affected by a sudden burst of light; the Image Orthicon was described as 100 times as sensitive as the Orthicon, and operates at all intensities of illumination from that of the darkened room to the high brilliance of a studio stage.

Radar signals were transmitted to and back from the moon.

Morris Liebmann Memorial Prize of the Institute of Radio Engineers was awarded to Dr. Peter C. Goldmark, Columbia Broadcasting System, in recognition of his contributions to electronic research.

February – Using completely new equipment, developed, built and installed since V-J Day, the Columbia Broadcasting System inaugurated, for members of the press and industry, a series of demonstrations of ultra-high frequency color television (Feb. 4).

First inter-city television broadcast from Washington to New York making first use of the Bell System's coaxial 225-mile-long cable link between the two cities (Feb. 12).

Charles R. Denny, Jr., a member of the Federal Communications Commission, was named acting chairman of the commission.

Television stations throughout the nation reconverted their transmitters to conform with frequency changes announced by the FCC last year.

Westinghouse reported the first results of tests employing airborne television and FM transmission, known as Stratovision. Report stated usable signals had been sent over a distance of 250 airline miles from an altitude of 25,000 feet using only 250 watts power.

March – The American Telephone & Telegraph Co. reported that it had manufactured 2,200 route miles of cable and about 1,600 miles of it had been placed during 1945. The transcontinental system to Los Angeles was expected to take place within two years, the report indicated.

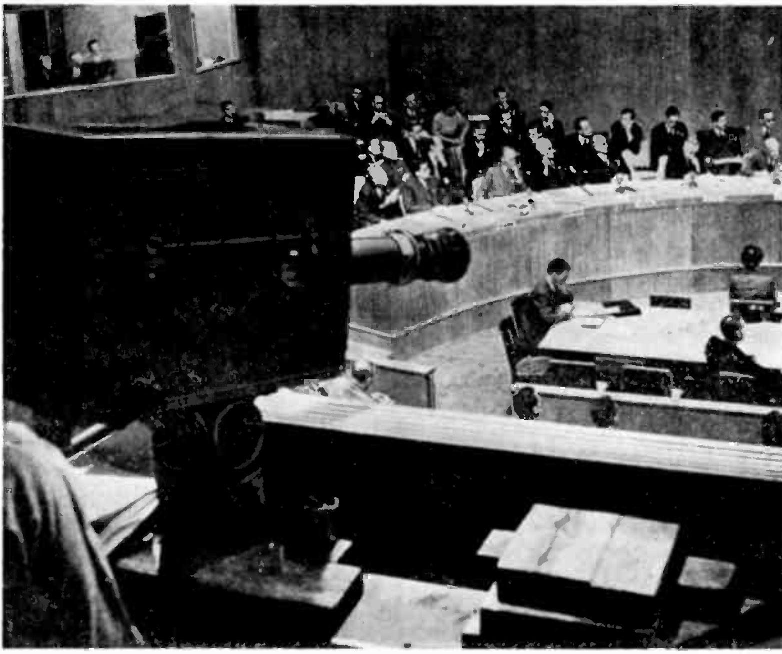
First construction permits for new commercial television stations to be granted by the FCC since the end of the war were announced for video stations in Washington, D. C. Channels were granted to NBC, Bamberger Broadcasting Service, and Evening Star Co. FCC reserved decision on granting fourth channel available pending oral arguments to be submitted by Allen B. DuMont Laboratories and the Philco Corp. Later, Philco withdrew its application leaving DuMont to get permit.

Airborne television demonstration under the joint sponsorship of the U. S. Navy and the Radio Corp. of America was held at Anacostia Naval Air Station near Washington, D. C. Block and Ring systems are announced.

Rosel H. Hyde appointed Federal Communications Commissioner.

Complete television pickup and receiving system made at Hunter College headquarters of United Nations Organization in New York.

April – General Electric in Schenectady, N. Y., demonstrated experimental electronic equipment which re-



— *Courtesy RCA Victor*

Telecasting a U.N. Session, Hunter College

vealed future possibilities for nationwide distribution and projection of theatre television. GE engineers used microwave radio relay equipment to send program from WRGB studio to Civic Playhouse in Schenectady, where it was flashed on an 11 by 15 foot screen by a special television projector provided by the Rauland Corp. of Chicago.

DuMont opened world's largest television studios in Wanamaker's — New York department store.

General Electric Co. announces a "pulsed light" film projector for television stations.

May — The American-built Moscow (Russia) Television Center, which closed during the war, resumed its operations, the Office of International Trade of the Department of Commerce reported.

A specially-designed antenna for WNBT, claimed to be the most advanced development ever used for television anywhere in the world, according to O. B. Hanson, NBC vice president and chief engineer, was placed atop the Empire State Building. Towering 61 feet above the top of the building, the antenna was 26 feet higher than its predecessor and is the fourth to be used in the New York video facilities since 1931. The new system could deliver an effective radiated signal 100 per cent more powerful than its predecessor, he indicated.

FCC held hearings in Los Angeles on applications for commercial television stations in that city.

FCC granted construction permits to nine applicants in eight states where television was not available. As a result, an additional 5,046,974 persons living within radiating distances of the proposed new stations will receive video service as soon as these stations are erected. Construction permits were for Worcester, Mass.; Waltham, Mass.; Providence, R. I.; Cleveland, O.; St. Paul, Minn.; Richmond, Va.; Salt Lake City; Portland, Ore.; and Baltimore, Md.

June — British Broadcasting Co. resumed television in England, June 7, after lapse of nearly seven years, on 405 line standard, thus enabling prewar receivers to be used.

NBC announces new micro-wave television relay transmitter which was claimed by O. B. Hanson, NBC vice-president and chief engineer, to generate less radio power than that required to operate a pencil flashlight (June 11).

Louis - Conn world's heavyweight championship boxing bout, held on June 19 at Yankee Stadium in New York City, televised. Largest television audience, estimated at 141,000, ever to witness a fight, looked on.

DuMont granted construction permit for five kilowatt television station in Washington to be named WTTG — call letters in honor of Dr. T. T. Goldsmith, Jr., director of research and engineering for the company.

July — Television participated in "Operation Crossroads" at Bikini Atoll, July 1. Television camera placed in noses of radio-controlled planes, actually flew through the radio-active formations caused by the volcanic explosion and conveyed valuable information to those gazing at television screens miles away. They were stationed on 75 foot towers on the Atoll.

August — Development of a 16 mm. motion picture film to record television programs direct from a monitor was described by the E. I. du Pont de Nemours & Co.

October — More than 1000 persons attended the Second Television Conference and Exhibition of the Television Broadcasters Association at New York City.

Kaufmann's Department Store in Pittsburgh held a two-week demonstration of intra-store television.

Philco Corp. and National Broadcasting Corp. agreed to exchange commercial television programs via cable and radio relay.

November — The Radio Corp. of America demonstrated an all-electronic system of television in color. The demonstration proved that flickerless, all-electronic color television was practical without rotating discs or other moving parts. It was stated that five years would elapse before color television reached the status of black and white on a comparable basis.

Federal Communications Commission grants for commercial television stations since the first of 1946 reached a new high of 36 permits issued for stations throughout 19 states.

A new development, whereby pictures and sound were transmitted from one point to another over a light beam instead of radio waves was demonstrated before the American Institute of Electrical Engineers at Washington, D. C., by Dr. T. T. Goldsmith, Jr., director of research for DuMont Laboratories.

December — The Columbia Broadcasting System announced that it would televise all of the Brooklyn Dodger baseball games the following season. DuMont Laboratories, owners and operators of WABD, also announced that it had agreed with the New York Yankees to televise all the home games of this baseball club.

The president of the Television Broadcasters Association, Jack R. Poppele, opposed the adoption of standards until research on all systems of color television was completed, in a hearing before the Federal Communications Commission on color television.

1947 — On April 29, color television pictures, on a 7½ x 10 feet theatre screen, were shown publicly for the first time at the Franklin Institute in Philadelphia by RCA, in a demonstration of its all-electronic simultaneous method of color television. Dr V. K. Zworykin, vice-president and technical consultant of RCA Laboratories stated, nevertheless, "remarkable as the advent of large screen color television pictures appears at this time, color television must be regarded as still in the laboratory stage."

The Columbia Broadcasting System discontinued its television studio operations on May 11.

RCA and Warner Brothers announced in July that they had reached an agreement for developing theatre television. RCA and 20th Century-Fox revealed an agreement to develop large screen television, in September. In December Paramount Pictures unveiled its large screen development for theatre television.

The Louis-Wolcott bout brought television to its greatest spectator audience, estimated at over one million.

But 1947 will go down in the annals of television history as the year in which the Common Man — John Q. Public — discovered television as a major entertainment medium and began purchasing home receivers — good, bad, and indifferent — in large numbers, irrespective of price. Prices were for the most part fantastically high, with extra "installation and antenna" charges ranging from $45 to $125, depending on the scruples of the individual company. Manufacturers in droves began "cashing in" on television, as production reached record levels.

II

Pioneers and Contemporaries In Television

This section is devoted to biographical sketches of people who, in the estimation of a committee of television experts,* have contributed to the development of television in one of the following major fields:

Research (theoretical and applied)
Administration
Programming
Engineering
Public Relations

The inclusion of contemporaries is always a matter of personal judgment, and open to discussion. In all cases, however a majority opinion of the committee was required before the candidate was included.

ADAMIAN – In 1908 he proposed the use of positive-column tubes (or Geissler tubes, as they were then called) to supply the modulated source of light at the receiver.

ADLER, BEN – Grad., Brooklyn Polytechnic Institute, 1926. His thesis was on a 60 megacycle communications system. For two years an instructor at Polytechnic evening school, in electrical engineering courses. Active in amateur radio, operating W2DAC in New York for a number of years. In 1926 employed by Phillips Petroleum. Joined RCA Research Dept. (Van Cortlandt Park Laboratories) in 1928. While at the labs, assisted in the development and use of field intensity measuring equipment for broadcast

* The members of this group have said that they desire to remain anonymous.

site surveys, the international broadcast receiving system at Riverhead, L. I., and large-screen television projection system and synchronizing systems. He was also responsible for the design and construction of the original W2XBS television transmitter. In 1934, he initiated a joint program with RCA, GE, and Westinghouse to improve the life of power tubes and develop external anode, air-cooled tubes. In 1936, became manager of RCA sales engineering office in New York, handling broadcast, television and FM equipment. He worked closely with both NBC and CBS television installations in New York. In 1942, became manager of the test and measuring equipment section of RCA, directing the development of special test procedures on radar, and other devices for the U. S. Army and Navy. Since 1944, he has been facilities engineer for the American Broadcasting Co., Mr. Adler is holder of patents on geophysical methods, large-screen television projection system and a synchronizing system.

ALBERTUS, MAGNUS — (Albert, of Cologne) (1193-1280) — Scholastic philosopher, also known as the "Universal Doctor" came of a Swabian family. He became a Dominican monk and later (1261), archbishop of Ratisbon. He was a noted teacher of science, theology, and philosophy in the Univ. of Paris (1230), and also at Cologne, where he died. He was one of the first to learn the phenomena of phosphorescence. Phosphors was the old name given to a substance which gave off a pale light without burning — like the luminous dials of watches. He knew that diamonds, for example, became phosphorescent when heated to a specific temperature. His vast knowledge of science caused him to be accused of wizardry and black magic.

— *Courtesy General Electric*

E. F. W. Alexanderson

ALEXANDERSON, ERNEST FREDRIK WERNER — (1878-). B., Uppsala, Sweden. Ed., Univ. of Lund. Grad., Royal Technical Univ., Stockholm, as electrical and mechanical engineer. For one year, post-graduate study in electrical engineering at the Technical University in Berlin, Germany, where he was a student of Prof. A. D. Slaby, creator of the once important Slaby-Arco system of radio communication. In 1901 he came to

U. S., joined General Electric Co.'s engineering staff at Schenectady under Dr. Charles N. Steinmetz.

An assignment to build a high frequency alternator for Prof. Reginald A. Fessenden, one of the pioneer radio experimenters, gave Alexanderson his great opportunity. After two years of work, during which several models were constructed, he delivered a practical alternator which was installed in the Fessenden Station at Brant Rock, Mass. On Christmas Eve, 1906, it enabled this station to transmit the first broadcast in history. Alexanderson kept improving his apparatus until it became the famous Alexanderson alternator, defined technically as "an inductor alternator having the rotor formed with alternate segments of magnetic and non-magnetic material, operated at high speeds for the production of high-frequency currents used in continuous wave transmission at high power." It assured reliable trans-Atlantic radio communication.

He did notable pioneer work in television and the transmission of pictures by radio. Using a perforated scanning disc and high frequency neon lamps, he staged in Schenectady, N.Y., the first home and theatre television demonstrations. The first home reception of television took place in 1927 at his home. On Jan. 13, 1928, there was a public demonstration. The theatre demonstration took place May 22, 1930 in Proctor's Theatre, Schenectady, N.Y. The theatre orchestra was led by the image of a conductor on a seven-foot screen which carried the faces of other performers miles away in the laboratory.

In 1931, he obtained a patent disclosing the principle of frequency modulation as it applied to the transmission of pictures.

In 1934, he was elected to the Royal Academy of Science, Sweden. He was the recipient of the Swedish Order of the North Star; the Medal of Honor of the Institute of Radio Engineers, (1919); Knighthood of the Polish Order of Polonia Restituta, 1924; the John Ericcson medal for outstanding contributions to the field of radio engineering, 1928. AIEE Edison Medal, 1944; and Carnegie Medal, Royal Technical Institute of Sweden, Feb. 1945. Member and past president, AIEE. In 1940, his name was listed on a "Wall of Fame," honoring foreign born citizens who have made notable contributions to American Democracy.

ALGEO, LARRY – B., Toledo, O. Grad., University of City of Toledo. Following graduation awarded apprenticeship to Cleveland Playhouse. Later joined Federal Theatre of Ohio. In New York, appeared in "Mulatto", "Arrest That Woman", "Boy Meets Girl", "One Good Year" and with Maurice Evans in "Richard II" and "Henry IV". Lecturer for Ford Motor Co. exhibit at first year of World's Fair in New York; and for General Electric display the following year. Joined GE publicity dept., writing and directing motion pictures, later being transferred to WRGB. Now in charge of all dramatic productions at that television station.

AL-HAZAN (Abu Ali Al-Hasan Ibn Alhasan — better known as Al-Hazan) (965-1039) Arab astronomer and optician, was a native of Bassora, which was near the mouth of the Tigris and Euphrates Rivers. Later settled in Cairo. Considered the greatest of Arabian scientists. He wrote a treatise on optics which was translated into Latin and published at Basel in 1572, under the title Opticae Thesaurus. His account of the power of lenses is the earliest known and he is credited with the first suggestion of spectacles. One result of his work was his examination of the human eye and his explanation of its workings. Before his time, scientists believed men could see because the light sent out invisible rays like a searchlight. Important for television, he declared that this theory was incorrect. He stated that vision was made possible by rays coming from the object at which one looked. These rays entered the eye and enabled one to see.

ALLEY, PAUL — Ed., George Washington Univ. Field representative for Ford Motor Co. Later joined Paramount News and then Warner Brothers to handle newsreels. Wrote many scripts for special film releases including RCA's "Radio At War" and "Music, Manpower and Morale". Joined National Broadcasting Television Dept. in June, 1944. Has pioneered in presenting news on film to television audiences and scored many impressive news beats. In 1945, given special award by American Television Society for work in editing film for nation's only television newsreel, *The War As It Happens*, presented during the war over NBC's station WNBT. Supervision of Film Programs, N.B.C. Television.

AMPERE, ANDRE MARIE (1775-1836) — French physicist and mathematician. B., Lyons. In 1801 he became professor of physics at Bourg, and a few years later professor of mathematics at Lyons. In 1805 he went to the Polytechnic School at Paris, becoming professor of analysis in 1809; and professor of physics at the College of France in 1824. His fame rests on his physical researches especially on the development of electrodynamics and his original demonstrations between magnetism and electricity. He was the inventor of the astatic needle, and first propounded the theory that currents of electricity in the earth attracted the magnetic needle. The measure of electricity called the ampere was named in his honor.

AMSTUTZ, NOAH STEINER (1864-). B., Milton Tp., Wayne Co., O. Research engineer. Ed., public schools; draftsman and student of patent law. Commercial artist and draftsman, in Cleveland, artist, lawyer. Did research in London, and European continent. Consulting and research engineer. Originated first phototelegraphy system, and first automatic half-tone engraving machine, known as the Akrograph. Complete historical exhibits of both systems donated to Smithsonian Institute in Washington, D.C. Described as . . . "one of the pioneers in the development of television . . . "

by Kenneth A. Hathaway, in his book "Television", published by the American Technical Society, Chicago. (1936)

ANDERSEN, THORVALD—B., Denmark. In 1921, by invitation of the London Daily Express, Andersen demonstrated in London a method of transmitting pictures long distances over a telegraph or telephone wire by coding and decoding a given picture, drawing or script by means of numbers. In the Andersen system, the original photograph or sketch had to be accentuated by an artist, so as to represent a decided contrast between light and shade. Horizontal lines were lettered A,B,C, while the vertical ones were numbered 1,2,3,4. Andersen's apparatus at the transmitter determined the brightness of the picture at every point which was represented by a dot. That intelligence, put into code, was telegraphed to any part of the earth that could be reached by wire or wireless. The operator at the receiving end was supplied with a typewriter with special type which enabled him to make dots of different sizes, and he punched these out in succession just as they were sent, side by side, and line under line, on a sheet of white paper. When the whole operation was finished a complete picture appeared on the sheet, which had only to be reduced to make it ready for the press.

ARMENGAUD, M.—B., Paris, France. Developed "The Armengaud System," an early form of television apparatus. Used a shutter to cover the image, which was formed by a lens on a ground glass screen. Behind it was the selenium cell, and between the image and cell, was the shutter. In order to permit all parts of the image to be covered in 1/10 of a second, he used the shutter device consisting of an endless horizontal band, which was mounted on rollers so as to move beltwise. Behind it was another band, this time a vertical one which was arranged to take a rapid downward movement. The square portion which was given by the crossing of the two bands was disposed so as to cover the whole surface of the image. When both bands were moved, it displaced a point (of light) from the image, so that the opening passed over all of its surface. The system was never proven practical, according to authorities of that day (about 1927).

ARMSTRONG, EDWIN HOWARD (1890-)—Electrical and radio engineer. B., New York City. Grad., Columbia Univ. in 1913 with degree of E.E.; the honorary degree of Doctor of Science was conferred upon him by Columbia in 1929; and the same degree was awarded him by Muhlenberg College in 1941. Studied under the late Dr. Michael I. Pupin and succeeded him as professor of electrical engineering when the latter died in 1935. Usually designated as the "Father of Frequency Modulation" and "Inventor of FM" latter is erroneous. He developed the wide-band system of frequency modulation which has had widespread acceptance. Armstrong invented the superheterodyne receiver which is employed almost universally today in radio reception. In addition to the numerous honors bestowed on him, he was among the first recipients of the Chief Signal Officer's Certificate of Appreciation in 1944. The National Association of Manufacturers selected him as one of the National Modern Pioneers in 1940. The citation read: "First to make use of the 3-electrode tube for generating continuous electric waves which made radio broadcasting feasible, inventor of the long and widely used superheterodyne receiving circuit, and inventor of the new broadcasting by frequency modulation that so well avoids static as almost to defy lightning."

ASHBRIDGE, NOEL (1889-). Fourth son of John Ashbridge of Wanstead, England. Ed., Forest School; King's College, London. Engineering training with Yarrow & Co., Ltd., shipbuilders; and British Thomson-Houston Co., Ltd., at Rugby. Served in European War, 1914-1919, with Royal Fusiliers and Royal Engineers. Six years with Marconi Co. in experimental section of designs department. Joined British Broadcasting Corp. in 1926 as assistant chief engineer, and in 1929 became chief engineer, in which capacity he had entire technical responsibility for all broadcasting stations in Britain. In September, 1943, appointed Deputy Director-General of the BBC. Created a knight in a British Order of Chivalry, 1935. In 1934, the Danish Government had conferred on him the honor of knighthood in the Royal Order of Dannebrog in recognition of the fact that, when their own system of radio broadcasting was reorganized, it was completely modeled upon that developed for the BBC by Ashbridge.

ATKINSON, L. B. – B., England. Invented an electrical seeing device using a mirror drum in 1882 but is not credited as being the inventor because no description of his apparatus was ever published. L. Weiller, who in 1889 devised a system of scanning in which the place of the Nipkow disc was taken by a rotating drum on which a number of mirrors were tilted at different angles, is usually considered the inventor of the mirror drum.

AUSTRIAN, RALPH B. (1898-). B., New York City. Ed., De Witt Clinton High School. At 16 he put together his first radio receiving set. A high school student by day, he was an instructor in Morse and continental code at night in the old New York School of Telegraphy. During this period, he also operated an amateur station in New York.

During World War I he was a radio instructor at the Signal Corps School of Communications at the College of the City of New York. After the war, he became manager of the radio department, Gimbel Bros., New York. Later he operated a nationwide chain of leased radio units in leading department stores. With Paramount Publix-Lasky film organization; Westinghouse Electric & Manufacturing Co. as manager of retail distribution; Kolster Radio Division of the International Telephone & Telegraph Co. as general sales manager; Emerson Radio & Phonograph as sales chief; and RCA Manufacturing Co.'s Photo-Phone Recording Division as assistant vice-president.

In 1942 he became a member of the Planning Committee of the War Production Board, and in October, 1943, became television and radio consultant to the Radio-Keith-Orpheum Corp. In June, 1944, he became executive vice president of the company's television subsidiary, and later, president. Named Vice-Pres. for Foote, Cone and Belding Advertising Agency in Autumn, 1947.

AYRTON (PROF.) – B., England. With a colleague, Perry, also of England, he planned to create an electrical system of sight that would use the human eye as a model. They proposed to construct a large mechanical eye, using a plate of selenium cells as the sensitive retina.

BACON, ROGER (1214-1294). English philosopher and scientist. Neither exact date or place of birth is certain. He is said to have been born in Ilchester, Somersetshire. Ed., Oxford Univ. and the Univ. of Paris. He entered the Franciscan order about 1250 and shortly thereafter returned to Oxford as a teacher. He became deeply interested in alchemy. In exploring the secrets of nature he made discoveries and inventions which were looked upon by many as the work of magic. He favored the use of mathematics and experimentation and by some is credited with the invention of the telescope, the microscope and gunpowder. He is said to have invented the magnifying glass, with the discovery of important chemical facts, such as the fact that explosions may be produced with sulphur, saltpetre, and charcoal and with a number of new and ingenious theories in optics. Bacon invented, or developed, the principles of the magic lantern, spectacles among other things. His study of the various uses of lens lifted the science of optics several rungs up the ladder.

BAIN, ALEXANDER (1818-1903). Scottish educator and psychologist. B., Aberdeen. Ed., university of that city. Lectured there as deputy professor for several years and later taught natural philosophy at the Andersonian Univ., Glasgow. Filled various other posts and was appointed to the chair of logic at Aberdeen in 1860. He resigned in 1881, and in the same year was elected rector of the university. At one time he was an examiner in logic and moral philosophy in London Univ. In 1842, while in London, he arranged metal letters on a conducting plate at a sending station, and a chemically prepared paper on a similar plate at the receiving end of the line, achieving a system of facsimile that was a forerunner of modern facsimile methods for sending photographs. Narrow conducting brushes, mounted side by side on an insulated strip, were moved slowly over their respective plates. The brushes at corresponding positions at the two stations were joined by individual wires so that when contact was made with the metal letters, current passed through the paper, producing a discoloration in the form of letters at the sending terminal. Chief obstacle to the system was the fact that too many wires were needed.

BAIRD, HOLLIS S. – Formerly with the Short Wave & Television Corp. (non-existent today), conducted television experiments with mechanical scanners in Boston many years back. He developed a scanner in the form of a horizontal metal plate called a "spider" which supported a narrow strip of thin steel perforated with square holes. Worked with U. A. Sanabria, Chicago, in early 1930's.

– Courtesy British Imformation

John Logie Baird

BAIRD, JOHN LOGIE (1888-1946). B., Helensburgh, Scotland. Ed., Larchfield; Royal Technical College and Glasgow Univ., where he studied electrical engineering. His hobbies as a youth were – significantly – electricity and photography. Worked as a supervising engineer for a Scottish electrical supply company. But ill-health, against which he had striven all his life, forced him to seek a less strenuous occupation, and for some years engaged in a one-man business with varying success. His is the story of a man who rose, despite poverty and ill-health, to world fame, obsessed with an idea which in itself made people think he was queer. He knew that sound could be made audible hundreds of miles away by telephone and that light affected selenium cells. The two things gave him an idea – it should be possible to make things visible hundreds of miles also.

Baird had an inventive mind. He invented a foot-warmer, and new types of soap and boot polish. He went to Trinidad to make jam. But the idea of television still persisted. He returned to England and started working on television in 1923. In 1926 he demonstrated the mechanical scanning system before the Royal Institution in London. In 1925, he had achieved the first actual television transmission almost simultaneously with C. F. Jenkins of the United States. He succeeded, in 1926, in producing the first half-tone effect, or light and shade in his television images. At about the same time he managed to project moving pictures on a receiving screen.

Baird has been discribed as "a self-taught inventor who matched inventive wits against the pooled ability and the vast resources of great laboratory physicists and engineers." In February, 1927, he showed his "televisor" to his kinsmen at Glasgow, Scotland. In February, 1928, he televised a Mrs. Mia Howe in London and transmitted her image across the Atlantic Ocean to Hartsdale, N. Y., in the first trans-Atlantic telecast ever made. On March 7 of that year he telecast the face of a woman named Dora Selvy to the S.S. Berengaria, which was 1000 miles out at sea. On June 3, 1931, he telecast the English Derby for the first time; and in 1932 transmitted the race to London to an audience of 4000 who sat in a theatre and watched the horses on a television screen.

In February, 1935, the Television Committee of the British Government considered two systems of television to be established as a public system. Baird's mechanical scanner was one of the two. The other was the electronic scanning method, which later was adopted. Baird also developed a system for transmitting pictures by use of infrared rays which he called Noctovision. The receiver was named "noctovisor." He was first to demonstrate color and stereoscopic television in December, 1941. With the advent of electronic scanning, Baird's disc became obsolete for standard world-wide usage. Baird also recorded a picture signal on a phonograph record and televised motion-picture films.

BAKER, WALTER RANSOM GAIL (Nov. 30, 1892-). B., Lockport, N. Y. Grad., Union College, Schenectady, N. Y., 1916, B.S. in electrical engineering, later receiving his master's degree and the honorary degree of Doctor of Science. Joined General Electric Co.'s general engineering laboratory in 1917. Became designing engineer, and then managing engineer of the GE Radio Department at Schenectady. In 1930, moved to Camden, N. Y., with a great part of GE's radio staff when the firm's radio interests were turned over to RCA.

— Courtesy General Electric

W. R. G. Baker

With RCA, became successively vice president in charge of engineering, vice president in charge of engineering and manufacturing, and finally, vice president and general manager. Returned to GE in 1935, where he became managing engineer, manager, and finally vice president in charge of the Electronics Department. As a means of a directly modulated electric arc.

BERZELIUS, JONS JAKOB, BARON (1779-1848). Swedish chemist. Ed., Uppsala Univ.; professor of Botany and Pharmacy at Stockholm Univ., 1807. He introduced the system of symbols in chemistry; made important chemical discoveries; isolated the element selenium in 1807; also discovered silicon and thorium.

BEVERAGE, HAROLD HENRY (1893-). B., North Haven, Me. Ed., Univ. of Maine, B.S., 1915. Employed at General Electric Co., Schenectady, N. Y., and later with Dr. E. F. W. Alexanderson at the radio laboratory. On engineering staff of RCA, 1920-29. In 1929, became chief research engineer, RCA Communications, Inc. In Dec. 1940, made vice president in charge of research and development. Introduced new antenna designs and made investigations of the behavior of electromagnetic waves; explored space and helped overcome static and fading in radio reception. In 1920, erected a full-size antenna on poles from which evolved the "wave antenna" destined to become the standard in the U. S. and other nations. Recipient, Morris Liebmann Memorial Prize, 1923, IRE.

BIDWELL, SHELFORD — B., England. Gave an account of the successful telephotography of a gas flame — perhaps the first thing to have its picture sent over a wire by its own light — on Jan. 5, 1881. The principle was fundamentally that used with photoelectric cells. As the transmitting cylinder revolved and vibrated on its spindle, it scanned the image focused upon it, and the contact registered the action of light or darkness upon sensitized paper stretched on a receiving cylinder. The pictures thus made, however, were not permanent and few people cared for the picture of a gas flame. Lights and solid shadows could be recorded, but not halftone values.

BINGLEY, FRANK JAMES — Chief television engineer for Philco Corp. B., Great Britain. Grad., Univ. of London in 1927. Associated with Baird Television, Ltd., London, following college graduation, and for two years (1929-1931) was in charge of Baird's New York laboratories. Joined Philco in 1931 as television research engineer. Under his direction Philco pioneered in many major improvements in television, and under him Philco's television station WPTZ, at Wyndmoor, Pa., was designed and constructed in 1941. He was instrumental in developing the Plane-O-Scope, a flat surface picture tube which presents an undistorted picture irrespective of the angle from which it is viewed. Remote pick-up equipment in the Philadelphia area and the mobile unit for "on-the-spot" television shows are other Philco televisior developments instituted by Bingley.

BIRKINSHAW, DOUGLAS (1906-). B., Sheffield, Yorkshire, England Ed., Oundle School and Corpus Christ

College, Cambridge, England. Before turning to radio, he spent five years in the research department of a Sheffield steel works. Joined the British Broadcasting Co.'s research department in 1932. Experimented in television from start and became engineer in charge of television when Alexandra Palace studio opened in 1936. During war, transferred to one of BBC's shortwave stations sending out overseas programs. More recently appointed superintendent engineer of the BBC Television Service at London.

BOOTH, PHIL (1907-). B., Liverpool, England. Grad., Cambridge Univ. After seven years with various commercial enterprises in U. S. enrolled in Dept. of Drama, Yale University, 1935. Spent 1936 in film work in England. Joined CBS Television as director in 1939, specializing in art shows. Enlisted in Royal Canadian Air Forces, 1942; discharged from British Army as captain in 1945. Rejoined CBS Television as director of such programs as "Draw Me Another," "Here's Dow," and other art shows during 1946. Left CBS in May, 1947.

BOWIE, R. M. (1906-). B., Tablerock, Nebr. Grad., Iowa State College, B.S. in chemical technology, 1929; M.S. in physics, 1931; Ph.D. in physics, 1933. Joined the staff of Sylvania Electric Products. Inc., October, 1933, as a physicist. Began active work on cathode ray tubes early in 1935 and was appointed head of the cathode ray tube engineering laboratories soon thereafter. Developed patents covering ion trap techniques for magnetically deflected electron beams between 1935 and 1938. These inventions help prevent the burning of fluorescent screens in large direct-viewing television tubes. Later, named manager of research for Sylvania Electric. During 1944 directed development of the equipment later used in the first moon radar contact.

BOWLEY, RAYMOND J. – Received degrees of S.B. and S.M. in electrical engineering from the Massachusetts Institute of Technology in 1930 and 1931, respectively, and then served for a year at his alma mater as a research assistant. Joined Philco Corp. in 1933 as a radio production test engineer, but after several months transferred to television engineering department as a research engineer. For next five years, was active in design and development of synchronizing generators, video amplifiers, deflection circuits, television transmitters, receivers and studio equipment. In 1939 was put in charge of Philco television studio's engineering operation and later as engineer in charge of both operations and maintenance of transmitter, studio and remote pick-up activities of Philco Television Station WPTZ. During war he was on leave of absence and did special research at Harvard University on radar counter measures. Thereafter, served four years as an officer in Army Signal Corps, becoming a major in 1945. Received an Army Commendation Citation for "supervising development of radar counter measures which served to defeat enemy radar weapons." Was member of Combined Counter-measures Committee of Combined (U. S.-British) Chiefs of Staff. Returning to Philco in 1946, was put in charge of television station, studio, relay and remote pickup operations for the corporation.

BRADLEY, WILLIAM E. – Television researcher. Grad., Moore School of Electrical Engineering of the Univ. of Pennsylvania, 1936. Joined Philco Corp. same year, first as factory test engineer in radio receiver production department, the following year becoming a research engineer in the television engineering department. Helped design wide band amplifiers for experimental television receivers. Between 1939 and 1941 engaged in design of high-power output circuits and broadcast antennas for the experimental Philco television transmitter. Also helped design beam antennas, receivers and portable transmitters for ultra-high frequency remote pick-up television equipment. In 1941 placed in charge of advanced research section of the Philco Research Division, and early in 1945 became assistant director of that section, and director in December, 1945.

BRANLY, DESIRE EDOUARD B., Amiens, France. D., Paris, France. Ed. the Sorbonne, where he received his Doctor of Physics degree. Later, professor at the Institut Catholique, Paris. French physicist invented the Branly coherer, a device to detect the Hertzian or radio waves; it was the first detector of wireless waves made.

– Courtesy Harper & Bros.

Edouard Branly

BRAUN, KARL FERDINAND (1850-1918). Scientist. B., Fulda, Germany. D., Brooklyn, N. Y. Ed., Marburg and Berlin, became professor of physics at Marburg, and later at Karlsruhe; later, director of the Physical Institute at Strasbourg. Noted for development of the (Braun) cathode-ray tube to the point where it remained chiefly to add the electron tube to bring the kinescope or television picture into existence. Electrical phenomena of cathode rays, oscillographs and the mysteries of wireless were his specialties in research. He discovered a means for showing visually the variations of alternating current in a vacuum tube, which he named the oscilloscope. Braun also developed the theory that the fluorescent spot could be made sharper and clearer by placing a magnetic field from a coil around the tube. Since the same power that produced the cathode ray also produced the spot of light at the end of the tube, it naturally followed that the light beam could be deflected by the same means. The Braun tube, as it was immediately named, at once assumed an important status in medical therapeutics.

— Courtesy Harper & Bros.

Karl Ferdinand Braun

Cathode rays were not originated with Braun for they had been utilized by Sir William Crookes and Wilhelm Roentgen, but up to the time of Braun, the cathode-ray streams had been like a rushing torrent, uncontrolled. It remained for Braun to apply older knowledge systematically in order to deflect the cathode rays. He produced a narrow, guided stream of electrons; deflected the stream electrostatically and so made it trace patterns on a fluorescent screen. This was a great forward advance in two fields, first in oscillography enabling study of fluctuating voltages and currents even if their frequencies were extremely high; the second, in television. The Braun tube lacked only one element to enable it to reproduce luminous images in motion. Braun used an electron stream of constant intensity. Later, Rosing modulated the electron stream in Braun's tube to follow the lights and shadows of an image – enabling electronic television to follow. Braun had the electron gun, the deflecting plates and the fluorescent screen, he lacked only the gun control. Had he found the gun control, he would have probably created the present-day Kinescope. Braun's tube was the next important step in television after the disc invention of Paul Nipkow. His tube was an evacuated funnel-shaped glass structure at the narrow end of which a source of free electrons was located. These electrons, sprayed like water from a hose, on a chemical substance, coated on the inside of the other end of the tube. This substance was found to glow under the impact of the electrons; that is, they created a spot of light where the electrons hit the coating.

With Marconi, in 1900, awarded the Nobel Prize, for wireless work. Devised a method of directional wireless which depended upon the interference of electric waves traveling in the same direction but different in phase. In 1903, with Adolph D. H. Slaby, Count George W. A. H. von Arco, and Siemens, formed the Telefunken system of transmission.

BROLLY, ARCHIBALD HART (1900-). Ed., Harvard Univ., B.S. in Electrical Communications Engineering. With Massachusetts Institute of Technology as research assistant, Communication Engineering, 1927-29; chief engineer, developmental laboratory, Farnsworth Radio & Television Corp., 1930-36; with Philco Corp. in television developmental engineering, 1937-40; chief engineer, Television Stations WBKB and W3XBK, Balaban & Katz Corp., Chicago, since 1940.

BROWN, GEORGE HAROLD (1908-). Designed the vestigial sideband filter put into use in the television transmitter atop the Empire State Building for the National Broadcasting Co. B., Milwaukee, Wis. Ed., Univ. of Wisconsin. Grad., B.S. degree in Electrical Engineering, 1930; M.S. degree, 1931; Ph.D., 1933. From 1933 to 1937 was a research engineer with RCA; later for one year a consulting engineer; rejoined RCA Laboratories in 1938. Active as pioneer in the field of radiothermics including the development of radio-electronic "sewing machine," radio rivet "hammer" and many other appliances. He supervised the development of these devices at the RCA Laboratories. More recently in the position of section head of the Radio Systems Research Laboratory of RCA Laboratories. His work has been largely in the field of radio and television with emphasis on the investigation and design of antennas. In 1940 he received the National Association of Manufacturers' Modern Pioneers award.

BUSS, FRANCES — Director, WCBW-CBS television. B., St. Louis, Mo. Attended Washington Univ., St. Louis. Left St. Louis in 1935 to join Equity. Actress in several road shows. Joined CBS Television in 1940 until December 1942, when CBS closed studio. Returned in 1944 as assistant director when studio reopened, and after a brief refresher course, was made full-fledged director. Director of such regular shows as John Reed King's "It's A Gift," and Milton Bacon's "Tales to Remember." Co-directed with John Houseman dramatic mystery, "Sorry, Wrong Number."

CALDWELL, ORESTES HAMPTON (1888-). B., Lexington, Ky. Ed., Purdue Univ.; B.S. in E.E., 1908; E.E., 1931; Doctor of Engineering, 1933. Associate editor, *Electrical World*, 1910-17; editor, *Electrical Merchandising*, 1918-29; *Radio & Television Retailing*, 1925-34; *Electronics*, 1930-35; *Radio & Television Today*, since 1935, *Electronic Industries* since 1942, *Radar* since 1943. Federal Radio Commissioner, 1927-29. Vice president, treasurer, Caldwell - Clements, Inc., publishers, New York.

CAMARENA, GUILLERMO GONZALES — Inventor. B., Mexico. On Oct. 20, 1944, *Television Daily* reported in a dispatch from the Mexico City Bureau of *Radio Daily*, "that Camarena, according to Professor Agustin Leyva, one of that country's best known radio authorities, had invented a new television system." The report quoted Dr. Leyva: "This valuable researcher has created a television system which, although similar in certain respects to that of the Englishman Baird, is entirely original and more advanced in both its methods and their application. It consists of a chromoscopic adapter that gives television the illusion of color. It works by means of three colored discs — red, green, and blue — which are rotated simultaneously before the screen and the camera. It is superior to the Baird method in that while the latter demands three cameras, that of Camarena requires only one. Moreover, in spite of the constant and future progress of television, the invention is so arranged that it can be adjusted to any new system. The chromoscopic adapter was first exhibited to the public at a recent meeting of the Scientific Clubs of Mexico."

CAREY, G. R. — B., Boston, Mass. In 1875 he designed what was probably the first television system. He proposed to imitate the human eye by a mosaic consisting of a great number of minute selenium cells. (See *Carey's television system.*)

CASCARIOLO, VINCENZO — A cobbler of Bologna, Italy, who is credited with making the first discovery of phosphorescence to produce results, some time around 1603.

CASE, NORMAN S. — B., Rhode Island. Ed., Brown Univ., A.B. degree; studied law at Harvard; and Boston Univ., LL.B. (1912). Republican Governor of Rhode Island for five years. Formerly member, Federal Communications Commission.

CASELLI, ABBE GIACOMO (1815-1891). In 1862 he transmitted the first electric picture from Amiens to Paris, France. He sent designs by telegraph utilizing a cylinder covered with tinfoil on which the figures were drawn in an insulating compound by a contact pin or needle traveling over the cylinder. Developed the Pantelegraph.

CAWEIN, MADISON (1904-). Manager of the research department, Farnsworth Television & Radio Corp. B., Louisville, Ky. Ed., Univ. of Kentucky, B.S. in Physics, 1924; 1926-28, post-graduate work in astro physics and nuclear physics at Univ. of Kentucky; graduate study, Cornell Univ., 1928. From 1925-26, with the Westinghouse Lamp Co. in the physics laboratory. Worked on the development and design of the first vacuum tubes (these were the early power tubes for radio); 1926, in research department, Brooklyn Edison Co., on high voltage cables and meters for measuring them. 1924-30, instructor in physics at Univ. of Kentucky. With the Hazeltine Corp. from 1930-38, doing pioneer work with the television receiver, and basic study of the television problem. His early work dealt with improvement of circuits. From 1938 to 1939 was television consultant for the Andrea Corp. on television and physics. Here, designed a television receiver kit. Joined Farnsworth, 1939, and until 1942 worked on television receiver development. During World War II, was responsible for many electronic developments which were utilized in the war.

CHAFFEE, EMORY LEON (1885-). B., Somerville, Mass. Ed., Mass. Inst. of Tech., B.S., 1907; Harvard Univ., M.A., 1908, and Ph.D., 1911. His doctor's thesis covered a new method of producing continuous oscillations by means of what became known as the "Chaffee gap," which was used successfully for radiotelephone transmission of distances from 35 to 50 miles during 1910-11. Harvard Univ., 1913, instructor; 1917, asst. prof. physics; 1923, assoc. prof. physics; 1926, prof. physics; later prof. physics and communication engineering; 1940, prof. of physics and director Cruft Laboratory. Conducted research with electromagnetic waves and experimented in theory of vacuum tubes and associated circuits. Delved into the mysteries and intricacies of the human eye. Engineer with John Hays Hammond, Jr., 1915-24, working on secret radio systems and radio-controlled torpedoes. Credited with contributing to theoretical development and practical applications of the electron tube.

CHIPP, RODNEY DUANE – Ed., M.I.T., George Washington Univ., and McKinley Roosevelt. Active in amateur radio, and in particular the five meter band since 1926. On staff of RCA Institute, Boston, and later lab. asst., M.I.T., participating in the construction of high voltage power supplies for spectroscopy. Then engineer in charge of WKAV, Laconia, N. H. Joined National Broadcasting Co., 1933, as a control engineer, transferring to the television group in 1938. During this period, he participated in many of the early television tests and field programs which were later to become the basis for network system practices. In 1941, served a tour of duty as staff radio officer; later transferred to the newly organized Radar section of the Bureau of Ships in Washington. From 1941 to 1946 concerned with the design and procurement of shipboard radar equipment and responsible for standardization of video and trigger levels for radar repeaters plus the design of complete shipboard video distribution systems. In 1946, became radio facilities engineer of the American Broadcasting Co. For work in the Bureau of Ships, Lt. Cmdr. Chipp was awarded the Commendation Ribbon, with a Citation.

CHRISTALDI, P. S. (1914-). B., Philadelphia, Pa. Grad., Rensselaer Polytechnic Institute, Troy, N. Y., E.E. A fellow in physics, at R.P.I., 1934-35, specializing in wave-guide communication. Received his Ph.D. there, 1938. Became development, and later chief engineer (1941), DuMont Laboratories, Inc., Passaic, N. J. Now engineering manager.

COE, FREDERICK – B., Nashville, Tenn. Grad., Vanderbilt Univ., later studying at Yale Drama School. Director for four years of Civic Theatre, Columbia, S. C. Directed radio dramatic work at Station WSM, Nashville. Produced and directed "Petticoat Fever" a stage success on Broadway in the 1930's. Joined National Broadcasting Co.'s television production staff in April, 1945. Among his productions on NBC television were: "Laughter in Paris," a full-length original drama for video; "A Game of Chess," famous one - act play; "A Strange Christmas Dinner"; "Dark Hammock"; and "The Magis Ribbon Series."

COLLING, ERNEST S. — B., Pittsburgh, Pa. Lehigh Univ. Television producer, actor, journalist, world traveler. Worked with little theatre groups from actor to stage manager and producer. Motion picture editor of *New York Post;* did publicity for Paramount Pictures at Astoria, L. I., studios. With National Broadcasting Co.'s press department from 1933 to 1935, then moved to RCA Department of Information. Aide to Maj. Gen. James G. Harbord. Before war had nearly 100 television hours on air during which time he produced sporting events and weekly video show, Radio City Matinee, which featured such personalities as Leopold Stokowski, Egon Petri, and the then little-known Frank Sinatra. When television was suspended in 1942, he turned to radio production, but in June 1944 returned to NBC's television and has since been active in WNBT's live variety show as producer in NBC Television.

COMPTON, ARTHUR H. (1892-). B., U. S. A. Grad., Princeton Univ. 1916; Cavendish Laboratory in England, research in radiation phenomena. Teacher at Univ. of Minnesota, and Washington Univ. Later Dean of Physical Sciences, Univ. of Chicago. Radiation and atomic physics are his major interests. Early recognition was based on his work with X-rays, namely the "Compton Effect." Nobel prize winner, 1927.

— *Courtesy Harper & Bros.*

Frank Conrad

CONRAD, FRANK (1874-1941). His enterprise led to the founding of the radio industry with the establishment of Radio Station KDKA in Pittsburgh, Nov. 3, 1920. B., Pittsburgh; D., Miami, Fla. Ed., at Pittsburgh schools which he left at the age of 16, after completing the seventh grade, to become a bench-hand in the original Westinghouse plant at Pittsburgh. An insatiable thirst for knowledge and a special aptitude for analyzing mechanical operations — a faculty which became almost legendary in his later years — combined to carry him to the heights of his chosen field of engineering. In 1904, appointed general engineer for Westinghouse and for many years, prior to his appointment as assistant chief engineer in 1921, he served as an assistant to the vice president in charge of engineering.

He operated an amateur radio station 8XK in a garage at the rear of his residence in Wilkinsburg, a Pittsburgh suburb. There, he began playing phonograph records to satisfy the flood of requests from fellow amateurs for special selections to convince skeptics among their acquaintances that music could be heard by radio. A Pittsburgh department store advertised radio sets to hear these programs. This ad led to the decision of Westinghouse officials to establish KDKA which presented the world's first regularly scheduled broadcast Nov. 2, 1920.

He played an even greater part in shortwave development. His experiments in this field date from 1920 when most radio authorities saw little use for these high frequencies and the Federal authorities, holding them in the same unimportant position, assigned them for the use of amateurs indulging their hobby. It was not until 1924, when Conrad demonstrated the possibilities of shortwave service to delegates at an international radio meeting in London — by receiving news from Pittsburgh with a small set and a curtain-rod antenna in a London hotel room — that shortwave radio began to come into its own.

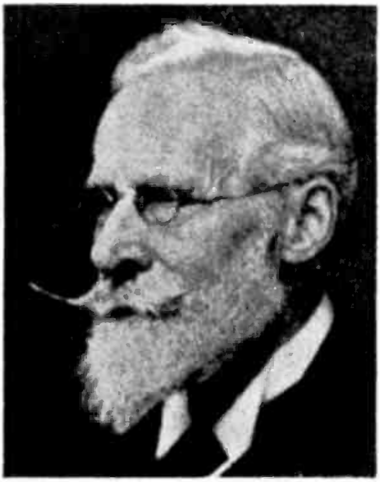
COOLIDGE, WILLIAM DAVID (1873-). B., Hudson, Mass. Ed., Mass. Inst. Tech., E.E., 1895; Leipzig Univ., Ph.D., 1899. Did fundamental physiochemical research, M.I.T., for five years; assistant director, General Electric's House of Magic, 1908; associate director, 1928; director, 1932; vice president and director of research, 1940. Contributed greatly to the advance of electron tubes, electronic devices, X-ray tubes, incandescent lamps, and production of high-voltage cathode rays outside the generating tube. Through his development of ductile tungsten, major advances in incandescent lamps and electron tubes were made. In 1913, he invented the "hot" cathode ray tube (Coolidge vacuum tube).

COY, WAYNE. — Appointed Chairman, Federal Communications Commission in January, 1948. Appointment to be confirmed by Senate. Former Indiana publisher and director of *Washington Post* radio station.

CRAIG, PALMER H. — Inventor of the Craig System of Television. Received Ph.D. in Physics, Univ. of Cincinnati, 1926. Professor of physics and head of Department of Physics, Mercer Univ. Physicist and consulting engineer, Harris Hammond interests, New York. Supervisor, War Research Laboratory, Univ. of Florida. More recently, head of Dept. of Electrical Engineering, Univ. of Florida.

CRAMER, LEONARD F. (1910-). B., Alden, N. Y. Ed., engineering home study courses, Montclair State Teachers College, and Newark College of Engineering. Joined General Motors in sales promotion work (1936). Appointed sales manager of Du Mont Laboratories in 1937. Became vice president and director in 1942. Credited with designing television facilities of WABD.

CROOKES, WILLIAM (1832-1919). B. and D., London, England. Ed., Royal College of Chemistry; later assistant in meteorological department of Radcliffe Observatory, Oxford.



— Courtesy Harper & Bros.
William Crookes

Invented the Crookes tube which isolated the principle of the cathode ray operating in a vacuum. The Crookes tube was first looked upon as a scientific curiosity or toy. But in 1895, Wilhelm Rontgen changed that appraisal when he found that when a Crookes tube was enclosed in a darkened box, mysterious rays emitted rendered fluorescent materials on the outside. For lack of a proper name he used the algebraic symbol for the unknown quantity and named them X-rays. (See cathode-rays.)

Crookes' cathode-ray tube emerged from a study of creation of vacua within a sealed glass vessel by means of electricity. Through developments in the air pump he made it possible to get almost perfect vacuum, which swept many an obstacle from inventors' paths. He recognized the existence of particles of matter smaller than the hydrogen atom. The luminous streams of cathode rays seemed to him as a "storm of projectiles"; he called them "a new or fourth state of matter." Although the exact nature of the particles was a mystery, Crookes sensed the fact that they were different from ordinary molecules. J. J. Thomson later demonstrated that Crookes' beliefs had been correct. Thomson defined the nature of the cathode ray – electrons. The cathode-ray tube became the "eye" of television.

Awarded Royal Medal in 1875; Davy Medal in 1880; Knighted in 1897; and Copley Medal of Royal Society, 1904.

CROTTY, BURKE (1912-). Director of Field Programs for the National Broadcasting Company in television. Started as a messenger in the NBC mail room in 1932, and was promoted to the network's press department and, in 1939, into television. His first show, the opening of the World's Fair at Flushing Meadows, in Long Island, New York, was also NBC's first purely entertainment program. Previously, airings had been designed for experimental purposes. Supervised the televising of President Truman State-of-the-Union address to congress, the United Nations meetings at Hunter College, in the

Bronx, the Louis-Conn fight and other notable news events.

CUFF, SAMUEL H. (1901-). B., of British parents in the American Colony in Jerusalem, Palestine. Attended the American Univ., Beirut, Syria, and the Biblical Seminary in New York City.

In 1937 he was named manager of the Radio Division of the Educational Department of the American Express Co., surveyed television facilities of National Broadcasting Co., planned, organized and operated what was known as the Television Cruise. When NBC Television closed its live studios, he joined Allen B. Du Mont Laboratories, Inc. In 1943, made commercial exploitation manager for Du Dont, and in 1944 he became general manager of WABD. On Dec. 10, 1945, was made general manager of the Television Broadcasting Division of Du Mont. One of pioneer television news commentators, author of numerous television articles, and instructor in television at New York University. Resigned early in 1947. With Allied Stores since, on transcontinental tour presenting television.

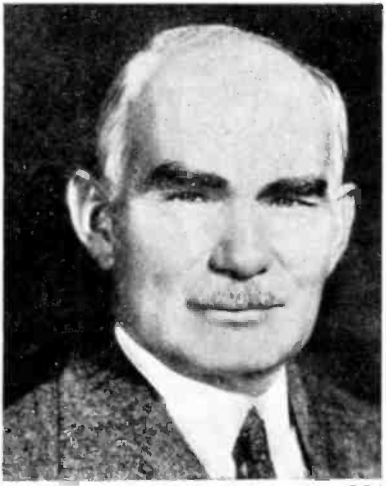
CUMMINGS, B. RAY – Vice president of the Farnsworth Television & Radio Corp., in charge of engineering and research development. Grad., Columbia Univ. in electrical engineering. His professional experience began with the U. S. Navy Department where he served as expert radio aide. From 1921-30 he was division engineer of the General Electric Co., Schenectady, N. Y., in charge of development and design of Government communication and broadcasting apparatus for that company. From 1930 to 1937 he was assistant vice president in charge of engineering for the RCA-Victor Co. From 1937 to 1939 he was vice president of Farnsworth Television, Inc., predecessor to the present firm.

DAGUERRE, LOUIS JACQUES MANDE (1789-1851). French inventor. Best known for his discovery of the daguerreotype process of photography, by which a likeness was fixed on a metal plate by the action of certain vapors. From his invention modern photography developed – and in a sense (image-wise) television. For his invention he was made a member of the Legion of Honor and given a pension. Associated with him was Joseph Nicephore Niepce.

D'ALBE, FOURNIER – In 1924, he proposed a television system which consisted in interrupting the beam reaching the selenium cells at different checkerboard points to produce a carrier signal. The interrupting windows were graduated in number from one end of each scanning line to another. The tubes corresponding to successive scanning lines were rotated at progressively increasing speeds from top to bottom. Thus each element of the checkerboard generated its own carrier signal. The receiver used a set of light vanes operated electromagnetically by the received signal. An acoustic resonating cavity was used to separate out the component of the signal of the frequency corresponding to the checkerboard element in question. Thus the vibration of the vane was responsive only to the signal generated at its corresponding checkerboard element at the transmitter. Through a mirror and optical system the vibration of the vane modulated the intensity of a light beam projected onto a screen. As many resonators and light beams were assembled together at the receiver as there were checkerboard elements.

DA VINCI, LEONARDO (1452-1519). Italian painter, sculptor, scientist, inventor, musician, and architect; one of the most versatile men of the Renaissance. He earns his right to be included in the "family tree of television" by being one of the first persons in comparatively modern times to examine a useful weakness of the human eye — useful, because it enabled television and motion pictures to work successfully as mediums of "motion."

DE FOREST, LEE (1873-). B., Council Bluffs, Ia. Attended Sheffield Scientific School, Yale Univ., Ph.B. 1896. Worked in the dynamo department, Western Electric Co., Chicago. Invented a self-restoring coherer; later in 1892 became vice president of De Forest Wireless Telegraph Co. (which failed several years later). In 1906, invented the audion or three-element radio-electron tube, which was used as an amplifier, made possible the clear reception of radio over great distances. The television researchers found this tube highly effective in boosting the power of the electric impulses generated by the mechanical television scanner. The tube revolutionized wireless and has been classed among the 20 great inventions of all time. It made radiophone and broadcasting possible.



— *Courtesy RCA*

Lee de Forest

De Forest added a zigzag piece of platinnm wire between the filament and plate, which he called the grid. It was also known as "the trigger" device which enabled the energy control of a local battery the incoming waves. With the plate battery still in the circuit, the result was the three-electrode thermionic vacuum tube, a generator of Hertzian waves as well as a detector and amplifier of them. The tube was later enclosed in glass by Clifford Babcock, De Forest's assistant. De Forest is the author of *Television Today and Tomorrow*, published in 1942.

Among numerous honors, he was IRE president in 1930.

DELLINGER, JOHN HOWARD (1886-). B., Cleveland, O. Ed., Western Reserve Univ., Cleveland, O.; George Washington Univ., B.A., 1904; D.Sc., 1932; Princeton Univ., Ph.D., 1913. Joined National Bureau of Standards, 1907, as physicist; became chief of Radio Section of Bureau, 1919. As an originator of basic methods of radio measurements, he initiated and supervised experiments to study radio fading, the ionosphere, and influence of cosmic attacks on radio waves. Did outstanding work in developing radio and antennas for aircraft; also in directing of radio-beacon, and blind-landing systems for use on the airways. Chairman, U. S. delegation at radio conferences in Portugal, 1934; and in Roumania, 1937. President, IRE, 1925. Recipient, Medal of Honor, IRE, 1938, for "development of radio measurements and standards, researches and discoveries of the relation between radio-wave propagation and other natural phenomena, and leadership in international conferences contributing to world-wide cooperation in telecommunications." First chief engineer, Federal Radio Commission, 1928-29; radio editor, Webster's Dictionary; chief of Radio Section, National Bureau of Standards; chief of Interservice Radio Propagation Laboratory; Joint United States Communication Board; chief of Radio Propagation Section; National Defense Research Committee; vice president, International Scientific Radio Union; and chairman, Radio Technical Commission for Aeronautics.

DENNY, CHARLES R., JR. (1912-). B., Baltimore, Md. Ed., Amherst College, 1933; Harvard Law School, 1936. From 1936-38, associated with Covington, Burling, Acheson & Shorb, of Washington, D. C. From 1938-42, in Lands Division, Dept. of Justice, first as attorney in Appellate Section, then as assistant chief, and finally as chief. At same time served as special assistant to Attorney General. Became general counsel of the Federal Communications Commission in Oct. 1942. He became the youngest man ever appointed to the FCC when on June 30, 1944, he was named to the commission as acting chairman. In October, 1947 resigned to join NBC as a Vice President.

DE VENDENIL, M. – B., France. About July 1910, developed a revolving shutter television apparatus. Between the image and selenium cell he interposed a revolving shutter so as to uncover all the points of the image in succession. The image was projected by a lens through a second lens and thence on to a selenium cell. Between the two lenses, the shutter was mounted, so that in actuality there was only one point of the image thrown on the selenium at one time. The shutters traveled at right angles to each other. To produce a corresponding effect in the receiver, he used the variations in an acetylene flame by using a chamber which was divided into halves by a diaphragm. The line current acted upon a magnet, so as to operate the diaphragm, and this gave differences of pressure in the acetylene gas which occupied the second chamber and fed the flames. Thus, a varying brightness of the flame was obtained according to the current in the line. This device was mounted in the receiver and the flame sent light through the lenses to the final screen. Between the lenses, was a second rotating shutter, so that each point of the image was thrown in succession on the screen.

DIECKMANN, MAX – B., Germany. He was director of the Research Laboratory for Radio Telegraphy and Atmospheric Electricity at Grafelfing, near Munich, in the 1920's. Inventor of the Dieckmann process for direct wire or radio picture transmission of the codeless type.

DONER, KITTY – B., Chicago, Ill., of theatrical parents. She became a well-known headliner in vaudeville, playing all the major circuits; starred with her brother, Ted, in the West Coast production of "Lady Be Good"; appeared in the Music Halls of London; made one of the first Warner Brothers singing and dancing shorts. She performed in one of the first television broadcasts at CBS in 1928. In 1939, she joined the production staff at the Roxy Theatre, where she created dance material and became one of the assistant producers. In 1945, she entered the field of television professionally, doing a series of ballets especially created and choreographed for television. These were broadcast under the general title of "Choreotones," and sustained for a period of 10 months at CBS. She directed dances from the controls at Du Mont's Wanamaker studio.

DRAPER, JOHN WILLIAM (1811-82). Anglo-American author and scientist. B., St. Helens, near Liverpool. Ed., London Univ.; came to the U. S. in 1831 and graduated in medicine at the Univ. of Pennsylvania. He became professor of physical sciences in Hampden-Sidney College, Virginia (1837), and later transferred to the chair of chemistry and natural history at New York Univ. (1839), and became professor of chemistry in the medical department on its establishment in 1841. He later also held the chair of physiology (1850), and was president of the medical department for many years. He was the first to take human likenesses, by an improvement of Daguerre's process. His research was in photography, chemical action of light, radiant energy, spectrum analysis, and the chemistry of living organisms. His books included works on plants, the body, history, religion and science.

DU FAY, CHARLES FRANCOIS (1689-1739). Member of the French Academy of Science. Recognized existence of two kinds of electricity and noted that like kinds repel each other; unlike attract. Later, Benjamin Franklin introduced the terms "positive" and "negative" electricity. He found that metal wires or wet objects were the best conductors of electricity although they were the most difficult to electrify. He is believed to have built the first electric transmission line when he strung a thread across a quarter of a mile, suspended it on glass tubes (as insulators), moistened the thread and sent impulses from one end to the other. Today, coaxial cables are used to convey television impulses from one city to another — a far cry from a wet thread experiment of Du Fay.

— Courtesy DuMont Labs.
Allen B. Du Mont

DU MONT, ALLEN BALCOM (1901-), B., Brooklyn, N. Y. Ed., Rensselaer Polytechnic Institute (Troy, N. Y.). Grad., electrical engineering, 1924. With Westinghouse Lamp Co., Bloomfield, N. J., 1924-28, at one time in charge of radio receiving tube production. From 1928-31, chief engineer and vice president of De Forest Radio Co. In June, 1931, organized Allen B. Du Mont Laboratories, Inc., in basement of own home as a cathode-ray tube manufacturing operation. With a $500 investment, he started the company which did $10,000,000 business in 1944.

Developed numerous advances in cathode-ray tube development and operation as well as related scientific fields. From simple commercial cathode-ray oscillographs to large, brilliant, high-definition tubes employing electro-static deflection for television reception, Du Mont has slashed a wide trail of technological advance. Helped create "Magic Eye" tuning indicator, the cathautograph (a mechanism by which writing appears on the cathode-ray tube at a distance from the writer), the Resonoscope (standard of musical frequencies), military, therapeutic and industrial cathode-ray tubes, and theatre television film recording-projection equipment. He holds more than sixty-five separate patents covering these and other advances.

Owns and operates WABD, New York television station, and plans nation-wide network. His manufacturing laboratories, besides cathode-ray tubes, make television receivers.

DUNLAP, ORRIN ELMER, JR. (1896-). B., Niagara Falls, N. Y. Grad., Colgate Univ., B.S. 1920; attended Harvard Graduate School of Business Administration. In 1917, he was chief operator of the Marconi Wireless Telegraph Co. aboard the S.S. Octorora. During World War I, he served as radio operator in the U. S. Navy, graduating from the U. S. Naval Radio School at Harvard as one of the three honor men of the class. He was assigned to duty at the Naval radio station NBD, Otter Cliffs, Me.

Radio editor, *New York Times*, 1922-40. Author of many books dealing with radio and television, including: *Radio's 100 Men of Science*, 1944; *The Future of Television*, 1942; *The Outlook for Television*, 1932; *Marconi: The Man and His Wireless*, 1938; *Talking on the*

Radio, 1936; *Radio in Advertising*, 1931; *The Story of Radio*, 1935; *Dunlap's Radio Manual*, 1924; *Advertising by Radio*, 1929; *Radar*, 1946. Now director of advertising and publicity, Radio Corp. of America.

DUPUY, JUDY – Writer, engineer, producer. Formerly radio editor of the newspaper *PM* in New York. She worked at WNEW and WBNX in New York, was a news broadcaster, and producer of beauty and fashion trade shows, spent seven and one-half months at the General Electric television station WRGB, Schenectady, N. Y., to learn programming and production from the ground up and gather material for her subsequent book, "Television Show Business," 1946. Editor, *Televiser, Journal of Television*.

DURR, CLIFFORD JUDKINS (1899-). B., Montgomery, Ala. Ed., Univ. of Alabama, A.B., 1919; Oxford Univ., England, B.A. in jurisprudence, 1922 (Rhodes Scholar). Admitted to Alabama bar in 1923, and Wisconsin bar, 1925. After 10 years of law practice in Montgomery, Milwaukee and Birmingham, joined legal dept. of Reconstruction Finance Corp. and became assistant general counsel in 1933; later for two years, director, Commodity Credit Corp.; in August, 1941, general counsel and still later a director to newly created Defense Plant Corp. In November, 1941, he was appointed to the Federal Communications Commission.

EDDY, WILLIAM CRAWFORD – Grad., U. S. Naval Academy, Annapolis, following which he served on battleships, cruisers, and extensively on submarines in Far Eastern waters. In 1934, an increasing deafness forced his retirement from active duty. Starting in television with Philo Farnsworth in Philadelphia in 1934, he joined NBC television in New York in 1937 as chief of video effects. He developed the lighting system now in use at studio there, and duplicated on smaller scale at WBKB. The system was used in modified form at other television stations throughout country. Inventions developed during this period included Projection Kaleidoscope, used extensively in NBC television programming, and the optical-mechanical dissolves used in title work. He joined Balaban & Katz Corp. as director of television, in the fall of 1940. Devices developed in connection with this work include a focusing device, new design for television cameras, and a collapsible lighting stand for field work. Eddy has approximately 50 patents on file or in preparation. After Pearl Harbor, he organized and supervised the operation of "Radio Chicago," training center for instruction of qualified technical personnel for Navy radar equipment. Made permanent captain, he was released from the Navy in 1945 and returned to Balaban & Katz as director of television. Late in May, 1946, he was recalled by the Navy Dept. for temporary duty as civilian consultant in connection with rebuilding the Naval Electronics Television program. Author: *Television, Eyes of Tomorrow*, 1945; has written articles on television for technical publications.

EDISON, THOMAS ALVA (1847-1931). "America's greatest inventor," according to several science writers. B., Milan, O. D., West Orange, N. J. Although he had little formal education, he early showed inventive genius. As a telegraph operator, he invented the transmitter and the receiver for the automatic telegraph and the quadruplex telegraph system. Started laboratory in New Jersey where he invented the mimeograph, improved the first typewriter, invented the telephone transmitter, and the phonograph. His most important contribution was in the electric lighting field in 1878, when his incandescent lamp, dynamo, and other electrical devices were put into use. In 1887, he perfected the kinetoscope into the moving picture machine. He was a most prolific inventor, holding over 1200 U. S. patents. In 1875 while on the track of wireless, Edison observed "new manifestations of electricity through mysterious sparks of an oscillatory nature." He examined the phenomena using what later was termed "Edison's famous black box." Within it, he had two carbon points which formed a micrometer gap across which tiny sparks could be seen through a window. Here was a strange force that had a tendency to diffuse or spread out in all directions; he could even draw the sparks from the gas pipe in his laboratory. He named it "etheric force"; it remained for Heinrich Rudolph Hertz to prove the existence of wireless waves. The "Edison Effect" was a phenomenon observed in 1883. (*See Edison Effect.*)

EDWARDS, BADEN JOHN (1912-). B., London, England. Ed., Woolwich Polytechnic and London Univ., England. Carried out research on television at Woolwich Polytechnic, 1930-33. Engaged in Cathode Ray Oscilloscope research under L. H. Bedford, at A. C. Connors; then research development at Standard Telephones & Cables on transient recorders. Started with Pye, Ltd., Cambridge, England, in 1935 as assistant chief engineer; made chief engineer, 1939. Engaged during World War II on controlling research and development on radar communication apparatus and proximity fuzes until 1943; then technical adviser to Air Chief Marshall Sir A. T. Harris, head of R.A.F. Bomber Command.

EINSTEIN, ALBERT (1879-). Formerly of Germany; came to the United States, acquired American citizenship in 1940. Physicist and mathematician. B., Ulm, Germany. Ed., Munich; and in Zurich, Switzerland. He was engineer in the Swiss Patent Office from 1902-09; professor of physics at Univ. of Zurich; and later director of the Kaiser Wilhelm Institute. His famous theory of relativity brought him universal fame and homage. He left Germany in 1933 and came to the U. S. where he first did research at Mt. Wilson Observatory, and later became head of mathematics at the Institute of Advanced Study at Princeton Univ. To television he brought the theory of photoelectric effect in

1905 which later was to become the fundamental principle of the modern television camera. It defined the way in which the camera would turn a picture into electricity.

ELLEFSON, B. S. (1911-). B., Canby, Minn.; received B.A. in chemistry from St. Olaf College, 1932; M.S. in chemistry from Univ. of Minnesota, 1933; served as Teaching Fellow in chemistry, New York Univ., 1933-34. Ph.D. in ceramics from Pennsylvania State, 1937. Director of the Central Engineering Laboratories for Sylvania Electric Products, Inc. Began pure and applied research on fluorescent powders and glass for cathode ray tubes for Sylvania Electric in March, 1937 and continued work through 1944 until his appointment as assistant to the vice president in charge of engineering. He holds several patents covering fluorescing chemical compounds which have helped make television images better with respect to brilliance and definition. Has applied for several patents for similar materials developed during the war to improve radar screens. His work with screens for color television viewing tubes began in 1940 and resulted in some of the first practical tubes.

EMERY, BOB (1899-). Radio program pioneer. Founded his "Big Brother Club" in Boston area (1922), one of radio's first organizations for children which has auditioned more than 18,000 youngsters for the series. In 1929 he moved his children's club to NBC; and in 1935 joined WOR where he instituted his "Rainbow House" program. Began television career in 1943 when he produced and directed series of WOR presentations over WABD in New York City. Later produced variety of programs including drama, comedy, quiz, and music. President, Television Producers' Association, 1946. Joined Du Mont late in 1946; presently program department manager of Station WABD.

ENGSTROM, E. W. — Grad., Univ. of Minnesota, Minneapolis, E.E. Associated with General Electric Co. for seven years before joining Radio Corp. of America in 1930, he served thirteen years in RCA research positions. In 1943 he was made director of research of RCA Laboratories, supervising research and engineering in wartime advances in television, radio, radar, and other electronic developments. In 1945, he became vice president in charge of research, RCA Laboratories Division.

ESPENCHIED, LLOYD (1889-). Electrical engineer. B., St. Louis, Mo. One of those mainly responsible for the development of the wide-band coaxial cable system whereby it became possible to transmit by wave-guides frequencies of millions of cycles — frequency which previously had been regarded as the province solely of radio. Invented a quartz crystal band-filter widely used for carving out sharply the communication channels of carrier and radio systems. Consulting engineer for Bell Telephone Laboratories. Cited for technical achievement by Television Broadcasters' Association, 1945. In December, 1945, TBA presented him with one of the five Co-ordinate Awards "For

— *Courtesy Harper & Bros.*
Lloyd Espenchied

adapting the coaxial cable to transmitting wide bands of radio frequency suitable for modern television."

FARADAY, MICHAEL (1791-1867). Physicist and chemist. B., London, England. He was self-educated. He built an "electrical machine" with a disc of copper between the poles of a large magnet. A metal brush rested on the shaft of the disc and another on the rim. Then he turned the disc and the result was a continuous current — the first dynamo ever built. For the first time mechanical motion had been converted into electrical energy. The generation of electricity by causing magnets and coils of wires to rotate relatively to each other marked the beginnings of an era of electrical "magic." Famous for his discovery also of magnetic induction plus his study of the transformation of mechanical energy into electrical which laid the foundation of modern electrical science. He was appointed assistant to Sir Humphry Davy, Royal Institute in London. Author: *Experimental Researches in Electricity*, 1839-1855; "*Researches in Chemistry and Physics*, 1859, etc. He introduced the terms electrode, anode, and cathode.

FARNSWORTH, PHILO TAYLOR (1906-). At the age of 15 he propounded a workable system of electronic television. Ed., Brigham Young Univ. He was a dreamer who became interested in "a thing called television" and determined to devote his life to it.

— *Courtesy Farnsworth Television*
Philo T. Farnsworth

One day when applying for a job in connection with the Salt Lake City Community Chest, he met Leslie Gorrell and George Everson, who were conducting the drive. Farnsworth was hired and becoming friendly with the two other men, he confided his interest in television to them. Everson agreed to finance Farnsworth, and a laboratory was set up in Los Angeles in October, 1926, establishing the Crocker Research Laboratories in San Francisco to "take all moving parts out of television." In 1927, Farnsworth transmitted his first image, a 60-line picture of a dollar sign. The company was reorganized as Television Laboratories, Inc., and later, in May, 1929, was renamed Farnsworth, Inc., of California. The Farnsworth Television & Radio Corp. was organized in 1938. Farnsworth was a vice president of that firm. He later resigned as research director. He resides in Maine, where he maintains a laboratory.

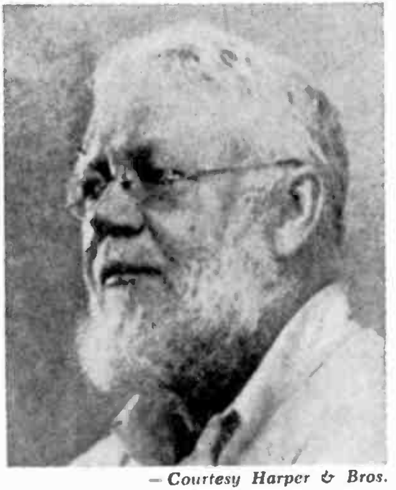
Milestones in Farnsworth's development of electronic television: 1927, he completed an electronic television system developed including the revolutionary Farnsworth Dissector tube; 1928, developed the electrical discharge apparatus which was an improvement over the first dissector tube and replaced electrostatic focusing and scanning by magnetic means; 1930, developed a new television scanning and synchronizing system, the net effect of which was to make television commercially practical, to take it out of the laboratory and make it suitable for the home; also designed the elec- first tube to embody the so-called image amplifier principle, making possible a great gain in sensitivity and flexibility, enabling the pickup of images with much less light; 1933, invented the multipactor, a tube in which an electronic cloud was caused to oscillate back and forth between two electrodes, producing secondary electrons at each impact with them, and multiplying the number of electrons a million times; in 1934, came the oscillator-generator, an improvement on the multipactor, making possible the efficient generation of ultra-high-frequency waves. Since 1934, achievements of Farnsworth laboratories have included development of special power tubes for television and other high-frequency transmission, refinements in television transmitting and receiving equipment.

FATES, GIL (1913-). B., Newark, N. J. Grad., Univ. of Virginia, 1937. From 1937-41 he was associated with Bob Proterfield in Barter Theatre of Virginia; later he was stage manager of the Alexander Woollcott road company of "The Man Who Came to Dinner"; played with Joan Bennett in "Stage Door" and performed in several other large productions. Joined Columbia Broadcasting System as an emcee and writer for the original "CBS Television Quiz" in 1941. He entered the U. S. Coast Guard in 1942, graduated from New London Academy and became skipper of his own ship, convoying along the Atlantic Coast and later through the English Channel during the invasion. He was discharged in March 1946, when he rejoined CBS Television as assistant to the program director, and master of ceremonies.

FEINER, BEN F., JR. (1904-). B., New York City. Ed., Princeton Univ. and Columbia Univ., B.A. Started with Columbia Broadcasting System in August 1942, as manager of shortwave script division, and shortly afterwards became head of script division and supervisor of broadcasts beamed to American forces overseas. In October, 1943, named assistant in charge of program planning for shortwave department, transferring from there to television early in 1944. Served as assistant program director of CBS Television until his appointment as acting program director in March, 1946. Directed and produced first Norman Corwin program in television, "Untitled," for the Sixth War Loan. Created-directed-produced "Opinions on Trial," 1944-45 American Television Society's award winner as the year's outstanding educational program. Left CBS in May, 1947.

FERGUSON, JOSEPH C. (1909-). B., Beaumont, Tex. Ed., Louisiana State Univ., B.S. in E.E. Grad. work, Harvard Univ., majored in communications engineering, 1934-35. With Westinghouse Electrical & Manufacturing Co. as junior engineer, 1930-34. He did development work in the higher frequencies and designed television power amplifier atop the Empire State Building in New York City. With RCA as radio design engineer, 1935-39, he made major developments and improved styling in transmitters, worked on power supply and all modulator circuits, pictures and sound coordination of equipment so that an entire television system would work as a unit. In 1937, he developed a relay transmitter for remote pickups — one of the first transmitters which could pick up a live program for relay to the main transmitter. Joined Farnsworth Television & Radio Corp., 1939. Later was made chief engineer. Made numerous developments in the field of television and holds patents on other electronic devices.

FERREE, MARVIN — Developed a system of transmitting photographs by radio. (See *Ferree System*.)



— *Courtesy Harper & Bros.*

Reginald Aubrey Fessenden

FESSENDEN, REGINALD AUBREY (1866-1932). B., East Bolton, Quebec. Ed., Bishop's College, Lennoxville, Quebec. Principal, Whitney Institute in Bermuda. Tester with Edison Machine Works; later assistant to Edison, then chief chemist of Edison Laboratory. From there he went to Purdue Univ., 1892, as professor of electrical engineering; then to Univ. of Pittsburgh (formerly Western Univ. of Pennsylvania), at Alleghany. Wireless expert of U. S. Weather Bureau. Credited with more than 500 inventions in electric waves, sound, and light. Encouraged Alexanderson to develop the alternator that won renown, and when used at Brant Rock, Mass., established communication with Machrihanish, Scotland. His electrolytic, or chemical detector, demonstrated in 1902, increased the range and effectiveness of wireless. As a detector it was a step between the coherer and the crystal to the electron tube.

FINCH, WILLIAM GEORGE HAROLD (1895-). B., Birmingham, England. Ed., electrical engineering course with Allis-Chalmers, Norwood, O.; radio communication course, Marconi Institute, New York, 1917; completed course in radio engineering and patent law, Columbia Univ., 1923. Engineer, editor. With Cleveland Electric Illuminating Co., 1916-17; inspecting engineer, National District Telegraph Co., N. Y. C.; New York Compensating Rating Board, 1917-19; electrical engineer, Royal Indemnity Co., 1919-21; radio engineer and editor, International News Service; radio editor, *N. Y. American*. Established first radiotypewriter press circuit between N. Y. and Havana, 1933. Chief radio construction engineer, Hearst Newspapers; technical director, Hearst Newspapers Radio Service; chief engineer and secretary, American Radio News Corp. (a W. R. Hearst Corp.), 1929-34; assistant chief engineer and chief telephone engineer, engineering division, Federal Communications Commission, and chief engineer, federal investigation telephone cos. President, Finch Telecommunications Labs, N. Y., since 1935; vice president, Station WCAE, Pittsburgh.

FINK, DONALD GLENN – Grad., Massachusetts Institute of Technology, 1933, B.S. in electrical communications. From 1933 to 1934, he was a research assistant in departments of geology and electrical engineering, M.I.T. He lectured on electronics, atomic physics, radiant energy in the engineering department, Westinghouse Lamp Co. Since June, 1934, except for a four-year war leave, he has been on the editorial staff of *Electronics*, technical magazine; later, he became managing editor, and then executive editor of that paper. In May, 1941, on leave from *Electronics*, he joined the Radiation Laboratory at M.I.T. and was assigned to a group that developed the Loran navigation system which since 1942 provided guidance to ships and aircraft. He headed Loran Division of the Laboratory in 1943, and soon thereafter traveled to England and Africa installing Loran service for navigation of bombers over Germany. Transferred to the Office of Secretary of War to advise Army Air Forces on uses of

Loran and related navigation devices. He was consultant at headquarters of Army Ground Forces on radar. Member, War Dept. Committee on navigation and traffic control. Member, Television, RTPB; member, national television system committee on traffic control of Radio Technical Commission for Aeronautics, and participated in the State Dept. preparatory conference on telecommunications. An "assimilated" commander in Navy (privileges and authority of rank but no pay), he participated in atomic bomb tests (Operation Crossroads) as assistant to the Navy's electronics coordinating officer for the operation. Author of *Principles of Television Engineering*, 1940; *Television Standards and Practice*, 1943; *Microwave Radar*, first textbook on radar — so secret at the time it was written that a complete printing plant was moved into the laboratory to print it.

FLEMING, AMBROSE (1850-1945). B. and D. in England. Classed as one of the greatest scientists of his time in British practical science, he studied science at London and Cambridge Universities. At Cambridge he worked with Clerk-Maxwell, Scottish mathematician and physicist whose researches laid the foundations of the whole theory of electromagnetic wave forms and their propagation. Fleming's earlier work was chiefly on development of electric lighting. It was a result of his research into the electric lamp that Fleming became aware of the emission of electrons by a heated filament in a vacuum.

His development of this discovery, together with the researches of two other British scientists, O. W. Richardson and J. J. Thompson, gave rise to the development of the whole field of electro - thermionics, and thermionic tubes, and all that has derived from them. From that time on, Fleming was chiefly concerned with the development of radio. Associated with design and installation of many early stations of Marconi Company, he did much to make possible the measurement of the frequency of radio waves. It was his invention of the simple diode tube — a tube containing a filament and an anode — that made possible the first really efficient detector of wireless waves. Without this development the possibility of speech broadcasting might have been long delayed. Since 1904, when Fleming's first diode was used, there have been many changes and developments, but essentially and basically it is Fleming's diode that is at the heart of every tube used for radio reception and transmission, television, radar, talking pictures and the other electronic devices of every conceivable use.

FLY, JAMES LAWRENCE (1898-). B., Seagoville, Dallas Co., Tex. Ed., U. S. Naval Acad., 1920; LL.B., Harvard, 1926. Began as naval officer, 1920, retired from naval service in 1923; law clerk, 1925; lawyer, 1925-29; special assistant, U. S. attorney (Government counsel in actions involving restraint of trade under Federal antitrust laws and regulatory measures under commerce power, 1929-34); general solicitor, Tennessee Valley Authority, and general counsel, Electric Home and Farm Authority, Inc., 1934-35. Chairman, Federal Communications Commission, presiding over Allocations Hearings on Television, etc., during 1945; resigned to go into private practice.

FOLSOM, FRANK M. (1894-). B., Sprague, Wash. Spent 30 years in retail mail order, chain store distribution fields in San Francisco; Montgomery Ward & Co. (vice president in charge of merchandising), Chicago; and other business organizations. Deputy director of purchases for War Production Board; chief, Procurement Branch of U. S. Navy. In 1944 he was named vice president and director, Radio Corp. of America, in charge of manufacturing division, RCA-Victor; later made executive vice-president.

FRANKLIN, BENJAMIN (1706-1790). B., Boston, Mass. American statesman, scientist, printer, etc. Founded the study of static, or atmospheric electricity. In the summer of 1752, his kite experiment enabled him to draw sparks from lightning during a thunderstorm. He made a kite with a wire projected from the upright stick and to the end of the kite string attached a length of silk ribbon for holding it, and a metal key from which to draw the sparks. The kite went up during a thunderstorm while he sheltered himself in a shed. He noted that the floss on the twine bristled as if electrified and as the kite string was made wet by the rain, it became a still better conductor and yielded sparks to the key. He established the law of conservation of the electric charge and determined that there was a "positive" and "negative" kind of electricity. His theories led others still later to the discovery that air could be substituted as the insulating material (dielectric) in place of glass in the construction of a leyden jar or condenser.

FRANKLIN, CHARLES SAMUEL (1879-). B., Walthamstow, England. Ed., Finsbury Technical School, England. With Manchester and later, Norwich Electricity Co. He joined the Wireless Telegraph & Signal Co. (Marconi Co.) in 1899. He did intensive research in short-wave, ultra-short and microwave spectrums and designed a short-wave beam transmitter and devised a flat-grid aerial which became noted as the beam aerial, giving England an imperial, all-empire, globe-girdling system of communication. In 1919 he succeeded in using electron tubes for generation of very short waves. He became Marconi's right-hand man in experimental research with numerous important patents credited to him. He concentrated radiation into a narrow searchlight-like beam, and built a special short-wave transmitter employing tubes of his own design. "The history of radio records that beam wireless is based on the original work done and the intuition and technical foresight of Marconi and Franklin." *

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* "Radio's 100 Men of Science," by Orrin E. Dunlap, Jr. Harper & Brothers, 1944.

FRAUNHOFER, JOSEPH (1787-1826). B., Bavaria. An optician by training, he specialized in grinding lenses. He was first to polish lenses, and mirrors, without altering their curvatures. Invented a machine for polishing parabolic surfaces. While observing the spectrum of a candle flame, he noticed a pair of narrow isolated lines which next led him to investigate sun's spectrum. Here he found large numbers of dark lines — some intense, some faint. By his keen observations and proper interpretation he gave new insight to problems of spectrum analysis. Physicists and astronomers now call such dark lines "Fraunhofer Lines." His link with television will undoubtedly merit more notable credit when color television finally comes into its own as a commonplace method of transmission and reception.

FROMENT, GUSTAV — Worked on final development of Abbe Giacomo Caselli's "Pantelegraph." Lived in Paris.

GALVANI, LUIGI (1737-1798). Italian physiologist and physician. B., Bologna, Italy. Studied medicine under the distinguished physician Galeazzi, whose daughter he married. Became professor of anatomy in 1762 at the Univ. of Bologna. His wife brought his attention to the fact that the muscles in a dissected frog's legs twitched and contracted spasmodically at the touch of a scalpel charged with electricity. He thereupon instituted a long series of experiments, as a result of which he wrote his treatise, "De Viribus Electricitatis in Motu Musculars," in 1791. (See *Galvanism* and *Galvanometer.*)

GAMBLE, R. B. "BUD" (1906-). B., Philadelphia. Ed., Univ. of Pennsylvania. Began his showman career as stage manager and director for theatres in Philadelphia, Rye, N. Y., and Boston. Worked on television production with Atwater Kent, RCA, and General Electric before joining Farnsworth in 1939. Manager of Farnsworth Corp.'s Mobile Television Unit which toured the country in 1939-40, demonstrating television to more than 4 million persons. In New York, since 1941, producer of television shows. Independent television producer and production consultant for the Farnsworth Television & Radio Corp. Formerly president, Television Producers' Association, New York.

GAUSS, KARL FRIEDRICH (1777-1855). German mathematician. B., Brunswick. Won early repute by his "Disquisitiones Arithmeticae" (1807). From 1807 until his death he held the directorship of the Göttingen observatory. In 1833 in association with W. E. Weber (see) he constructed a magnetic observatory at Göttingen, and a Magnetic Association was organized. At that time they discovered they could transmit telegraph signals over a line making use of induced currents produced by the motion of a coil of wire surrounding a bar magnet. These are probably the fundamental discoveries upon which the present-day electrical communications systems are based.

GEISSLER, HEINRICH (1814-79).

German inventor and physicist. B., Saxe-Meiningen. Spent time in Holland and finally settled in Holland in 1854. Among his inventions are a mercury air pump, an aerometer, a voporimeter, and the Geissler tube.

GERNSBACK, HUGO (1884-). B., Luxembourg City, Luxembourg. Ed., Ecole Industriele, Luxembourg; Technikum, Bingen, Germany. Came to the U. S. in 1904, he was a pioneer manufacturer, editor, and publisher. Started and published first radio magazine, *Modern Electrics*, 1908; opened first radio store, New York City, 1909; wrote first radio phone (broadcasting) book on record, "The Wireless Telephone," 1910; wrote first technical and illustrated description of radar as far back as December, 1911, in *Modern Electrics*. Made hundreds of predictions in radio, television and electronics which eventually came true. Among them were (1) "Visual radio reception – the oscilloscope and tuning eye indicator" of today; (2) "Television without wires" – forecasted present-day radio television; (3) Prediction of "cathode-ray tube for television" – now universally used; (4) Use of "short waves for both sight and sound"; (5) "Radio Controlled Television Plane," a prediction realized about two decades later during World War II.

Television, published by him in the Summer of 1927, is said to have been the first television magazine in the world. The first regular broadcasting of images by television over the radio was made from New York (Aug. 14, 1928), over WRNY, at the Hotel Roosevelt.

Gernsback is of the belief that television for the masses is still far away because of the prohibitive costs. "Television as it exists today cannot be compared to the early days of radio when every boy could buy parts to make a receiver, or buy a wireless set for about $7.50." He believes that television cathode ray tubes are too cumbersome and big. "Scanning line-by-line, both horizontally and vertically, is still a crude method. Until the image is transmitted in its entirety, not as in present systems of line-by-line, television will continue to be in its present crude state. Someday, some new genius will solve the problem, thus eliminating large - equipment, and higher prices. When television sets will be made available at prices for the millions of prospective viewers, then television will have arrived." (From an interview with the author, 1947.)

Author: *The Wireless Telephone*, 1908; *Radio for All*, 1922; *Ralph 124 C 41 Plus* (a scientific romance), 1925. Editor, *Official Radio Service Manuals, Official Auto Radio Manual, Official Short Wave Radio Manuals.* Inventor of hypnobioscope, a machine used to instruct sleeping individuals; the osophone, an instrument enabling those hard of hearing to hear through their teeth; also a number of radio instruments and radio circuits, interflex, and peridyne.

GESSFORD, R. K. (1906-). B., Niagara Falls, N. Y. Grad., Univ. of Maryland, 1929, B.S. in electrical engineering; graduate study: Univ. of Pittsburgh, Univ. of Michigan, and

Pennsylvania State. Majored in cathode ray tube design and development work for Sylvania Electric Products Co. since 1937, starting as a cathode ray tube engineer; supervisor of cathode ray and gas tube design and development in 1940; supervisor of cathode ray tube engineering department in 1942; supervisor of special tube product engineering in 1943; and company television coordinator in 1946. His specific contributions to the cathode ray tube art included screen development and application, mechanical design and electrical design. Chairman, Joint Electron Tube Engineering Council Committee on Cathode Ray Tubes for the Radio Manufacturers' Association, which develops standards and does engineering work for cathode ray and pickup tubes.

GIAMPIETRO, MARIO – B., Montevideo, Uruguay. Since 1924 he has staked out a claim of being the first South American to broadcast visual images successfully over a distance of more than a mile, and to hold first successful exhibition of television broadcasts in South America. Uruguay Congress employee, he is a self-educated radio technician. Worked on a scanning system broadcasting outdoor scenes of 440 lines, although interior images in that country have usually been confined to 220 lines. In one experiment he used fluorescent tubes to illuminate night and reported satisfactory results despite their limited intensity. Granted an experimental wave length, he was authorized use of CXHAQ as his call letters. He is said to be working on idea of broadcasting three-dimensional images.

– Courtesy Harper & Bros.

William Gilbert

GILBERT, WILLIAM (1544-1603). Scientist. B. and D. at Colchester, England. Studied at both Cambridge and Oxford, receiving his A.B. degree from St. John's College, Cambridge. In 1569 achieved his degree of M.D. and in 1600 was appointed physician to the Court of Queen Elizabeth. He wrote "Of the Magnet and Magnetic Bodies, and That Great Magnet the Earth," published in 1600. It reported his many experiments in electricity and magnetism and his important discovery that the earth itself is a huge globular magnet. He used the term "electric" after the Greek word "elektron" to describe the attraction of amber and other bodies for certain light objects, when subject to friction. He discovered that many materials besides amber had the power to attract light things after being rubbed, while others did not. To prove it, he held the particles excited by friction toward an "electroscope" which he invented. It was a straw pivoted like a compass needle so that it indicated the approach of an electrically charged body. For example, he discovered that glass, sealing wax, diamond and other crystals were electric, while ivory flint, marble, metals, and the emerald were non-electric. Scientists have since learned that all bodies are capable of becoming electric when "frictionized," if they are properly insulated. Many of his discoveries were later incorporated in television devices or apparatus of one kind of another.

GOLDMARK, PETER C. (1906-). B., Budapest, Hungary. Ed., Universities of Berlin and Vienna. Ph.D., 1931. Associated with Pye Radio, Ltd., Cambridge, England, from graduation to 1933, engaged in television activities. Joined CBS in 1936, where, as chief television engineer, he supervised installation of the first CBS television transmitter atop the Chrysler Building in New York City. Later, director of engineering research and development, Columbia Broadcasting System. Invented CBS system of full-color television, first publicly demonstrated in September, 1940. Engaged exclusively in electronic research for the armed services during World War II. From this research, developed and demonstrated a system of color television in 1945, using a 16-megacycle band (480-496 megacycles) in the ultra-high frequencies. Received Morris Liebman Memorial Prize, in 1945,

—Courtesy CBS

Peter C. Goldmark

in recognition of outstanding contributions to electronic research. Author of many scientific papers and holder of several patents on scientific inventions.

GOLDSMITH, ALFRED NORTON (1887-). Engineer. B., New York City. Ed., College of the City of New York, B.S. 1907; and Columbia Univ., Ph.D. 1911. Professor of electrical engineering at CCNY; and director of research, Marconi Wireless Telegraph Co. of America, 1917-19. Consulting

HALEY, WILLIAM JOHN (1901-). B., Jersey, England. Ed., Victoria College, Jersey. At sea, 1918-19. Joined *Manchester Evening News* as reporter, 1922; chief sub-editor, 1925; managing editor, 1930; director *Manchester Guardian & Evening News Ltd.*, 1930; joint manager-director, 1939-45; director, Press Association, 1939-43; director, Reuters, 1939-45. Undertook mission to U. S. for Reuters in 1942; second mission to Australia, 1942 - 43. Editor - in - chief, British Broadcasting Corporation, 1943-44.

HALLMARK, CLYDE EDWIN (1909-). Project engineer. Grad., Tri-State College, B.S. in E.E., 1930; graduate work at Univ. of Pennsylvania. Analyst with Western Electric Co., 1929; electrical research department of Leeds-Northrup Co., conducting research work on problems of precision measurement devices and methods at communication frequencies, 1930-31; Acoustics Research Laboratories of American Steel & Wire Co., 1932; Ken-Rad Corp. as commercial engineer working on receiving tubes and tube application problems in television receivers, 1933-35; research division of RCA working on television receivers, test equipment and radar equipment, 1935 to 1941. Since 1941 with Farnsworth Television & Radio Corp. of which he is currently project engineer of television studio equipment. He is experienced in the construction and analysis of operation of transmission networks of the low-pass and band-pass types in the "lumped constant" frequency range for applications in various wide-band systems, development of amplifiers and filters as applied to television, and ultra-high frequency amplifier and oscillator problems.

John Hays Hammond, Jr.

HAMMOND, JOHN HAYS, JR. (1888-). Scientist. B., San Francisco, Cal. Grad., Yale Univ., 1910. Founded the Hammond Research Corp., Gloucester, Mass. Predicted before leaving college that some day he would control a moving body at a distance by the sound of his voice. His remote controlled boat "Radio" later fulfilled his prediction. He described a projected system whereby a combination of television and direction finding, the pilot of an airplane approaching an airport in a fog could see on a small screen in the dashboard, an image of the airport and its surroundings together with his position over it. This was done by televising on the ground a model of the airport on which the constantly changing positions of the plane, as indicated by cross bearings taken from the radio signals coming out of the plane, were marked. The television signals were then radioed to the plane. He was a consultant to RCA. Hundreds of patents pertaining to television, ultra-short waves, frequency modulation, direction finders, circuits, etc., were granted to him. With the advent of radio broadcasting, he suggested a pay-as-you-listen system utilizing a coin tune boxing.

HANSON, O. B. (1894-). B., Huddersfield, England. Ed. at school in Broad Brook, Conn. (His father had moved the family to Conn.) Then back to England for eight years. Later returned to U. S., studied electricity, drafting and automotive engineering at night at Hillyer Institute, Hartford, Conn., while working days at Underwood typewriter factory. During a radio career spanning nearly three decades, he was successively a radio operator at sea, chief testing engineer, American Marconi Co.; a pioneer broadcaster at Station WAAM in Newark, N. J.; and assistant to the plant engineer at Station WEAF in New York City before joining NBC. When NBC was organized in 1926 he went to the firm and has since directed technical operations and engineering activities therein. His association with television dates back to the days of mechanical scanning systems through the period of experiments with ultra-short waves and the final installation of the all-electriconic systems at Radio City and the Empire State Building transmitter of NBC. Has an international reputation as a radio engineer. Since the inception of radio broadcasting, he has contributed largely to its technical development. Credited with half-dozen significant inventions and hundreds of his suggestions have been built into equipment developed at Radio City. Named chief engineer several years after NBC began operations and a vice president in 1938.

HARBORD, (General) JAMES GUTHERIE (1866-). American Army officer, and executive, Radio Corp of America. Served in Cuba; with Pershing in Mexico, 1916; Chief of Staff, A.E.F. in France, 1917; commander, marine brigade, Chateau Thierry. From Jan. 1, 1923-1930, second president of RCA; since Jan. 3, 1930, chairman of the board of directors.

HEAVISIDE, OLIVER (1850-1925). Engineer. B., London. D., Torquay, England. In the science of radio it has long become recognized that up in the sky, at an altitude of 60 miles and higher, billowing up and down like the big top of a circus tent, is the "Heaviside Layer." It is the ceiling or mirror that reflects radio waves back to the earth. For that discovery Sir Heaviside is linked with world-wide radio since his theory accounts for the ease with which short waves hop, skip and leap around the globe. His fame is pinnacled upon the laws governing propagation of energy in electrical circuits, which led him to investigate the effects of land, water and the upper atmosphere on the propagation of wireless waves. Engaged in tele-

— *Courtesy Harper & Bros.*
Oliver Heaviside

graph work for several years but retired in 1874. Thereafter, he studied Maxwell's theory and applied it to telegraph and wireless problems, expounded the theory of the existence of a permanently ionized layer in the upper atmosphere capable of deflecting eltctromagnetic waves and thus permitted wireless communication around the world. Heaviside's theory supposes the assumed layer or stratus to consist of heavily ionized gas which is conductive and acts as a gigantic reflector of electromagnetic (radio) waves. It is this layer which is supposed to reflect the electric waves and compel them to follow the curvature of the earth. The theory, if true, partially explains why signals are transmitted over great distances instead of being radiated off into space and lost.

HEISING, RAYMOND A. (1888-). B., Albert Lea, Minn. Grad., Univ. of North Dakota, E.E., 1912; Univ. of Wisconsin, M.S., 1914. Joined Western Electric Co. (later Bell Telephone Laboratories), engineering department. Extended use of electron tubes, developing important inventions in vacuum-tube technique, oscillators, modulators, and amplifiers as well as in carrier current and radio transmission systems. Holder of more than 120 U. S. patents. Multi-channel carrier telephone systems are a result of his early work. Some of his radio inventions were applied in first long-distance radiophone communication from Arlington to Paris in 1915. The economical and practical method of constant current modulation which he invented was used in nearly all high-power broadcasting stations for many years. Delved also into short wave and piezo-electric phenomena.

HELT, SCOTT (1907-). B., Prichard, Ala. Member of the Radio Division, Interstate Electric Co., New Orleans, La., 1926-1930; 1930-32, Vice-President, chief engineer, Mobile Broadcasting Corp., Mobile, Ala.; 1932-34, radio engineer, Station WKBF (now WIRE), Indianapolis, Ind.; 1934-35, radio engineer, Station WLAP, Lexington, Ky.; 1935-44, chief engineer, Station WIS, Columbia, S. C. and chief engineer, Columbia, S. C. police radio system, 1941-44; 1940-43, instructor (evenings), radio engineering, Univ. of South Carolina, Columbia, S. C. During part of 1944 was on loan to Major Edwin H. Armstrong, FM Station W2XMN, Alpine, N. J. More recently, chief network engineer, television broadcasting division, Du Mont Laboratories, Inc.

HENRY, BABETTE ("BOBBIE") L. Grad., Cornell Univ., 1936. Joined Columbia Broadcasting System television as secretary in October, 1939, and worked with all producers there. Became office manager, a production girl and then assistant director at time war closed down television. Transferred to radio at CBS – local station WABC in New York. Became a director. In May, 1946, joined American Broadcasting Co. and has been directing television shows for ABC at Schenectady.

HENRY, JOSEPH (1797 - 1878). American physicist. B., Albany, N. Y. Ed. at Albany Academy; later became a professor there. Went to Princeton Univ., then known as the College of New Jersey (1832-46). First secretary of the Smithsonian Institution at Washington, D. C. (1846-1878); president, National Academy for the Advancement of Science. His discoveries and experiments in the field of electromagnetism were widespread and important to the later development of radio, telephone and telegraph. In 1827, while still at Albany Academy, he gave a demonstration of an insulated magnet by wrapping the iron core with copper wire that was covered with silk and then passing an electric current through it. He made an electromagnet for Yale Univ. showing the increased lifting power produced by insulation. A unit of electric self-induction termed "henry" is named in his honor. He was also interested in acoustics, meteorology, and signaling through fog.

HERSCHEL, JOHN FREDERICK WILLIAM BART (1792-1871). English astronomer. Investigated photography, and first applied the terms "negative" and "positive" to plate and print. Learned how to fix a plate or picture so exposure to additional light would not destroy it.

HERTZ, HEINRICH RUDOLPH (1857-94). B., Hamburg, Germany; D., Bonn, Germany. German physicist. Ed. at the Univ. of Berlin, where he became assistant to H. L. F. von Helmholtz in 1880. He was professor of physics at the Univ. of Kiel and at Bonn. Known for his experimental physics and discovery of electromagnetic waves now known as radio waves in 1887. Michael Faraday's electromagnetic theory of light was proved by him. He wrote *Electric Waves and Principles of Mechanics.* As the first to create, detect and measure electromagnetic waves, he confirmed J. C. Maxwell's theory of the "ether" waves. He found a close relationship between wireless and light by observing that the velocity of the electric impulses was the same as that of light, and that the law of this electrical radiation was the same as the corresponding law of optics. He proved that invisible waves could be reflected, refracted and polarized like the waves of light, and declared that if the rate of oscillation were increased a millionfold, the electromagnetic waves actually would travel of their own accord through space unaided by wires or other mechanical means of transportation. His epochal experiments were described in a paper entitled, *Electromagnetic Waves in Air and Their Reflections*, published in May of 1888. He also made valuable experiments with electric phenomena in vacuum tubes.

HIRSCHMANN, IRA A. – Ed., Johns Hopkins Univ., majored in economics. Advertising and sales manager, 1925-31, A. L. Bamberger & Co., Newark, N. J. (with store from 1921); member of executive committee of company; vice president, Saks Fifth Avenue, 1932-38; vice president, Bloomingdale Bros., Inc., 1938-45. Set up first intra-store television shows in store in 1939. Set up Metropolitan Television, Inc., as subsidiary of Abraham & Straus, and Bloomingdale Bros., Inc., and FM Station WABF. Was vice president in charge of Metropolitan from January, 1941, to January, 1945, when he was appointed to organize FM and Television activities for Federated Department Stores. Later purchased WABF and W2XMT (FM).

HOGAN, JOHN VINCENT LAWLESS (1890-). B., Philadelphia, Pa. Grad., University School, New Haven, Conn., 1908; student, Sheffield Scientific School, Yale Univ., 1908-10. In 1906 was assistant to Dr. Lee De Forest; joined National Electrical Signaling Co., International Radio Telegraph Co., 1909-21; advancing to chief research engineer and manager; president, Radio Inventions, Inc.; Radio Pictures, Inc. Author: *The Outline of Radio*. Inventor, radio devices.

HOGLUND, GUSTAV E. – A Chicagoan. In 1912 was granted a patent on a "telephot." It related to that class of devices for cutting up and dividing light rays emanating from an image and causing them to act upon a selenium cell capable of changing its electrical resistance under light rays of different degrees of intensity. These vibrations were sent over a line and acted upon a luminous center at the other end thereof, which caused a fluctuation in the brilliance of the arc and caused light rays to emanate therefrom, said rays being of varying intensity according to the strength of the current. These rays followed each other in the same order, and were comparatively of the same intensity as the light rays emanating from the objects. Therefore, when the rays from a lamp were projected onto the retina of the eye they caused an image to be built up before the eye, which was composed of the varying light rays of the same strength and in the same order as those emanating from the original image.

Basically the Hoglund "telephot" made use of two revolving shutters, turning in opposite directions. The selenium cell was influenced by the light rays and the picture at the receiver was reconstructed by means of the light variations of the lamp.

HOLE, LEONARD (1908-). B., Montclair, N. J. Grad., 1930, Univ. of North Carolina. B.A., Business Management Course at Columbia Univ. Joined CBS in 1935 as director of program service. 1939 he joined CBS television. From 1942 until 1945 he served in the Navy.

HOLMES, RALPH S. – Manager, technical services of RCA Laboratories. Has specialized in radio and television receiver design and development since his entry into commercial life, after graduating from the Univ. of Nebraska in 1923 with the degree of B.S. in Electrical Engineering. Joined General Electric Co. in 1923 to work on radio receiver development. Seven years later he transferred to Radio Corp. of America and soon was participating in television research. Beginning in 1940, his assignments were divided between advanced receiver development and centimeter wave field research, much of the latter being concerned with the design of equipment on Government contracts. Holmes has been responsible for many inventions in radio receivers and television systems with basic patents on noise suppression and automatic background control.

HOUSE, ROYAL E. – B., Vermont. Patented the first teletype system in 1846. An operator could type a message on a keyboard which would automatically be typed out at the other end of the circuit.

HUBBELL, RICHARD W. (1915-). B., Mt. Vernon, N. Y. Television author and program director. Ed., Wesleyan Univ., Middletown, Conn., B.A., 1936; graduate study at Columbia Univ., N. Y. Formerly associated with radio stations WQXR and WOR, New York. Writer-director-producer for Columbia Broadcasting System (Television) in New York. Coordinator of the original (1944) Television Seminar sponsored by the Radio Executives Club in New York. Co-founder and first chairman of the Board of Governors, Television Press Club of New York. Author: *4000 Years of Television*, 1942, and *Television Programming and Production*, 1945. Production manager and television consultant of the Crosley Corp., Broadcasting Division, Cincinnati, O. (1945-47). More recently, head of his own firm of television, radio and motion picture consultants.

HUGHES, DAVID EDWARD (1831-1900). Anglo-American inventor. B., London, England, and emigrated to the United States at an early age. Ed. at Bardstown College, Kentucky, where he later became professor of music (1850) and of natural philosophy. In 1855, invented the type-printing telegraph which later was widely used in the U. S. and Europe; in 1878, the

—*Courtesy Harper & Bros.*
David Edward Hughes

microphone, and in 1879, the induction balance.

HULL, ALBERT WALLACE (1880-). B., Southington, Conn. Grad., Yale Univ., B.A., 1905; Ph.D., 1909. From 1909-11, instructor of physics at Worcester Polytechnic Institute; assistant professor, 1912-14. Joined General Electric Co. as research physicist, 1914. In 1928 became assistant director of research, GE, "House of Magic." Invented ultra-high frequency generator, the magnetron, in 1920, for generating microwaves. A prolific inventor of electron tubes. In 1931, patented the "thyratron" tube, which is essential to electronic industrial control. His tubes are said to have helped make television and frequency modulation possible. Has approximately 100 patents to his credit.

HURWITZ, LEO (1909-). B., New York City. Ed., Harvard Univ., 1930, B.A. To 1933 did free-lance still and movie work, editorial work on creative art, articles and book reviews, taught photography. From 1933-34, managing editor and motion picture editor of *New Theatre Magazine;* 1934-36, stills for *Harper's Bazaar, Life,* etc. Edited short films; 1935, photographer on the resettlement film, Pare Lorentz's *The Plow that Broke the Plains,* one of first important American documentary films; 1936-38, taught photography at Sarah Lawrence College; 1937-42, founder and vice president of Frontier Films, Inc., first independent company organized for production of documentary films; 1942, co-producer and director of *Native Land;* 1942-43, edited *Tomorrow We Fly,* for U. S. Navy; 1944-45, writer-director for David O. Selznick; supervised all news shows on CBS Television, 1944; July, 1946, resigned to co-produce and direct a feature film.

HUTCHINSON, THOMAS H.—B., Calistoga, Cal. Stage director, actor and playwright, 1911-26; appeared in or directed over 500 plays in the majority of principal cities of U. S. and Canada. Co-author of successful stage play "Out of Night," produced in Chicago, 1926; in New York, 1927. Joined National Broadcasting Co. in San Francisco, Cal., as director and writer, 1928; program manager, Pacific Division, 1931. Joined McKee & Albright, advertising agency, as Pacific

Coast radio director, 1932; NBC radio director in New York, 1935. Began production of television programs, 1936, and on July 7 participated in the first demonstration of electronic television in America. Produced and directed first commercial television program, using studio, film, and mobile unit. Other firsts: adapted and directed first 30-minute dramatic program; adapted and directed first television dramatic program using five cameras; directed first television presentation of scene from a Broadway play; directed first television demonstrations in Washington, D. C., 1939; adapted and directed first full length dramatic play presented in the U. S. During 1939 and 1940, supervised 15 hours of television programs weekly, during which period over 40 full length plays were presented. Television director, Rauhrauff & Ryan, 1941; television production manager, RKO Television Corp., 1944; 1945-48, independent program consultant, producer-director. Author: *Here's Television* a programming book, 1947.

HUYGENS, CHRISTIAN (1629-1695). Dutch physicist and horologist. B., The Hague. Trained for law at Breda but his inclination was toward mathematics. Formulated the theory that light, like sound, is a form of wave motion; in order for a wave to move, it must have something to move in. Just as a waterwave must have an ocean or river in which to exist, so a lightwave must have something in which to wave. It could not be air, because light goes right through a vacuum and through the great empty spaces between planets and stars, where there is no air. For want of a better name, he called the unknown "ether." His theory, however, was disproved in 1873. He defined the wave theory of light and discovered the phenomenon of polarization.

HYDE, ROSEL H. (1900-). B., Banock, Idaho. Ed., Utah Agricultural College, Logan, Utah; and George Washington Univ., Washington, D. C., 1929 (law). Member of bar of District of Columbia, member of bar of Supreme Court of United States. Joined Civil Service Commission; held various clerical and administrative classifications prior to 1928 when he became associated with the Federal Radio Commission and its successor, the Federal Communications Commission, in various legal capacities and until prior to his appointment to the FCC as a member on April 17, 1946, he was general counsel. Member, U. S. Delegation to Third Inter-American Telecommunications Conference held in Rio de Janeiro in 1945.

ISRAEL, DORMAN DANIEL (1900-). B., Newport, Ky. Grad., Univ. of Cincinnati, E.E. Radio design engineer, Crosley Radio Corp., 1921-24; chief engineer and director, Cleartone Radio Co., 1924-29; chief development engineer, Crosley Radio Corp., 1929-31; chief engineer, radio division, Grigsby - Grunow Corp. (Majestic Radio), 1931-32; chief radio engineer, Crosley Radio Corp. 1932-36; chief engineer, Emerson Radio & Phonograph Corp., 1936-42, and vice president in charge of engineering and production since 1944. As chairman of the Receiver Section of the engineering department of RMA he had under his jurisdiction, as one of the committees of this group, the Committee on Television Receivers, which proposes and develops industry standards. At Emerson, in engineering department (under his administration), developed several television receivers as well as a complete industrial television system.

—Courtesy Harper & Bros.

Herbert E. Ives

IVES, HERBERT EUGENE (1882-). Physicist. B., Philadelphia. Grad., Univ. of Pennsylvania, B.S., 1905; received his Ph.D. from Johns Hopkins in 1908. Hon. Sc.D., Dartmouth and Yale, 1928; Pennsylvania, 1929. Became assistant physicist of the Bureau of Standards, Washington, D. C., 1908-09; physicist of the National Electric Lamp Association of Cleveland, 1909-12; with the United Gas Improvement Co., 1912-18; and with the Western Electric Co. and Bell Telephone Laboratories, 1919 to date.

As electrooptical research director of the Bell Telephone Labs, he was the first to demonstrate a camera that would televise outdoor scenes without the glare of artificial light (1928). Later he showed television in color (1929), and followed with two-way television demonstrations in which speakers at either end of telephones saw and conversed with each other. In 1923, Dr. Ives and his colleagues at Bell Labs developed the method and device for the transmission of photographs over telephone wires used at the National Political Convention in 1924 and later at the inauguration of Calvin Coolidge as president in 1925.

Medals from Franklin Institute for difraction color photography, artificial daylight and Welsbach mantle; John Scott medal and award, 1927, for electrical telephotography and television. Inventor, apparatus for testing visual acuity, various photometric instruments, illuminating devices, means for producing artificial daylight, relief pictures, electrical photo-engraving, apparatus for transmission of pictures over telephone lines; in charge of experimental and development work culminating in first demonstration of television by wire and radio, 1927. Author: "Airplane Photography," 1920. Contributor to scientific journals, *Encyclopaedia Britannica*, etc.

JACKSON, D. A. – In early 1923, he described a system of code transmission of photographs which transmitted five changes of color, from black to white.

JAMIESON, ROBERT F. (1915-). Manager of station operation, Station WABD. Since prewar days, with the Allen B. Du Mont Laboratories where he designed and built test equipment for cathode-ray tubes. As the war drew to a close, he was transferred to postwar products planning, where he designed Du Mont studio equipment – notably the video console, mechanical microphone boom and the camera dollies, plus numerous gadgets. About this time Du Mont studios began a regular broadcast schedule and he was immediately assigned to W2XWV, now WABD.

JEFFREE, J. W. – Invented the supersonic light valve which stores up in liquid form the picture element images, projecting as many as 50 or more of them simultaneously along a single scanning line upon the screen.

JENKINS, CHARLES FRANCIS (1867-1934). B., Dayton, Ohio; D., Washington, D. C. Physicist, inventor and pioneer in television research. Ed. at Earlham College. In 1890 became secretary in the United States Life Saving Service at Washington, D. C., but resigned in 1895 to become an inventor. As early as 1894 he proposed a plan for the electrical transmission of pictures. On June 13, 1925, he demonstrated his own mechanical television scanning system using a revolving disc, the rim being lined with tiny lenses. Almost simultaneously with J. L. Baird, he achieved the first actual transmission of television.

C. Francis Jenkins

Jenkins' apparatus was distinguished by its originality, especially in the scanning mechanisms used. In the previous systems, light beams had been bent by means of mirrors. He used prisms capable of performing the same service, and his device, named the Jenkins Prismatic Disc, represented an entirely new contribution to optical science. The prismatic disc was a new optical shape in glass which gave a beam of light passing through a fixed axis on one side of the prism and a hinged or oscillating axis on the other side of the prism. By these means a picture image was made to move over a light sensitive cell in such a manner that every part of the picture finally impinged on the cell so that the successive picture characteristics were impressed on the radio carrier wave. At the receiving station these picture characteristics caused a fluctuating point of light to travel in lines over a photographic plate, which when developed became a negative of the picture or scene transmitted.

JETT, EWELL K. (1894-). B., Baltimore, Md. Entered U. S. Naval Service in June, 1911, and served in almost every branch of the service's communications sections until 1929 when he was loaned to the engineering department of the Federal Radio Commission, and later, upon retirement from the Navy was appointed as senior radio engineer, FCC. In 1931, he was named assistant chief engineer until Dec. 31, 1937. On Jan. 1, 1938, became FCC chief engineer, and on Feb. 15, 1944, a member of the commission.

JOHNSON, JOHN BERTRAND – In 1922 produced the first low-voltage, gas - focused, sealed - off cathode - ray tube, as research physicist of the Bell Telephone Laboratories.

JOHNSTON, DENIS (1901-). B., Dublin, Ireland. Ed., Dublin and Edinburgh; also, Cambridge Univ. and Harvard Univ. Practiced at English bar from 1925-27, and subsequently at the Irish bar. While working at the Temple, became interested in the theatre. First play, "The Old Lady Said No," played originally at Dublin, then London. In 1934, became stage manager, Westminster Theatre; later director, Dublin Gate Theatre; in 1936, joined the British Broadcasting Corp. In June, 1942, at Cairo as a BBC war correspondent, and with Eighth Army in earlier part of final desert campaign. Appointed program director of the BBC Television Service early in 1946, with authority to act as deputy for the Head of the Service in the latter's absence and supervise the overall quality of the BBC television output.

JOLLIFFE, CHARLES B. – B., Morgantown, W. Va. Grad., West Virginia Univ., B.Sc., 1915; Cornell Univ., Ph.D., 1922; honorary degree of LL.D., 1942, West Virginia Univ. From 1922-30, served as physicist in radio section of Bureau of Standards, resigning to become chief engineer of the old Federal Radio Commission, which job he held for five years. Joined Radio Corp. of America as engineer-in-charge of the RCA Frequency Bureau. In 1941, became chief engineer, RCA Laboratories, and early in 1942, assistant to president of RCA. In September, 1942, appointed chief engineer of RCA-Victor Division, Camden, N. J. Now executive vice-president in charge of RCA Laboratories Division.

KAROLUS, AUGUST – German. Perfected an electrochemical light tube which facilitated more power illumination of the object or scene to be televised. It controlled the flow of light with great rapidity. Up to this time all mechanical shutters had failed to operate at sufficient speed. The Karolus valve (or tube) helped to push television ahead. Associated with Leipzig Univ. as a professor, he was one of Germany's (1932) principal television workers.

KELL, RAY DAVIS (1904-). Electronic research engineer at RCA Laboratories. Formerly a development engineer. B., Kell, Ill. Grad., Univ. of Illinois, 1927, B.S. in electrical engineering. Following three years in the Radio Consulting Laboratory of the General Electric Co. at Schenectady, N. Y., where he assisted Dr. E. F. W. Alexanderson, he joined the Radio Corp. of America in 1930. He is responsible for several inventions in the television field.

KELLY, MERVIN J. – Executive vice president and a director of Bell Telephone Laboratories. In the engineering department of the Western Electric Co. (which became Bell Labs in 1925) he developed many types of thermionic devices. Appointed director of research of Bell Labs in 1936, and made executive vice president in 1944. During World War II, worked on war projects and was in particularly close touch with progress of radar.

KELVIN, LORD – See *Thomson, William*.

KENNELLY, ARTHUR EDWIN (1861-1939). B., Bombay, India. Ed., England, Scotland, France and Belgium. Mathematical physicist. Assistant secretary, Telegraph of London; in 1876 joined Eastern Telegraph Co., working on submarine cables and mathematical treatment of the phenomena of transmission lines. In 1887, came to America as electrical assistant to Thomas A. Edison and held that position until 1894. Appointed professor of electrical engineering, Harvard, 1902-30. From 1913 to 1924, professor of electrical engineering at Massachusetts Institute of Technology; in 1916, president, Institute of Radio Engineers.

– Courtesy Harper & Bros.

Arthur Edwin Kennelly

He investigated the ether, and is best remembered for his explanation of the mechanism of transmission of electric waves. He propounded the theory that an electrically conducting stratum must exist because of rarefaction of the atmosphere, at a height of about 50 miles, with conductivity several times as great as that of sea water. Working independently, both he and Sir Oliver Heaviside (in England), were credited as co-discoverers of the radio mirror or roof, and their findings were thereafter termed the "Kennelly-Heaviside surface, or layer."

KERR, JOHN – English scientist. In 1875 he discovered what became known as the Kerr Effect from which was developed the Kerr Cell, a device used to control light rays in a number of mechanical television systems of later years. His was the discovery of the electrostatic birefringence of optical media long sought for by Michael Faraday. The first of these effects, namely, the magnetic rotation, was used by Nipkow in his proposed television receiver, while the use of birefringence developed in carbon disulphide was proposed by Sutton.

KERSTA, NORAN E. (1911-). B., Jersey City, N. J. Attended Bell Laboratories School for two years; two years at Georgia School of Technology; one year at New York Univ.; and additional work at M.I.T. Majored in engineering and business administration. Joined National Broadcasting Co. in 1935 and worked for two years on rate research, circulation, sales points and similar matters regarding television. During most of 1937 worked in television group of the engineering department. Named assistant television coordinator in the office of the president of NBC from December 1937 to May 1941 when he became assistant to the vice president in charge of television. In December 1941, made manager of television department, until he entered the Marine Corps on military leave in August 1943. Until Oct. 1, 1945, was radar and operations officer in Marine Corps, serving many months overseas. Returned to NBC as manager of television department on Oct. 1, 1945.

KESTEN, PAUL W. (1898-). B., Milwaukee, Wis. Ed., Univ. of Wisconsin. Joined Columbia Broadcasting System, 1930, from Lennen & Mitchell, New York City. Organized and headed CBS research and sales promotion departments. Named vice president, 1934; executive vice president, 1943; vice chairman, Board of Directors 1946. Served as head of CBS during war-service absence of President William S. Paley from October 1943, to November 1945. His active interest in television dates from 1936 when Dr. Peter Goldmark came to CBS and, under the encouragement of Kesten, developed the CBS system of full-color television in 1940. In April 1944, Kesten initiated and led the cause of ultra-high frequency, high-definition television. He announced the successful transmission and reception of full-color television in the ultra-high frequencies before the Federal Communications Commission in October 1945. Regular daily broadcasts of CBS ultra-high frequency full-color television (1946) were scheduled under his direction for demonstrations before the press, industry, advertisers and the public. Resigned from active participation in this work early in 1946.

KIRCHOFF, GUSTAV (1824-1887). B., Germany. Made extensive research in analysis of both light and electricity. Together with R. W. Bunsen, analyzed the spectra of flames into which were introduced vaporized substances. Observations showed that such spectra, instead of being a continuous band of colors ranging from red to violet, were made up of individual lines scattered throughout the entire spectral band.

These were called "emission line spectra" to distinguish them from "absorption line spectra" of Wollaston-Fraunhofer. Since each chemical element possesses its own individual spectrum, he found by using these line spectra, a technique for analyzing unknown chemical substances. Propounded Kirchoff's Law of Black Body Radiation. A "black body" is defined as "that body the surface of which will absorb all incident radiation upon it." Kirchoff demonstrated that this body was a good source of uniform radiant energy. No such body, in actuality, exists, but a surface covered with lamp black does approach the required condition. He also propounded a series of laws known today as "Kirchoff Laws" which are important in solving complicated problems dealing with electric circuits.

KNIPE, KARL (1895-). B., Radnor, Pa. Ed., Friends Central School, Philadelphia, Pa. Formerly public relations director, General Asphalt Corp.; sales promotion director, *Collier's;* manager of Paris office, J. Walter Thompson; sales manager, Columbia Broadcasting System; radio director, Newell Emmett; sales manager and publicity director, John Wanamaker, New York and Philadelphia. Later assistant to president, Anderson, Davis & Platt, and director of television for agency.

KNOTHE, A. — An earlier experimenter in television. Devised the so-called "Knothe Device." Proposed using lines from the batteries to a camera with a selenium cell bridging the space between each pair of wires. The light entering the camera would fall on the selenium and all other cells, close the circuit to operate the spark coils. This furnished a discharge as a single ray in the X-ray tube. This single ray was to be thrown as a single point on a fluorescent screen. Several hundred sells, spark coils, and parabolic mirrors would have been required to transmit a picture. The X-ray tube, therefore, would necessarily have been of huge dimensions. Several hundred wires, in addition, would have been necessary. All these requirements made the device impracticable.

KNUDSON, HANS — In 1909 he sent a drawing by radio.

KOBAK, EDGAR A. (1895-). President Mutual Broadcasting System since November 1944. B., Chicago. Ed., studied electrical engineering at Georgia Tech. Started business career as member of electrical engineering department of Georgia Railway & Power Co., Atlanta, Ga., where he remained for five years. Spent next 18 years with McGraw-Hill publications; joined National Broadcasting Co. in 1934 as vice president in charge of sales. Later became vice president, advertising agency, Lord & Thomas. Returned to NBC to assist in setting up Blue Network as separate division of RCA and early in 1942 became its executive vice president and general manager.

KONER, PAULINE — Dancer, choreographer. B., New York. Pupil of Michel Fokine. Then developed personal style based on a synthesis of modern and ballet elements. Dance highlights: toured in concerts throughout U. S.; toured the

Near East in 1932; concert tour of Russia, 1935 and 1936. Television highlights: debut at General Electric WRGB, spring of 1945; inaugurated "Choreotone" Ballet Series in association with Kitty Doner at WCBW, Columbia Television Studio, in October 1945. Specially choreographed these programs for television with Miss Doner and was featured dancer in them; since then, has presented numerous ballets as a sustaining dance feature on CBS.

— Courtesy Harper & Bros.

Arthur Korn

KORN, ARTHUR (1870-1945). Pioneer in the development of phototransmission by wire and radio. B., Breslau, Germany; D., Jersey City, N. J. Studied at Leipzig and Paris, majoring in physics and mathematics. Became professor of physics at Univ. of Munich in 1903 and retired in 1908; later, professor, Polytechnical High School, Charlottenburg, Berlin. From 1914 to 1936 was professor of electrophysics at the Berlin Institute of Technology. In 1908 he developed a system of "seeing by wire." A photo-film was placed on a revolving glass drum inside a cylinder lighted only by a small aperture. The light was allowed to traverse both film and glass. The light ray regulated by the lights and shadows of the picture was caught by a prism and cast on a selenium cell connected with a battery. He sent telephone wire-photos with this apparatus from Munich to Nuremberg, a distance of over 600 miles; also from the Continent to England in 1907 and was acclaimed for the achievement. In 1922 he revealed a new method of radio signaling. He demonstrated a device that radioed pictures by dots — "half-tone groups of dots." His radio or wire printer was named a "phototelegraph"; the system: "phototelegraphy." It was used by both sides during the Spanish Civil War and by military authorities in Russia, Germany, Italy and Poland. At the time of his death he was engaged in research in physics for *The Times* Telephoto Equipment, Inc., New York.

KUGEL, FREDERICK ALLEN (1916-). B., New York City. Ed., London School of Economics, the Univ. of London; and the Wharton School of Finance and Commerce, Univ. of Pennsylvania. Before entering television, he was in advertising and sales, as ad manager of Carbona Products Co., and later as account executive with an ad agency. Sold television receivers for Du Mont Laboratories and later became assistant to the vice president. Publisher, *Television* (monthly magazine), and *Review of Recorded Music.*

LACK, FREDERICK – Vice president and a director of the Western Electric Co. and head of its Radio Division. Joined manufacturing department in 1911, and in 1912 transferred to engineering department of Bell Labs. During World War I served overseas and returned to company in 1919. Thereafter his work was concerned broadly with development of several aspects of radio telephony, including use of piezo-electric crystals for stabilizing radio frequency generators, and vacuum tubes for various types of radio telephone application. Left Bell Labs in 1938 to return to Western Electric as commercial manager. Elected vice president and made manager of Radio Division, 1942. Director of Army and Navy Electronic Production Agency, 1942-43.

LANDSBERG, KLAUS (1917-) Director of television in charge of West Coast operations of Television Productions, Inc. B., Berlin, Germany. Grad., Polytechnical Institute in Czechoslovakia, E.E. (Electrical Engineer) and C.E. (Communications Engineer). Attended graduate courses, Univ. of Berlin. Designed all-wave radio receiver exhibited at Berlin Radio Exhibition in 1931; assistant to Prof. Faerber, European television pioneer and director of one of first television laboratories (1935-37) during which time Landsberg designed mechanical and early cathode-ray tube type television equipment. During this time, he also lectured throughout Europe on television principles and gave many of first demonstrations of such equipment. In summer of 1936 assisted in television experiment at Olympic Games in Berlin. In 1937, invented electronic aid to navigation and blind landing device, filed patent application for same. In 1937, laboratory engineer and assistant to Dr. A. Korn, picture telegraphy and television designer; 1938-39, television development engineer, Farnsworth Television, Inc., Philadelphia; 1939-40, television development and operating engineer, National Broadcasting Co.; 1940-41, television design and development engineer, Du Mont Laboratories; later, supervised technical operation of television unit at U. S. Army maneuvers, Canton, N. Y. Developed automatic synchronizing circuits.

Recognitions: 1937, Czechoslovakia Federal Government and City Administration commended and requested for Government files his original design of entire television station which constituted engineering graduate thesis; 1937, invention of navigation electronic aid declared important to defense of Germany (later taken to U. S.); 1942, invention of high sensitivity camera tube declared U. S. military secret; 1944, TBA award for adaption of motion picture techniques to television; and June, 1945, ATS award for continued excellence in television production.

LANGMUIR, IRVING (1881-). B., Brooklyn, N. Y. Ed., Pratt Institute, Brooklyn, N. Y.; School of Mines, Columbia Univ. Grad., 1903, as metallurgical engineer; Univ. of Goettingen, Germany, Ph.D., 1906. Instructor of chemistry, Stevens Institute of Technology, 1906-09. Joined General Electric Co.'s research staff, 1909. Worked on electron tubes and found new laws relating to electronic emissions in a vacuum. Developed radio tube to a power of several kilowatts, 1912, as a result of discovery that electrons in a gas-free space built up a space charge which limits the current. Developed thoriated filament for electron tubes. Recipient: Nobel prize in chemistry, 1932; Hughes Medal from Royal Society of London; Rumford Medal from American Academy of Arts and Sciences for thermionic researches; Faraday Medal from Institution of Electrical Engineers in England.

LAUSTE, EUGENE AUGUSTIN – An electrical engineer who worked for Thomas A. Edison and the old Biograph Movie Co., patented his own invention – a method of "simultaneously recording and reproducing movements and sounds." His patent is the master patent through which modern sound movies developed.

LAWSON, DENNIS ILLINGWORTH (1911-). B., Sheffield, England. Ed., Manchester Univ. (research on X-ray Crystallography under Prof. Lawrence Bragg). Was physics teacher, Woolwich Polytechnic. Took charge of Research Laboratory, Pye Ltd., radio and television equipment manufacturers, Cambridge, England, in 1939. Engaged during World War II on development of proximity fuse and since then on Pye Videosonic Television System. Papers published: *Multipath Interference Television Reception;* IEE; *Videosonic System – Combining the Sound and Vision Transmission,* IEE; paper on *Frequency Modulation, Wireless Engineering,* 1940; also other papers in various technical journals.

LE BLANC, MAURICE – A Frenchman regarded by many as the father of moving pictures. While scientists argued over the best method to transmit a single picture over a wire, he inquired as to how was it possible to achieve motion with pictures. He answered his own inquiry by advancing the theory that it would be necessary to dissect a moving object into a series of pictures which, if projected in a predetermined sequence, would deceive the eye into believing it was actually viewing motion. The success of this optical illusion depended, naturally, on the perfect timing in the transmission of the images and more important still, their reception in exactly the identical sequence in which they were sent. LeBlanc's theory was a restatement of his fundamental theory of motion pictures of his day. Instead of flashing these pictures on a tape before a magic lantern light to project them onto a screen, he proposed to send them electrically across a telegraph wire. Twin mirrors were suggested by him to solve the problem of the mechanical scanning. He proposed that the mirrors should vibrate at different speeds; slow for vertical, and fast for horizontal. The sending of a picture over a wire by separating the darks from the lights and attributing a separate electrical value each, was still a theory to be discovered in the future. (See *LeBlanc Theory of Scanning.*)

LEE, GILBERT C. – About 1931, developed a method of transmitting an object in its entirety, reproducing it in the space of 15 seconds. Line drawings, etc., were televised and recorded on film or bromide paper. He worked with members of the Los Angeles Television Society on his system.

LEISHMAN, LEROY J. – See *Leishman Code System, Leishman Direct Wire System.*

LEMPERT, IRVING E. (1917-). B., New York City. Ed. Lehigh U., B.S. in E. E., 1939. Since graduation, with Du Mont Labs, in development and production engineering work on television equipment, cathode-ray tubes and other electronic equipment. Presently, engineering manager, television receivers.

LE PONTOIS – Combined the practices of Paul Nipkow with those of L. Weiller in a system of television which is important because it was the first attempt to attain synchronism between the transmitter and receiver without the use of directly coupled machines. He made use of alternating-current motors with the result that once the scanning apparatus had been set in operation with the perforations at both the transmitter and receiver in the same relationship, that status or relationship was maintained indefinitely.

LEVERENZ, H. W. – Research chemico-physicist on the RCA Laboratories staff. Grad., Stanford Univ., A.B. in chemistry. Later attended Univ. of Munster, Germany. Before joining RCA in 1931, he was associated with the California & Hawaiian Sugar Refinery, and the Isthmian Line (U. S. Steel). Holder of numerous patents in the fields of television, electronics and luminescence.

Nils Erik Lindenblad

LINDENBLAD, NILS ERIK (1895-). Designer of antennas. B., Norrkoping, Sweden. Ed., Norrkoping Polytechnic Institute evenings, while imbued with an idea – the thought that if the radiation could be increased, developed, and controlled, it would be possible to signal across vast distances. He gathered together the induction coil, the Hertz wave emitter, the Righi gap, the telegraph key, batteries, the Branly coherer, and constructed them into transmitting and receiving stations on his father's estate at Pontecchio, near Bologna. He sent cricketlike sounds for three-quarters of a mile. That was the birth of wireless; from that moment on no obstacle in the world or distance could stop wireless. He took out an English patent and made his first demonstrations from the roof of the General Post Office in London, 1896. In 1897, the Italian Government invited him to Spezia, where he supervised the construction of a wireless land station which communicated successfully with Italian battleships. In the same year a company was formed in England to take over all his patents in every country except Italy. One of his notable discoveries was the beam system which made it possible to direct wireless waves. In 1933, he improved the low-power short-wave transmission. Also invented tuning – the key to a great advance in wireless. It prevented overlapping of signals, reduced interference, opened the way for a multiplicity of stations and made ethereal communication practical. Awarded the Nobel Prize for Physics in 1909; made a Marquis in 1929.

MARKHAM, G. EMERSON – B., Binghamton, N. Y. Ed., Stetson Univ. Joined General Electric Co. in 1923 in accounting and advertising departments. In 1925 joined WGY and that year established Farm Forum and Farm Paper of Air; in 1929 GE honored him with Charles A. Coffin Award in recognition for meritorious services and outstanding achievement. In 1942 appointed manager of FM station WGFM, and in January 1945 manager of television station WRGB. In 1946 appointed station manager of all GE stations, WGY, WGFM, and WRGB.

MARKS, ERNEST A. – Manager, Television Receiver Division, Du Mont Laboratories. Ed., B.S. in E. E., Columbia University. Radio operator in World War I. Taught radio theory at Navy radio school. Represented leading banking houses in Europe. Lt. Cmdr. Navy, World War II. Joined Du Mont 1945.

MARLOWE, HARVEY – Television producer. Has been producer, director, writer, actor, and M.C. in musicals, light operettas, dramas, minstrel shows, night clubs, movies, radio and television. Formerly WOR television producer; also produced independently at WABD; Later with American Broadcasting Co. as senior producer-director in television. Started his own production agency in 1947.

MARX, FRANK L. – Ed., Shreveport College, Univ. of Virginia, William and Mary College, and Columbia Univ. As amateur operator owned W3QF in Norfolk, Va., during middle 1920's. Entered commercial broadcasting in

1925 as operator-engineer for WPAB and WRCV; later chief engineer of WSEA, 1926; then engineer in charge of KLRA, Little Rock, Ark. Joined W. K. Henderson Iron & Supply Co., Shreveport, La., which operated KWKH in Shreveport. In 1929 associated as chief engineer with WPCH and WMCA, New York City; later WPCH combined with WMCA, and he served as chief engineer of that station for 15 years. In 1931 the Knickerbocker Broadcasting Co. and Baird Television entered into a joint program of development and research to be carried on in this country. An application was filed with the Federal Radio Commision for a television license to transmit programs using the Baird System. Marx was responsible for the development of the proposed transmitter, acted as consultant for Baird and appeared as witness during the Federal Radio Commission hearing. In 1944, became technical advisor to the Blue Network, later the American Broadcasting Co. In 1945 named director in charge of all engineering problems relating to standard broadcast, television and FM for ABC.

MAXWELL, JAMES CLERK (1831-1879). B., Edinburgh, Scotland; D., Cambridge, England. Physicist, author, natural philosopher, eminent mathematician. Discoverer of the ether. Ed., Univ. of Edinburg. In 1856 named professor of natural philosophy in the Marischal College of Aberdeen. In 1860 taught natural philosophy at King's College, London. In 1867 evolved a mathematical equation from which he derived the existence of waves; described the possibility of electromagnetic waves which would detach themselves from a source of origin. Heinrich Hertz at a later date produced the electromagnetic waves and proved Maxwell's theory to be correct. In 1873 published "Electricity and Magnetism" in which he formulated his famous electromagnetic theory of light and his theories on electric waves, which developed into the system of wireless telegraphy and telephony through the experiments of Hertz.

MAY (first name unknown) — An obscure telegraph operator who accidentally discovered the unique property of selenium. He lived on a little terminal station for the Atlantic Cable on the coast of Ireland. One day as the sun shone at intervals through the window on his apparatus, he noticed that the moment more light fell upon the selenium the current increased, causing resistance variations although he had made no change in the circuit.

McDONALD, EUGENE F., JR. (1890-). B., Syracuse, N. Y. Ed., Syracuse Univ. In radio business since 1920; president-general manager W9XZV — (WTZR) — W9XZC experimental television station, Chicago; now president, Zenith Radio Corp.

McLEAN, JAMES D. — B., Framingham, Mass. Grad., Massachusetts Institute of Technology, B.S. and M.S. in electrical engineering. Joined General Electric Co. as a student engineer in 1935. In 1936 engaged as radio engineer by Republican National Committee during presidential campaign. Returned to GE in 1938 as development engineer in laboratory and in 1939 transferred to the electronics department, first as a design engineer in the transmitter division, and later as coordinator of Army radio and radar equipment in the Government division. Appointed manager of sales in 1943. Has been spokesman for GE on many occasions in publicizing television innovations, studio design introductions, and explaining transmitter-station costs.

MICHELSON, ALBERT (1852-1931). B., Germany. Came to U. S. A. Grad., U. S. Naval Academy, 1873. Taught at Academy for four years; then professor at Case School of Applied Science; physics department, Clark Univ.; professor of physics, Univ. of Chicago, 1892-1931. Built ingenious apparatus to demonstrate and measure speed of light (about 186,000 miles per second) in the laboratory. Received Nobel Prize (first American physicist to receive such honor) for investigations on speed of light and interference phenomena. Worked on relative motion of the earth and the ether, for which he invented the interferometer. He was unsuccessful in those endeavors, but laid the foundations from which Albert Einstein was to formulate the theory of relativity.

MILLIKAN, ROBERT A. (1868-). B., U. S. A. Ed., Oberlin College. Physics instructor there; later on physics staff, Univ. of Chicago; and California Institute of Technology. By means of his famous "oil-drop" experiment he was successful in determining the charge on a single electron.

MINER, WORTHINGTON C. (1900-). B., Buffalo, N. Y. Grad., Yale Univ., 1922; grad. work at Cambridge Univ., England. Served 19 months in the 16th Field Artillery, Fourth Division (overseas), World War I. From 1925 to 1939 was actor, director, producer, and co-author in theatre, motion pictures and radio. Produced 17 Broadway successes. Director for RKO (Radio - Keith - Orpheum), 1933 - 34. Member, Board of the Theatre Guild, 1938-39; to CBS Television, 1939, as program director; named manager of CBS Television, December 1942; and director in March 1946.

MOORE, D. MACFARLANE – Inventor of lamp upon which the Jenkins receiver depended. (See *Jenkins-Moore machine.*)

MORSE, SAMUEL FINLEY BREESE (1791-1872). American scientist, inventor and artist. B., Charlestown, Mass. Famed as the inventor of the telegraph, engaged in investigations along the line of a single wire to connect each of a large group of cells with others of a reproducing device so that the relationship of individual cells was the same on the receiving and transmitting screens. The "cells" referred to, instead of being actual cells, were in reality the ends of the wire cable dipped in selenium.

MORTON, ALFRED H. – Formerly vice president in charge of television, National Broadcasting Co. (1939-40). Ed., Univ. of Illinois (engineering). With General Electric Co., 1919-21; joined Radio Corp. of America in 1921, first as manager of RCA's Washington office and later as the firm's European manager. He supervised the construction of pioneer radio stations in the U. S.; Rome and Milan in Italy. In the interim he was commercial manager of RCA Communications, Inc., for a period of six years. In 1934 he was transferred to NBC as manager of the program department where he remained until 1937 when he became chief of NBC's Managed and Operated Stations Division. When television was launched on May 1, 1939, by NBC, he was named to head the country's first formal television broadcasting organization. Now, President, National Concert and Artist Corporation.

— Courtesy Harper & Bros.
Samuel F. B. Morse

MORTON, GEORGE A. – Electronic research engineer of RCA Laboratories. Grad., Massachusetts Institue of Technology, 1926, B.S. degree. After one year of graduate study at Union College, returned to M.I.T. for degree of Master of Science, 1928, and in 1932 received doctorate in physics from the same institution. From 1926 to 1927 conducted vacuum tube research at General Electric Co., after which he became research associate and instructor at M.I.T., a position he held for six years. In 1933 joined Radio Corp. of America as research engineer. Credited with about 15 patents in television tubes including iconoscopes, secondary emission multipliers and image tubes. With Dr. V. K. Zworykin, he was co-author of book "Television," and has prepared nearly 20 papers on television, electron optics, and multipliers for engineering publications. With Dr. Zworykin and L. E. Flory, both of the RCA Laboratories staff, he received an Overseas Award from the British Institute of Electrical Engineers for a paper on "Theory and Performance of Iconoscopes."

MOSKOVICS, GEORGE – Commercial manager, CBS; Television since June, 1945. Joined CBS, 1936. Former sales manager Columbia Pacific Network with headquarters in Los Angeles. Asst. sales mgr. for CBS Radio sales in N. Y. prior to joining television.

MOUNTJOY, GARRARD (1905-). Ed., Washington Univ., B.S., 1929. Lectured, Graduate School of Stevens Institute of Technology and Newark College of Engineering. Worked with Sparks Withington Co., Jackson, Mich., 1929-1935, on development of radio receivers (chief engineer during part of this period). Joined RCA License Laboratory in New York, 1935-44, as consulting engineer; later head of License Laboratory Consulting Section. Author of many licensee bulletins on television and radio for distribution to all RCA licensees. During World War II, participated in development work on Loran system of navigation and other projects. Director of research and development for Lear, Inc., 1944-46; later for a short period, president, Electronic Corp. of America. Holds over 100 domestic and foreign patents on television and radio. In 1940, received "Modern Pioneer Award" from National Association of Manufacturers.

MOWREY, PAUL BURNHAM (1915-). B., Dayton, O. Ed., Ithaca College, Ithaca, N. Y., B.S. On Aug. 1, 1939, joined Columbia Broadcasting System as a lighting expert in television lighting. During five years employed at CBS, he was successively director of lighting, floor manager, assistant manager of studio operations, and manager of remote operations, and commercial manager of CBS Television. In December 1941, given leave of absence from CBS to join the War Production Board, and returned later to become senior producer at CBS's key station WABC. During war years while CBS Television was restricted to use of film, he concentrated on adapting radio shows for television. On Nov. 1, 1944, joined American Broadcasting Co. as manager of television. His present title is national director of television for ABC.

MURPHY, ADRIAN (1905-). Vice president and general executive, Columbia Broadcasting System. B., New York City. Grad., Princeton Univ., 1927. Joined CBS in 1936 as an assistant to Paul W. Kesten, then vice president. He was placed in charge of Columbia's television activities in 1939. He was executive director of CBS television in May 1942, when he entered service as a lieut. in Signal Corps. He became a lt.-col. with duties as assistant chief of Information Control Division for operations, United States Forces, European Theatre. Returned to CBS in present position in January 1946, where he is responsible for general engineering, construction and building operations, as well as television.

MURRAY, PATRICIA – Grad., Univ. of Pennsylvania, member of Jasper Deeter's Hedgerow Theatre for four years and on many radio television programs for many years. Started with NBC Television in 1938 as actress, announcer and mistress of ceremonies. In May 1939, selected "Miss Liberty" for MacFadden (publications) Exhibit, at the New York World's Fair, and as "Miss Television of the New York World's Fair" for the RCA Exhibit. Joined *Printer's Ink* in 1942 as assistant to the news editor, and in 1946 became associate editor of the *Journal of Frequency Modulation* for a short interim. Widely known as announcer for Lever Bros. television shows.

MUYBRIDGE, E. J. – See *Zoogyroscope*.

NALLY, EDWARD JULIAN (1859-). B., Philadelphia, Pa. At 15, joined Western Union as a messenger at St. Louis, Mo., rose rapidly and in 1890 became assistant general superintendent of the Postal Telegraph-Cable Corp. in Chicago; general superintendent of Western Division in 1892; vice-president, 1906; later general manager. Resigned in 1913 to become vice president and general manager of Marconi Wireless Telegraph Co. of America. First president, Radio Corp. of America on formation of company in November 1919. Resigned December, 1922. Member of RCA's Board of Directors.

NELSON, RAYMOND EVERETT (1907-). B., Cleveland, O. Ed., LL.B., Cleveland Law School; Baldwin Wallace Univ., 1927; graduate student, Columbia Univ. Background includes positions as radio program director for WCOH, WJAY, WEVD, WCDA, WEBR, etc.; actor and director, Empire Players, and Provincetown Playhouse. Announcer and producer, National Broadcasting Co., 1937-42; Eastern production manager, 1942; director daytime programs, WOR; supervisor of television activities, Mutual Broadcasting System, 1943. Vice president in charge of radio and television, Charles M. Storm Co., Inc. (advertising agency), 1944-46. President, Raymond E. Nelson, Inc. (advertising agency). Produced over 100 television programs, best known of which was "Boys from Boise," first full length original musical comedy in television.

NEWTON, ISAAC (1642-1727). English natural philosopher and mathematician. B., Woolsthorpe, Lincolnshire. Ed., Trinity College. In 1666 he made a major investigation of the spectrum when he resolved white light into its constituent colors, proving that a band of colors formed when white light shines through a glass prism. His experiments led to the acceptance of the fact that all the colors of the rainbow are present in pure white light, such as sunlight. The prism did not make the colors, it divided the white light into separate colors. If these colors were all shown on one spot at the identical moment, white light was again formed. This principle was later used in color television.

NICHOLAS, EDWIN AUGUST (1893-). President of Farnsworth Television & Radio Corp. since organization of company in 1938. B., Cleveland, O. Ed., New York Univ., special student. From 1910 to 1917 associated with Marconi Wireless Telegraph Co. of America, predecessor to the Radio Corp. of America; 1925 to 1926, assistant to vice president and general manager of RCA, and later sales manager of the Eastern District; 1926 to 1929, manager of Radiola Division; 1929 to 1930, vice president, Radiola Division, RCA-Victor Corp.; 1931 to 1934, vice president in charge of sales for RCA-Victor; manager, licensing division of RCA, and also a member of advisory board for RCA, 1934 to 1938. For a one year period, he was president of E. A. Nicholas, Inc., of Chicago. Served as a vice president of the Radio Manufacturers Association.

NICOL, WILLIAM (1768-1851). B., Scotland. Constructed the prism that provided a successful means of polarizing light. In modern usage, Nicol's prisms may be found in some television apparatus and other equipment using polarized light. His share in leading to modern day advances is thus recognized.

NICOLSON – In 1917 devised a television system which was similar to that of Boris Rosing's, which was a cathode-ray tube receiver linked with a mirror wheel transmitter. Nicolson's differed in that it was adapted for spiral scanning.

NIEPCE, JOSEPH NICEPHORE (1765 - 1833). French chemist. B., Châlons-sur Saone. With Louis Daguerre discovered the means of reproducing spontaneously, images received in the camera and from this developed present-day photography – and later, television.

NIPKOW, PAUL (1860-1940) – Invented the television disc. B., Lauenburg, Pomerania, Germany; D., Berlin, Germany. Ed., local school at Lauenburg and at Neustadt; and later attended lectures by Heimholtz and Slaby in Berlin and Charlottenburg. On Dec. 24, 1883, the solution of the general idea for television was achieved when he created the perforated spiral distributing disc or scanner. That disc was the basic scanner used in all of

– Courtesy Harper & Bros.

Paul Nipkow

the early television systems right up to the time electronic scanning was adopted in the 1920's. Numerous scientists of today when asked to name the inventor of television reply that the nearest answer is that "television was invented by Nipkow." The scanning disc is recalled as the device which whirled television into actuality; it proved that pictures in motion could be flashed over wire and radio. However, he lacked the radio amplifier, light-sensitive cells, neon lamps, photoelectric cells, cathode-ray and radio-electron tubes. (See *Nipkow Disc.*)

NOBLE, EDWARD JOHN (1882 -). B., Gouverneur, N. Y. Ed., Yale

Univ., B.A., 1905. With Ward & Gow, New York City advertising agency. With J. Royal Allen, purchased small candy company for $5,000 which later developed into the present Life Savers Corp. Chairman, Civil Aeronautics Authority, August 1938-May 1939. In January 1941, purchased New York radio station WMCA and sold it to Nathan Strauss on Nov. 19, 1943, after purchasing the Blue Network Co., Inc. (later, American Broadcasting Corp.), July 30, 1943 from the Radio Corp. of America. Chairman, board of directors, American Broadcasting Co., Inc.

NOBLES, CHARLES EDWARD (1918-). B., Dallas, Tex. Ed., Texas A. & M., School of Electrical Engineering, B.S. in E.E., 1939. Joined Radio Division, Westinghouse Electric Corp., in television development, and during the war worked on radar. Developed system of "Stratovision." airborne system of television and FM radio broadcasting.

OERSTED, HANS CHRISTIAN (1777 - 1851). Danish physicist. B., Island of Langeland. Ed., Univ. of Copenhagen, Ph.D. Professor of physics at the Univ. of Copenhagen. Discovered electromagnetism (see) for which he was honored by the Royal Society of London and the Institute of Paris. Author of "Manual of Mechanical Physics," 1844, and studies in chemistry and popular science.

OHM, GEORGE SIMON (1785 - 1854). Physicist. B., Erlangen, Germany. Ed., Univ. of Erlangen. Won the Copley Medal for his work on electric currents. In 1849 became professor at Munich, and from 1852 held the physics chair. He is famous for discovering the law of electricity which bears his name – Ohm's Law – a standard measurement of resistance to electrical current flow.

PATREMIO, SAL R. (1917-). B., Lodi, N. J. Ed., Hackensack High School, in neighboring town. At the age of ten began building radio receivers; building all types of receivers and circuits led him to become interested in transmitting. At the age of 16 obtained amateur radio license and operated own transmitting station, W2ITL, which is still active today. Since 1940 employed with Allen B. Du Mont Laboratories, Inc., beginning with experimental and development work on television cameras and transmitters in the Passaic research department. Now Chief engineer, Station WABD.

PAYNE, GEORGE H. (1882-1945). B., New York City. Ed., C.C.N.Y., the College of Pharmacy, and New York Law School. For many years active in newspaper work and later an important figure in Republican party affairs. In 1920, opposed James W. Wadsworth for the Republican nomination for United States Senator. From 1916-33, was City Tax Commissioner, New York. Appointed member, Federal Communications Commission, 1934-43. After leaving the FCC, became vice president and a director of Finch Telecommunications Co., New York.

PECK, WILLIAM HOYT — Used a unique form of reflecting lenses, angularly displaced, to arrange lenses on a scanning disc in a circle instead of a spiral, and so was able to concentrate his light beam to a small spot, all of which was reflected (save for the usual reflection and refraction losses) to a screen. This produced images of considerable size and brilliance. In late 1937, he put this device into commercial use for bulletin transmission. In the 1930's using a neon "crater" tube (a tube with a tiny "crater" of brilliantly-glowing ionized gas, bright enough to project a picture a few inches square when used with a scanner in which the lenses replaced the pinholes, to pass more light) Peck had shown images about 2 by 3 feet.

PLUCKER, JULIUS — B., Germany. A mathematician and physicist. About 1859, the effects of a discharge of electricity through a vacuum had been studied by him. He coined the term "cathode ray." Was the first to investigate the effect of magnetism on cathode rays.

POPPELE, JACK R. (1898-). B. and Ed., Newark, N. J. Studied electrical engineering at Newark Tech. and Penn State. At the age of 14 constructed and operated an amateur station with an early spark coil transmitter. At 17 obtained his first job on the S.S. Iroquois of the Clyde Line as radio operator. Became WOR's engineer when that station began radio broadcasting in February 1922 and has been with that station since. Originally the station's only engineer, he now heads a staff of 60 crack technical experts as chief engineer. Since December 1944, president of the Television Broadcasters Association; formerly secretary of the board of directors of WOR, elected vice president, Bamberger Broadcasting Service, Inc. (WOR), January, 1946.

PORTER, PAUL ALDERMANDT (1904-). B., Joplin, Mo. Ed., Kentucky Wesleyan College, 1923-26. After practicing law and working on newspapers for six years, he entered Government service in 1932 as special counsel for the Department of Agriculture; in 1937 became Washington counsel for Columbia Broadcasting System; in 1942, deputy administrator in charge of the New Rent Division, Office of Price Administration; in July 1943 moved over to the War Food Administration, where he was associate administrator and then deputy administrator. Later was associate director of Office of Economic Stabilization. In 1944 during the presidential campaign became publicity director of Democratic National Committee. On Dec. 21, 1944, became chairman, Federal Communications Commission. Early in 1946, became chief O.P.A. administrator, resigning just before the demise of that agency.

PRIESS, WILLIAM H. — Former chief engineer of the De Forest Radio Co. Inventor of the "reflex" receiving circuits and numerous important devices for the U. S. Armed Forces. Developed the "Priess Television System," a mechanical system which took advantage of the sharply marked resonance of a short round rod or wire of highly tempered steel or silver, tightly clamped at each end, and carrying at its midpoint a small (usually one-quarter inch square) metal mirror. To the underside of this mirror was brazed a small "fin" of iron which could swing back and forth in a narrow air-gap between the two pole pieces of a small electromagnet in such a way that as it swung, it set up tortional vibrations in the spring wire to which it was welded. Through the coil of the electromagnet flowed a small alternating current. When the frequency of this current was made exactly the same as the frequency of the tortional rod with its attached mirror and fin, the system set into wide-angle oscillation. Thus a beam of light from some fixed source thrown upon the vibrating mirror was caused to sweep back and forth through a wide angle. The screen was scanned 10,000 times per second horizontally and 50 times vertically.

PUPIN, MICHAEL IDVORSKY (1858-1935). B., Serbia, came to U. S. 1874. Grad., Columbia Univ. in 1883; further study Cambridge Univ., England, Univ. of Berlin, under Hermann F. von Hemholtz. Appointed professor of mathematical physics at Columbia Univ. in 1891. In 1896 invented rapid X-ray photography and discovered various X-ray facts. Invented self-inducting coils which, used at intervals along the circuit, made possible long-distance telephony. Gave U. S. Government his method for eliminating wireless static interference. Recipient Edison Medal, 1920.

— Courtesy Harper & Bros.

Michael Idvorsky Pupin

RAIBOURN, PAUL (1896-). President, Television Productions, Inc. B., Frankford, Ind. Grad., Univ. of Illinois, E.E. degree, 1917. Served as engineer on airplane radio telegraphy with what is now Bell Laboratories, 1917. Technical Officer, U. S. Army Air Corps, 1918. Western Electric engineer, 1919-20; post grad study in economics and psychology, Columbia Univ., 1919-21. Joined Paramount Pictures, Inc., 1920; made a survey for firm in television, 1937, resulting in concern's purchase of interest in Du Mont Laboratories. In 1938, made personal investigation of television developments in England, France and Germany. In charge of Paramount's television operations in Chicago through Balaban & Katz Corp., and those in

Los Angeles through Television Productions, Inc. Helped organize Television Broadcasters' Association, 1938.

— *Courtesy Harper & Bros.*
Richard Ranger

RANGER, RICHARD HOWLAND 1889-). Pioneer in radiophotos. B., Indianapolis, Ind. Grad., Massachusetts Institute of Technology in 1911. Was with Radio Corp. of America in research and development department, 1920 to 1930. Specialized in the development of radiophoto and facsimile equipment. Devised a system of sending photographs by radio; sent from Honolulu to New York, a distance of 5,136 miles. (See *Ranger facsimile System.*)

RAWLS, RICHARD BIRRELL — Started career as actor, stage manager in amateur theatricals in 1926; later became professional actor and stage manager, shows including "Counsellor at Law," "Between Two Worlds," "Black Limelight," "Crime Marches On," "Romeo and Juliet," "The Barretts of Wimpole Street," "Candida." He was production assistant for First National Pictures and free lance cameraman for Metro - Goldwyn - Mayer news. In 1935 with Federal Theatre as general stage manager and later national technical director. During this period conducted technical experimentation in cooperation with General Electric Co., Corning Glass, and Borg Theatre of Vienna, on rear projection of scenery, mercury - vapor lighting, stroboscopic lighting. Joined CBS television as floor manager in 1939 and progressed to manager of studio operations. At shutdown of television in 1942, continued at CBS as director of service operations. After term of service in U. S. Army, joined American Broadcasting Corp. Television in January 1946, as manager of television operations and assistant to Paul B. Mowrey.

REIS, PHILIP — B., Germany. Before 1889, he advanced the theory that light falling upon selenium liberated electrons which aided in conducting the current.

RHODES, HELEN — Grad., Univ. of Michigan, A.B. in speech, 1942. In charge of the production of variety and commercial television programs, WRGB, Schenectady.

RIBBE — In 1904 he perfected a two-way television system using only one channel of communication, and also a system for transmitting continuously moving message-bands.

RICKEY, FRED (1907-). B., Mt. Vernon, N. Y. Attended Western Reserve in Cleveland, and later New York Univ., from which he was graduated in 1942. In U. S. Army Medical Corps, 1942-43. Joined CBS as night manager of shortwave production in 1943 and later became an assistant director on shortwave production in 1944. After completing some film scenarios and a full length play for U. S. Army Special Services, joined CBS Television as assistant director and writer. Began directing late in 1945; associate news director, CBS television since March 1946.

RIGNOUX – A French physicist who with Fournier developed an early (1906) television system which sent crude pictures over wires.

ROBERTS, CLEDGE – Staff director at television station WCBS-TV. Has specialized on cartoonists and artists with "Draw Me Another," "Tales by Hoff" and "Here's Dow" typical of what can be done with strictly visual material. Also directs "Consumer's Quiz," "You Be the Judge" and "Photocrime" series. Owner-operator of The Harbor Playhouse at Marion, Mass., which he runs during the summer months on a hiatus from television. Has appeared in and directed Broadway shows. His motion picture background includes innumerable short subjects, plus two feature pictures. In radio, he has been heard on many dramatic programs over CBS and other networks, and on a number of independent stations. Resigned in the Fall of 1946.

ROEMER, OLAUS (OLE) – In 1676 discovered that light travels at a definite fixed speed.

RONTGEN, WILHELM (1845-1923). B., Germany. Discovered X-rays. Working on cathode rays with a Crookes' tube he opened up for further exploration a new section of the electromagnetic spectrum beyond visible light.

ROSENTHAL, A. H. – His early scientific work was concerned with various optical and electronic problems, including "a novel design of an apparatus applying television technique to the investigation of the sun's surface." His industrial experience includes various aspects of television and electronics, photographic and optical instruments, radio crystal production, etc. Was for several years head of the electronic television department of Scophony, Ltd., and later director of research and development, Scophony Corp. of America.

ROSING, BORIS – Russian scientist. Added a new chapter to television when he patented a television tube in 1907. In experimenting with the Braun tube he discovered that scanning the fluorescent surface at the end of the tube would instantaneously recreate the original picture at the receiver. Rosing proposed to shoot a stream of minute electric particles, called electrons, at a screen coated with a fluorescent material, instead of a beam of light from an electric lamp as Paul Nipkow suggested. The electrons were to bombard the screen with a force depending upon the current received from the transmitter and to follow the corresponding path across the picture as did the light beam through the scanning disc, which he intended to use at the transmitter. The fluorescent screen glowed with an intensity depending upon the force of the electron stream at its point of contact, producing the same intensity of light or shade as in the original scene. Since the electrons covered the screen in a very brief time, it would be impossible to distinguish individual lines, or frames of the image, and a complete glowing, moving picture would be seen on the screen.

He placed his electron device inside an evacuated glass tube, originally invented by Sir William Crookes and developed by Karl F. Braun, A. R. B. Wehnelt and Ryan, and which had been named a "cathode ray tube" because the beam of electrons was emitted from an electrical cathode within the tube. But because of the absence of an essential amplifier, Rosing's idea remained a "physicist's dream" of something which was to come in the future.

Rosing in Russia, and A. A. Campbell Swinton in England, separately and simultaneously in 1907, published methods of electrical image-reproduction using electromagnetic means for scanning. The first all-electronic television system utilizing cathode-ray at both transmitter and receiver was later proposed by Campbell Swinton (See *Swinton, Campbell*) in 1911. In 1911, Rosing also evolved a system of reproduction by a different method, in which the variations in the picture brightness were produced by varying the speed of travel of the light beam instead of its intensity. This scheme was later applied to cathode ray tube reproduction and is generally known as "velocity modulation." The brightness of the trace on the fluorescent screen of the tube is governed by the rate at which the beam sweeps across it and a retardation in speed will thus give a brighter line. A complete system based on this principle was independently invented and described by L. H. Bedford and O. S. Puckle in England in 1934.

ROYAL, JOHN F. (1886-). B., Boston, Mass. A reporter at 18, he was assistant city editor of the *Boston Post*. In 1929, director and general manager of WTAM, Cleveland; 1931, joined National Broadcasting Co. as program director and a few months later became vice president in charge of programs; in October 1940, made vice president in charge of television.

RUHMER, ERNEST – B., Germany. A pioneer in the wireless telephony field who constructed a selenium television system using thousands of cells, and shutters plus connecting wires. The intricacies of the countless connecting wires made the adoption of his system impracticable, however. It was known as the "talking arc light." The vital part of his apparatus was a selenium cell.

SAGALL, SOLOMON – Founded the Scophony Co. in England, 1930, and became managing director. Under his guidance the organization grew from a $10,000 syndicate to a $1,500,000 corporation. Came to U. S. A. in 1940, founded Telicom Corp., U. S. A., which manufactured crystals for radio frequency controls, transmitters and receivers for armed forces. His concern now makes television receivers, crystals, and "intra-video" antennas.

SALINGER, HANS (April 1, 1891-). Television researcher. B., Berlin, Germany. Educated Univ. of Berlin, 1909-14, Ph.D. Engaged in research work in Berlin, 1919-29, at Reichspostzentalant in telephony and telegraph – actively engaged in development and laying of submarine cable. Was department head at Henrich-Hertz Institute from 1929-35; at the same time associate professor of Polytechnical Institute at Berlin. Conducted research and testing on transmission and oscillation theory. Left Germany in 1936. Became associated with Farnsworth Television, Inc., of Philadelphia, predecessor of Farnsworth Television & Radio Co., of which he currently is a mathematical physicist in the research department. From 1936-40 engaged in research of new multiplier tubes, dissector tube developments, and various scanning circuits. Made advancements on distortions and the theory which is behind the dissector tube. Holds numerous patents on electronic developments. From 1939 to 1941 designed and worked on development of a new type of wave filter for television transmitter systems, a unit of which is now in operation at the Farnsworth experimental television station W9XFT, Ft. Wayne, Ind. During World War II did research work for the Armed Forces on multiplier tubes for infra-red equipment. Today is busily engaged in development of television tubes and mathematical problems as they apply to circuits and television.

SANABRIA, ULISSES A. – President of the American Television Laboratories, Inc., Chicago, Ill. Engaged exclusively in television work for 20 years. Formerly chief engineer of the Western Television Corp., Chicago. In 1930, produced television images on a two-foot screen, and later on a 10-foot screen in exhibitions in Chicago and New York City. In 1932 took television exhibits around the country and demonstrated them to over 5,000,000 spectators. Advocate of "franchized channels."

David Sarnoff

SARNOFF, DAVID (1891-). President, Radio Corp. of America. B., Uzlian'Minsk, Russia. Ed., electrical engineering, Pratt Institute, Brooklyn, N. Y. Marconi Wireless Telegraph Co., 1906; promoted to manager, Marconi Station, Sea Gate, Brooklyn, N. Y., 1909; wireless operator on S.S. Beothic, Newfoundland, 1911; wireless operator for Marconi Co. at John Wanamaker's Dept. Store, 1911-12. Radio inspector for Marconi Co., and instructor, Marconi Institute, 1912.

Chief radio inspector and assistant chief engineer, Marconi Co., 1913; successively contract manager, assistant traffic manager, and commercial manager, same company until 1919 and upon absorption of Marconi Co. by Radio Corp. of America in 1919, became commercial manager of RCA; general manager, 1921; vice president and general manager, 1922; executive vice president, Jan. 1, 1929, and president since Jan. 3, 1930. President and director RCA; RCA Communications, Inc.; chairman of the board and director, RCA Manufacturing Co., Inc., National Broadcasting Co., Inc.; director, Radio-Keith-Orpheum Corp., Electrical & Musical Industries, Ltd., Motion Picture Producers and Distributors of America, Inc. Appointed lieutenant-colonel, 1924, colonel in December 1931, and later brigadier general, U. S. Army, Dec. 6, 1944.

In 1944, Television Broadcasters Association conferred on him the title of "Father of American Television" in recognition of his work in introducing and developing television in U. S. Holds numerous honorary degrees and decorations from several foreign governments; also the American Legion of Merit, awarded to him by the War Department in 1944.

SAWYER, W. E. – In 1877 described to witnesses a system of television similar to that announced by G. R. Carey (or Corey). In a letter published on May 12, 1880, Sawyer outlined his theory of modern television: "The transmitting ray and invisible index in the darkened receiver tube were to start at the periphery and describe their spiral motions in exact unison until the center should be reached, and, the speed being sufficiently great, it is obvious that, as the first spark between the receiving platinum points would not have ceased to affect the retina until the last spark, with the index at center, would have been produced, an exact image of the object at the transmitter would be reproduced before the eye of the receiver."

He contemplated the use (to reproduce the image) of a small, very rapidly moving electrical arc, whose brilliancy would compensate for its small size and the short time it would occupy in any one position. Thus, he advanced the theory of a continuous image, by virtue of persistence of vision. However, his plan was purely theoretical as he himself realized. He was quite correct for his time, selenium was too slow and insensitive for his system, radio had not yet been discovered, and wire lines were far from their present state of utility; synchronizing devices were limited, etc.

SCHANTZ, JOSEPH B. (1910-). Television researcher. B., Schaefferstown, Pa. Ed., U. S. Naval Academy (1 year); received a B.S. in M.E.E. from Gettysburg College; did graduate work at Stanford Univ.; received his Master of Science in Engineering degree from Michigan; did advanced work at Univ. of Pennsylvania. With RCA from 1934-36, did research on acoustics, sound recording, facsimile and air omnidirectional radio range (navigational aid for radio). With Farnsworth Television, Inc., of Philadelphia, predecessor of Farnsworth Television & Radio Corp., from 1936-39, working on primary circuit research and television terminal equipment. Since 1939, active in the research and development circuit for terminal studio equipment with Farnsworth. Is assistant manager of the research department, Farnsworth Television & Radio Corp. Was in charge of the company's postwar participation in Navy Department's development of supersonic guided missiles.

SCHOFFLER – In 1896 suggested a system to transmit television. Successive photographic plates were exposed to subject material and placed in plate holders around a wheel which rotated slowly. The wheel gradually rotated faster and successive points on its scanned the photographic plates, taking each in turn as the previous one was completed. At the receiver a similar mechanism was used to expose fresh photographic plates. These were developed and projected in succession. Schoffler's proposed system was devised primarily for the transmission of rapid dispatches via facsimile but was also offered a television possibility. Of particular interest in this system was the hand-operated synchronizing means. The operator witnessed a field of view much similar to that which exposed the photographic plates and adjusted by hand the speed of the receiving mechanism so that it would follow that of the transmitter. The operator accomplished this feat by insuring that the edges of the field of view which he saw formed a rectangular picture.

SELDES, GILBERT (1893-). B., Alliance, N. J. Grad., Harvard Univ. Reporter in Pittsburgh, music critic in Philadelphia, correspondent in World War I, author, editor, formerly director of television programs, Columbia Broadcasting System. Best known book *Seven Lively Arts*, 1924. In television, made his presence felt by introducing new program ideas, brought studio technique to a degree of perfection not before attained and directed CBS television effort until it became the programming exemplary (in his day) of the new entertainment medium. At the end of 1945, he resigned from CBS, and later joined Paramount Pictures as a writer.

SENLECQ, M. (Senlecq d'Ardres) – B., France. A physician. (See *Telectroscope*.)

SHANE, IRWIN A. (1914-). B., Chicago, Ill. Ed., Univ. of Illinois, Northwestern Univ., New York Univ., and New York School for Social Research. Founder and publisher, *Televiser, Journal of Television;* also founded Television Workshop in 1943, video programming and production firm, of which he is executive director. Produced more than 100 television shows. Inaugurated first traveling television stock company, July 4, 1944. Sponsored series of "Television Institutes" in major cities to acquaint public with contemporary trends in television; also operated "Television School" on various phases of the art. Television consultant to leading department stores.

SHUPERT, GEORGE T. (1904-). B., Alpena, Mich. Attended Univ. of Michigan. Investment Banking Business, 1925. In 1936 helped organize National Security Traders Association, and for two years was an officer and director of Michigan Traders Association. In 1938 joined Industrial Pictures, Inc., of Detroit. Organized and became sales director of Paramount Pictures Industrial Film Division in 1940, producing advertising films. In 1943, made assistant to Paul Raibourn, vice president of Paramount Pictures, Inc., and president of Television Productions, Inc., operating television station W6XYZ located on the Paramount lot in Hollywood, Cal. President, American Television Society, 1945-46.

SLABY, ADOLPH D. H. (1849-1913). B., Berlin, Germany. Ed., Royal Trade School, Potsdam; professor of electrotechnics, 1882; and director of electrotechnical laboratory, Technical High School, Charlottenburg, 1884. Honorary professor on Philosophical Faculty of Univ. of Berlin. His scientific research in the early nineties was related to thermodynamics, motors and gas engines. Known as "the German Marconi" because of his experiments in the field of wireless. Developed the Slaby-Arco system, which was consolidated with Braun and Siemen-Halske systems in 1903, forming Telefunken, the German national system.

SMITH, DAVID B. – Vice president in charge of engineering, Philco Corp., Philadelphia. Authority on television, radio and radar. Grad., M.I.T. with S.B. and S.M. in electrical engineering. Joined Philco in 1934, first serving as a patent engineer on television radio and other applications of electronics, and later in charge of a special advanced studies group in research and engineering department. Appointed technical consultant to the vice president in charge of engineering in 1938, and later director of research in 1941. He has taken an active part in the development of television in the establishment of national television standards. Member, original Television Committee of Radio Manufacturers Association, and chairman of Panel 9 of the National Television Systems Committee in 1940. Served as chairman of the Television Panel No. 6 of Radio Technical Planning Board. In November 1945, named chairman of the new Television Systems Committee of the RMA. Credited with a substantial number of patents and patent applications, covering inventions in television, radio, and radar.

SMITH, NEWLAND F., JR. – Television research and development engineer. Ed., B.S. in physics, The Citadel, 1931; S.B. in electrical engineering, 1933; S.M., 1934, from M.I.T. Employed in electrical research at Lynn Works of General Electric Co. prior to obtaining degrees from M.I.T. Joined Philco Corp. in February 1934 as development engineer on television projects. Concentrated on improving performance of cathode ray tubes for television receivers, and later specialized on designing new synchronizing generators, deflection circuits, video amplifiers and receiver circuits. Helped develop some of the pioneer television studio cameras and remote pickup equipment. In 1943, promoted to section engineer in charge of much of the development work of Philco's television engineering department, and was responsible for the engineering design and construction of the multiple-relay television network between Washington and Philadelphia. Also handled development of both studio and transmitter equipment for television station WPTZ. Author television technical papers, and credited with number of patents and patent applications covering inventions in television, particularly on new synchronizing and deflection systems.

SMITH, WILLOUGHBY – An experimenter who was informed by May, his subordinate, about the peculiar behavior of selenium in 1783 and notified the Society of Telegraph Engineers of his investigations.

SOBOL, EDWARD – B., Brooklyn, N. Y. Entered theatre via vaudeville when still a boy. Agent, producer, stage manager and director. Associated with Max Gordon. Time-test director at RKO studios in Hollywood. In London directed "Dodsworth"; then followed several years on Broadway during which he directed Francine Larrimore in "As We Forgive Our Debtors," and "Spring Thaw," with Roland Young. Joined NBC's television department in 1939 as producer. When war curtailed video, he returned to Broadway as manager of "Doughgirls"; and general manager of "Decision." Rejoined NBC in June 1944 as producer of "live" telecasts. Now NBC television producer.

SPOSA, LOUIS A. Joined Du Mont in 1941 from Station WGYN. After numerous jobs at WABD, became program operators manager. Resigned in 1947. With Allied Stores. (See Cuff, Sam). Author of "Television Primer," on production and direction.

SQUIER, (Maj. Gen.) GEORGE OWEN (1865-1934). B., Dryden, Mich. D. Washington, D. C. Army scientist. Graduated from West Point in 1887, with high honors. Chief signal officer, Third Army Corps, during Spanish-American War. Sent to the Phillipine in 1900 to lay cable telegraph system. Did research in multiplex telephony, for which he was awarded medal in 1912. Wartime chief signal officer and chief of American Air Service, 1916-1918. Chief signal officer of the Army, 1919.

— *Courtesy Harper & Bros.*
George Owen Squier

STANLEY, C. O. (1899-). B., Eire. 1934, managing director, Pye, Ltd., London; 1942, awarded O.B.E. for work with tank communications; 1945, awarded C.B.E. for work in connection with radar production, and 1943-46, adviser to Sir Robert Renwick, C.C.E., Air Ministry Controller of Production, Ministry of Aircraft Production Communications. Chairman of Radio Communications and Electronic Engineering Assoc., Television Policy Committee and Radio Industry Council. Television Promotion Committee.

STANTON, FRANK (1908-). B., Muskegon, Mich. Ed., Ohio Wesleyan Univ., B.A.; Ohio State Univ., M.A. and Ph.D. Resigned Ohio State faculty to join Columbia Broadcasting System as research director in 1935. Named vice president in 1942, vice president and general manager in 1945. Elected to board of directors in 1945, to presidency on Jan. 9, 1946. Consultant during war to the Secretary of War, Navy Department, Office of Facts and Figures, OWI. Author of articles and books on psychology, marketing and radio research. Has given public and official support, as CBS president, to development of ultra-high frequency color television.

STEINMETZ, CHARLES (1865-1923). B., Germany. Emigrated to America in 1889. Employed at R. Eichemeyer, manufacturer of hat machinery and electrical devices; and later with General Electric Co. when they purchased the Eichemeyer factory. Not an inventor, but through abstract reasoning established formulas and broad principles that could be utilized in practical work by engineers. Became one of the nation's leading electrical engineers. Had several hundred patents, the most famous in investigations on magnetism resulting in "Law of Hysteresis," which enabled losses of electric power due to magnetism to be calculated before beginning on the construction of transformers, motors, generators and other electrical devices utilizing iron. Steinmetz did not believe in the existence of ether waves. He declared that radio and light waves were merely properties of an alternating electromagnetic field of force which extended through space.

STILL, WILLIAM BUNDY (1914-). B., Danville, Ky. Ed., C.C.N.Y.. Worked with Marine Radio Corp., Collins Radio Corp., and Rexall Radio Stores before going into own business. Television "practitioner" who built his own television experimental broadcast station W2XJT, in Jamaica, L. I., at a cost of about $20,000 as compared to similar stations at $100,000. His station is said to be the first small, independent television station to be constructed in the U. S. and the initial television station of any sort in operation on Long Island. He has been described as "television's first ham," "an enthusiast who has taught himself the fundamentals and rudiments of television and made his own contributions to the art."

STOKES, GEORGE GABRIEL (1819 - 1903). Irish physicist. B., Skreen, Co. Sligo. Ed., Pembroke College, Cambridge; later appointed Lucasian professor of mathematics. Devoted himself to the mathematical investigation of physical problems, primarily in hydro-dynamics. In 1849 published his researches on the dynamical theory of diffraction. His later endeavors were in the field of optics, with his most important research being on fluorescence, and the fact that the refrangibility of light is in general reduced by the dispersion caused by fluorescent substances is known as Stokes' law. Published results of his investigations on double refraction, the effect of wind on the propagation of sound, and about his researches in pure mathematics.

STONE, ROBERT B. – Grad., Eastman School of Music, Rochester, N. Y., in 1932, and in fall of that year became a member of WGY, General Electric's pioneer radio station in Schenectady, N. Y. His duties included program production and writing of scripts and musical arrangements. Joined radio-recording division of the National Broadcasting Co. in January 1936, and later the production staff of Columbia Broadcasting System. In November 1941, rejoined GE as a member of the production staff at television station WRGB. Named program manager of the station in January 1943, but soon after asked to be relieved of managerial responsibilities in order to devote his entire time to experimentation and development of programming technique. As producer of television shows, is now responsible for all musical productions including everything from spots in variety shows to Metropolitan Opera guest singers, etc.

SUTTON – Englishman who (about 1890) proposed a system for a television receiver which ranks in importance with Paul Nipkow's system. He used a scanning disc and an electrically controlled light source known as the "Kerr Cell." His method of reassembling the image was ingenious in that it was later in use on a widespread scale for more than 40 years in practical television systems. This system, as with Nipkow's scanning disc, is now obsolete.

SWINTON, ALAN ARCHIBALD CAMPBELL (1863-1930). Third son of A. Campbell Swinton of Kimmerghame, Berwickshire, England, and Georgiana, daughter of Sir George

Sitwell, Bart. Ed., Cargilfield, Edinburgh (where although only a boy, gave exhibitions with a magic lantern and became quite skilled in taking photographs). In 1878 attended Fettes College; in 1879 after reading a description of a telephone given in a technical paper, constructed two telephones which functioned excellently; in 1882, apprenticed to Lord Armstrong in the works at Elswick, during which period he fitted a Chilian battleship with electric gun firing control which enabled any number of guns to be fired simultaneously. Left Elswick in 1887 and set up in London as an electrical contractor and consulting engineer and installed the electric light in many town and country mansions.

Alan A. Campbell Swinton

Early in January, 1895, after reading an account in the morning paper of Prof. W. C. Rontgen's discovery of X-rays, Swinton was successful in obtaining a shadow photograph by means of a Crookes tube which he owned. A few days later he obtained a shadow photograph of the bones in his own hand. He recognized at once the great benefit of his discovery to mankind. This photograph was reproduced in the magazine *Nature* of January 1986. In 1904, gave up contracting work and became exclusively a consulting engineer, with special interest in radio work.

Campbell-Swinton in England and Rosing in Russia, separately and simultaneously in 1907 published methods of electrical image reproduction using electromagnetic means for scanning. The first all-electronic television system using the cathode-ray at both transmitter and receiver was suggested by Campbell-Swinton before the Rontgen Ray Society of London, of which he was president, in 1911. In most respects his suggestion paralleled the systems in use today with one feature missing. That missing feature was the storage of the electric charge between successive scannings – the principle that would give the electronic pickup apparatus or "eye" the sensitivity necessary to make it workable with high-definition scanning. However, it was impossible to give a practicable workable system of his suggestions because amplification devices had not yet been developed. V. K. Zworykin later perfected to an amazing degree the Campbell-Swinton device which resulted in electronic television universally in use today.

SZCEZPANIK – See *van Szcezpanik*.

TALBOT, WILLIAM HENRY FOX (1800-77). English pioneer of photography. B., Chippenham, Wiltshire. In 1833, discovered the process of photography, but did not announce it publicly until 1839. Louis Daguerre announced a similar discovery in January 1839, but the Talbottype eventually was the more acceptable.

TESLA, NIKOLA (1857-1943). B., Smiljan, Lika, Serbia. D., New York. Student, four years, in Polytechnic School, Gratz., in mathematics, physics, and mechanics; afterward, two years Philos. studies, Univ. of Prague. Came to the United States in 1884 and was employed in Edison's experimental laboratory. Made valuable contributions in the field of electrical science and engineering. Invented the system of arc lighting, the Tesla coil transformer, dynamos and generators. His discoveries have been of great aid in the development of radio transmission. In 1895 devised a new method for generating electricity (alternating current) for transmission over long distances. His invention of the induction motor and the Tesla coil and his discovery of the rotary magnetic field principle won him universal homage as the "electrical wizard" of the last decade in the 19th century.

THALES (640 B.C.-546 B.C.). Greek philosopher of Miletus and one of the

Thales

seven wise men of Greece. It is said that he foretold the solar eclipse of May 24, 585 B.C., and that he believed the entire world was formed of one single element, namely, water. He was the founder of Greek philosophy. He also was acclaimed as the "Patriarch of Electricians" through his observations of the phenomena of frictional electricity and magnetism. His familiarity with the fact that amber acquired an electrical charge by friction has given him priority of being the first of the world's "electronic scientists."

THOMPSON, BROWDER JULIAN (1904-1944). B., Roanoke, Va. Grad., Univ. of Washington, B.S. in E.E., 1925. Also did graduate work. Later employed at the research laboratory of General Electric Co. at Schenectady, N. Y. (1926-31). In June, 1931, became head of research section of the research and engineering department of the Radiotron Division of Radio Corp. of America at Harrison, N. J. In 1940 made associate director of the research lab, and when RCA Labs opened at Princeton, N. J., became associate director of general research. In 1944 named civilian consultant to War Department.

Did research and development on broadcast receiving tubes, ultra-high frequency receiving and transmitting tubes as well as electron tubes for industrial applications. He directed work in the field of television tubes and contributed a great deal to original studies of amplifiers and radio-electron tube theory and design. For his analysis of the fundamental frequency limitations of the conventional type of tube, he developed a new conception of mechanical and electrical design which would allow the operation of tubes at ultra-high frequencies. The acorn tube was the result of his research which extended the useful radio frequency range far beyond previous practical possibilities. He headed important research work on television tubes, and tubes for generating power, and was credited with advances in screen-grid tubes and power pentodes that became mainstays in broadcast reception.

He was killed in action during a flight in an Army plane in the Mediterranean Theatre while on a special mission for the Secretary of War. Awarded Morris Liebmann Memorial Prize by I.R.E. in 1936 for his contributions to ultra-high frequency field of radio.

THOMPSON, JOSEPH JOHN (1856-1940). British physicist. Ed., Trinity College, Cambridge, of which he became Master in 1918, and was president of the Royal Society, London, 1916-20; physics professor at Cambridge Univ., 1938. Best known for his work on the mathematical theory of electricity, and his discovery of the electron. As a student of electricity and magnetism he concentrated on the study of conduction of electricity through gases and upon his classical investigations into the behavior and properties of electrons, the modern theory of thermionic emission was based. By "finding" the electron, electron emission, and the development of means for their control (notably by the grid electrode), he opened the way to present-day radio broadcasting and communications systems.

THOMPSON, WILLIAM (LORD KELVIN) (1824-1907). B., Belfast, Ireland. Grad., Cambridge Univ., 1845. In 1846, professor at Univ. of Glasgow. At 23, wrote mathematical treatise that gave Maxwell information from which to evolve his electromagnetic theory of light. Made discoveries in the mathematical theories of magnetism, electricity, elasticity and heat. Invented mirror galvanometer used for cable signaling. Electrical engineer for the Atlantic cables, 1857-58, and 1865-66, making numerous contributions to the advance of communication over cables, for which he was knighted in 1866, and raised to the peerage in 1892. He showed how physics might be practically applied to communication and transportation. Evolved telegrapher's equation, which facilitated systematic studies and predictions to be made with long-distance cable telegraphy and stimulated thought in field of blurring or distortion of electromagnetic waves traveling along conductors. Kelvin's work in this and allied directions improved telegraphy, produced improvements in telegraph circuits and "even today is the ancestor of studies of television image degradation in normal circuits."

TOWN, GEORGE R. — Manager, engineering and research, and assistant secretary, Stromberg-Carlson Co., Rochester, N. Y. One of nation's outstanding authorities on television standards. Grad., Rensselaer Polytechnic Institute, 1926, receiving his doctorate at R.P.I. in 1929. Prior to joining Stromberg-Carlson, worked as research and development engineet at Leeds & Northrup, Philadelphia, and Arma Engineering Co., Brooklyn, N. Y. From September 1933 to September 1936, instructor in electrical engineering, Rensselaer Polytechnic Institute. Joined Stromberg-Carlson in 1936 as engineer in the research laboratory and in 1940 was made engineer in charge of the firm's television laboratory; in 1941 became director of research; and in April 1944, named manager of research and engineering.

TRAMMELL, NILES (1894-). B., Marietta, Ga. Ed. at Sewanee Military Academy and the Univ. of the South. Commissioned second lieutenant in the regular army at Fort Leavenworth, Kan., in World War I. After the war until 1923, member of staff of Major General Charles G. Morton; married the step-daughter of General Morton. In March 1923 resigned from army to become commercial representative, traffic department, RCA; in 1924, made district manager of Pacific Northwest for Marine Division of RCA. By 1925, had risen to assistant sales manager, Pacific Division. Joined National Broadcasting Co. as salesman in March 1928; two months later named manager of Central Division; March 1929, vice president in charge of Central Division. In January 1939, transferred to New York and elected executive vice president. On July 12, 1940, he assumed the presidency of the company.

TRAUB, ERNEST H. (1912-). Television researcher. B., Singapore. Ed., Switzerland and England; attended London Univ. Built his first television receiver in 1929, and in 1933 after two years' experience in technical journalism joined International Television Corp., Ltd., London, as chief research engineer. In 1935 became vice president in charge of research, and from that time until 1939 helped develop the Mihaly-Traub optical-mechanical system of television transmission and reception. Came to U. S. in 1939, and did consulting engineering work in New York and California, joining Philco Corp. in 1940 as a television engineer. Began to develop television receivers of the projection type but this work was interrupted by the war, during which he concentrated on radar equipment. After the war put in charge of the television optics projects of the research division, Philco Corp. He has been responsible for much of the research in developing Philco's postwar projection receiver models. Credited with a considerable number of television patents and patent applications.

VAN DER BIJL, HENDRIK JOHANNES (1887-). B., Pretoria, South Africa. Ed., South Africa; later attended Victoria College; postgraduate work at Halle Univ. and Univ. of Leipzig, Ph.D. Then came to U. S. and studied physics at Univ. of Chicago under Prof. Albert Michelson, and Dr. Robert A. Millikan. Joined research department, Western Electric Co., 1913-20. Returned to own country as technical adviser to Department of Mines and Industry of Union of South Africa, 1920. Pioneered in electronics, invented modulation system used successfully by American Telephone & Telegraph Co. (1915), in historic long-distance radiophone tests between U. S. naval radio station NAA at Arlington, Va., and Honolulu and Paris. Specialized on thermionics and did pioneer work in developing characteristics of electron tubes. Constructed hundreds of tubes of various types. Named directorate-general, War Supplies Board, Union of South Africa, 1939.

VAN MUSSCHENBROEK, PIETER (1692-1761). Physicist. B., Leyden, Holland. Discovered the lungs of radio: the condenser. While professor at Leyden Univ. working on experiments which might "store up" electricity by charging water in a bottle, found that when a jar of water was on a table it could not be electrified, but when a hand was put around the bottle, an electric shock was received. Seeking a substitute for the hand, he put on a metal coating which served as an insulator. The Leyden jar, as the bottle was termed, became a scientific mystery until Benjamin Franklin explained that the inner coating (a wire dipped into water) was positively charged whereas the outer coating (the human hand) was negatively charged. When these two were joined by a conductor the positive rushed to the negative and caused a shock to a body (of an individual holding the jar). Later, further experiments proved that a dry bottle with the lower part coated inside and out with tinfoil produced a more violent discharge. The bottle or Leyden jar was put into valuable use when wireless came into use and was utilized as electrostatic condensers.

VAN SZCEZPANIK, JAN — B., Krakow, Poland. In 1897 invented one of the most representative of early television systems. He is said to have built an apparatus which did not achieve success. His two paramount difficulties were the unavailability of light-sensitive devices in his time, and the difficulty of maintaining synchronism. There is no evidence, however, that he ever tried to build this device.

VARLEY, CORNELIUS (1781-1873). English inventor and water-color painter, invented lenses and the graphic telescope (1811). Wrote various scientific papers.

VARLEY, CROMWELL FLEETWOOD (1828-83). English electrical engineer, son of Cornelius Varley, invented the double-current key and relay (1854). Also a cymaphen, an instrument resembling a telephone (1870). At that time (1870) he discovered that sound could be emitted from a condenser. After the failure of the first Atlantic cable (1858), he contributed greatly to the success of the second.

VOLTA, ALESSANDRO (1745-1827). Italian physicist. B., Como. A pioneer in electrical science. Led by the experiments of Luigi Galvani, invented the voltaic cell, forerunner of all electric batteries. (See *voltaic cell.*)

VON ARCO, (COUNT) GEORGE WILHELM ALEXANDER HANS (1869-1940). B., Grassgorschutz, Silesia, Germany. Ed., Berlin Univ. Was assistant to Prof. A. D. H. Slaby, 1894; part inventor of Slaby-Arco system of wireless telegraph. Manager, Gesellschaft fur Drahtlose Telegraphie, 1903. Said to have been first to carry out a practical radio telephony demonstration over a distance of 21 miles in 1906. At one time chief engineer, Telefunken Gesellschaft.

VON ARDENNE, MANFRED (BARON) – Radio engineer. Pioneered in television in Germany during the 1930's. In 1930 began his researches on cathode-ray systems for the reconstitution of television images, and later was the first to produce results comparable with those of mechanical reconstituting devices.

VON HELMHOLTZ, HERMANN L. F. (1821-94). B., Potsdam, Germany. Ed., medical school. Entered Prussian army as a surgeon. Became assistant in Berlin Anatomical Museum, and professor of physiology at Konigsberg, at Bonn, and later at Heidelberg (1858-71). Then professor of physics. Univ. of Berlin. Made contributions to the development of the electromagnetic theory of light and indicated its possibilities. It was his research into the phenomena of electrical oscillations and electromagnetic induction which encouraged his pupil, Heinrich Hertz, who demonstrated the existence of electromagnetic waves. Helmholtz encouraged him to study the problem, pursue the invisible impulses, prove that they existed and measure their length.

VON MIHALY, DENES (DIONYS) – B., Budapest, Hungary. Worked in Germany. Experimented about 1931 with a mechanical television apparatus, which although very complex, was of interest. The main feature of his device was the image-scanning mechanism which took the form of a system of very small oscillating mirrors having an area of one square millimeter or less. The mirror was attached to a loop of extremely fine platinum wire. The device could not achieve television because of the unsuitability of the selenium cell and principally because the optical system used was incorrect. Difficulty was also experienced in keeping all the oscillograph mirrors vibrating in synchronism. However, by means of this apparatus he succeeded in transmitting and receiving crude shadowgraphs. Von Mihaly's experiments were subsidized by the German Post Office, which assisted him in his work.

WADE, WARREN – After completing high school, for two decades toured country in stock, on Broadway as actor and director, and wrote, directed and acted in radio plays (WTAM, Cleveland) for eight years. Joined NBC radio (1930); television (1938), became chief of production in 1940 until 1942, when he joined the Army and became assistant executive producer of the Signal Corps Photographic Center which produced all Army training, morale and combat films. Had served as a sergeant during World War I; re-entered service in July 1942 as a captain and came out a major. Rejoined NBC Television in December, 1945 as executive producer.

WAKEFIELD, RAY C. (1895-). B., Fresno, Cal. Grad., Stanford Univ., B.A., 1916, and Doctor of Jurisprudence, 1918. Admitted to California bar, 1918. Had varied experience in public utility work, mainly railroads. From 1920-23, reputy district attorney, Fresno County. State inheritance tax appraiser for that county from 1923 to 1937, and served as president of that state group. President, California Railroad Commission (August 1938-January 1940), member since 1937. Appointed member Federal Communications Commission on March 22, 1941.

WALKER, PAUL ATLEE (1881-). B., Washington County, Pa. Grad., Univ. of Chicago, 1909, Ph.B.; Univ. of Oklahoma Law School, 1912, LL.B. For more than 15 years with State Corporation Commission of Oklahoma, serving as counsel and commissioner. Elected to State Corporation Commission; chairman of the Commission, July 11, 1934; named member of the Federal Communications Commission. Served as chairman, Committee on Cooperation with Interstate Commerce Commission in National Association of Railroad and Utilities Commissioners from 1925 until appointed to FCC. Elected vice chairman, FCC. Received his home state's highest honor, Nov. 16, 1945, when he became a member of the Oklahoma Hall of Fame.

WARREN, RALPH (1895-). B., New York City. Director, Columbia Broadcasting Co.'s television station WCBW, New York. Ed., New York Univ., Columbia Univ., and C.C.N.Y. Identified with theatre and photography for a score of years. Joined CBS Television as a cameraman in June 1944. Televised more than 500 WCBW shows before being made a staff director in May, 1946. Resigned early in 1947.

WATSON-WATT, ROBERT ALEXANDER (1892-). B., Brechin, Angus, Great Britain. Ed., Univ. College; Dundee, a college of the Univ. of St. Andrews. Holds degrees of B.Sc. (Eng.), St. Andrews (with special distinction in electrical engineer-

Courtesy British Information Services
Sir Robert A. Watson-Watt, C.B.

ing), and B.Sc. (London) with honorary degrees of LL.D., St. Andrews, and D.Sc., Toronto. Meteorologist-in-charge at Royal Aircraft Establishment, 1917-21; superintendent, Radio Research Stations of Department of Scientific and Industrial Research, 1921-33; superintendent, Radio Department, National Physical Laboratory, 1933-36; superintendent, Bawdsey Research Station, Air Ministry, 1936-8; director, Communications Development, Air Ministry, 1938-40. In 1940 appointed scientific adviser on Telecommunications to the Air Ministry, and in 1942 in addition became vice controller, Communications Equipment, Ministry of Aircraft Production. He was one of the two deputy chairmen of the Radio Board of the War Cabinet Board of England.

With J. F. Herd and L. H. Bainbridge Bell published "Application of the Cathode Ray Oscillograph in Radio Research," showing the use of the cathode ray tube and in radiolocation as a tool for research into the behavior of wireless waves. Often described as the "Father of Radar," for the British scientist is the first who took radar out of the laboratory and made it a practical proposition. His discoveries and inventions made it possible for Britain to have a working system of radar protection in readiness for World War II. After British radar proved itself in the Battle of Britain, Watson - Watt came to America in 1941-42 at the request of the U. S. Government, to advise army and air force chiefs on its principles and practice.

WEAGANT, ROY ALEXANDER (1881-1942). B., Morrisburg, Ontario. Ed., college in Stanstead, Quebec; McGill Univ., Montreal, B.S., 1905. Joined Montreal Light & Power Co., later Western Electric Co., New York, in apparatus design department. Then with Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., as draftsman, May 7-Oct. 31, 1907; joined General Electric Co. at West Lynn, Mass., and two months later DeLaval Steam Turbine Co., Trenton, N. J. In 1912 joined Marconi Wireless Telegraph Co. of America as a designer and there introduced many innovations, including the panel type of transmitter which became a standard. Became Marconi's chief engineer. Consulting engineer, RCA, 1920-24. Developed directional antennas and other anti-static devices which minimized the effect of atmospherics in trans-Atlantic reception. He is best noted for his efforts to eliminate static. Left RCA in 1924 and joined Lee De Forest in research, finally retiring in 1925. Recipient, Morris Liebmann Memorial Prize, IRE, 1920.

WEBER, WILHELM EDUARD (1804-91). German physicist. B., Wittenberg and appointed physics professor at Halle (1828); and at Göttingen (1831) but was deposed in 1937 for protesting against the political action of the Prussian Government. Thereafter, he devoted his attentions to researches in acoustics, magnetism, elasticity and electro-dynamics, mainly in association with Karl Friedrich Gauss (see). With Gauss he discovered that telegraph signals could be transmitted over a line making use of induced currents produced by the action of a coil of wire surrounding a bar magnet. These are probably the fundamental discoveries upon which our present-day electrical communications systems are based.

WEHNELT, A. R. B. – Made improvements on the cathode-ray tube in 1904 and 1905.

WEILLER, LAZARE – In the late 19th century invented a system of scanning replacing the Nipkow disc with a rotating drum studded with minute mirrors. Each mirror was placed at a slightly different angle, and when the drum revolved it scanned all parts of the picture and reflected the drum onto a selenium cell. Although Weiller, in actuality, was not the the first to develop a mirror drum, he is generally considered the inventor. L. B. Atkinson constructed an electrical viewing apparatus using a drum in 1882, but no description of it was ever published.

WERRENRATH, REINALD, JR. (1915-). B., New York City. Ed., Cornell Univ. With National Broadcasting Co. as lighting and special effects technician, 1936-40; program manager, Balaban & Katz Television, 1940-42; U. S. Navy, combat information center and fighter director officer, U.S.S. Cabot, 1942-45; director of sales and promotion, special events, and assistant to Captain Eddy, 1945, WBKB, Chicago, Ill.

WHEATSTONE, CHARLES (1802-75). English physicist. B., near Gloucester. His first researches were in connection with sound. Became professor of experimental philosophy at King's College, London, in 1834. In 1837 took out patents for an apparatus which gave signals by electricity and is now known as telegraphy. In 1838 invented the stereoscope and in 1843 instruments for measuring the constants of a voltaic series. The Wheatstone Bridge, a device for the measuring of electrical resistance by a method of balance, was not his invention but it was he who brought it to the attention of the public. His *Scientific Papers* were published in 1879.

WIKKENHAUSER, GUSTAV – Ed., Budapest (Hungary) Technical Univ. mechanical and electrical engineering). Joined Radio Laboratory of

Messrs. Suss (scientific instrument manufacturers in Budapest) as an engineer in experimental department. Later with General Electric Co. of Germany (A.E.G.) equipping Budapest railroad stations experimentally with A.E.G. automatic ticket printing machines. Later joined A.E.G. design staff in Berlin in ticket printing machine department. During his stay in Berlin, spent much of his free time in experimental laboratory of D. von Mihaly, who at the time (1928) started intensive work on television. Wikkenhauser built a television transmitter and two receivers for 30 line definition for transmission of transparencies shown at 1928 Berlin Radio Exhibition, when television was shown publicly for first time. He ran equipment through whole course of exhibition and remained in charge when exhibition transferred to Copenhagen, Sweden.

Shortly afterwards D. von Mihaly and group of financiers formed Telehor A.G. in Berlin for development and exploitation of Mihaly system of television. Wikkenhauser joined company as chief engineer. In March 1929, firm transmitted television pictures for first time over a broadcast transmitter (Berlin Witzleben — 30 lines). Subsequently, Telehor A.G. was taken over by radio firm of Tekade in Nuremberg, where Wikkenhauser continued his work on development of television until 1932. At that time the British firm of Scophony, Ltd., was formed in London to develop and exploit the ideas of George W. Walton. Wikkenhauser joined this firm in 1932 as chief television development engineer. He helped develop the Scophony supersonic optical - mechanical television system and his efforts culminated in 1938 in the transmission and reception of projected high definition pictures 16 feet in size, on 405 line definition demonstrated in one of London's largest cinemas. When war broke out in 1939, he became general manager and chief engineer of Scophony, Ltd. The firm devoted its activities to development of special instruments for radar purposes. In 1946, joined board of directors of Scophony, Ltd., and controls all firm's technical and scientific activities. Work is continuing on Scophony optical - mechanical television system, and electro-opacity television system.

— Courtesy RCA

Irving Wolff

WOLFF, IRVING (1894-). B., New York City. Ed., Dartmouth Coll., B.S., 1916; graduate work, Cornell Univ., where he was also physics instructor, until 1923, when he received his Ph.D.

In 1924 conducted research at Cornell Univ. Joined RCA Laboratories in 1928, developed first beat-frequency audio signal generator, and worked out new methods of loud-speaker testing. In early 1930's turned to development of equipment for producing microwaves. Pioneered in radar, and many of the possibilities of radar were first shown by him and his associates in the RCA Labs.

WOODRUFF, E. T. (1915-). B., Richmond Hill, N. Y. Ed., New York Univ. With NBC programming for 1½ years. In U. S. Navy (1937-41). Joined Du Mont Labs. in 1941, becoming first television cameramen to double as announcer and technician; made Program Coordinator (1945). A founder of the Television Producers Assn. (vice-president).

WOODS, MARK (1901-). B., Louisville, Ky. Ed., two business colleges. Served in U. S. Naval Service during World War I. Joined Thomas A. Edison Industries in 1919; and New York Telephone Co. (revenue accounting division), 1920. Later joined American Telephone & Telegraph Co., remaining there until 1926. In 1926, was assistant treasurer and assistant secretary of the Broadcasting Co. of America, an AT&T subsidiary operating WEAF. On Nov. 1, 1926, the National Broadcasting Co. took over the broadcasting operations of AT&T and he became treasurer in charge of finances while continuing his other positions. In 1934 he became assistant executive vice president and administrative officer of NBC, and in 1936 vice president and treasurer. Elected president of the Blue Network Co., Inc., in January 1942, when it became a separate, wholly owned RCA subsidiary. Later the Blue Network name was changed to its present one of American Broadcasting Co., Inc. For his "leadership and outstanding contributions to the welfare of the American public," Woods received the 1944 citation of merit by the Poor Richard Club, of Philadelphia.

YOUNG, OWEN D. (1874-). B., Van Hornesville, N. Y. Ed., St. Lawrence Univ., 1894; honorary degrees from numerous educational institutions. Counsel, General Electric Co., 1913; vice president until 1922, chairman of the board since 1932; chairman of the board, Radio Corp. of America, until 1929; chairman of the executive board until 1933; chairman, advisory council, NBC; director, International General Electric Co. Founder of RCA. Chairman, Committee of Experts, Reparations Commission, and German Government. Holds numerous distinctions, awards, commendations, etc.

ZWORYKIN, VLADIMIR KOSMA (1889-). Television scientist. B., Mourom, Russia. Invented the iconoscope – electric "eye" of the television camera; and the kinescope, or "eye" of the receiver. Grad., Technological Institute (electrical engineering), 1912. Studied under Boris Rosing, physics professor and a pioneer in realizing the possibilities of cathode rays as applied to television. In 1913 went to Paris and worked at X-ray experiments at the College de France.

—Courtesy RCA

V. K. Zworykin

Came to the U. S. A. in 1919 as a penniless Russian immigrant. Obtained a job with Westinghouse Electric & Manufacturing Co. at Pittsburgh, Pa., in the research laboratory. It was while there that he evolved the basic principles of the *iconoscope*. Joined RCA at Camden, N. J., 1930, and became a member of the research staff, and later associate research director of RCA Laboratories at Princeton, N. J.

Holder of many awards for electronic achievements. Has also perfected the celebrated electron microscope which is capable of magnification up to 100,000 diameters. In addition to the Rumford Medal awarded him in 1941 by the American Academy of Arts and Sciences, he was the winner in 1941 of the famed Morris Liebmann Memorial Prize awarded by the Institute of Radio Engineers. In 1940, received honorary degree of Doctor of Science, from the Brooklyn Polytechnic Institute; National Modern Pioneers Award, given by the National Association of Manufacturers, in 1940. Zworykin and his disciples perfected to an amazing degree the old Campbell-Swinton device and set the pace in electronic television for the world. In April, 1947, became Vice President and technical consultant of RCA Laboratories.

III

Television's Technical Vocabulary

This section ins a compilation of television — and pertinent radio words and phrases in contemporary use.

A

A 3 — technical designation of an audio broadcast.

A 5 — technical designation of a video broadcast.

ABC — abbreviation for the American Broadcasting System (formerly the Blue Network of the National Broadcasting Co.), one of the major radio networks, with Station WJZ in New York as key station.

A. C. — abbreviation for "alternating current."

A. C. RECEIVER — a set designed to operate from a. c. power source. The power peaks of these receivers nearly always employ a power transformer for stepping the a. c. line up or down.

A. C.-D. C. RECEIVER — a set which will work either from an a. c. or d. c. power source and does not have a power transformer.

A. F. — abbreviation for "audio frequency."

A. F. M. — American Federation of Musicians.

AIEE — American Institute of Electrical Engineers.

AM — abbreviation for amplitude modulation, commonly or better known as "standard" broadcasting.

ASCAP — abbreviation for American Society of Composers, Authors, and Publishers.

ATS — American Television Society.

A. U. — abbreviation for Angstrom unit.

ABAXIAL — being or moving away from the axis. The term is sometimes used to denote the marginal rays of light which pass obliquely through a lens in optical systems.

ABERRATION — an imperfection in an optical picture or image, caused by a defect in the lens or mirror to bring all light rays to the same focus. It may occur in an electronic optical system resulting in a halo around the light spot.

ABSTRACT SET — a setting or background suitable for fashion shows, musical acts or variety, composed of arbitrary architectural or other units, steps, platforms, columns, abstracts or geometrical forms, pylons, pilasters or draperies, combined in a pleasing, though not necessarily rational, composition. A setting without definite locale: purely decorative. Also, abstraction.

ABSTRACTION — See *abstract set*.

ACHROMATIC — without color; the transmission of light without breaking it up, as a prism does, into the colors of the spectrum.

ACHROMATIC LENS — two lenses, one of converging type and the other of diverging type, used to overcome chromatic dispersion which is the term used to describe the different focus point for dissimilar colors. The dispersion of one lens serves to correct that of the other.

ACOUSTIC – pertaining to sound.

ACOUSTICS – the science that refers to the making, sending and results or effects of sound; the study of the cause, application, and effect of vibrations on the human and animal ear which enables hearing.

ACOUSTIC WAVE – used occasionally to describe a soundwave.

ACTINIC – description applied to light rays which cause a chemical or electrochemical action. From the Greek "aktis," meaning "a ray." Usually the actinic rays of the spectrum are those which comprise ultra-violet, blue-violet, and blue light.

ACTIVATING LIGHT – See *exciting light.*

ACTIVE – quick, lively, moving, using energy, energetic.

ACTIVE LINES – those occasions when the electron beam, as such, is said to be active or exist in a television camera or picture tube, and is either reproducing the lights and shades of the image or is scanning it.

ACTIVE MATERIAL – designation often given to the fluorescent substances which are used in the production of cathode-ray tube screens. The principal materials include zinc phosphate, zinc silicate, and calcium tungstate, etc.

ACTUALITIES – British definition of "Special Events," such as news occurrences, and other happenings throughout the day, from a human interest, or feature viewpoint.

ADAPTER – a device used for changing temporarily or permanently the terminal connections of a circuit or part.

ADIACTINIC – name given to a material that prevents the passage of actinic rays of light, such as a sheet of red glass, or celluloid.

AD LIB – to speak a part, phrase or word which has not been previously rehearsed, prepared or planned. Usually in a humorous vein to provoke laughs, to cover an "awkward" situation or in place of a forgotten phrase, passage, or speech. Further, to improvise, to speak lines not written in the script, or, in music, to play unwritten parts.

AERIAL – a series or system of wires arranged in suspension in the air so that they are away from other objects used for the radiation or reception of television and/or radio waves; also, a conductor or system of conductors for the purpose of intercepting electromagnetic waves. Also, an elevated wire insulated from the earth, an insulated wire built inside the house or apartment, or an insulated wire wound on a frame. More familiarly known in America as an *antenna.*

AERIAL-GROUND SYSTEM – wire arrangement, consisting of three integral parts: (1) the antenna or aerial; (2) the lead-in wiring; and (3) the ground. Function of this system or arrangement is to intercept, receive.

or capture some of the radio waves being sent out by the broadcasting stations.

AERIAL, TELEVISION TRANSMITTING — There are two sets of radiating aerials: (1) the upper which is for vision or video signals; (2) for sound or audio signals. Each set is equally spaced out around the mast so that uniform radiation is obtained.

AFFILIATED — united with other stations to form a network.

AFFILIATES — stations associated with, or working in conjunction with a group, or network.

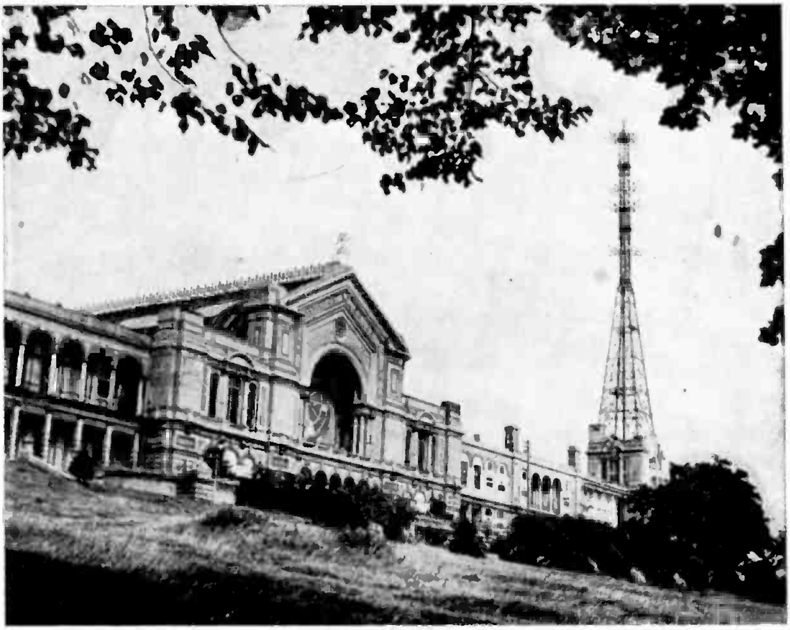
AFTERGLOW — In cathode-ray tubes the screen remains shining or luminous after the exciting cause or stimulus has passed away. Usually to describe the emission of light from a fluorescent material after the cathode rays have been removed. Synonymous term might well be "persistence of luminosity." Material which possesses a very slight afterglow is considered highly desirable as it enhances the persistence of vision and thus enables the building up of a clear image on a cathode-ray tube screen. Another term for phosphorescence.

AHRONHEIM SYSTEM OF COLOR TELEVISION — Early in 1931, Ahronheim, a German researcher, patented a television system to transmit colored film, employing a color filter or analyzer, each color acting upon a different photocell. At the receiver the image was viewed through a synchronously driven color filter, placed between the scanning disc and the eye. (See *Color television*.)

AIRBORNE TELEVISION — television systems, equipment, or utilization of airplanes in conjunction with the pick-up, transmission, and/or reception of television. (See *Block television; Ring television; Stratovision.*)

ALEXANDERSON SYSTEM OF TELEVISION — Dr. E. F. W. Alexanderson of the General Electric Co., Schenectady, N. Y., demonstrated a modification of the mirror-scanning method in Dec., 1926. He developed novel mechanical scanners for television. His projector reflected a cluster of seven lights on the screen and when associated mirrors on a drum revolved, the spots of light gyrated to cover the entire screen with light that "painted" the picture. He described it as "a multiple light-brush system" and demonstrated it in St. Louis on Dec. 15, 1926. At Proctor's Theatre in Schenectady on May 22, 1930, he projected a seven-foot television picture on a screen, flashed from his laboratory by radio. He used a perforated scanning disc and high-frequency neon lamps.

His system consisted of a drum with many mirrors arranged side by side around the circumference (the Weiller-wheel design), each mirror having a different inclination to the drum axis. The drum was mounted on a horizontal shaft, and the image of the object being televised was projected upon the mirrors and thence by reflection upon a cluster of seven light-sensitive cells. Seven arc lights, each one of which was modulated in intensity by a separate incoming television signal, furnished the light source



— *Courtesy BBC*

Alexandra Palace: home of the BBC.

at the receiver. Dr. Alexanderson used seven transmitting channels, each provided with a photoelectric cell at the transmitting end and a light modulator at the receiving end of the system.

In 1927, Dr. Alexanderson had put together the first television system for transmission to the home. He gave the first public demonstration of his newer system in January, 1928, at his own home. The camera outfit used contained a perforated scanning disc. Through the holes of this "sieve" from a 1000-watt lamp a flying spot of light flooded the subject's face. In two smaller cabinets were photoelectric tubes that converted the play of light and shadow on the face into electrical impulses. These impulses then were transmitted to home receivers on the long radio waves used by WGY, the General Electric radio-television station at Schenectady, N. Y. But the pictures on the home receiver screen were haunted by other images that floated palely in, like ghosts. It was then that Dr. Alexanderson and his associates began reaching into the shorter waves for the transmission that ended the ghosting. In the home television receiver at this time, the electrical impulses from the studio were amplified within the receiver and delivered to a neon lamp, which responded to the variations of the current to produce the lights and shadows of the picture.

ALEXANDRA PALACE — in London, the BBC's main television studio and transmission center in Great Britain.

ALKALI — one of a class of bases, such as soda or potash, that neutralizes acids and forms salts.

ALKALI METALS — names describing a group of alkali-producing metals, such as lithium, caesium, potassium, rubidium, and sodium, which owing to their more or less pronounced photoelectric characteristics, provide the active material for many types of photoelectric cells used in television.

ALLOY — a mixture of two or more metals.

ALL-WAVE ANTENNA — a receiving aerial system designed to pick up stations reasonably well over a wide range of carrier frequencies including the short-wave bands as well as the broadcast band.

ALL-WAVE RECEIVER — a set capable of receiving stations on all of the ordinarily used wavelengths in short bands as well as in the broadcast band.

ALTERNATING CURRENT — an electric current which changes its direction of flow at regular intervals many times per second.

AMERICAN BROADCASTING CO. — See *ABC*.

AMERICAN TELEPHONE & TELEGRAPH CO. WIRE TRANSMISSION — About 1924, A. T. & T. was using vacuum tube transmission to send photographs across the U. S. The positive film of the photograph was held on a cylindrical form, and a light beam was passed through the various light and dark portions of the film, and fell upon a photoelectric cell. Vacuum tube amplifiers were used at certain points along the route (from city to city) to boost the picture current until it reached the receiver. The fluctuating electric current passing over the circuit acted on a magnetically controlled light valve, which constantly changed the diameter of the beam of light passing through a lens on to the unexposed film rotating progressively before it, and caused lines of varying constriction to be photographically formed on the sensitized film. The received image came in the form of a negative which when developed, enabled the making of prints.

AMPERE – common unit of measurement of electric current; the amount of current that one volt can send through one ohm of resistance. Named after Andre Marie Ampère.

AMPLIFICATION – the process of increasing the strength, current, voltage or power of a signal. In television as in radio circuits video signal amplification is carried out through the use of vacuum tubes.

AMPLIFIER – a device consisting of one or more vacuum tubes and associated parts, used to increase the strength of a sound or picture signal. The ability to increase feeble and very rapid electrical variations has been basic to the growth of radio communications. The amplifiers now in use are fundamentally relay contrivances in which a feeble electrical voltage gives off a constant source of power in such a manner as to give a new electrical variation similar in all respects to the original except of very much greater power. This process is repeated continuously until the final variations are perhaps more than one million times greater than the original electrical impulses.

AMPLIFY – in radio or television means to increase in strength or volume.

AMPLITUDE – the greatest distance between the normal and amplified values of an alternating current. Or, the height of the crest of a wave above the surface of the medium at rest. A method of modulating a carrier-frequency current by causing the amplitude of the current to vary above and below its normal value in reference to the sound or other signal to be transmitted.

AMPLITUDE MODULATION – the standard or common form of radio broadcasting in which the changing in amplitude of a carrier wave corresponds to the variations in the power (amplitude) of the signal to be transmitted. Again, the carrier frequency is fixed, but its amplitude or strength rises and falls in accordance with the variations in the signal. In amplitude modulation, the carrier wave is maintained at a constant frequency, and the sound waves are impressed on the carrier wave so as to modify the amplitude. Abbreviation: *AM.*

ANDERSEN BROTHERS TELEPHOT – In 1912, a patent was granted to A. C. and L. S. Andersen, brothers, on a telephot. The sending apparatus comprised a dark chamber in which was placed a 6-inch lens that received the rays issuing from the dark chamber. These rays after being refracted met a small selenium cell, placed behind a 6-inch prism. A revolving belt having perforations rapidly passed in front of the camera influencing a selenium cell. At the receiver, a sensitive electromagnetic arrangement acting as a shutter cut off the light impulses, thus theoretically reconstructing the picture.

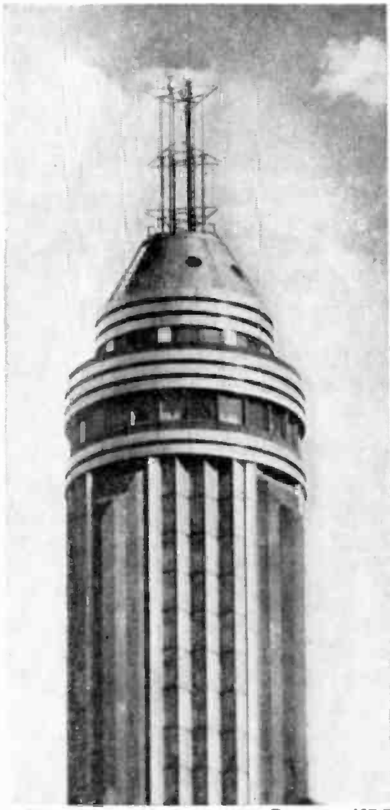
ANGLE SHOT – a camera technique in which a scene or object is shot from an unusual or extreme angle, such as an abnormal side view, down from a high boom level, or up from a low boom level. The angle shot is usually used for dramatic effect.

ANGSTROM UNIT – a unit of length used for expressing the wavelength of light. Abbreviation: A.U. One Angstrom unit equals one-one hundred millionth of a centimeter, or approximately four-billionths of an inch. (The diameter of a pin head is approximately 20,000,000 Angstrom units.) The wavelength of visible light ranges from 3900 Angstrom units to 7700 Angstrom units. Ultraviolet wavelengths measure from about 150 to 3900 Angstrom units. Infrared wavelengths run upwards from 7700 A.U. units.

ANIMATIONS – mechanical devices which in various ways impart seeming movement to inanimate subjects. Generally, a series of drawings presented in rapid succession to give the illusion of motion. More particularly, in television, any moving device used on graphic material such as charts or maps.

ANODE – a tube element which is usually positive in relation to the cathode. The electrode of an electron tube towards which the main electron stream flows. The anodes are used for concentrating and focusing and causes the electrons to move faster.

ANTENNA – a conductor or system of conductors for the transmission or reception of electromagnetic waves exclusive of the connecting wires between its main portion and the apparatus associated with it. In countries outside the U. S., it is synonymous



– *Courtesy NBC*

Antenna: for transmission of telecasts

with an elevated aerial. Also, a structure for sending or receiving radio waves. The antenna radiates the modulated currents, or their effects, into space. In television, the higher the television transmitter antenna, the further the area covered. For example, an antenna 100 feet high can cover a service area of 12.2 miles – or its horizon is 12.2. If it is 1500 feet high, then its horizon is theoretically 47.2 miles. That is theoretically, since as a practical matter, due to refraction, the horizon of a television station generally exceeds its theoretical value.

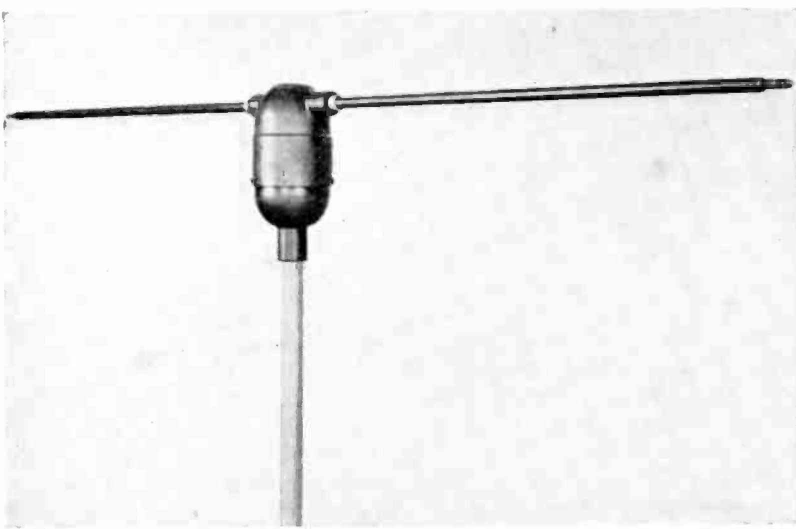
ANTENNA ARRAY – a system of two or more antennas, usually similar, excited by the same source, in order that directional effects may be obtained.

ANTENNA DOWNLEAD – a wire running down from the raised horizontal part of an antenna to the transmitting or receiving equipment.

ANTENNA HEIGHT ABOVE AVERAGE TERRAIN – the average heights above the terrain from two to ten miles from the antenna. (In general, a different antenna height will be determined by each direction from the antenna. The average of these various heights is considered as the antenna height above average terrain.)

ANTENNA SYSTEM – all of the equipment of a transmitter or receiver related to the antenna-to-earth circuit.

APERTURE – the opening in a lens



– Courtesy Farnsworth Television & Radio Corp

Antenna: for receiving telecasts

which limits the amount of light that passes through a camera lens. Also, the actual size of the scanning electron beam striking the mosaic of the iconoscope tube.

APERTURE DISTORTION – distortion which results in sharp changes of shade in the image, causing it to appear uniformly grey because the aperture is, or has become, too large. For maximum perfection, the opening in the lens should be small.

APERTURED DISC – a flat metal disc in which a series of holes, usually square, have been punched in spiral or circular formation. Described as the simplest type of scanning disc. Used mainly in mechanical system.

APERTURED DRUM – a simple device for projecting a television picture on to a screen. It consisted of a hollow metal drum, with a series of holes punched in spiral formation about it and by putting a light source at the center of the drum and then revolving it at a constant speed, a video image could be cast upon a nearby screen.

APPLETON LAYER – one of the group of ionised regions in the upper atmosphere which reflects radio waves and is frequently known as the "F-layer."

ARC MODULATION – a television system in which the signal currents transmitted are caused to modulate or vary in intensity by means of a special type of arc light. The arc lamp is focused through an optical system of lenses on to a revolving mirror-drum resulting in a brilliantly televised picture on a whitened motion-picture screen.

ARCO – See *von Arco.*

ARRAY – a combination of antennas at proper intervals, forming an antenna system, which enables directional transmission and reception. Usually used in connection with high-frequency designs.

ASPECT RATIO – in television, the numerical ratio of frame width to frame height, as transmitted. Now 4:3. (See *transmission standards.*)

ASPHERICAL SYSTEM FOR PROJECTION TELEVISION – D. O. Landis, an optician working in the laboratories of the RCA Manufacturing Co. (now RCA Victor Division), many years ago, conceived the idea that an optical system could be built using aspherical elements for projection of television images. Some time later he demonstrated to Camden laboratory research engineers his aspherical system for projection television from cathode-ray tubes onto a viewing screen. The first public showing of a theatre-television system made by RCA using this system was given in New York City on May 7, 1940, before the stockholders at the annual meeting. It was shown previously to F.C.C. members on February 5, 1940, in Camden at an informal gathering. Landis applied and received his patent on the system (U. S. No. 2,273,-801), granted in 1938.

(Several researchers whose efforts contributed to the improved optical systems based on Landis', were E. G. Ramberg and D. W. Epstein [RCA Labs] who worked out the theory of the finite-throw systems and produced practical designs; and also, R. Leuschner, whose skill in working glass surfaces saved much time and effort.)

In the system demonstrated in New York, a scene transmitted from a studio was reconstructed as a picture on the curved wide end of a cathode-ray tube about 7 inches in diameter. This picture was very brilliant, but small. The spherical mirror, 30 inches in diameter, gathered the light emanating from the tube and reflected it through a 22½-inch lens on the theatre screen. This screen was a regular motion picture screen. All the light (except for slight losses in reflection and transmission), which the large mirror gathered, found its way to the screen.

ASTIGMATISM – a defect in the structure of the human eye, causing a blur in parts of the field of vision; similarly, a defect in a lens causing indistinctness. Also, a control which adjusts the electron optical system to condition so that there is minimum aberration due to astigmatism.

ASYCHRONOUS – not synchronized – not in synchronism or synchronization with.

ATMOSPHERE – the air surrounding our planet, divided by the scientists into a number of regions, as follows (in their sequence), beginning from the earth's surface: the trophosphere, the tropopause, the stratosphere, the ozone layer, and the ionosphere. Beyond the ionosphere is interplanetary and interstellar space. These separate regions have no specific boundaries and no recognizable fixed positions. They sometimes are higher, lower and often overlap.

ATMOSPHERIC INTERFERENCE – disturbances, such as crackling and hissing noises in the loudspeaker caused by electrical storms.

ATMOSPHERICS – interference or disturbance signals of natural origin. Known also as "Static," "Strays," and "X's."

ATTENUATION – reduction in the strength of an electrical impulse. Signals are greatly attenuated in passing from the transmitting radiator to the receiving antenna.

AUDIBILITY – The human ear is unable to hear all kinds of sounds. It can hear sounds produced by air vibrations having a frequency ranging approximately between 20 and 20,000 vibrations per second depending on the individual. These two frequencies are the known approximate limits of audibility.

AUDIBLE – capable of being heard by the average human ear. The average approximate human hearing range is between 20 and 20,000 cycles per second, but actual limits differ among various individuals because of age variations or inherent inability to hear above or below the average.

AUDIO – the sound phase of television, that is, the part transmitted and received for the ear rather than for the eye. Pertaining to sound. From the Latin, "audio" meaning "I hear." Synonym for the word "sound," or the electrical impulses which carry aural intelligence.

AUDIO AMPLIFIER – the vacuum tube device which increases the voltage and power of the audio frequency signal. It may be found as a distinct piece of equipment or a section in a radio receiver.

AUDIO FREQUENCY – An audio frequency is a frequency corresponding to a normally audible sound wave ranging roughly from 20 to 20,000 cycles per second. Also, the name given when referring to the electrical impulse corresponding to sound.

AUDIO SIGNAL – a signal of audible frequency.

AUDION – A three electrode valve or tube invented by Lee de Forest in 1906, but now obsolete. It made possible, through its use as an amplifier, the clear reception of radio waves over great distances. Heralded as "revolutionary" in its time, it has been described as one of the greatest basic inventions in communications enabling further and faster progress in bringing radio, and later television, to technical success. The name audion was coined and given the tube by C. D. Babcock.

AUDITION – a studio test of a singer, dramatic actor, or similar participant seeking a role or position in a television or radio show, or with an orchestra.

AURAL – relative to the sense of hearing or pertaining to the ear.

AURAL TRANSMITTER – the term "aural transmitter" means the radio equipment for the transmission of the aural signal only.

AUSTRALIA – the International Television Corp. was set up in that country in 1938, but apparently nothing ever came of it.

AUTOMATIC BRIGHTNESS CONTROL – a device which automatically controls the average illumination of the television image on the receiver.

AUTOMATIC RELAY – unattended station which passes on signals from one point to another.

AUTOMATIC STATION – same as automatic relay; an unattended station, which, under predetermined conditions, operates automatically.

AVAILABLE AUDIENCE – the number of television or radio receivers tuned to all the broadcasting stations at specific times.

AYRTON AND PERRY'S APPARATUS – one of the earliest television systems, devised about 1880. The transmitter was composed of a mosaic of selenium cells, each of which was connected by means of a wire to a correspondingly placed magnetic needle on the receiving apparatus. This receiver, by electromagnetic influence opened and closed a light shutter, and so reproduced to some extent the degree of light which fell upon the selenium cell counterpart of the transmitter. The overabundance of wires, however, made the machine unwieldy, ungainly and impracticable for communication over any vast distances. G. R. Carey in Boston, Mass., tried to construct the same machine. Ayrton and Perry, however, are credited with having been the first to announce a practical system for conducting luminous images from one point to another electrically.

AXIS — used in reference to the various optical systems in television. The axis of a lens is that imaginary straight line which passes through its center and through the center of its radius of curvature. This is better known as the "principle axis" of the lens. Any other imaginary straight line passing through the center of the lens is known as a "secondary axis."

B

BBC — abbreviation for British Broadcasting Corp., a governmental agency that controls all television and radio broadcasting in Great Britain.

BCU — abbreviation for big close-up.

BACKDROP — a curtain used against a wall or elsewhere as scenic background or setting during a television scene.

BACKGROUND — the scenic arrangement or setting in back of the performers during a television performance in the studio; outdoors it may be people or other views behind the main object or person focused in the camera. Also, a sound effect, musical or otherwise, designed for use behind dialogue, etc.

BACKGROUND NOISE — sound received with a regular program, due to atmospheric interferences or circuit conditions.

BACKGROUND PROJECTION — scenic effects produced by throwing or projecting motion pictures on a translucent screen.

BACKGROUND SOUND — same as background noise.

BAIRD ELECTRON CAMERA — In the Baird Electron Camera, a development of the image dissector tube, an optical image of the scene to be scanned is focused upon a large uniform photoelectric cathode of high sensitivity. Electrons are liberated from the cathode at any particular point in direct proportion to the degree of illumination up to that point. This produces an "electron image" corresponding to the optical image, at or very near the surface of the cathode. In a normal photo-cell, the emission of electrons becomes diffused inside the tube, but in this type of electron camera the electron image is brought to sharp focus in a plane parallel to the cathode, but at some distance removed from it, by a combination of magnetic and electrostatic fields. This electron image is naturally invisible and is composed of variations in electron density corresponding to variations of illumination on the cathode. For television purposes, scanning is accomplished by displacing the focused electron image by two auxiliary magnetic fields perpendicular to the focusing field and thus sweeping the electron image across a fixed scanning aperture placed before a collecting anode. The remainder of the circuits associated with the camera consist of vision signal amplifiers, generators for the scanning currents which cause the traversal of the image over the aperture, a master frequency generator for synchronizing these scanning generators and pulse generators for injecting the synchronizing pulses into the vision signal.

BAIRD SYSTEM — used the Nipkow disc or light-spot system; the scanning beam was directed through the side of the disc, achieving vertical scanning. The Baird system was employed by BBC at the inception of its television service at which time it used both the Baird and Marconi-E.M.I. systems. Baird transmitted a 240-line picture at the rate of 25 per second. Baird Television System employed two different methods for the transmission of studio scenes, namely the spotlight (see) and intermediate film processes (see). After a period of trial the British decided that transmissions should be on one standard only and selected the Marconi-E.M.I., which transmitted 405 lines and 50 frames per second with interlaced scanning.

BAKEWELL'S APPARATUS — an 1847 picture-transmitting mechanism invented by F. C. Bakewell. The picture was traced in outline in a resinous ink on a rotating cylinder covered with tinfoil on which a traveling metal stylus passed. A corresponding cylinder turned at a similar speed. With each complete tour of the sending stylus over an ink line, a current was transmitted to the receiving point where, by the electrochemical action it created, a mark on the chemically treated paper was obtained.

BAND — frequencies which are within two definite limits and are set aside for a definite use or purpose.

BAND-PASS FILTER — an electric circuit which will transmit frequencies between two limits and reject others outside those limits.

BAND SWITCH — a device which simultaneously changes all tuning circuits in a television or radio transmitter or receiver to a desired band of frequencies.

BAND-WIDTH — that section of the radio spectrum vital to the transmission of information, whether aural or visual. For example, 6 megacycle band-width is presently required for television. Future television plans a 16 megacycle band-width. Radio, on the other hand, requires only 10 kilocycles band-width for broadcasting; the range of frequencies of the width sent out by a transmitting station. The number of cycles per second in the band of frequency required to transmit the visual or aural signal.

BARIUM PLATINOCYANIDE — a yellow crystalline salt containing platinum. Chemical formula: BaPt (CN). Because of its strong fluorescent characteristics, it may be used as an ingredient in the fluorescent screen material of cathode ray tubes.

BARTLANE PROCESS OF CODE PICTURE TRANSMISSION — system evolved by Captain M. D. McFarlane in collaboration with H. G. Bartholomew of the "London Daily Mirror," which in the early 1920's transmitted photos by radio or cable and via telegraph lines. A photo was taken of a scene or object or person; five prints on zinc were made from the negative, each of a different exposure, which gave the five principal tones of light and shadow. The five prints on zinc left certain parts of metal exposed and an electric circuit was established through these portions, corresponding to lights and shadows, each registering on certain perforators. The cable company received the perforated tape, transmitted its readings across the ocean from overseas to New York. Then, as contact needles were passed over the surface, circuits were made and broken and the tape was perforated. These perforations were then transmitted in the usual manner, received and recorded. When received, the recorded tape was photographically impressed on a sensitized film, a print made from a wet negative, photocopied by engravers to get a half-tone screen, then printed on a copper plate, etched, and sent to the press, for print on newspaper.

BASE — the panchromatic toning color used in make-up for television performers.

BAZOOKA — a device installed at the end of a coaxial transmission line to isolate the outer conductor from the ground. Also known as a line-balance converter.

BEAM — the pencil of light rays or other electromagnetic waves.

BEAM ANTENNA — an aerial with very marked directional characteristics.

BEAM ARRAY — a beam antenna consisting of a number of spaced radiators with directional properties.

BEAM CONVERGENT — rays which start out separately in the distance and meet or converge at a point.

BEAM CURRENT — the electron current of the beam on its arrival at the screen.

BEAM PARALLEL — a beam of light in which the rays are equidistant at all points (parallel) to each other.

BEAM TRANSMISSION — a directional system of short-wave transmission in which a special reflectory apparatus of wires is used to supplement the transmitting antenna. This results in the radiated waves leaving the antenna in the form of a divergent beam at an angle of from 10 to 15 degrees instead of being radiated in every direction. This method is more economical as a greater amount of energy can be concentrated in a given direction with a smaller amount of power. This method was developed by Marconi and is used in Great Britain.

BEEHIVE LAMP — the commercial form of a neon lamp, in which a spiral or "beehive" of wire enclosed a flat metal disc, these forming the electrodes of the lamp. Used for early experiments in television.

BELIN AND HOLWECK'S SYSTEM — a television system invented by the French scientists M. E. Belin and M. Holweck in France. Two vibrating mirrors were set at right angles to each other causing a reflection of the image that was to be televised to fall upon a light-sensitive cell.

BELIN CODE SYSTEM — In late 1920, or thereabouts, M. E. Belin, of Paris, was transmitting photographs and drawings, as well as writing, over an ordinary telephone circuit, by means of his rapid transmitting and recording instrument which he had perfected to a high degree. An ordinary original photograph was first retouched or redrawn so as to resemble a line-cut. This represented an enlargement of a plate made for printing in a magazine. In the original, the dots constituting the picture were so small they could hardly be distinguished by the naked eye. In his system the cut was reconstructed by the receiving instrument or by decoding a cablegram or telegraph message composed of numbers indicating the positions of the various dots, lines, etc., the picture suitably reduced so as to give a faithful reproduction of the photo or picture in question.

BELL TELEPHONE LABORATORIES — research laboratories of the American Telephone & Telegraph Co. in New York City. Bell engineers in the early days developed a system of television transmission known as the beam scanning method. A mechanical system, the scanning beam was directed through the top of the disc resulting in a horizontal instead of a vertical scanning. The Nipkow disc or light-spot system principle was used. In 1927, the Bell system set up a television demonstration over a substantial distance. The standard were 50 lines in the field of view reproduced at 17.5 frames per second and using a frequency of about 20 kilocycles. In 1930, the Bell system set up a demonstration using 72 lines, about 18 frames per second and a total band width of about 40 kilocycles. In 1937, a demonstration over coaxial cable with the standards which had a frame frequency of 25 per second, was set up.

BELT DRUM — See *belt scanner*.

BELT SCANNER — a flexible belt punched with a series of holes at equidistant intervals diagonally across it. The ends of the belt were fastened together and made to move quickly over two or three pulleys. A light source was situated between the pulleys and the televised image was projected. Synoanym: belt drum. (See *film scanner.*)

BERYLLIUM – a silvery-white metal, closely related in properties to magnesium. Also known as "glucinum." Chemical symbol: Be. Used for the coating of the cathode in certain kinds of neon lamps which have to deal with high-power currents. This coating gives the lamps longer life. These were used by the Bell Telephone in its television water-cooled neon lamp arrangement.

BIDWELL'S CELL – a selenium cell developed by Shelford Bidwell, famous electrical experimenter, in 1880. It was made out of a square of thin slate containing notches cut on the edges, over which two platinum wires had been wound. The spaces between the wires were then filled with active selenium.

BIDWELL'S THEORY – a theory described by Shelford Bidwell whereby the light-sensitivity of the selenium is due to the presence of selenides in the material. The theory has been described as "extremely improbable" by scientists.

BIG CLOSE-UP – a head shot, used to show facial characteristics and reactions of a performer. Abbreviation: BCU. Also called tight close-up.

BIG-NAME TALENT – individual television or radio performers or groups of performers who have already established reputations for themselves and have found public acceptance.

BIG SCREEN – large-size motion picture screen television images.

BILATERAL SCANNING – scanning in which the alternate strips are traversed in a reverse direction or alternate pictures are scanned in a direction at right-angles to that of a previous strip or picture.

BINAURAL – two-eared; ability to hear with two ears, as human beings do. The advantage of having two hearing systems (ears), or seeing-systems (eyes) is that in the former, it enables the ears to "accurately judge" sound and determine the location of any given sound. In the latter, it enables the eyes to judge distances or depth accurately.

BINOCULAR – two-eyed; sight with two eyes.

BIRDSEYE LAMP – studio lamps invented by Roger Birdseye, famous for his work in frozen foods. In this lamp, the powerful actinic rays used in motion picture studios have been eliminated. Although exceedingly bright, they are not harmful. Use of these lamps resulted in the elimination of over excessively accentuating the performer's make-up.

BIRD'S-EYE PERSPECTIVE – a drawing or other illustration of a setting as it would be viewed from the front and above. The normal angle of view is from the front of the setting, looking downward, at approximately

45 degrees. These views are utilized to clarify stage sets, positions and sizes not readily discernible on a staging plan.

BIT — a performer who has a very minor role in a television, radio, or dramatic show.

BLACK-AND-WHITE — colorless grey tinted appearance of ordinary pictures on television receivers in universal use today.

BLACK LEVEL — eliminating all traces of a picture being televised; i.e., switching or fading all cameras off the on-the-air line. A producer may desire to go black level for dramatic effect. Black level also means the electrical picture signal level which produces a black picture. (See *transmission standards.*) Black levels mean that no pictures are being transmitted — the home receiver screens go blank.

BLACK LIGHT — an invisible radiation which is neither black nor light. It may be either ultraviolet or infrared radiation, both of which are invisible. Used by Baird and National Broadcasting Co. in different television demonstrations. (See *"near" ultraviolet light.*)

BLACK OUT — a short act.

BLACK SELENIUM — term sometimes given to the metallic form of selenium which is light-sensitive.

BLACK SPOT — a small discoloration or darkening in the center of a cathode-ray screen, due primarily to unwanted impurities in the fluorescent screen.

BLACKER - THAN - BLACK — a portion of the television signal devoted to the synchronization. These synchronizing signals are transmitted at a higher power than the blackest part of the image, so that they will not appear on the screen.

BLANK OUT — a term used in tuning a receiver when the picture on the cathode ray tube is "erased" or blanked out while adjusting the receiver for picture reception.

BLANKET AREAS — A "blanket area" of a television broadcast station is that area adjacent to a transmitter in which the reception of other stations is subject to interference due to the strong signal from this station.

BLANKING — the process of cutting off the beam of electrons in a picture or camera tube during the time it is not forming a picture. This happens when the beam returns from the far right to the left to scan a new line or from the bottom to the top of the picture. (See *blanking pulse, blanking signal.*)

BLANKING PULSE — the pulse used in television to remove the lines that would otherwise be traced every time the electron beam returned to begin another line or frame.

BLANKING SIGNAL — that part of a television signal that blanks or erases the electron beam in the picture tube of the receiver while the beam is being blanked in the camera tube at the transmitter.

BLIND SPOT — the small section of the retina of the human eye at which the optic nerve trunk is joined. This spot is entirely without light and is quite insensitive to light.

BLIZZARD HEAD — an actress with blonde hair. Because of the color of her hair, it is necessary to have proper lights in the studio to avoid "flares."

— *Courtesy RCA*

Block Airborne Television:
a camera unit

BLOCK AIRBORNE TELEVISION — airborne television system using equipment developed for military use. It utilizes a light short-range type of apparatus. The camera is fixed in the nose of a Beechcraft JRB airplane. The image can be transmitted from 15 to 20 miles and can be used in advanced field operations. The panning effect with "block" equipment is accomplished by the pilot moving the controls of the aircraft so that the television camera screens the desired target. Announced and demonstrated publicly for the first time on March 21, 1946, at Anacostia Naval Air Station, Washington, D. C., by the United States Navy in conjunction with the Radio Corp. of America.

BLOCKING OSCILLATOR — a type of oscillator which generates intermittent signals used for scanning in cathode ray tubes.

BLOOM — glare caused by an object reflecting too much light into the lens of the camera. The excess brightness condition in the cathode ray tends to oscure picture detail. This happens when an area of white bounces light; for instance, the white bosom front worn by a man with his black tuxedo may cause the picture to bloom and obscure the details of his face.

BLOOMING — the glaring effect in a video image because of the defocusing of the electron beam in the picture tube due to excessively strong signals having been applied to the electron gun.

BLOW-UP — photographic or photostatic enlargement of written, printed or pictorial materials, in whole or in part, in order that portions, which must be legible or clearly defined, may be effectively photographed and transmitted through television. Also, maximum close-up; making the outgoing picture as large as possible.

BLUE NETWORK – See *ABC*.

BOARD FADE – fade out the picture by turning down the camera control.

BOBBLE – to fumble; an error made while reading lines from a script.

BOOM – a mechanical support for a microphone used in a television studio to suspend the microphone within range of the performers' voices yet above the range of the camera's focus. Also used with a camera in the television studio.

BOOM-ARM MIKE – overhead microphone, mounted on a swivel which enables it to be swung in any desired direction.

BOOM DOWN – The dolly boom is lowered, thereby lowering the camera, for a head-on shot or a tilted-up shot.

BOOM MICROPHONE – a microphone suspended from a boom which can be lowered or raised, extended or retracted by an operator to keep the microphone over the performers as they move about the stage set.

BOOM SHOT – an action taken by the television camera using the camera boom which allows greater radius in physical floor space.

BOOM UP – the camera dolly boom is raised, thereby elevating the position of the camera for a high head-on shot or a tilted-down shot.

BOOSTER – See *booster stations;* also, *relay station.*

BOOSTER ANODE – a conductive coating placed inside a cathode-ray tube near the screen which because of a high positive voltage applied to it, results in a brighter picture.

BOOSTER STATIONS – automatic radio relays approximately 20 miles apart which convey television transmissions from point-to-point.

BOTTOM FLARE – the elimination of the detail in the lower portion of a video picture.

BOUNCE – the reflected radiation of a high-frequency signal.

BOUNDARIES OF TELEVISION – Television of today has several limitations which may be overcome as the art advances. These include: (1) the distance over which the ultra-short waves may be considered reliable in giving an acceptable quality of television is limited to the horizon as viewed from the transmitting area. This generally runs from 25 miles in low-level countries to from 45 miles in cities where the transmitter is atop a high skyscraper such as the Empire State Building or the Chrysler Building in New York, or on a mountain top as in the Helderberg Mountains, near Schenectady, N. Y.; (2) the inability of present-day camera equipment and receiver screens to receive a picture of too wide an area which would enable fine detail. The video apparatus or system of today can reproduce an image about equal to that of a 16-mm home motion picture. Although wide areas may be telecast such as baseball or football fields, the images are received too small to be easily identified. Close-ups enable the reception of more detail and thus finer pictures; (3) black and white images are the only practical images at the present time which can be used on the video receivers. Although color has been demonstrated by Columbia Broadcasting System and the Radio Corp. of America, both using mechanical systems, actual color in every-day reception seems several years away. Electronic color systems are still in the laboratory stage and althrough demonstrated by RCA will not be ready until the early 1950's, according to that company.

BRACING FLATS – anchoring scenery flats by means of stage braces and weighing down the braces with sand bags. Stage screws are not used because they would mar the studio floor.

BRANLY COHERER – a device used to detect radio waves. (See *Branly*, and *coherer*.)

BRAUN TUBE – early name for a cathode-ray tube. Named after its inventor, Professor Ferdinand Braun (see), of the University of Strasbourg, who in 1897 described the construction and operation of the tube. When electricity is passed through a vacuum at a very high voltage, an electrical discharge results and this has been described as the cathode ray. These rays can be produced in a very fine light beam and made visible if projected onto a suitable screen.

BREAK – a break in rehearsal. Time out. Also as in: "Break a set" – to remove set from studio. Also: "Break it down" – to remove and dissemble equipment used on an outside telecast. Furthermore, a temporary cessation of a program or program schedule, engerally for station identification.

BREAK CAMERA – an order or direction to move the camera from one shooting position to the next as soon as it goes off the air. Specific directions to break camera are given when rapid moves are necessary.

BRIDGE – a brief television or radio action used to gap or connect two parts of a program together.

BRIGHTNESS – the degree of illumination of an image on the receiver or picture tube. The average overall brilliance of the television image.

BRIGHTNESS CONTROL – the knob on the receiver which affects or varies the general level of illumination of the reproduced picture.

BRIGHTNESS LEVEL – term used by engineers to designate the intensity, or brightness, of light seen with the naked eye. The brightness-level outdoors in bright sunlight is probably 500,000 times higher than the brightness-level in full moonlight.

BRILLIANCE – the amount of brightness and clarity in a reproduced television picture.

BRILLIANCE CONTROL – the knob on the television receiver which controls the brightness of the image.

BROADCAST – usually refers to

radio transmission intended for reception by the general public. (See *broadcasting.*)

BROADCAST BAND – that band of frequencies in the spectrum between 550 kilocycles and 1600 kilocycles to which are assigned all standard (AM) broadcasting stations operating within the United States. These have been assigned by the Federal Communications Commission. (See *broadcast channel.*)

BROADCAST CHANNEL – that frequency band used for interference-free and widespread reception from one transmission source. (See *broadcast band.*)

BROADCAST RECEIVER – receiving apparatus, commonly named a "receiver," "set," "chassis housed in a cabinet," which picks up and transposes radio waves into sound and sight, in a radio and television "vehicle." It contains all necessary parts including a condenser, speaker, tubes, etc.

BROADCAST STATION – a radio station used for transmitting programs to the general public. Can also be a television broadcast station.

BROADCAST TELEVISION – the transmission of both video and aural waves for reception at the receivers by the general public. Thus the term *broadcast* has been extended to cover the sending of television. However, the word "telecast" is more commonly used in describing transmission of television, with broadcast generally meaning radio transmission.

BROADCAST TRANSMITTER – sending apparatus, namely a radiotelephone signal equipment, which picks up sound and/or sight, converts it into electromagnetic or radionic currents and then hurls it into the atmosphere in all directions until picked up by a receiver.

BROADCASTING – refers to the sending of radio waves, carrying programs devoted to entertainment, education, or in the public interest. (See *broadcast.*)

BROADS – units or batteries of incandescent or fluorescent lamps.

BUGS – trouble in apparatus or equipment which cannot be easily or quickly ascertained.

BUILT-IN ANTENNA – an aerial located inside the cabinet of a radio receiver generally. It may be a loop, a sheet of metal, or a power line connection.

BURSTS – the sudden increase in signal level of a distant station for a period running from a fraction of a second up to several seconds.

BUSINESS – in television anything for which a technical designation is lacking, or forgotten by the actor. Again, a rehearsed bit of action by the player. Also, incidental action or devices used to add atmosphere and interest to the main theme of a program.

BUSY – term used to describe a setting or background that is too elaborate or which contains excessively detailed ornamentation which obscures the movement of actors or detracts from the logical center of interest in a scene.

BUSY BACKGROUND – a background of a picture or stage set with too much detail or with the same general tonality as the action played in front of it.

BUSY PICTURE – a picture with too many shapes or pictorial elements or too much detail.

C

CBS – abbreviation for Columbia Broadcasting System.

CU – abbreviation for closeup.

CABINET – an enclosure, either of wood or plastic materials, which encases the chassis of a radio, cathode ray tube of a television receiver, and other essential parts, such as an antenna, etc.

CABLE – an insulated bundle of wires or conductors which will convey sound and video signals from one place to another. (See *coaxial cable.*)

CABLE REELS – reels on mobile units used to hold camera cable, etc.

CABLE SHEATH – the protective cover, usually lead, which encases the cable.

CAESIUM – an alkali metal used in forming the cathodes of certain types of phototubes.

CALL LETTERS – identifying symbols assigned by the Federal Communications Commission on television and radio stations to distinguish one from the other.

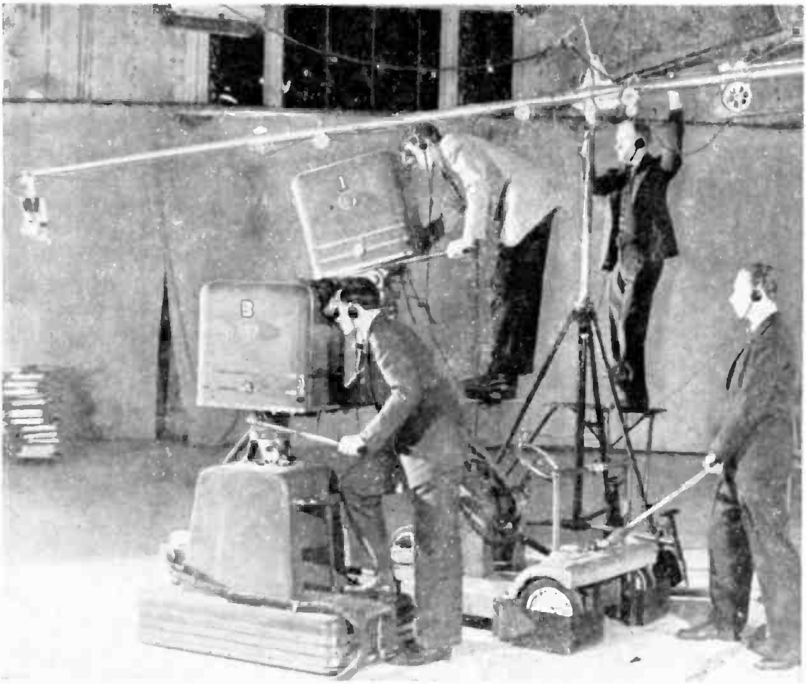
CAMERA – the box or other housing in which the images of objects are projected on a light-sensitive surface. In a television camera the surface is the mosaic or other light-sensitive surface in the video camera tube. A camera takes pictures because light waves enter it and affect the photosensitive surface. Again, a unit containing the optical system and light sensitive pick-up tube which transforms the visual image into electrical impulses.

CAMERA ANGLES – various types of positions possible with a camera. These may be any of the following: long shot, longer long shot, medium shot, angle shot, reverse angle, close-up, and closer close-up.

CAMERA FIELD ANGLE – an angle of divergence from a parallel line inscribed by the borders of the camera picture at various distances from the lens.

CAMERA FIELD ANGLE SCALE – triangular, transparent plastic scale whose converging sides indicate the width of the picture picked up by a specific lens at prescribed distances from the photographed object. Inscribed lines on the scale also indicate the height of the picture at corresponding distances. This scale is used in conjunction with a "stage plan" in laying out and designing settings and in planning camera shots.

CAMERA LIGHT – light on camera



— *Courtesy General Electric*

Camera and Boom, Station WRGB.

which is on when camera is on the air, otherwise off.

CAMERA MAN — the operator who operates the camera and is responsible for the photographic quality of the finished picture going out via television into the homes or other places where there are receivers.

CAMERA REPORTING — televising a program that has not been adapted, planned and directed for television; for example, putting a stage directed and rehearsed play before the video cameras.

CAMERA RIGHT-LEFT — an indication of direction in a setting from the point of view of the camera or as seen on the kinescope; as opposed to "stage right" and "stage left" used in the theatre to indicate a direction to the actor's left or right as he faces the audience.

CAMERA SCRIPT — manuscript outlining camera positions in a telecast.

CAMERA SHOTS — various views or images obtained by moving cameras about during a performance. The major camera shots and their abbreviations or script notations are: Close-up (CU); Medium close-up (MCU or Med. CU); Tight or big close-up (TCU or BCU); (BCU, big close-up, used by motion picture industry which does not use TCU); Long shot (LS); Medium shot (MS or Med. S.); Pan — pan right or pan left; Tilt — tilt up or tilt down; Two-shot, 2-shot or 2-S; Boom up (and tilt-down) (BU-TD); Boom down (and tilt up) (BD-TU); and Follow shot — follow (performer or action).

CAMERA SIGNAL — the television output of a video camera.

CAMERA SWITCHING OR MIXING — the control room operation by the technical director (TD) or video operator by which he switches camera channels on the air or mixes camera channels on the air by depressing the controlling keys associated with the camera channels.

CAMERA TUBE — a device, generally a special vacuum tube, that converts light energy into corresponding electrical energy. The conversion of the optical image into the corresponding electrical image is the first step followed by the requirement of selecting the picture elements in their proper sequence of alternate rows as needed for interlaced transmission. The orthiconoscope, or improved iconoscope, and image orthicon developed by the Radio Corp. of America, and the image dissector tube developed by Philo Farnsworth, are the camera tubes most generally used in the U. S. A.

CANADA — Television experimentation has taken place in Montreal and Toronto laboratories but because of finances the Canadian Broadcasting Corp. has looked to progress in England and the U. S. before planning to make its full entrance into the video field.

CANNED MUSIC — phonograph records or transcriptions.

CANNED SIGHT — syndicated motion picture films used for television broadcasting.

CANS — television head-phones worn by personnel in the studio.

CAPACITOR — See *condenser.*

CARBON ARC — the brightest source of illumination available for television studio lighting. Light is produced by means of burning carbon.

CAREY'S TELEVISION SYSTEM — G. R. Carey tried to design a video system based on the construction of the human eye. He tried to send the picture in its entirety at one time. The design was focused on the "retina" by a lens just as in the human eye. In the place of nerve endings, he substituted a mosaic of selenium cells which would react to light in a photoelectric manner. Each cell was connected by a separate wire to an electric light. There were just as many lights as cells. Each light, in the bank of lamps, occupied the same corresponding position as its selenium cell in the mosaic. The design of light, focused on the mosaic, touched some of the cells, causing them to react and pass a current. The remaining cells, not touched by light, did not react and, therefore, passed no current. The cells which did react sent currents through their wires to their electric lamps which lit up, reproducing the shape of the original design. Very little detail could be sent by such a crude method — only a rough outline. Furthermore, it was too cumbersome.

Carey divided the picture into sections, dissecting it, and tried to transmit all of the sections, simultaneously, through a number of separate wires. He failed because selenium cells alone could not drive currents through wires to the bank of lamps. The tiny currents of the cells were too weak. They had to be magnified (amplified) millions of times before they would be strong enough but amplifier radio tubes had not yet been developed. Carey's contribution to television was made when he divided the picture into sections before attempting to transmit it. This has remained the basic principle in all his systems.

Carey's scheme, however, related more particularly to picture telegraphy rather than to television because his proposed receiver was capable only of reproducing the image on a piece of chemically sensitized paper. His transmitter was identical in principle with that suggested by Ayrton and Perry the receiver was to consist of a screen having a large number of contact points, each connected by a separate wire to the corresponding selenium cell in the transmitter. Carey's scheme had the merit of being workable, which was more than could be said for the other proposals of that period. It was only impracticable because of the great number of conductors needed.

CARRIER — the radio wave used for conveying the signals through the ether from transmitter to receiver. (See *transmission standards.*)

CARRIER FREQUENCY — the higher frequency used for sending modulated with the television or sound signals, is described as the carrier frequency. The carrier frequency is defined as "the frequency of the unmodulated carrier wave."

CARRIER WAVE — same as "carrier."

CARTOON SET — a drop or other background treated as a large line drawing suitable as a setting for some types of variety or educational programs or to create mood as in a fantasy.

CASELLI'S APPARATUS — See *Pantelegraph.*

CAST — the group of players or actors in a program; also, the selection of the players for a particular play, show, performance, etc.

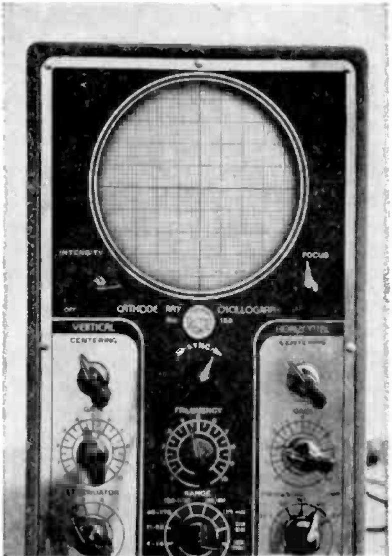
CATHODE — the negative side or terminal of a battery or cell. The negative electrode of a valve or photoelectric cell. The primary source from which the electrons constituting the beam are emitted. A metal sleeve surrounding the filament in a tube and coated with chemicals that shoot off electrons when heated by the filament. Another name for negative electrode.

The part (electrode) in an electron tube that gives off electrons. Some tubes employ cathodes that emit electrons when heated, others (phototubes)utilize cathodes that emit electrons when exposed to light.

CATHODE BEAM — synonymous with cathode-ray; cathode beam is used more in England than the word "ray."

CATHODE BEAM TELEVISION SYSTEM — English name for cathode-ray video system.

CATHODE RAY — a stream of electrons in a highly exhausted glass tube. It is a form of electrical discharge which occurs in a sealed glass tube from which the air has been removed when electricity at very high potential is forced through the very high vacuum. The rays are produced in the form of a thin pencil-like stream, directed to a special fluorescent screen where they are transformed into visible images. Cathode rays were first discovered by Sir Wm. Crookes. They are emitted from the cathode or negative electrode. In 1889 Sir J. J. Thompson proved that the cathode rays were quite independent of the nature of the cathode used for their generation, and were, in fact, nothing more or less than a stream of negative electrons traveling with a high velocity. It is upon this electron stream in a cathode-ray tube of special design that many of today's television systems are based.



— *Courtesy Life*

Cathode Ray Oscillograph

CATHODE RAY OSCILLOSCOPE — a test instrument using a cathode ray tube to make visible the wave form of a varying current or voltage.

CATHODE-RAY OSCILLOGRAPH — See *Cathode Ray Tube.*

CATHODE RAY SCREEN — the fluorescent material covering the inner surface of the picture-end of the kinescope.

CATHODE RAY STREAM – stream of electrons, capable of being moved or diverted, either electrically or magnetically. When the rays strike a screen of fluorescent material, a brilliant spot is produced, which becomes visible in large numbers and forms the received image.

CATHODE RAY TUBE – a vacuum tube utilizing a beam of electrons which can be reflected and guided toward a fluorescent point or screen. The screen glows wherever the electron beam strikes it. The cathode ray tube, in television, is known as the Kinescope, or picture tube, or receiving cathode ray tube. In its simplified form, it consists of an electron gun to generate an electron beam of high velocity, a set of perpendicular devices, and a fluorescent screen to make visual the actual path described by the end of this electron beam.

The tube consists essentially of five component parts:

(1) the glass envelope, sealed for the maintenance of the vacuum;

(2) the cathode, from which the cathode rays, or using the more contemporary term, the electron beam, originates;

(3) a device for concentrating, controlling and focusing of this electron beam;

(4) an internal or external arrangement for deflecting the beam;

(5) the screen or target which is covered with a fluorescent material.

Since 1925, the use of the cathode-ray tube as both transmitter and receiver has been found a very satisfactory method of scanning, translating light values into exceedingly rapid electrical modulations and building up the television picture from the electric signals. This has resulted largely from the individual work of Vladimir Zworykin of the Radio Corp. of America, and Philo Farnsworth of the Farnsworth Television & Radio Corp.

Advantages of the cathode ray tube over other receiving devices include:

(1) an absence of moving mechanical parts with consequent noiseless operation;

(2) a simplification of synchronization permitting operation even over a single carrier channel;

(3) an ample amount of light for plain visibility of the picture;

(4) the persistence of the fluorescent of the screen acting in coordination with the persistence of vision of the human eye, permitting reduction of the number of images per second without noticeable flicker. This optical phenomenon allows a greater number of lines and, therefore, better detail in the image without increasing the frequency band width.

The original cathode-ray tube was developed by F. Braun. The modern tube is a version of that tube with additional refinements.

The first tube was built by Braun in 1897. For almost 30 years it was known as the oscilloscope. In 1889, Sir J. J. Thompson proved that the cathode rays were quite independent of the nature of the cathode used for their generation, and that they were, in fact, nothing more or less than a stream of negative electrons traveling with high velocity. The tube is a direct descendant of the Crookes discharge tube, and can be described as a low-voltage tube with a large fluorescent screen opposite the cathode. Thus the electron beam, impinging upon the screen, produces a luminous spot which can travel all over the screen if the beam is deflected.

From 1900 to 1910, Prof. Boris Rosing of St. Petersburg, Russia, and A. A. Campbell Swinton in England, experimented with the Braun tube attempting to use it for television. Rosing succeeded in staging some initial experiments in that direction but it was not until years later, when Zworykin developed and designed his Kinescope and Iconoscope, and Farnsworth, his Dissector tube, that video was made possible through the medium of the cathode ray tube. Important work was also done by the engineers of the Philips Incandescent Lamp Co. of Eindenhoven, Holland, especially in projection receivers. Campbell Swinton is given credit for using the cathode ray tube at both ends of the system.

Cathode ray tubes are now built in many sizes ranging from 5, 7, 9, 12, 20, to 24 inches in diameter for direct viewing.

Also known as the "cathode-ray oscillograph."

CATHODE RAY TUBE LIGHT CONTROL – modulation of the light is accomplished by varying the potential of the grid which surrounds the cathode.

CATWALKS – specially built lanes in theatres, above stages, or alongside of a theatrical set, generally used to hold special equipment. In the television studio, the overhead structure gives a technician footway to adjust banks of lights or other ceiling equipment.

CELL – a chemical device or unit used to generate an electron pressure of a voltage, by converting chemical energy into electrical energy.

CENTERCASTING – another word suggested as a substitute for "broadcasting" – more as a possible futuristic system rather than along the present-day lines – in which a circular arrangement of many small-power stations about a populous area "point" their waves inward over the region to be covered.

CENTERING CONTROL – a knob on the television receiver used to move the entire reproduced picture on the screen. The horizontal centering control moves the picture sideways, while the vertical centering control moves the image up and down. Purpose is to center the picture.

CENTER UP – to position the composition of the picture at the tele studio so that it is exactly centered in the camera.

CHAIN – a group of broadcasting stations connected by special telephone lines, coaxial cable, or radio relay links so that all can simultaneously broadcast a program originating at one particular point.

CHAINBREAK — a commercial announcement usually placed in the station identification period. It is given by an advertiser who has no connection either with the previous or successive program.

CHAIN BROADCAST — transmission of the same program from a focal station over a network or hook-up of stations.

CHANNEL — a band of frequencies in the radio spectrum including the assigned carrier frequency within which a television or radio station must maintain its modulated carrier signal to prevent interference with stations on adjoining channels. Also, one path or branch over which signals can travel. (See *television channels, spectrum.*)

CHANNEL ALLOCATION — the channel or band in the radio spectrum to which a television and/or a radio station is assigned by the authority of the Federal Communications Commission, or the channel space in the radio spectrum to which a communications service has been assigned.

CHARACTER — a dramatic role which lends itself to characterization.

CHARGE — a quantity of electrical energy held on an insulated object. The electrical energy stored in a condenser. Again, the act of supplying electrical energy to a metal object, to a condenser, or to a storage battery. When an object has more electrons than normal, it has a negative charge. When an object has less electrons than normal, it has a normal charge.

CHARGER — a device used to convert alternating current into a pulsating direct current which can be used for charging an exhausted storage battery.

CHASSIS — the metal frame on which the parts of a radio receiver, transmitter, or other electronic unit are mounted. Also used to designate the completed piece of radio equipment before it is mounted in a cabinet.

CHEAT — an acting technique, peculiar to all camera work, by which the performer "cheats" on perspective or normal-relation to other performers or objects. A performer, for example, would cheat in body position when talking to a seated companion. He would stand close against the chair, facing forward, inclining the head slightly towards the companion without actually looking at him. Thus the television audience could see both persons and they would appear in "normal" perspective to each other on the receiving screen.

CHEMICAL RAYS — sometimes applied to ultra-violet rays because of their photo-chemical action.

CHEMI - LUMINESCENCE — descriptive term referring to the generation of light by chemical action.

CHINESE — the feature of a camera dolly which allows the boom to be rotated, thus moving the camera in a horizontal circle without moving the dolly.

CHOROID — anatomical term denoting the second layer or coat of the eyeball. It is composed for the most part of a network of veins and capillaries.

CHROMATIC — (1) relating to color; (2) written or sounded in half-tones of the diatonic scale.

CHROMATIC ABERRATION — deviation from a true focus due to the unequal refrangibilities of colored rays of the spectrum.

CHROMATISM — in optics, unequal convergence of light rays issuing from a single source.

CHROMATOLOGY — the science of color.

CHROMOPHOTOGRAPH — photograph showing scenes and objects in their natural colors.

CHROMOSCOPIC ADAPTER — a device which gives television the illusion of color. Invented by Guillermo Gonzales Camarena, of Mexico, first demonstrated before the Scientific Clubs of Mexico, October 1944. Works by means of three colored discs, red, green and blue, which are rotated simultaneously before the screen and camera. (See *Camarena.*)

CHRONOPHOTOPHONE — a combination disc phonograph and magic lantern developed by Demeney, a Frenchman, in 1892, which combined the voice and picture. Known as the chronophotophone, it met with success at that time in France.

CILIARY MUSCLES — small, hair-like muscles which, acting upon the crystalline lens of the eye, vary the formation of the latter as regarding curvature and depth, and thus enable an image to be focused clearly upon the retina at the back of the eye. From the Latin, "cilium," an eyelash — in reference to the extreme fineness of the muscle concerned.

CINEMA — a motion picture or in a motion-picture theatre. Usually in referance to Great Britain's movies or theatres.

CINEMATOGRAPH — motion-picture camera or projector. (See *television cinematography.*)

CIRCUIT — a complete path over which an electric current may flow. Also a number of conductors connected to carry an electric current.

CIRCULATION — potential audience in terms of families owning receivers; one family, regardless of the number of sets it owns, equals one unit of circulation.

CLEAR A NUMBER — to obtain official permission to make use of a particular musical selection.

CLEARED CHANNEL — when a station has the exclusive use of a frequency for a given period. That is, a channel which is cleared within an area rather than cleared on a nation-wide basis.

CLEAR THE RIGHTS — check the musical and literary copyrights.

CLIFF-DWELLER — a commercial advertising message, inserted at the end of a program, following the commercial for the main product to which the program is devoted. Also, the term "cliff-hanger" is used to denote same meaning.

CLIFF-HANGER — same as cliff-dweller.

CLINKER — a bad or sour musical note; also, any mistakes made while on the air.

CLIPPER — a circuit used to separate signals of different amplitudes. In television, these circuits are used to separate the synchronizing pulses to the video and signal.

CLOCKWISE — the direction in which the hands of a clock move.

CLOSE SCANNING — synonymous with "fine scanning."

CLOSE SHOT — a shot taken at close range, which includes a portion of the background. Centering camera on some particular detail, a chair, a glass on a table, a person's face, or hand.

CLOSE-UP — The camera is moved nearer to the subject or a long-focus lens is used so as to obtain a larger-than-normal image. Abbreviated CU. (See *tight or big close-up, medium close-up, long shot, medium shot, two-shot,* and *follow-shot.*)

CLOSE-UP CAMERA — the camera registering the least area of the stage.

CLOSE-UP SHOT — very narrow angle picture, such as head shot of an individual. (See *close shot, close up.*)

CLOVER-LEAF STAGES — cluster of several sound stages around a central unit of cameras used in television studios, resembling a four-leaf clover.

COARSE SCANNING — occurs when the light-spot is of relatively large diameter, and when it covers the image in a comparatively small number of lines or sweeps.

COAXIAL — See *coaxial cable.*

COAXIAL CABLE — a metal tube having at its center a wire supported by insulators used in television to carry big-frequency wide-band signals. It is also used in radio, telephone and telegraph systems. Also known as coaxial, coaxial line, concentric line, pipe line, etc.

CODE PICTURE SYSTEM — a crude method of transmitting pictures by wire or wireless. The picture that is to be transmitted is split up beforehand into a large number of small patches or areas, the degree of blackness of each patch being indicated by a previously arranged code letter, which is telegraphed in the usual manner. After reception, the various transmitted letters, corresponding to the different patches in the picture, are decoded and subsequently pieced together, and assembled into a rough reproduction of the original picture. The method is an ingenious one but it is entirely without practical possibilities despite the fact that coded pictures of this nature have been transmitted across the Atlantic Ocean.

COHERER — a form of detector for radio waves; a device used in a radio system as an integral part of that system for the transmission and reception of communication.

CO-INCIDENTAL SURVEY — a telephone survey made while a show is being telecast or immediately after the program has been on the air.

COLD — without preparation or rehearsal. A program that may begin without preliminaries.

COLD CATHODE — a cathode which does not depend upon heat for electron emission. Electrons may be pulled out of it by a sufficiently high voltage appointed to it. The cathode of a phototube may be considered in this class since it emits electrons when exposed to light rather than heat.

COLD CATHODE TUBE — a vacuum tube in which the cathode is not heated.

COLD LIGHT — There are two types: (1) mercury vapor, and (2) fluorescent.

COLLECTOR — an electrode used to collect electrons in certain types of electronic tubes. In a cathode-ray television camera tube, it may be a conductive coating on the inside of the glass envelope about halfway between the mosaic screen and the electron gun.

COLONIAL RADIO BROADCASTING — national radio broadcasting intended to be received primarily in possessions not contiguous to the land area in which the originating station is located.

COLOR — Color depends on the wavelength of the light. In viewing a continuous spectrum the normal eye perceives a graduation of color from red at the long-wavelength through orange, yellow, green, blue to violet at the short-wavelength limit. Any of these, or other colors, can be matched by suitability adjusting the stimulations from the three primary colors of red, green and blue-violet. the wavelengths of these primaries being selected so that a minimum account of negative primary is required in matching. (See *color television.*)In ordinary television transmission reproduction shades vary from extreme dark to bright light. Actual colors of televised scenes become shades of grey and suggest the correct outlines, but not the correct color. A girl's lips covered with dark red lipstick will be telecast and received as colorless, may come out even lighter in tone than the corresponding televised lips in natural color. It becomes, therefore, imperative that correction be made of these "color into grey" sense values by a make-ready process using brown lipstick or some other color.

COLOR TELEVISION — was first demonstrated by John L. Baird in England in July, 1928. Bell Telephone Laboratories, New York City, in July of 1929, demonstrated a three-color television system employing three independent channels. The live-pickup equipment consisted of three banks of cells with the three primary-color responses. A flying spot scanned the object and a scanning disc served on the receiving end to reconstitute the image. Three discharge tubes furnishing red, green and blue light and superimposed by mirrors behind the scanning disc served as the light source. Bell Labs used a three-channel system which occupied three times the frequency spectrum over the corresponding black-and-white picture and required three times the facilities. Baird, similarly, requiring three times the frequency space, employed rotating filters and was thus the first to demonstrate the sequential, additive method of color.

In mechanical color television systems used by Baird, the Columbia Broadcasting System (Peter Goldmark), and the Radio Corp. of America, a triple scanning is necessary. In the Baird experimental system of color television, a triple scanning disc is used. This disc contained three spiral series of holes, the series of holes being provided with red, blue and green color filters respectively. By means of this arrangement, the picture is scanned three times. CBS and RCA used a tri-parte color filter, with one-third red, one-third blue, and one-third green.

On Aug. 28, 1940, a three-color, high-definition system using electronic scanning both at the transmitter and at the receiver was broadcast for the first time over Columbia Broadcasting System's Television Station W2XAB in New York City. A color motion-picture film was used. Soon thereafter, a live pickup using the same trichromatic system was shown.

On June 1, 1941, daily color transmissions over CBS's WCBW, (WCBS-TV) were begun for a field-test period to determine the practicability of color television. Color drums were used at the receiver as well as at the transmitter instead of color filters. A short cathode-ray tube was placed within this drum which rotated at about half the speed usually possible with a disc. On Oct. 10, 1945, CBS demonstrated ultra-high frequency broadcasting of clear, ghost-free color pictures. Although nominally 525-line pictures, each image contained 1575 imperceptible lines of detailed color.

In principle, color systems may be divided into two classes: (1)—those in which scanning is repeated two or three times all over the scanned area in different colors, and (2) those in which adjacent small elementary areas are permanently colored but are so small that when the picture is viewed from a distance they blend into a tinted whole. The first colored television images were produced by the former system, which is now the one most widely demonstrated.

Television in twelve colors: In *Television News*, March–April, 1931 issue, Dr. Fritz Noack, of Berlin, Germany, described a television system by a Berlin engineer—Ahronheim—which used twelve-color discs. It was based upon the assumption that the colored image points showed, not different intensities of light, but different color tones; that dark red and light red were not merely red of different intensity but, actually, different colors. Ahronheim's methods of scanning the images were the same as previous mechanical systems; the novelty was in filtering the light before it entered the photocell, according to its place in the spectrum. The visible spectrum contains many gradations of color, but Ahronheim undertook "to reproduce it with twelve."

The revolving disc was to be arranged with colored glass sectors through which the light had to pass from the scanning apparatus to the photocell; the ray of light could penetrate only the filters of appropriate color. The scanning mechanism was to operate as in other systems, and the filter disc only had to revolve at higher speed, to make up for the fact that the light ray penetrated only one of its sectors at each revolution. At the receiving end, a suitable system of scanning was to be used to build up the image; but here also a glass filter with twelve sectors was placed between the source of light and the eye of the observer. If the two discs were synchronized, a picture corresponding most exactly to the image at the transmitter was to be seen.

Ahronheim proposed, not to build a mechanical filter system thus described, but to utilize a prism, which would decompse white light into its constituent colors. The entire spectrum was to come out only when light had been directed into the prism; light of a single color would emerge unchanged. Since the light rays were dispersed at different angles, according to their wave lengths, Ahronheim suggested arranging twelve photoelectric cells side by side behind a prism, so that one would receive all the dark-red light which entered the prism, another all the light blue, etc. In practice, only one cell was to be used, however, and, by the use of a scanning device only the color corresponding to the image point reproduced at the instant was to be conveyed to the cell. One model was said to have been completed, but arranged for only a few color tones; "but it demonstrated the fundamental characteristics of the invention," according to Dr. Noack. He declared that it was especially well adapted for televising colored motion-picture film, and made it possible to transmit simultaneously from the sound track.

Television in color has previously been accomplished by three methods. In the first demonstration of color television, revolving discs were used by John L. Baird of Great Britain, to accomplish the scanning and also supply the color component. In his second method the scanning was done by the cathode-ray tube and the color supplied by a revolving color disc. In his third method, images produced side by side on the face of a cathode-ray tube were colored by stationary color filters superimposed by projection upon a viewing screen. Of these, the first two come within the category of mechanical systems.

The third, which requires no moving parts, might best be described as an electro-optical system, as the color is added to the image by optical means. This system has the very considerable disadvantage that the fluorescent screen cannot be viewed directly, the colored image being obtained by projection which involves a substantial loss of light.

A great stride was made in the development of color television during the war. One of Baird's last inventions – the Telechrome eliminated the revolving disc and lenses previously necessary for color and stereoscopic television. The present system is entirely electronic, the colored image appearing directly upon the fluorescent screen, two cathode-ray beams being required for a two-color system and three for a three-color system. These cathode-ray beams are modulated by the incoming signals corresponding to the primary color picture and impinge upon superimposed screens coated with fluorescent powders of the appropriate colors. For example, in a two-color system the two cathode-ray beams scan the opposite sides of a thin plate of transparent mica, one side of which has been coated with orange-red fluorescent powder and the other with blue-green fluorescent powder. Thus the screen has formed upon its front face an image containing the orange-red color components and on its back face an image containing the blue-green components. These images are superimposed and thus give a picture in natural color. Where three colors are to be used the back screen is ridged and a third cathode-ray beam added, the front face of the screen giving the red component, one side of the back ridges giving the green components, and the other sides of the ridges the blue component.

A two-sided tube developed by Baird is able to receive a picture from a 600-line triple interlaced moving spot transmitter using a cathode-ray tube in combination with a revolving disc with orange-red and blue-green filters. The screen is a 10-in. diameter disc of thin mica coated on one side with blue-green fluorescent powder and on the other with orange-red fluorescent powder. (The color may alternatively be provided for the back screen by using a white powder and coloring the mica itself.)

In the new form of scanning developed by Baird, successive lines are of different color and the number of lines is made a non-multiple of the number of colors, so that every line of the complete color picture has successively shown each of the primary colors. The object of this is to reduce color flicker. Where frame-by-frame color alteration is used, flicker becomes prominent in any large area of a single color for example, if the picture is showing a large blue area, this blue appears in the blue frame only. While the red and green frames are appearing, it is not shown, so that the frequency of the repetition is reduced and flicker accentuated. With line by line color alteration, each color appears in every frame. This form of scanning does not lend itself to the revolving disc system.

COLUMBIA BROADCASTING SYSTEM – radio and television broadcasting network, with main offices in New York City. Owns and operates television station WCBS-TV in New York. Key radio station in the network is WCBS, formerly WABC, in New York. Exponent of color in the higher frequencies.

COMMENTATOR – one who edits and telecasts or broadcasts news at a television or radio station, interspersed with personal opinions and observations.

COMMERCIAL – the sales talk, or selling message, before, after, or in the middle of regularly scheduled programs. (See *visual comercial, dramatized commercial, film commercial, gadget commercial–remote pickup commercial.*)

COMMERCIAL CREDITS – specific mention of showing of the name of the sponsor or his products. An element of the commercial.

COMMERCIAL TELEVISION – the sponsorship by an advertiser over television program transmission; that is, time and talent is paid for by one who has something to sell, promote, or advocate.

COMMISSION – abbreviation for the Federal Communications Commission (FCC).

COMMUNICATION BAND – the band of frequencies effectively occupied by the emission of a radio transmitter for the type of transmissions and the speed of signaling used.

COMMUNITY STATION – local station (television or radio) designed primarily for rendering service to the smaller metropolitan districts or principal cities. Television channel No. 1, 44-50 megacycles, is assigned exclusively for community stations provided they comply with the FCC section which shows the allocation of television channels to metropolitan districts in the United States. The main studio of a community station must be located in the city or town served and the transmitter must be located as near the center of the city as practicable. The maximum antenna height for such a station is put at 500 feet above the average terrain as determined by methods prescribed in the Standards of Good Engineering Practice Concerning Television Broadcast Stations, as set forth by the FCC. (See *metropolitan station, rural station.*)

COMPLEMENTARY COLORS – name given to any colors which when mixed together form white. Examples are red and green, yellow and indigo, orange and blue, greenish-yellow and violet. Owing, however, to practical difficulties in obtaining perfectly pure colors, most complementary colors when combined together produce a gray rather than a pure white.

CONCENTRIC CABLE – See *coaxial cable.*

CONCENTRIC LINE – a metal tube having at its center a wire supported by insulators. It is used as a transmission line for television or radio signals or for transmitting a number of telephone or telegraph signals, simultaneously in a carrier system. Also known as coaxial cable, coaxial line, pipe line, etc.

CONDENSER – a lens device which collects rays of light from a light-source and condenses them on to a limited surface area. In television, optical condensers are employed principally for illuminating the film systems of film video. They are also used for concentrating light rays on light-sensitive cells. In radio or electricity, a condenser consists of two or more conducting surfaces placed in relation to each other and separated from each other by an insulating material such as air, oil, paper, glass or mica. A condenser is capable of storing electrical energy. In radio circuits the condensers are used to block the flow of direct currents, store the electrical current, and also to allow tuning. Also known as a "capacitor."

CONDUCTING MATERIAL – any material having the property that will be, when a potential difference exists between any two points on, or in, a body constructed from the material, between the two points, a current which is appreciable for the application under consideration. Materials like metals and strong electrolytes are considered conductors in all applications, while materials like wood and distilled water are considered conductors in some applications and insulators in others.

CONDUCTIVITY – the ability of a material to carry electric current.

CONDUCTOR – any wire, cable, or other structure which provides a path of electric current between two points. A good conductor offers little opposition to the continuous flow of electric current.

CONDUIT – a soled or flexible metal or other tubing through which insulated electric wires can be run.

CONKING OUT – term applied to a camera or other apparatus which becomes inoperative because of a circuit or tube failure.

CONSECUTIVE INTERCALATION – Groups of areas or light sections are scanned in sequence in this television system.

CONSOLE – a large wooden or plastic cabinet for a television or radio receiver, standing on the floor rather than on a table. Also a control desk in a control room at the studio.

CONSOLE RECEIVER – a television or radio set in a console cabinet.

CONSTRUCTION UNITS – stock structural units, serving the same purpose as "flats" or "wings" in the theatre and architectural or plastic pieces which may be combined in various juxtapositions to provide a basis for a television set. Such elements may be repainted or redecorated.

CONTACT – a terminal to which a connection can be made. A joining of bodies to allow the flow of electrical current.

CONTIGUOUS RATES – Network rate cards sometimes used to permit an advertiser to lump together two segments of time which are not non-tinuous (non-contiguous) and consider them so far as charges are concerned, as one continuous time period.

CONTINUITY – prepared copy for television or radio programs.

CONTINUOUS FILM SYSTEMS – name applied to a system of film television transmission in which the person, scene, or object to be televised is photographed on motion picture film. The film is then automatically led to a developing tank and directly from there to the television transmitter where it is scanned in its wet condition. By such methods, a scene can be televised within about half a minute of its being photographically recorded on the motion picture film.

CONTINUOUS SCANNING – tracing a continuous figure on the area to be scanned, or a scan in the form of a spiral track covering a circular area. Also known as "Lissajou" and "spiral scanning."

CONTRAST – the degree of difference in tone between the lightest and darkest areas in a received television picture, photograph, or facsimile reproduction. Contrast is the opposite of detail; low or poor contrast means good reproduction of details. Pictures having low contrast have an overall gray appearance while those with high contrast have very deep black and brilliant whites.

CONTRAST CONTROL – the manual control or knob on the television receiver for adjusting the range of brightness between high lights and shadows in a picture. In effect, by regulating the television signal strength, it varies the contrast between bright and dark portions of the reproduced image by increasing or decreasing the range between black and the brightest possible area.

CONTRAST RANGE – the range of light values between the lightest and darkest elements of a transmitted picture.

CONTROL – adjusting conditions in a system through some influence not connected with that system.

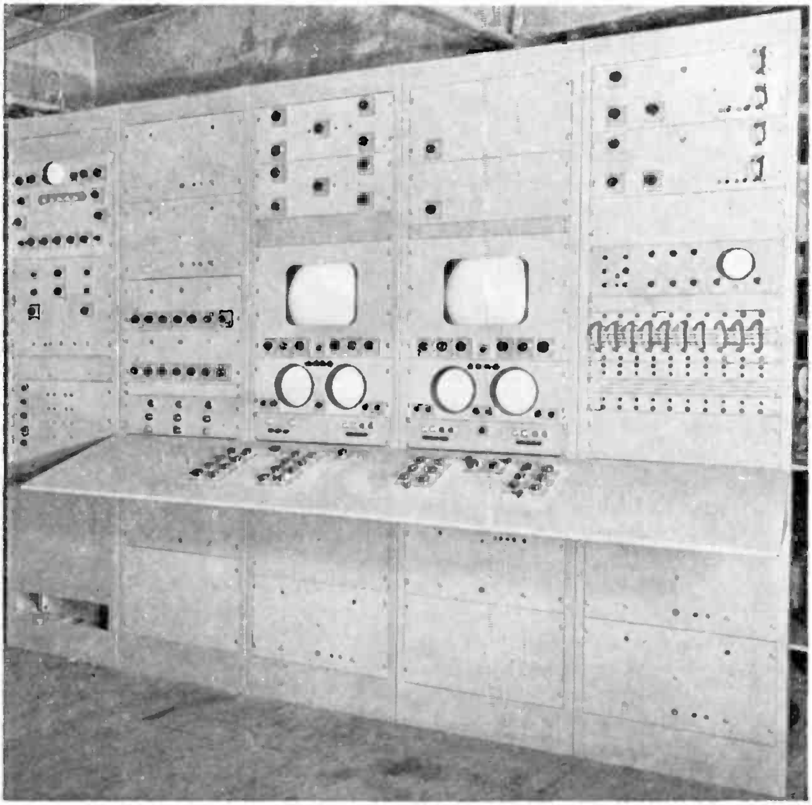
CONTROL CONSOLE – cabinet containing controls.

CONTROL ROOM – the anteroom or adjoining chamber, usually separated from the studio by soundproof glass windows. Here the monitoring equipment controls the output of sight and sound, where camera pictures are mixed and switched onto the air. Here, too, the producer or director guides his cameramen and performers usually via special telephone wires direct to the studio floor.

CONVERGENT RAYS – light rays which close in or converge as they travel to an object. Rays of light which are focused from an object on to a television transmitter or a camera screen are said to be convergent.

CONVERGING LENS – a converging lens causes light passing through it to come together. If parallel rays of light strike this lens, they will converge in a single point at the focal distance.

CONVERSION OF LIGHT IMPULSES INTO ELECTRICAL IMPULSES AND ELECTRIC SIGNALS



— *Courtesy Station WABD*

Control Room in a Television Station

INTO A VISUAL IMAGE — Every television process depends upon the transformation of light rays reflected from an object field. For it is only as electric currents that picture elements can be transmitted by wire or radio. The last step in television after the analysis of the object field by the scanning, the translation of the picture-element light values into electrical equivalents, and the transmission of these signals as electromagnetic waves to the receiver, consists in intercepting these waves and reconverting them into the television images. In order to do this, the receiving apparatus and transmitting equipment must be carefully synchronized. For unless the video receiver is building up the image, picture element for picture element, in exactly the same sequence and at the same speed as the image is being scanned at the transmitter, a completely scrambled and unrecognizable image will result.

There must also be a controlled light source which can build up the picture, following the scanning process, with each spot of light corresponding in intensity exactly to the light value of the original picture element. This must also be brought about so rapidly that the image appears as a continuously lighted area instead of what it really is — a series of intermittent points of light, comprising the picture line by line. In the picture tube of the television receivers as they are usually designed today, this light source is usually a fluorescent surface which is activated by a moving electron beam which is controlled by the television signal coming through the air.

COPY — the wordage used in titling.

CORN — simple and obvious dialogue or musical arrangement in a program.

CORNEA — the clear transparent front part of the eye which bulges outward, and through which light is transmitted to the pupil. (See *eye.*)

COSTUME DEFINITION — a quality in a costume which, either through contrast in tone quality, texture or design, makes it stand out distinctly from the background or from surrounding objects without the agency of special lighting.

COUNTER-CLOCKWISE — in a direction opposite that in which the handle of the clock turns or rotates.

COVERAGE — pertaining to area and markets "covered" by one or more television or radio stations.

COVERING POWER — range of a camera or lens that will produce a well-defined image.

COW-CATCHERS — advertising messages sent out just before a particular program by the sponsor extolling the merits of an auxiliary product before presenting the main article to which the show is devoted.

CRAIG SYSTEM OF TELEVISION — a system of television developed by Palmer H. Craig, Ph.D., based on an entirely different concept in the transmission and reception of television signals than heretofore used. The system contemplates the simultaneous transmission of the entire image as a whole, rather than by scanning that image. Scanning is employed in the receiver but bears no synchronous relation to any part of the transmitter, at least as such synchronism is normally now employed. The Craig System aims to obtain a very marked reduction in the side-band width, thus enabling one to utilize a carrier frequency which is not in a short wave band necessarily, and, therefore, the coverage of which is approximately equal to the coverage of present radio broadcast transmitters.

The transmitter analyzes the entire picture area almost instantaneously and transmits a complex wave on each analyzing operation, the wave being made up of component waves having different frequencies determined by the elementary image areas which are illuminated at any given instant. The transmitter of this system does not scan the image in the usual way, but each elementary area of the image to be transmitted acts simultaneously with the other elementary areas to establish separate component waves of a frequency dependent upon the position of the corresponding elementary area in the image area, the amplitude of each component wave being dependent upon the degree of illumination of the corresponding elementary area. The analyzing operation is repeated periodically at a rate of sixteen times per second or higher; that is, a rate sufficient to secure the illusion of continuous change in the reproduced image at the receiving station.

At the receiving station, the transmitted image is reproduced by building up the elementary areas with scanning apparatus which traverses each point of the image area in the usual manner, but there is no necessary relation between the rate of scanning of the receiver and the rate of transmission of the composite wave from the transmitting station. At the receiving station a wave receiver is provided which may be tuned to selectively receive any component of the complex wave within the entire range of frequencies transmitted. The tuning of the receiver is varied simultaneously with the scanning operation to select the wave component being transmitted by an elementary area of the transmitter image corresponding in position to the elementary area of the received image which is being scanned at the particular instant of consideration. The scanning cycle of the receiver is made sufficiently high to secure the illusion of continuous change in the reproduced image. Dr. Craig made no claims regarding his principles as a complete system and his claims were made only on what the individual components of his system would do.

Dr. D. M. Robinson, of the British Air Commission, and an observer to Panel 6 on Television of the Radio Technical Planning Board stated that one main disadvantage of the Craig system was the slow speed at which a picture could be transmitted. R. E. Shelby, National Broadcasting Co., and a member of the panel, declared that the fundamental weakness in the system was the time required for build-up and decay in the receivers. At a meeting of Panel 6 on Television, on Feb. 25, 1944, at the Hotel New Yorker, New York City, the group unanimously passed the following resolution: "On the basis of the information which has been submitted by Dr. Craig and in view of the fact that no apparatus has been built to demonstrate the Craig system, it is the opinion of this committee that the material submitted by Dr. Craig does not justify any change in television standards now being considered nor any delay in arriving at such standards."

CRANE — the swinging arm of a camera dolly which gives the camera flexibility of motion.

CRATER LAMP – a gaseous lamp, a variation of the glow lamp, usually containing neon, which provides a point source of light that can be modulated with a signal. It was used in mechanical television systems and for sound-on-film recording. It gave a small point of light of high intensity, and, therefore, could be utilized for the projection of received television images.

CREDIT – the acknowledgment of the source of program material used. Usually used to describe the material designed to familiarize the listener with the advertiser's (sponsor's) product.

CROOKES TUBE – an early form of vacuum tube used by Sir William Crookes in his studies of cathode rays and electrical discharges at low pressure.

CROOKESITE – one of the natural ores of selenium, consisting of copper selenide, containing approximately 17 per cent of thallium, and occasionally a little silver. It derives its name from Sir William Crookes, famed scientist.

CROWD NOISES – medley of voices serving to depict a crowd or mob scene.

CROWFOOT – three-legged device placed under tripod to prevent the television cameras from slipping.

CUE – a prearranged signal calling for action or music in a program. A cue may be for an actor, announcer, musician or technician.

CUE LIGHT – See *camera light*.

CUE SHEET – a written script or outline of the program which indicates the routine and action for each moment of the telecast by performers, cameramen, and technicians.

CUES AND TIMINGS – summary of work or musical cues together with timings in minutes and seconds, and of various assignments of a program, usually furnished in advance for the guidance of engineers, announcers, and producers.

CURRENT – the movement of electrons through a conductor; the amount of electricity flowing in a wire.

CURVATURE OF TUBE – roundness of the cathode ray tubes at each side in television receiver.

CUSHION – a flexible musical number near the end of a program, which can be lengthened or shortened in the event the actors speed up or slow up their particular role during the performance.

CUT – a control technique by which a scene on a camera is instantaneously switched on or off the air. It is the abrupt transition from one image to another done instantaneously by pressing a button which switches in one camera and knocks out the other. A cut is the standard method of effecting a transition from one camera to another, standard in that it is used most frequently because it speeds up the action instead of slowing it down. Also, deletion of program material to fit a prescribed period of time.

CYCLE – one complete alternation of a current, or electric wave. The number of cycles occurring in one second is called the frequency.

CYCLORAMA – a term commonly applied to a backdrop of the upstage curtain.

D

DB – abbreviation for decibel.

D.C. – abbreviation for direct current.

D.C. PICTURE TRANSMISSION – transmission of the direct-current component of the television picture signal. This component represented the background or average illumination of the overall scene, and varied only with the overall illumination. In contrast, the alternating component or video signal varied with the brilliance of the small area of the scene being scanned at the moment.

D.C. RECEIVER – a set designed to operate from a direct current power line such as from the 110 volt d.c. lines still being used in various parts of the country.

D.C. RESTORER – the circuit which regulates the average brightness of the television picture tube to correspond with the average brightness of the scene being transmitted.

D.C. TRANSMISSION – the transmission of a television signal with the direct current component represented in the picture signal.

D-LAYER – a layer or region of the outer earth considered to exist as a result of particles of radiation from hydrogen bursts from the sun, bringing about complete inhibition of short-wave communication but some improvement in long-wave communication.

DARK SPOT – sometimes observed in a reproduced television picture or image. This is due to the formation of electron clouds in the front of the mosaic screen in the camera tube at the television transmitter.

DARK-SPOT SIGNAL – the signal existing in a television system during the scanning of a dark spot by the television camera.

D'ARLINCOURT'S APPARATUS – a picture-transmitting device which operated on principles similar to those underlying the operation of Bakewell's apparatus. Operated for the first time about 1876, a synchronizing mechanism maintained the transmitting and receiving cylinders at an identical rotation speed. The apparatus was very popular and widely used by the French Military of that period.

DAMPEN – to place sound-absorbent material, in a studio or auditorium, to prevent echoes.

DAMPING CIRCUITS – the circuits used to prevent high voltages from being induced in the deflection coils when the current changes suddenly.

DAMPING CONTROL – a device on the receiver which helps in removing the horizontal distortion or bulge which may appear on the left side of an image.

DEMODULATION – the process of taking the signal off a carrier frequency at the receiver. Syn.: detection.

DEMONSTRATION – a special video program produced for a possible sponsor and/or an advertising agency but not for public consumption or distribution.

DENMARK – Before World War II, the Danish Government was reported contemplating the construction of a television transmitter on the highest point of ground in Reykjavik, the capital of Iceland, where it expected to conduct video experiments.

DE PEROSINI TELEVISION SYSTEM – In 1879, Dr. Carlo Mario de Perosini, an Italian physicist, presented to the Royal Academy at Turin, the plans of a "Telectroscope" or "Telephotograph," for single-wire transmission of a scene to be focused on the rear surface wall of a camera, which a bit of selenium was caused to scan. The variation in the current, passed through the selenium, and then over a telegraph line, was to be impressed on paper which had been sensitized with potassium ferrocyanide. The transmission of line drawings, made with a suitable insulating ink, by telegraph, had been known for some years; although it had found no commercial application since its demonstration in 1862 by Caselli. Dr. de Perosini's system employed a reciprocating or slide-arm motion, which caused the selenium point to scan the image in the back of the camera horizontally, while vertical motion was obtained by clockwork. It is not probable, however, that a model was ever attempted.

DEPTH – the limits, with respect to distance from the camera, within which objects may be photographed with satisfactory definition under a given set of conditions.

DEPTH OF FIELD – the distance between the closest point to the camera lens and the farthest point from it at which an object will appear in focus without adjustment of the camera. Not to be confused with depth-of-focus.

DEPTH-OF-FOCUS – that portion of the area in front of the camera in which everything appears in sharp clear focus without adjustments of the camera. It is the distance from the camera within which objects may be photographed satisfactorily under a given set of conditions. It extends from the closest point of the camera at which the object will be in focus to the farthest point. (The distance between these two points is the focal depth of the scene.)

DETAIL – absence of a deep contrast. Opposite of contrast.

DETECTION – See *demodulation*.

DETECTOR – a vacuum tube in the receiving circuit used to separate (demodulate) the incoming carrier from the superimposed video or audio signal. For television work, power detection or diode detection is used.

DIAGONAL DISSOLVE – holding one camera image in the lower left-hand corner and the second camera image in the upper right-hand corner, and dissolving them in on the air at half-lap. This is for unusual (trick) or montage effects, particularly to show two persons at different locations speaking to one another. Same as oblique dissolve. (See *dissolve, lap-dissolve, lateral dissolve.*)

DIAL — a control knob usually referred to as on a radio receiver, which indicates the value to which a control has been set. Thus, the tuning dial of a radio receiver indicates the frequency at which the set has been tuned. Also, the apparatus for adjusting and for indicating the adjustment of the tuning controls.

DIAL LIGHT — the pilot lamp which illuminates the tuning dial of a radio receiver.

DIAPHOTE — an early form of television mechanism said to have been developed by Dr. H. E. Hicks of Bethlehem, Pa., about 1880. However: ". . . Oddly enough, a successful television experiment was described in the public press only 7 years after the discovery of selenium — and 4 years before the simplest scanning disc was invented! Calling the system 'diaphote,' one H. E. Hicks hoaxed the press of the United States by describing an imaginary experiment in which a selenium pickup was used" — from "Mileposts in Television," *Radio-Craft*, Jubilee Souvenir Number, March 1938.

DIAPHRAGM — a thin flexible metallic or non-metallic sheet which vibrates when hit by soundwaves, as in a microphone, or can produce sound waves when moved, as in a loudspeaker. Also, an adjustable opening used in a television camera to reduce the effective area of a lens in order to increase the depth of focus. If the light on a scene is weak, the stop-opening is opened wide; if strong, it can be made smaller. Thus, it is used to admit more or less light. Diaphragms are also known as "stops."

DIATHERMY — the therapeutic use of a high-frequency current to generate heat within some part of the human body. Frequencies used range from several hundred thousand cycles up to millions of cycles. Diathermic machines in operation are one of the main interfering elements in the reception of television and radio.

DIECKMANN PROCESS — a method for the wireless transmission of drawings; refers primarily to its application in aviation. Pictures via this system could be transmitted from airplanes to the ground (topographic sketches, reports, etc.).

DIELECTRIC — a substance possible of supporting an electric stress. An insulating material between the plates of a condenser. A vacuum is a dielectric.

DIFFERENTIATING CIRCUITS — circuits which respond to the rate of change of a pulse and are used in synchronizing the receiver scanning.

DIFFRACTION — the property, as shown by an electromagnetic wave, of curvature around the edges of an obstruction in their path. It is one of the factors which account for the propagation of radio waves around the curved surface of the earth.

DIFFRACTION FRINGES — same as diffraction.

DIFFRACTION GRATING — one of the most useful optical devices for producing spectra. In one of its forms, the diffraction grating consists of a flat glass plate of the surface on which have been ruled, with a diamond, equidistant parallel straight lines, which may be as close as 20,000 to the inch. If a narrow source of light is viewed through such a grating it is seen to be accompanied on each side by one or more spectra produced by diffraction.

DIODE — a vacuum tube having two electrodes, one being the cathode, the other the plate or anode. A diode allows electrons to pass in only one direction, from the cathode to the anode.

DIORAMA — a miniature setting usually employing free perspective in its execution, and used as a means of establishing large locations, impossible of construction in the studio. In actual practice, small local areas of such a diorama may be produced in actual size to accommodate actors.

DIPOLE — a common type of television antenna having physical strength to one-half of the signal's wavelength. It may be a doublet with element one-quarter wavelength in size. Used for reception of high-frequency transmissions.

DIPOLE ANTENNA — an antenna consisting of two conductors of equal length in the same straight line, with a pair of lead wires connected at the inner ends, is known as a doublet or dipole antenna. For short-waves, the physical dimensions are such that self-supporting metal rods or tubes can be used.

DIRECT CURRENT — electric current which flows in only one direction. *(See D.C.)*

DIRECT INTERNATIONAL RADIO BROADCASTING — in which the general public receives the radio emissions directly from the originating station in another country without relay.

DIRECT PICKUP — the transmission of television images, without intermediate photographic recording.

DIRECT SCANNING — a scanning process in which the object or scene is illuminated at all times and only one elemental area of the object or scene is viewed at a time by the television camera.

DIRECT TRANSMISSION — term applied to television transmission where the image, view, or scene to be televised is focused directly on to the scanning device employed by the instrument, as opposed to indirect transmitting systems in which the transmission takes a photographic image in one form or another.

DIRECT - VIEW SCREEN — the screen-face of a cathode-ray tube. It presents the primary television image directly to the viewer. Distinguished from the projection screen in which the picture is passed through a series of mirrors and lens before being seen in the receiver. (See *direct viewing.*)

DIRECT VIEWING – television reception in which the image is seen or viewed directly on the screen of a cathode ray tube, without intermediate amplifying or reflecting device.

DIRECT-VIEWING RECEIVER – a type of television receiver in which the picture is sent directly on the end of the cathode-ray tube. All prewar receivers were direct-viewers.

DIRECTION FINDER – a special type of radio receiver employing a highly directional loop antenna so as to permit determination of the direction from which the radio waves are arriving.

DIRECTIONAL ANTENNA – any antenna which sends or picks up or radiates signals better in one direction.

DIRECTLY-HEATED CATHODE – a cathode heated by a current which passes through the whole or part of it. This type of cathode is commonly known as a filament.

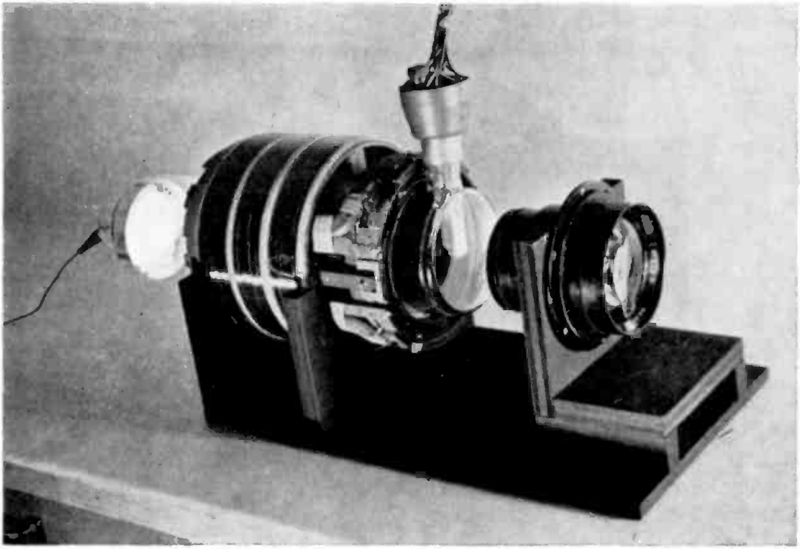
DIRECTOR – (1) person who guides, directs, the action of participants on a program; (2) an additional array used with a dipole receiving antenna to increase the pick-up from the side on which the director is placed.

DISC – a recording; a record.

DISCHARGE LAMPS – Discharge lamps containing neon gas were used by J. L. Baird in his early experiments in conjunction with a Nipkow disc. When the gas pressure had been suitably chosen, the variation of current through the lamp was linear with respect to the applied voltage over a wide range. The television signal variations produced by the changing light values at the transmitter were applied to the neon tube and the overall brightness change in the gas glow spread over the negative electrode was seen through the apertures of the synchronized scanning disc. In this manner the picture was built up in its correct form as a coarse miniature replica of the scene or subject at the transmitter.

A combination of "positive column" discharge tubes in which one tube contained substantially pure neon, and the other a mixture of mercury and helium was used for Baird's first color demonstration in 1928. The tubes were used in conjunction with a triple spiral apertured disc having red, blue and green filters.

In addition to the flat plate neon lamp used in conjunction with an apertured disc scanner, neon and other lamps of the point cathode type have also been used with varying degrees of success with picture reconstituting devices of the oscillating mirror or rotating mirror drum type, but the limited frequency response and the restricting effect of inter-electrode capacities made this class of light control unsuitable for high definition television. (See *light control, light control cells, Kerr cell, double-image Kerr cell,*



— *Courtesy Life*

Dissector Tube

supersonic light control, and *light control in cathode ray tubes.*)

DISCRIMINATOR — in a frequency modulation receiver, the section which converts frequency modulated signals into audio signals.

DISPERSION — the separation of composite light into several colors in the solar spectrum. When white light is split up it can be proven that it is made up of several different colors.

DISSECTOR — a non-storage-type pick-up tube in the television camera developed by Philo Farnsworth. (See *dissector tube.*) Used especially for motion picture film.

DISSECTOR TUBE — The dissector tube forms an electron image by focusing the electrons from a hot cathode on which the image being televised is projected. In the Farnsworth dissector tube, all of the electrons emitted by the photo-sensitive surface are drawn out simultaneously into a broad stream. This entire electron stream is moved, horizontally and vertically, past a single collector point, preferably by electro-magnetic means. This collector point thus delivers an electrical signal which, at any moment is proportional to the brightness of an elemental picture area.

DISSOLVE — the momentary overlapping or intermingling of an image produced by one camera with that of another and the gradual disappearance of the first image and gradual emergence of the other into full view. One picture appears to dissolve into another. It does not break off the action and continuity as a fade-out does, although it may slow down the action and continuity as a fade-out does if it is a very gradual dissolve. They are used for bridging a jump in time or space without breaking or slowing down the action, and even may replace a fade and connect two separate sequences. Its purpose is to combine two or more pictures to create an effect shot. (See *lap-dissolve; oblique or diagonal dissolve*, and *lateral dissolve*.)

DISTINGUOUS SCANNING – scanning in which the strips do not touch each other but leave dark gaps between them.

DISTORTION – an unfaithful reproduction of television or sound signals due to the changes occurring in the wave form of the originating signal somewhere in the course it takes through the transmission and reception systems.

DISTORTION OF THE SCANNING PATTERN – deviation of the pattern from its normal rectangular shape. When all the four corners are pulled away farther than they should be, a pincushion pattern is effected, and when these corners are not pulled far enough a barrel pattern is obtained.

DISTRIBUTION CONTROL – control on the video receiver that varies the amount of correction applied to the saw-tooth scanning wave in order to provide the desired linear scanning of lines.

DISTURBANCE – interference or noise signal affecting television, radio or facsimile reception.

DIVERGENCE – the spreading of a cathode ray stream due primarily to the mutual repulsion between the electrons that compose it. The function of the focusing arrangement in the tube is to counteract this effect.

DOLLY – a wheeled truck or movable platform upon which a television camera has been mounted so that it may easily be moved in any desired direction on the set. Also, (verb) – the act in moving the camera in for a close-up, or out for a long shot. Same as *dollying*.

DOLLY-BACK – See *dolly out*.

DOLLY IN – to move in from any distance, or further point for close-up by means of a camera mounted on a platform which is movable because of attached wheels.

DOLLY MAN – the operator who pushes or moves the camera dolly about during a telecast.

DOLLY OUT – to move backwards from a close-up to a position further away from the object, person or scene being televised so that a larger area may be viewed by the camera. Also known as dolly-back.

DOLLY SHOT – a camera picture

which involves the moving of the camera while the picture is on the air, such as dollying in from a long shot to a close-up. A shot taken when the camera is moving upon a dolly.

DOLLYING – a camera technique in which the shot is taken as the camera moves toward or away from its subject. Same as *dolly*.

DOT FREQUENCY – half of the number of elements transmitted per second.

DOUBLE BAND – to erect one stage-setting in front of a second and later setting.

DOUBLE - BEAM CATHODE - RAY TUBE – two complete "guns" in a single glass envelope, both aimed or converging on the single screen for simultaneous and superimposed traces. Announced by the Allen B. Du Mont Laboratories, Inc., in August, 1945. Previously the simultaneous comparison of two phenomena could be accomplished either by using two separate tubes or oscillographs placed side by side, or by using an electronic switch in order to present first one phenomenon and then the other on the same tube screen in rapid succession. However, the former method was obviously unwieldy and did not permit the superimposing of traces for accurate comparison, while the latter had limitations caused by the frequency response and the switching rate of the electronic switch, as well as the inability to use independent time bases or sweeps. With the double-beam cathode-ray tube, the previous limitations were removed.

DOUBLE IMAGE – a second picture, displaced from and generally weaker than the principal image, formed on the television screen usually as a result of the presence of echo signals from the transmitter. Synonym: ghost image.

DOUBLE-IMAGE KERR CELL – an improved type of Kerr cell which uses double-image prisms that separate the incident light into two images, light in one image being polarized differently from that in the other. Once separated, the Kerr cell controls both components simultaneously, and a double image analyzing prism brings about re-combination, or still further separation of the lights of the two images, according to the method used. The light emerging from the arrangement is preferably adjusted so that three images are formed, light being transferred by the signal from the center image to the outside images and vice versa. A stop is provided to eliminate the side images, the center image only being utilized. Alternately, by stopping out the central image, the side images can be utilized. The double-image Kerr cell passes at least twice as much light as the normal Kerr cell.

DOUBLE RECEPTION – simultaneous reception of two signals on different wavelengths by two receivers connected to the same antenna.

DOUBLE SIDE BAND – when a carrier is modulated by a plurality of signal frequencies, two distinct bands of frequencies appear, due to the modulation process, one on each side of the carrier frequency.

DOUBLET ANTENNA – an antenna system with an insulator inserted at the exact center, with one lead of a two-wire transmission line connected to each half of the antenna at this insulator.

DOUGHNUT – the large circular portion of a transmitting antenna; the part from which audio waves are broadcast as distinguished from the crossbar or turnstile part from which video waves are broadcast.

DOWN IN THE MUD – a very low production volume.

DOWN LEAD – the wire that connects the antenna to the receiving or transmitting apparatus. Usually known as the lead-in.

DOWN STAGE – toward the camera. Example: "Move down stage."

DRAMATIC OR SCENIC LIGHTING – special lighting effects utilized to establish a mood to indicate the time of day.

DRAMATIZED COMMERCIAL – a playlet which may portray in the commercial the sponsor's institutional setup, history, or product in use, research or development stages.

DRAPES – the curtains used as stage set backgrounds or used on travelers to curtain off a stage set. Also known as curtains, draperies, or hangings. Usually referred to by their color, such as the "blues" or "tans."

DRESS – to arrange the minor properties of a stage setting before telecasting; also the final complete rehearsal of a program.

DRESSER – a person who is responsible for the delivery, checking and handling of costumes for individual program units. He or she also handles minor alterations and repairs in the course of rehearsals and broadcasts and checks in all costumes included in the telecast.

DRESSING – properties, set decorations, objects d'art and other definitive material added to a setting to provide character or interest.

DUAL AFFILIATES – stations affiliated with two networks.

DUB-IN – introduction of pictures or sound which do not originate in the studios at the time of the telecast.

DUBBING – transposing recorded material to a new record.

DUMMY ANTENNA – a resistor or other apparatus which duplicates the electrical characteristics of a transmitting antenna without radiating radio waves. It is used for the testing and adjusting of transmitters.

DURATION OF VISION – the length of time during which a light stimulus must be given to the retina of the eye in order to set up the sensation of sight. This time-length has not yet been accurately determined. It is, however, an exceedingly minute fraction of a second, as may be judged from the fact that an electric spark discharged from a Leyden jar condenser has a duration of only 0.000000866 of a second, yet it is plainly visible to the naked eye.

DUSSAUD SYSTEM – In 1898, Dussaud described a Telephot which used two perforated discs revolving synchronously. The holes were arranged helically, thus every point of the picture was covered during one revolution of the disc. A selenium cell transmitted the impulses to the receiver which vibrated a plate. This plate only passed parallel rays of light. With this apparatus it was – theoretically – possible to transmit objects in motion electrically. The system, however, was purely theoretical for as far as records reveal, no practical apparatus was ever built.

E

EARPHONES – two flat receivers, held over the head by a spring.

ECHELON DEVICE – name given to the prism or mirror-reflecting apparatus used in the Scophony system of television, the prism, or mirrors, being stepped or cut in ladder-like, or echelon formation. Derived from the French, *echelle*, "a step or ladder."

ECHO – reflection of sound waves from a hard surface, or that of electromagnetic waves from an ionized layer. It is a wave which has been returned with sufficient magnitude and delay as to be recognized in some manner as different or distinct from that transmitted directly.

ECHOES OF LONG DELAY – When a signal is sent from a transmitter, the radio waves are propagated in all directions, unless the antenna has a system of reflectors and is thus made directional. Some of the radio waves are propagated along the ground – these are called "direct rays"; and others go up and are deflected back to the earth's surface by the electrified layers in the upper regions of our atmosphere – these are called "reflected rays." In the case of short waves, some of them circle the earth in one-seventh of a second, and produce what is known as "round-the-world echoes." That is, repeated signals occurring every seventh of a second.

EDGE FLARE – a rim of illumination around the edge of the picture on the receiver tube.

EDISON EFFECT – Flow of current through space known as the discharge of electrons or negative charges of electricity are known as the Edison Effect. Edison discovered in 1883 that if the plate of an evacuated bulb was connected to the positive terminal of a battery, a current flowed between the plate and the filament. But if the plate was connected to the negative end of the filament, no current occurred. Therefore, Edison really discovered that if the plate is given a positive potential with respect to the filament, a current will flow through the space between the plate and the filament, and that if the plate is given a negative potential with respect to the filament, no current will flow.

EFFECT SHOT – a particular or special camera shot that produces a desired effect.

EIDOPHORE SYSTEM – large-screen theatre television system patented in the United States by Prof. F. E. Fischer of Zurich, Switzerland. Patent was assigned to the Institute for Industrial Research in Switzerland.

ELECTRIC – See *electricity*.

ELECTRIC CURRENT – An electric current through a surface is the time rate at which positive or negative electricity passes through the surface. If both positive and negative electricity simultaneously pass through the surface, it is the time rate of passage of the algebraic sum of the two.

ELECTRIC EYE – a synonym for iconoscope; a popular term for light-sensitive and photoelectric cells.

ELECTRIC FIELD – a region in space surrounding a charged object. A moving electric field, such as that associated with electrons in motion or with a radio wave, is always accompanied by a moving magnetic field.

ELECTRIC TELESCOPE – name of a television apparatus described by Paul Nipkow who in 1884 applied for a patent of what he called the "Electric Telescope." In this patent he described a method of picture transmission at a distance with the aid of a mechanical scanning system. It was Nipkow who invented the scanning disc.

ELECTRIC VISION – a name synonymous with television and used by the earliest experimenters in the field. Also, the English term for television. In tracing the history it must be remembered that every system of "electric vision" which has ever been proposed depends fundamentally upon certain physical changes which are produced by light. If the phenomena known as photoelectricity were non-existent, all television would be impossible, and the possibility of television, therefore, "may be said to date from the original discovery of the electro-chemical effect of light by Henri Becquerel in 1939," according to English scientists. (*Television*, published by the Board of Education, Science Museum, London, England, 1937.)

ELECTRICAL SCANNING – name given to any process of scanning as, for example, the cathode-ray system in which the exploration of the image to be televised is obtained by means of an electrical beam, of one type or another. It is accomplished by means of a stream of electrons controlled by alternating electrical currents which are introduced in such a relationship to the electronic stream that they cause the stream to move horizontally and vertically at a predetermined speed.

ELECTRICAL TELESCOPE – television system invented by Paul Nipkow of Berlin, Germany, who invented a scanning device in 1883, patent applied for in 1884, which he termed an "electrical telescope." The important part of both the transmitting and receiving portions of his system was a metal disc provided with a single series of perforations spirally arranged around the margin. Each succeeding perforation was slightly nearer the margin than the preceding one, and spaced from it by a distance equal to the size of the image being scanned. A picture aperture or frame was so arranged that as the disc revolved each perforation passed successively from side to side in front of it. At the transmitter an image of the object field to be televised was projected by means of a lens upon the scanning disc at the picture aperture. Immediately behind the disc, at the picture-aperture region, was a photoelectric cell upon which a beam of light could fall after passing through a perforation in the disc. As the first perforation moved across the picture aperture, with its projected image, it permitted light rays from a single line of picture elements to pass through in succession to the photoelectric cell. The next perforation, being slightly nearer the margin than the first one, then swept across an adjacent line of the image, with its picture elements. In this way, as the disc revolved, the image was broken down into as many lines as there were holes in the disc. Each perforation was small enough to admit only a tiny light beam from a small portion of the image, whose light value was thus translated by the photoelectric cell.

Nipkow began the scanning of the image with the innermost perforation, which as the disc rotated, allowed a series of varying light impulses to hit the photoelectric cell as a line of picture elements was scanned. As soon as the first perforation passed out of the picture aperture the second perforation began its scanning of the second line, translating the light values of this row of picture elements into electric impulses. When the disc had completed its rotation once, the image had been completely scanned; and the light values – picture element for picture element – had been changed by the photoelectric cell into a wire current whose strength varied with the light intensity of the particular spot in the line being transmitted at any given moment. The wire carrying this current which had been thus affected by the light values of the image, was led to a receiver which was basically like the transmitter, with the scanning process reversed. Here, instead of an image being resolved into a series of lines of picture elements, the picture elements were built up, line by line, to form an image. In the receiver, the disc terminated in a selenium tip and, therefore, acted as a light-sensitive cell. The diameter of the cable necessarily determined the size of the image; that is, the sending of the picture elements simultaneously. (See *persistence of vision.*)

ELECTRICAL TRANSCRIPTION – a disc recording of a complete program, as contrasted with a phonograph record which ordinarily contains only a single musical selection. Transcriptions are made to permit broadcasting or rebroadcasting of a particular program at any specified time by any number of stations.

ELECTRICITY – the term "electricity" comes from the Greek word "electron" which means "amber," the substance wherein the phenomenon of magnetism was most manifest. Electricity is a general term referring to the manifestation of a form of energy believed to be due to the separation or movement of certain constituent parts of an atom known as electrons.

ELECTRIFICATION – a body is said to be electrified when its surface atoms have either a surplus or a deficiency of electrons. A body possessing a surplus of electrons is said to be electrified negatively, and a body possessing a deficient of electrons (predominance of protons) is said to be electrified positively.

ELECTRO – from the Greek meaning "amber" – a prefix used in the construction of compound terms, i.e., electromagnetic, electro-luminescence.

ELECTRODE – a conductor whereby an electric current is led into a liquid (as in an electrolytic cell) or into a gas (gas in an electric gas discharge tube). An essential part inside a vacuum tube, such as the cathode, the various grids, and the anode. Also the plates of a primary cell, secondary cell or electrolytic condenser.

ELECTRODYNAMICS – the science of electric currents and their interaction.

ELECTRODYNAMOMETER – an instrument for measuring the strength of an electric current.

ELECTROGRAPH – (1) apparatus for tracing a design to be etched; (2) device for sending pictures, maps, etc., by electricity; (3) tracing made by an electrometer; (4) a motion picture camera using an arc light; (5) an X-ray picture.

ELECTROKINETICS – that branch of science which deals with the laws of electricity in motion (distribution of electric current): distinct from electrostatics.

ELECTRO LUMINESCENCE – a scientific term applied to all cases of fluorescences and phosphorescences which are caused by cathode rays, X-rays and by radioactive compounds.

ELECTROLYSIS – the decomposition of a chemical compound by electricity.

ELECTROLYTE – substance which in solution conducts an electric current and is decomposed by it. A type of conductor in which the electric current liberates matter at the electrodes. May be an acid, salt or base.

ELECTROLYTIC SELENIUM CELLS – name given to specific types of selenium cells which instead of varying their resistance under the influence of light generally generate minute currents under the light action.

ELECTROMAGNET – a coil of wire, usually wound on an iron or steel core, which produces a strong magnetic field when a current is sent through the coil. It behaves, therefore, like a magnet all the time the current is flowing. When the current ceases, the magnetism disappears – not altogether, a little is left – as iron does not remain magnetized permanently.

ELECTROMAGNETIC – referring to a magnetic field produced by an electric current. Compare with electrostatic. Also, pertaining to an electromagnetic or to the combined electric and magnetic fields associated with movements of electrons through conductors.

ELECTROMAGNETIC COMPONENT – (1) strictly, that component of the combined field surrounding a transmitting antenna which represents the radiated energy; (2) the magnetic component of an electromagnetic wave.

ELECTROMAGNETIC FOCUSING – system in which magnetic fields, parallel the motion of the electrons, are used to confine them to a narrow beam.

ELECTROMAGNETIC LENS – an electron lens in which focusing is produced electromagnetically.

ELECTROMAGNETIC WAVE – the wave associated with an electromagnetic field traveling through space or through material media. It consists of electric and magnetic fields at right angles to each other. Electromagnetic waves are known as radio waves, heat rays, light, X-rays, etc., depending on their frequency. Often called electric waves. Electromagnetic waves are set up near the earth's surface. They are partly transmitted as guided wave trains along the earth's surface, modified by refractions and absorption at its irregularities. Another part, however, goes off as space waves, which by reflections at the upper and lower layers of the conducting boundaries may recombine with the guided waves in such a way as either to add or subtract their effects, depending on the circumstances. In daytime, the upper conducting boundary will be less definitely marked than at night, because of partial ionization of the air by the sun's radiation. Hence, there will be less reflection of the space wave in the daytime, and consequently the guided wave will not be assisted materially by any reflected or refracted part of the space wave. At night, however, when the upper boundary is more sharply defined, there is more reflection of the space wave and in general, signals received at night are stronger than during the day. Night signals are, however, more variable in intensity particularly for short waves. This is especially true during the time when the sunset line is passing between two communication stations, clouds and other meteorological conditions would cause great variations in the sharpness of this boundary surface, and this may explain the rapid fluctuations in the signal strength of received signals often observed.

ELECTROMAGNETISM – magnetism produced by an electric current. The science which treats of relations between the phenomena of electricity and magnetism.

ELECTROMALUX – a tube employing a mosaic, which functions photoelectrically when used as a television camera.

ELECTROMETER – an apparatus for

measuring difference of potential between two conductors.

ELECTROMETRY – science or process of making electrical measurements.

ELECTROMOTION – passage of an electric current. Motion produced by electricity.

ELECTRON – the most elementary charge of negative electricity. It is the electrical opposite of the proton. Electrons and protons are all atoms. Electrons constitute cathode rays, and beta rays, and are emitted by hot bodies. An electric current consists of movements of electrons. The word is believed to have been originated by an Englishman – Dr. George Johnstone Stoney – in an article written in the July, 1891, issue of *The Scientific Transactions of the Royal Dublin Society*. Although it is far too minute to be seen even with the aid of the most powerful magnifying apparatus in existence, it has been carefully measured by direct means, and a great deal of knowledge has been obtained about it.

Sir J. J. Thompson is credited with having worked on the actual proof of the earlier assumptions which led to the discovery of the electrons. He, with others, are credited with actually measuring electrons, weighing the minute particles of negative electricity. Also defined as "the unit of negative electrical charge." This is the unit of electricity that is released by the cathode in an electron tube.

ELECTRON BEAM – a concentrated stream of electrons focused into the shape of a beam by external electrostatic or magnetic fields – also called cathode-ray beam. It is a narrow pencil of negatively charged particles moving with great velocities of the order of 30,000 miles per second. Its original name was "cathode ray."

ELECTRON CAMERA – a generic term for any apparatus which converts an optical image into a corresponding electric current directly by electronic means, without the intervention of mechanical scanning. (See *iconoscope*.)

ELECTRON EMISSION – the ejection of electrons from the surface of a material into surrounding space under the influence of heat, light, high voltage, or other cause. In a thermionic vacuum tube, electron emission from the cathode is produced by heat. Electron emission actually is the rate at which electrons are emitted from the cathode.

ELECTRON GUN – the structure or system of metallic cylinders in the narraw neck of a cathode-ray tube in both camera and receiver consisting of an electron-emitting cathode and associated electrodes that concentrate, control, and focus the stream of emitted electrons into a beam that produces a spot of the desired size on the screen at the end of the tube. (See *cathode ray*.) Included in the gun are the cathode, shield, and one or more anodes.

ELECTRON IMAGE TUBE – cathode-ray tube having a cathode of large area, coated with light-sensitive material upon which an optical image is projected. This causes corresponding emission of electrons from each point on the cathode. The resulting emission, if focused by electron lenses upon a fluorescent screen, produces a visible image of whatever has been projected on the cathode.

ELECTRON LENS — an electrical arrangement of electrodes in the cathode ray tube used to control the direction and size of a beam of electrons in much the same manner that a glass lens controls a beam of light.

ELECTRON MULTIPLIER — a specially designed tube that provides a large number of electrons at the output electrode as compared with the number of electrodes at the input. The operation depends on secondary emission. Invention of Philo Farnsworth. The purpose of this tube is to increase the number of electrons making up the original tiny picture element; therefore, improving sensitivity so that outdoor scenes and motion picture film can be reproduced.

ELECTRON OPTICS — the underlying principles of electron optics are not difficult to understand. An electron is always attracted to a positively charged electrode, but the path which the electron takes in reaching the anode is quite important. Electric lines of force exist between any two differently charged bodies; it is along these lines of force that the electrons travel.

ELECTRON THEORY — a theory which explains the nature of an electric current as electrons moving through a conductor.

ELECTRON TUBE — any partly-evacuated, completely-evacuated, or gas-filled tube, used to control the flow of electrons in a circuit. Vacuum tubes, phototubes, mercury vapor rectifier tubes and cathode ray tubes are all electron tubes. (See *electronic tube.*)

ELECTRONEGATIVE — a substance appearing at the positive pole in an electrolysis. Bearing a negative charge; assuming negative potential when in contact with another substance.

ELECTRONIC — of or pertaining to an electron, electrons, or the general field of electronics.

ELECTRONIC BAEDEKER — colloquial term for *television*.

ELECTRONIC CELL — dry cell, containing no liquid.

ELECTRONIC CONTROL — control of a machine or device by apparatus employing electron tubes.

ELECTRONIC SCANNING — scanning with a cathode-ray tube, as contrasted with mechanical scanning with a rotating disc or mirror drum.

ELECTRONIC TELEVISION — video system using cathode-ray tubes to scan the object or scene at the transmitter and to reconstruct it at the receiver. The process is electrical with no moving mechanical parts. This is the system universally used in America today. Essentially it operates in the following manner: (1) the scene is transformed into an optical image by a lens in the same manner that a camera, either still or motion picture, works; (2) this optical image is then transformed into an electron image. Every point of this electron image gives off emissions which are in proportion to the amount of light falling upon this particular point; (3) this electron image is then taken apart in an orderly manner, in sequence, "dissected," and the emissions are then transformed into electrical impulses, which, in turn, are proportional to the amount of light falling on the respective parts. It must be remembered that in electronic television, this "taking apart" or "dissection" is done electrically; there are no mechanical parts; (4) the electrical impulses, or signals, after proper amplification, are transmitted over a single channel either through the air or specially designed (coaxial) cables to a receiver; (5) in the receiver the procedure is reversed, and the "dissected" picture is reassembled.

ELECTRONIC THEORY – Scientists now almost generally agree that the atom, the smallest particle into which it was hitherto assumed that any element could be divided, itself is made up of a system of two kinds of even smaller particles; each individual atom consisting of one proton with a positive charge of electricity and varying numbers of electrons with negative charges. The proton, and some of the electrons, form a central "kernel" which is the smaller, but more massive part of the atom. The remaining number of electrons in the atom circulate about this kernel much in the same manner that the planets revolve about the sun. The number of electrons and their arrangement about the proton are different in each element. These roving electrons are free to move in their paths, but are restrained when they reach the boundary of the atom. If, however, energy is supplied to the roving electrons from outside of the atom, one or more of the roving electrons may approach the boundary of the atom with sufficient force to break loose. The roving electrons may be compared to marbles rolling around in a deep dish such as a cereal or soup plate. They can roll around the bottom but cannot escape. However, if some outside force is applied, they can be given enough impetus to roll up the edge and become free.

ELECTRONIC TUBE – a device employing a cathode, an anode, and possibly additional electrodes for controlling the volume and direction of flow of electrons which constitute the electric current. (See *electron tube.*) Early in the 1920's, serious work had begun on electronic tubes for reproducing the television pictures. The principle upon which these tubes were based was that of allowing a sharply defined narrow cathode-ray beam to strike a screen of fluorescent material which became brilliantly luminous at the point of impact of the electrons. By deflecting the beam back and forth across the screen in a series of straight parallel lines, a scanning pattern was formed, corresponding to that of the pick-up device. The intensity of the light at every point of the screen was controlled by modulating the electron current in the cathode-ray beam with a suitable control grid. (See *cathode ray tube, kinescope, iconoscope, orthicon, image orthicon.*)

ELECTRONICS — the science which deals with the behavior of free electrons. Also, that broad field of electricity covering work with all types of apparatus employing tubes for industrial applications. Television and radio are broad branches of this field. Also, that branch of science which relates to the conduction of electricity through gases or in a vacuum. Electronics is thus a broad field including all types of applications for electron tubes, in television, radio, facsimile, diathermy, industrial control, etc. In simplest language: electronics is the science of freeing electrons — invisible particles of electricity — from matter and putting them to work — for example, every time a switch is turned on the radio set.

ELECTROPHORUS — a device for producing electric charges by induction, consisting of a disc of resin or vulcanite and one of metal.

ELECTROPOSITIVE — a substance, as potassium, which appears at the negative pole in electrolysis. Charged with positive electricity; becoming positively charged by contact or chemical action.

ELECTROSCOPE — apparatus for detecting the existence of an electric charge and determining its positive or negative character.

ELECTROSTATIC — referring to an electric charge, as distinct from a flow of an electric current. The action of a condenser, of a Leyden jar, or the mosaic in an iconoscope camera is electrostatic. (Compare with electromagnetic, referring to magnetic field produced when a current moves through a conductor.)

ELECTROSTATIC FOCUSING — a method of focusing high-vacuum cathode ray tubes by the electrostatic field produced by two or more electrodes, maintained at suitable potentials; that is, the system in which electrical fields are employed to confine the flow of electrons to a narrow beam.

ELECTROSTATICS — that branch of science which deals with the laws of electricity at rest.

ELEMENT — one of the 93 known basic forms of matter which make up the universe. The term is also used to refer to the important parts of a device; for example, the cathode, grid, and plate would be called the elements of a triode vacuum tube.

ELEMENTAL AREA — the smallest segment scanned at any given instant in a television or facsimile system.

ELEVATION PLAN — a scaled sketch made of stage sections and special props to facilitate construction and painting of the set or props.

EMISSION — In television terminology, as in radio nomenclature, this term usually refers to the emitting of a stream of electrons from the surface of a body, either under the influence of heat, as in a cathode-ray tube or radio valve, or by means of light action as in a photoelectric cell. In a cathode-ray tube, or radio valve, the electron emission is controlled primarily by the temperature to which the cathode or filament is raised, and, in a photoelectric cell, by the intensity of the light acting upon it. Also, emission means the act of sending forth.

EMISSION CELL – a type of photoelectric cell in which a light-sensitive cathode emits electrons under the influence of light. The free electrons are captured by a positively charged anode, suitably placed, after which the minute current thus created is amplified by normal methods.

EMITRON – the British version of a camera tube used in television. Although differing considerably in construction and design from the RCA camera tube, the iconoscope, and in its improved form the Orthicon; and the Farnsworth camera tube, the dissector tube, the results they produce are basically the same. Emitron is the trade name for the form of electron camera in which the optical image is focused on a photo-emitting mosaic which is scanned by an electron beam.

EMITRON CAMERA – Modern English television camera which, in addition to the usual refined optical system, contains a cathode-ray tube with a mosaic screen. The picture to be televised is focused with the aid of the optical system on the mosaic screen. (See *storage tube.*) The American system of cathode-ray tube and electronic scanning is fundamental in this camera. An image of the object or scene being televised is produced by a lens on a mosaic light-sensitive screen inside the cathode-ray tube. Deflection coils outside the tube cause an electron beam, produced by an electron gun, to scan the mosaic screen in parallel lines. The electron beam releases in turn the charge produced on each light-sensitive particle or cell of the screen, and this gives a varying signal proportional to the illumination on the screen element being scanned at each moment.

ENERGY – ability to do work. Thus, the electrical energy stored in a dry cell has the ability to heat a radio tube filament, operate a buzzer, etc.

ENVELOPE – the glass or metal housing of a cathode-ray or radio tube.

EQUALIZING PULSES – these signals are transmitted before and after each vertical synchronizing pulse to insure correct start of the horizontal sweep trace in iconoscope and picture tubes.

ESTABLISHING SHOT – a camera shot establishing the nature or location of the action by showing all important parts of the scene. This may be obtained by placing the camera squarely in front of the subject at a normal eye level and at a distance which will permit the inclusion of the complete scenic area just as any spectator would see the scene or person if he was standing before the subject. This is the standard long shot.

ETHER — the medium, permeating all space, which is supposed to fill all space and matter, the exact nature of which still remains unknown. There is no concrete proof that ether does or does not exist. The idea of an "ether" was propounded by Sir Isaac Newton in the 17th century and given prominence by Christian Huygens, Dutch physicist, who discovered polarized light. The ether has the property or ability of transmitting electromagnetic waves (light, radiant heat, X-rays, etc.).

ETHER SPECTRUM — range which will include all of the frequencies.

ETHER WAVE — a wave of energy which uses ether as a medium.

EXCITING LIGHT — any light that will induce luminescence in responsive materials. Thus, "black" light is an "exciting" light. It is sometimes called an "activating" light.

EXPERIMENTAL TELEVISION BROADCAST STATION — a station licensed by the Federal Communications Commission for experimental transmission of transient visual images of moving or fixed objects for simultaneous reception and reproduction by the general public.

EXPLORE — to scan.

EYE — a nearly spherical hollow organ, in humans and animals, with a transparent covering over its exposed surface, protecting two important underlying structures, the iris and the lens. On the inside surface of the back of the eyeball is another important visual structure, the retina. The eye, in its general design, is thus much like a camera; it possesses structures, comparable to the iris, the lens, and the sensitive film (retina). It is also like a camera in that it transforms light rays reflected from an object field into a photochemical image. The human eye has two sets of light receivers spread over the surface of the retina. One set, called cones, is located in the periphery of the retina, and is used in night vision, scotopic vision. The other set, rods, are approximately 100,000 times more sensitive to light than the cones, but are insensitive to differences in color. In other words, the rods function even at very low brightness-levels when the eye is dark-adapted. Dark-adaptation is defined as the condition of the eye when it has become so accustomed to darkness that you can see your way around even at very low brightness levels.

F

FCC — abbreviation for Federal Communications Commission.

F-LAYER — the upper ionized layer in the ionosphere resulting from the ultra-violet radiation from the sun. At a regular height of 300 km. during the night; it falls to about 200 km. during the day. During some seasons, this remains as the F_1 layer while an extra F_2 layer rises to a maximum of 400 km. at noon. Considerable variations are possible during particle bombardment from the sun, the layer rising to great heights or vanishing.

F-M – abbreviation for *frequency modulation.* Also used as FM, F.M.

F.M.B.I. – abbreviation for Frequency Modulation Broadcasters Association, Inc. Now non-existent and incorporated as a separate division with NAB (National Association of Broadcasters.)

FS – abbreviation, follow shot.

FACILITIES – stations of a given network lineup.

FACILITIES COST – used to distinguish from program costs.

FACILITIES DIRECTOR – the supervisor of all matters of scenic equipment in the production of a program, coordinating production ideas with stage set, costume, make-up, properties, etc.

FACSIMILE – a system of communication in which images are electrically transmitted and reproduced on paper. The images transmitted may be photographs, drawings, handwriting, and printed matter of any kind. There are two types of facsimile: (1) Type A facsimile is a system in which images are built up of lines or dots of constant intensity, (2) Type B (telephotography, photoradio, etc.) is a system in which images are built up of lines or dots of varying intensity.

FACSIMILE RADIO – the transmission of a still picture by means of a radio link.

FACSIMILE RECORDER – an instrument which reproduces on paper the illustration, writing or printed matter being transmitted by a facsimile system.

FACSIMILE TRANSMISSION – the transmission of pictures by radio. (See *facsimile.*)

FADE DOWN – to reduce or lower the brilliance of the television picture to zero. Normally used at the completion of a sequence.

FADE GREY – consists of producing an even grey screen without cutting the signal off the air.

FADE-IN – to electronically increase the signal strength so that the television image appears on the screen gradually from total darkness to its full visibility. (See *fade up.*)

– Courtesy Radio Inventions, Inc.
Facsimile System Scanner unit

FADE-OUT – to reduce electronically the signal strength or black out the television image from its full brilliance so as to make the image disappear gradually to total darkness. It is the opposite of fade-in; that is, intentional and gradual disappearance of a television scene produced at one video camera or its control circuit prior to or during changeover to another video camera. Also, in radio, failure of the radio waves to arrive at a location either because of magnetic storms, atmospheric disturbances, or other conditions along the transmission line. (See *fades.*)

FADE-TO – change gradually in signal strength. The signal associated with the sound program is faded in by making it gradually stronger and is faded out by reducing the volume slowly to zero.

FADE UP – to build up the picture brilliance from zero to normal levels. (See *fade-in.*)

FADE WHITE – produced by increasing the intensity of the image to produce an all-white screen. This method is not very satisfactory, inasmuch as the brilliance of the all-white screen is dazzling to the eye.

FADER – the control used in reducing the audio or video output. This is a multiple-unit volume control used in television for changeover from one camera to another; in radio, used for the gradual changeover from one microphone or audio channel to another.

FADES – used principally to open and close a program or a sequence in the program. A fade-out evokes the feeling of an ending and for that reason is practically never used except to end a sequence or program performance. A fade-out is to a video show what a chapter ending is to a book; that is, a complete break, giving a sense of finality. The duration of the fade depends entirely on the mood and the subject matter of the scene at hand and may range from a split-second fade, which is almost a cut, to five or ten seconds but rarely longer.

FADING – an undesired weakening or variation in the strength of the radio signal. This is essentially due to variations in transmission conditions along the path taken by the radio waves from the transmitting station to the transmitter. Fading is not generally observed at short distances from the broadcasting station, but usually only at distances which are at least some 10 or 20 per cent of the normal transmitting range of the station. A certain station will be received with normal intensity for several minutes; then for a minute or two the incoming program will become much louder; and then rapidly become much fainter and may become so weak that it cannot be heard at all for a short interim. Fading is usually observed particularly at night and usually only in transmission over land. Fading variations may be very rapid, with a period of about one second or very slow, with a period of one hour or more. Broadcasting stations located on the sea coast appear to fade more than inland stations. The best method to avoid transmission difficulties caused by bad fading is to considerably increase the wavelength of the broadcasting stations, when this is possible.

FALSE CEILING – term used to describe various devices such as, partial ceilings, beams, etc., utilized to create the effect of a room enclosed from above without effecting an actual covering which would prevent practical and desirable overhead lighting.

FARADAY EFFECT – In 1845, Michael Faraday discovered the rotation of the plane of polarization of polarized light when passed through a magnetically stressed section of heavy lead glass. This discovery is listed as starting the history of electro-optical methods of light control. (See *light control cells.*)

FARNSWORTH IMAGE DISSECTOR TUBE – a special cathode-ray tube for use in television cameras developed by Philo T. Farnsworth.

FARNSWORTH SYSTEM – a television system originated by Philo T. Farnsworth, which employs cathode-ray scanning. The transmitter centers about the pick-up tube, which is known as the image dissector. This is a vacuum tube which converts the various light intensities of a scene focused upon its photosensitive surface into fluctuations of an electric current. In addition, it analyzes the area of the scene into a regular succession of space elements converting them into corresponding signal currents that can be transmitted over a single communications channel. Essentially, the image dissector is an evacuated tube, with a silver oxide-caesium cathode, in the form of a disc. This disc is perfectly smooth, almost polished and gives the photoelectric element required. The system employs cathode-ray scanning, with a special type of cathode-ray tube in which the hot cathode is replayed by a mirror coated with light-sensitive material. The image to be televised is focused upon this mirror, whereupon a stream of electrons is emitted from the mirror. By suitable devices, these electrons are guided to another part of the tube where they meet a small rod or cylinder which acts as a collector, and which leads them into an amplifier from where the currents are transmitted in the usual manner.

FEDERAL COMMUNICATIONS COMMISSION – a board of seven commissioners appointed by the President of the United States under the Communications Act of 1934. This Board has the power to regulate and license all electrical communications systems originating in the U. S. A. and all its possessions, including television, radio, facsimile, telegraph, telephone and cable systems. Term of office is for seven years. Salaries are $10,000 per year. Abbreviation: FCC.

FEDERAL RADIO COMMISSION – created in 1926 by an act of U. S. Congress to supervise radio broadcasting. First appointees March 2, 1927) included Rear Admiral W. H. G. Bullard, John F. Dillon, Judge E. O. Sykes, Dr. O. H. Caldwell, and H. A. Bellows. The FRC later became the Federal Communications Commission.

FEED — to supply a signal to the input of a circuit; also, to transmit a program over telephone lines to other television or radio stations in a network or to any listening or viewing point.

FEED LINES — lines connecting a transmitter to an antenna.

FEEDER — a conductor connecting an antenna with radio transmitting or receiving equipment. Also, one of the wires or cables used to feed electrical energy from a source to a load or a point from which it is distributed.

FERREE SYSTEM — a method of transmitting photographs by radio, developed by Marvin Ferree about January 1924. The image received was reproduced on chemically treated paper by an electrical current. The current itself changed the color of the paper. In transmitting, a cylinder was rotated by means of an electric phonograph motor. The photograph, made into a half - tone on copper or zinc with a one-line screen, was placed on the cylinder with a stylus in contact with it. The stylus moved in a spiral course at a rate of 175 turns to the inch. The stylus, working over the indented surface of the half-tone, caused fluctuations in the current. The transmitting cylinder turned at the same speed as the receiving cylinder. The receiving stylus acted on a chemically prepared paper which turned black or gray, forming the picture. A picture could be sent up to 400 and 900 miles in less than five minutes.

FIDELITY — the faithfulness or degree with which part or all of a system accurately reproduces or delivers at its output the signal which is impressed upon it.

FIELD — This word may be used (1) technically — the scanning of a picture from top to bottom is known as a field. A field does not necessarily cover all the lines that make up the image. Strictly, it refers to one set of scanning lines making up part of the final picture. In present standards, pictures are transmitted in two fields of alternate lines which are interlaced to form a 525 picture at the rate of 30 complete frames or pictures per second. Also, the area or solid angle picked up by the lens system of the television camera. In normal scanning where one line touches the next, the field is the entire scene being televised. In double interlaced scanning, the field is half the area of the scene, while in triple scanning (interlaced), the field is one-third the area of the scene. (2) program-wise — to mean that area of a stage or scene covered by the camera as seen on the receiver tube, depending on the type of lens and distance of the camera from the scene.

FIELD FREQUENCY — in television, the number of complete downward sweeps of the scanning element per second. In interlaced scanning, it represents the number of times per second that the frame area is fractionally scanned. That is, this term refers to the repetition rate of the field, which in present television systems is 60 fields for second.

FIELD OF VIEW – syn. for field of vision.

FIELD OF VISION – the vertical and horizontal range of vision. Normally, in human beings, the field of vision extends to about 150 degrees horizontally and 120 degrees vertically. Syn.: field of view.

FIELD PICK-UP – the transmission of out-of-studio events by mobile unit cameras.

FILAMENT – a cathode heated by a current which passes through all or part of it. Also known as *directly heated cathode.*

FILAMENT-TYPE TUBES – electron tubes using a heated filament to produce electron emission.

FILL – an added program material.

FILL IN – one who stands by to perform in case a program change has to be made immediately. (See *standby.*)

FILM CLIP – a sequence of material recorded on film that is inserted into a "live talent" studio program. It is used to present scenes or action not possible in the studio.

FILM COMMERCIAL – telling the advertiser's story via the medium of motion pictures.

FILM LOOP – a short piece of motion picture film spliced end to end to form a loop, which can be threaded on a projector and run continuously during a show so that it can be brought into the picture sequence as wanted.

FILM PICK-UP – the electronic transmission of motion pictures from film by means of television.

FILM SCANNER – a type of belt scanner consisting of an endless band of film in which the diagonal series of holes are photographically printed on a background. (See *belt scanner.*)

FILM SCANNING – the process of converting movie film into corresponding electrical signals that can be transmitted by a video system and shown as motion pictures at the television receiver.

FILM SEQUENCE – a portion of a television broadcast made up of various movie scenes; or in a movie, the relation of various views of a scene which build into an incident climax.

FILM SLIDE – a slide made on film. This may be a 35 mm. frame, or it may be a 3¼ by 4-inch negative or positive plate.

FILM STRIP – a sequence of several 35 mm. frames shown individually.

FILM STUDIO – a studio equipped for televising motion picture film.

FILTER – lens device used to eliminate, reduce or change a portion of the light spectrum.

television, the illuminating agency is the electron beam. If the emission of valuable light from the crystalline phosphor materials *persist for a noticeable period after the exciting agent stops,* it is called phosphorescence. (See *phosphors* and *phosphorescence.*)

FLUORESCENT BANKS – a specific kind of "cold" light used for illumination in the television studios.

FLUORESCENT LIGHTS – mercury-vapor electron tubes coated internally with fluorescent materials.

FLUORESCENT MATERIAL – a material that emits valuable light readily when exposed to electron beams, X-rays or other radiation.

FLUORESCENT PIGMENTS – pigments which have fluorescent properties only; that is, they glow only during the time of excitation. (See *luminescent pigments.*)

FLUORESCENT SCREEN – a sheet of suitable material coated with a substance that glows visibly when hit by an electron beam, X-ray, or radium rays. In a cathode-ray tube, it is usually a coating on the inside surface of the glass envelope at the large end of the tube, commonly known as the screen. The screen must provide high luminosity in response to small power of the cathode beam. The ray must be kept moving all the time for if left on one spot it will burn a hole in the screen. The fundamental importance of the fluorescent screen of the kinescope is obvious. The properties determine the color of the image, its brightness for a given beam current, and also, to a certain extent, the contrast, flicker, etc. The screen consists of a thin layer of finely powdered fluorescent material and is applied in a variety of ways. Generally used are dusting, spraying and settling through a liquid medium. The last technique permits an accurate control of screen thickness, and is, therefore, well suited to experimental production of screens. Furthermore, it wastes no material.

FLY – to lift a stage setting above the stage.

FLYBACK – return stroke or sweep of the cathode ray beam to its initial position so that it may re-start the trace of the next line.

FLYING SPOT – the moving spot of light that scans the scene or subject being televised in a mechanical television system. In a great deal of J. L. Baird's later work with mechanical systems, he used the flying spot. The subject being televised was put into a relatively dark room or booth, in front of a scanning disc. Behind the disc was a bright arc light, and a lens in front of the disc focused an image of the perforation in the disc upon the subject. When the disc rotated, the subject was scanned by the bright spots of light coming from the holes in the disc. Around the lens opening on which this flying spot of light was being projected were placed several photoelectric cells facing the subject. These received light reflected from the subject, and the amount of light thus received was dependent upon whether the moving spot of light touched a dark portion of the subject's hair or his white shirt front. There were two marked advantages to this system: (1) the subject did not have to sit in the glare of bright lights; (2) several cells could be coupled so that a greater electrical response was obtained. This flying-spot method of scanning was used by many other television experimenters.

FOCAL-PLANE SCANNING DEVICE – characterized by the fact that an element moved in the scanning area itself. This is illustrated, for example, by scanning discs, drums, band, etc., in which an area upon which an optical image was focused at the transmitter or behind which a modulated light source was placed at the receiver. Used in mechanical systems, now obsolete.

FOCUS – the point where the rays of light passing through a lens meet to form an image. Also, the control on a television receiver which affects the sharpness of the observed picture. If the television camera is not kept in focus, the scene is not clear.

FOCUSING – the act of moving an optical lens back and forth until a sharp image is obtained, or the corresponding adjustment of an electron lens in the cathode-ray tube to obtain a sharp image which is clear to the eye when viewed on the related camera picture monitor.

FOCUSING CONTROL – a knob on the television receiver used for bringing the picture into sharper definition. It adjusts the size of the visible spot produced at the screen by the electron gun in the cathode ray tube.

FOLLOW – short for *follow shot*.

FOLLOW FOCUS – the technique of constantly adjusting the focus of camera lenses while a scene is being shot. "Follow focus" is essential when either cameras or performers move about during a dolly shot or during a pan shot while following the movements of a dancer.

FOLLOW SHOT – the camera follows the performer, action, or scene about the stage set or off the stage set. Abbreviation: *follow*, or *FS*.

FOOT CANDLE – the unit of illumination measurement.

FOREGROUND – the front or forward space of a stage set or playing area.

FOUNDATION LIGHTING – non-characteristic light, producing sufficient illumination to register a satisfactory electronic picture on the camera tube.

FOURNIER – French physicist who with Rignoux developed a television system which sent crude pictures over wires. (See *D'Albe, Fournier*. Also, *Rignoux and Fournier Television System*.)

FRAME – a single complete picture. In double interlaced scanning the frame is produced by two successive fields, each including half the total area of the frame. In present standards, pictures are transmitted at the rate of 30 frames per second, giving the effect of a moving picture. In relation to film, frame means one complete picture on a 35 mm. or 16 mm. film. 35 mm. movies are projected at the rate of 24 frames per second.

FRAME ANTENNA — an antenna consisting of a loop with one or more turns of conductor wound on a frame, its plane being oriented in the direction of the incoming waves, or in the case of transmission, in the direction of maximum radiation. The transmitter or receiver is connected across the two ends of the loop. Also called the loop antenna and coil antenna.

FRAME FREQUENCY — the number of times per second the complete image is scanned. In double-interlaced scanning, the frame frequency is half the field frequency since two downward sweeps are needed to scan every element in the frame. Also called picture frequency. See *transmission standards.*

FRAME SHIFT — control which normally positions picture so that it is centered within horizontal edges of the mask.

FRAME - SYNCHRONIZING IMPULSE — an impulse transmitted at the end of each complete frame-scanning operation, to synchronize in the framing oscillator at the receiver with that at the transmitter.

FRAMING — adjustment of the image to the desired position relative to the field of view, generally a central position.

FRAMING CONTROL — knob or knobs on the television receiver to center and adjust the height, width, and centering of the images. Also known as *framing the image.*

FRAMING MASK — name given to a sheet of metal or other material having a rectangular aperture cut in the middle of it. Used in mechanical systems, it was placed in front of the revolving disc in a television receiver in order to give an image of the required size and to eliminate any unwanted light from the neon light. (See *framing control.*)

FRAMING THE IMAGE — See *framing control.*

FRANCE — In France experimental television broadcasts had been maintained in 1923 by the Television Baird-Nathan Co., an affiliate of the John L. Baird Co., in England. These tests, using a mechanical scanning system, were continued through 1935. In April of that year, the transmission standards were raised to 60 lines of definition in the picture. This was increased to 180 with the improved mechanical system installed atop the Eiffel Tower on Nov. 17, the same year. In 1937, the French Administration des Postes, Télégraphes et Téléphones made improvements on the Parisian television station using an iconoscope which gave 441-line definition. In April, 1938, a special cable was laid joining Paris with Bordeaux for future television network stations. About that same period a new transmitter was put into operation in the Eiffel Tower, with pictures at 445-line definition. With the advent of World War II, French television facilities became a casualty. In 1940, the Nazis occupied the land and took over all physical equipment.

In May, 1945, the International Telephone & Telegraph Corp. received a cablegram from Guy Rabuteau, French scientist in charge of the laboratories of Le Materiel Telephonique, Paris, the French I. T. & T. associate which designed and installed the world's most powerful television station in the Eiffel Tower in Paris in 1938.

Rabuteau stated that Robert Buron, French broadcasting administrator, declared that "despite German occupation, French research organizations had continued developing television technique and manufacturers are now in a position to deliver pick-up equipment, transmitters, receivers suitable for black-and-white, high definition television and later on full color television. . . . Experiments (in the future) will be made on both 700- and 1000-line black-and-white images."

FRANCHIZED CHANNELS – plan suggested by U. A. Sanabria, president, American Television Laboratories, before the Federal Communications Commission in October of 1944, whereby the five best "present telecasting channels will be known as 'franchized channels'." The United States was to be divided into television areas, and each area would have a federally supervised utility consisting of five or less telecasting companies. Every owner of a television receiver would register each set with the local utility through the necessary legal steps, and a sum of approximately $2 a month would be paid by the owner of each registered receiver to the utility which in turn would provide good programs, principally on motion picture film.

FREE ELECTRONS – those electrons which are free to move between the atom of a material when acted upon by electric or magnetic forces. These are the outer electrons of atoms and are shot off copiously from the surface of certain materials when the latter are subjected to light or heat action. Hence they are the electrons which enable the cathode-ray tube, the valve, the photoelectric cell and other electronic apparatus to function.

FREE LANCE – personnel not regularly employed which receive an occasional special assignment.

FREE PERSPECTIVE – the deliberate falsification of normal perspective in the painting and/or construction of television, or stage settings in order to achieve, visually, greater distance or depth.

FREEZE IT – term used to indicate that set designs and arrangements, or positions of furnishings, dressing, etc., or other production facilities, are approved and should be executed as planned.

FREQUENCIES – Broadly speaking, these are units of electrical wave bands. Colloquial expression for *spectrum, channels, bands*. Because television requires such wide bands on the frequency spectrum, programs can only be broadcast on ultra-high frequencies or short-wave bands. Otherwise the stations would interfere with each other.

FREQUENCY – the number of vibrations or cycles in a unit of time. Radio waves fall into low frequencies, high frequencies, and ultra high frequencies and micro maves. Frequency is expressed in cycles per second. Frequencies for standard sound broadcast station reach a high of about one and one-half million cycles. Television uses still higher frequencies up to fifty million.

FREQUENCY ALLOCATION – assignment of available frequencies in the radio spectrum by the FCC to specific stations for designated purposes to give the maximum utilization of frequencies with minimum interference between stations.

FREQUENCY BAND – a continuous range of frequencies extending between two limiting frequencies. (See *channel, television channel, spectrum.*)

FREQUENCY MODULATION – abbreviation, *FM*. A method of radio wave transmission by which the carrier wave varies in frequency in accordance with the sound waves impressed on it while its amplitude (loudness or power) remains constant. FM waves are transmitted in straight lines to receivers and transmission, therefore, is limited to short distances. FM is used to send the audio in television reception. The system is practically free of atmospheric and man-made interference, and there is little or no interference between stations; hence it can transmit a greater volume range and wide audio-frequency range than is being done with comparable amplitude-modulation systems. One disadvantage is the necessity of employing ultra-high carrier frequencies at which the range of a station is limited to approximately 100 miles. The idea of modulating the radio carrier waves by changing their frequencies instead of varying their amplitudes is by no means new. In 1922, Dr. J. R. Carson of the Bell Telephone Laboratories, analyzed mathematically the frequency modulation principle and showed that if the frequency band was kept within the limits then allowed for sound amplitude-modulated carriers, bad distortions would result. Interest in the idea was, therefore, accordingly largely dropped. Later, however, Major Edwin H. Armstrong, working entirely in the short or ultra-short wavelength regions – less than 10 meters wavelength – demonstrated that with frequency bands ten to twenty times wider than those permissible with amplitude modulation, astonishingly fine results were possible. Such wide-band frequency modulation gives reception practically free from static and man-made electrical noises or disturbances. Armstrong's wide-band FM has become universally popular. He has, erroneously at times, been called the "inventor" and the "father" of FM. He has developed FM into a widely workable and acceptable system, probably doing more to popularize this system than any other individual in history.

FREQUENCY MODULATION BROADCASTERS ASSOCIATION, INC. — formerly an association, organized to popularize FM, and which tended to promote Armstrong's system as The System. The organization was merged with the National Association of Broadcasters on Nov. 1, 1945, which now operates a separate FM division or section. Abbreviation: *FMBI.*

FREQUENCY SWING — the instantaneous departure of the frequency of the emitted wave from the center frequency resulting from modulation.

FRINGING — a distortion common to gas-filled cathode ray tubes which caused some of the straight lines to appear wavy. Also known as "fringing effects."

FRINGING EFFECTS — name given to wave-like effects, which sometimes were seen on the screens of high-powered cathode-ray tubes. This seemed to be due to the presence of wandering electrons and other obscure causes within the tube.

FRITTS' CELL — a form of selenium cell developed in 1883 by an Englishman named Fritts. The cell consisted of two small glass plates coated on the insides with gold leaf with an extremely thin layer of selenium between them. The selenium layer was activated by the light passing through the semi-transparent gold leaf. Although the cell was a permanent one, it had low sensitivity.

FULL-SERVICE TELEVISION STATION — a video station with facilities providing for a complete programming service: "live talent" shows, motion picture films and remote field events, as against stations which offer only film and "live talent" shows, or in unusual cases, only film transcriptions.

FULTOGRAPH — a still - picture - transmission and reception apparatus invented by Captain Otto Fulton in England. The British Broadcasting System used the Fultograph System for the first time in October 1928. The transmitted picture was traced out by an electrical stylus moving over iodized or chemically prepared paper carried on a rotating drum.

FUNDAMENTAL — the basic frequency of a wave or sound. It is sometimes referred to as the "first" harmonic.

G

GADGET — any article or piece of apparatus for which there is no descriptive title.

GADGET COMMERCIAL — using an attention-getting mechanical apparatus, device or gadget, such as a marionette, a revolving or dancing doll, a mechanical robot, or a talking man, to convey the advertiser's message to the television viewer.

GAG – a comedy situation or a joke; a routine for the purpose of provoking laughter from the audience and viewer.

GAIN – an increase of the volume in the apparatus for controlling that increase in the volume.

GALVANOMETER – an instrument for detecting or measuring electric currents. Based on the discovery by H. C. Oersted that a magnetic needle is deflected by electricity flowing through a conductor; the machine consists of a coil composed of several turns of insulated copper wire, a small magnet hung at its center, and a pointer; the earlier galvanometer had needle free to turn; later models used a fixed needle with movable coil.

GAMMA – a unit of magnetic intensity; a specific numeral indication of the degree of contrast received in an image, facsimile reproduction or photograph.

GAS FOCUSING – a method of focusing the beam in a cathode ray tube by the action of a small amount of residual gas in the envelope, which on becoming ionized by collision forms a core of positive ions along the center of the beam and provides the necessary focusing field.

GAS-FILLED TRIODE – a type of vacuum tube in which the elements operate in an atmosphere of gas, such as mercury, argon, helium, etc.

GASEOUS TUBE – an electronic tube into which a small amount of vapor is admitted after the tube has been evacuated. Ionization of the gas molecules during the operation of the tube gives greatly increased current flow.

GEISSLER TUBE – In its simplest form the Geissler tube consists of a glass vacuum tube, perhaps an inch in diameter, and one to two feet long, in which, at each end, an aluminum electrode is sealed. Briefly, within the tube the interrupted electric current is made to pass through rarified gases.

GELATINE – a translucent screen used to diffuse the beam of a light source.

GENERATOR – an apparatus or machine by which electric power, gas, or steam is produced. Used in a television and radio transmitter, the generator generates the particular form of electric currents needed.

GERMANY – The German Post Office first began to show an active interest in television in 1928 when it cooperated with von Mihaly by subsidy and other aids in his experiments. In 1929, after several of the German P. O. engineers had seen a Baird system demonstration in Lóndon, official interest in Baird was so keen that the Post Office assisted in the formation of Fernseh,

A. G., which was an equal partnership between Baird Co., Zeiss-Ikon Optical Co. (optical products), Bosch Magneto Co. (magneto and electrical equipment), and Loewe Radio Co., created for the purpose of developing Baird system in Germany. The P. O. also began active experiments of its own based on Baird's system but was more interested in the film aspects of his system rather than television. For this purpose they selected a 30-hole disc, horizontal scanning, and a picture ratio of 3 to 4. At the transmitter, films were run through a standard motion picture, with the light beam being interrupted by a scanning disc which scanned each "frame" of the film. The receiver followed in the steps of the Baird apparatus, but instead of using the usual flat plate neon tube as a light source, it employed a rather large mercury-argon light source. This consisted of a thin glass tube bent to and fro upon itself to form a grid 4 by 6 inches. Between this grid and the scanning disc was placed a ground glass screen to diffuse the bars of light from the grid-shaped tube. In front of the disc, nearest to the viewer, was placed the usual large magnifying lens. This receiver, demonstrated in the 1929 Berlin Radio Exhibition, did not claim to be commercial inasmuch as it was too bulky for home use while the mercury-argon lamp required about 200 watts (obtained from a large power amplifier) to operate it. The light from such a tube was bluish in color and the picture though good in detail, was lacking in depth and intensity of illumination. The speed of transmission standardized by the German P. O. was the same as that used by Baird, 12½ pictures per flicker effect, but it had the advantage that it reduced the transmission frequency, an important factor when it is remembered that at that time transmission was possible only on a 9 kilocycle band. Another feature of the P. O. exhibit at the 1929 Radio Exhibition was the two-way television system wherein two telephone boxes at opposite ends of the Post Office enclosure were utilized for two-way telephone sight-and-conversing purposes. For this purpose a single scanning disc was used at each end of the circuit, so arranged that while the face of the telephonist was being scanned by a beam of light, emanating from perforations at the bottom of the disc, by looking at the top of the same disc the image of the person at the other end could be seen. The received image, however, was not satisfactory; owing to the spotlight playing on one's face it was difficult to see. The German P. O. controlled all sound broadcasting in Germany, with development of receivers in the hands of commercial enterprises.

The principal television works and workers in the 1930's were Denys von Mihaly, a Hungarian; Dr. August Karolus of Leipzig Univ., who worked in conjunction with the Telefunken Co.; the German Post Office; Fernseh, A. G., an offshoot of the British Baird Co., and Manfred von Ardenne, radio engineer.

In 1931, the following specifications were adopted by the three German companies working on television development: clockwise scanning, as seen by the observer, from top to bottom; a ratio of 4 units of breadth to 3 in height for the image; a 30-line image reproduced at the rate of 12½ frames a second, or 750 a minute. In addition, each line of the image was scanned in the same time; that is, the holes in the disc were spaced at equal angles between the radii. Only the Telehor Co. was making home television receivers on a production basis. Systems in use during that period were (1) The Telefunken had a mirror-wheel system; (2) The Deutsche Fernsehgesellschaft (German Television Co.) system included the scanning disc using an image-frequency (normally 375 cycles) to obtain synchronization; (3) the Telehor Co. used a scanning disc with a glow-lamp, a driving motor and synchronizing motor (the Mihaly method). In the latter part of 1935, there were five concerns making video receivers. Four of them had cathode-ray models with a picture size from about 4 x 6 inches, up to 10 x 12 inches. The fifth firm, Tekade, used the mirror-screw type of scanning equipment; the 180 tiny mirrors on the spindle revolved the image screen into 180 lines. The Fernseh, A. G. used by the German Broadcasting Co., utilized a cathode-ray receiver, with 180-line definition — 25 pictures per second. The German broadcasting station had opened up an experimental "high-definition" television service to the general public on ultra-short waves using 180-line scanning and 25 frames per second. Ultra-short wave tests were said to have been conducted in Berlin for several years. Plans for television service included the erection of 25 ultra - short wave transmitters throughout the country.

In April, 1935, Farnsworth Television Corp. of Philadelphia signed agreements with the German company, Fernseh, A. G., for a complete interchange of patents. Fernseh announced its mechanical scanning disc methods would be replaced by the Farnsworth image dissector tube. In 1936, high-definition program service began in Berlin.

Under the Nazis, the two large German television manufacturing firms were Telefunken, and Fernseh A. G. German. Television was placed under the jurisdiction of the aviation minister about August, 1935. That summer, television became a part of the German Air Force. In September, 1937 what was claimed to be the world's longest television cable went into operation for the German Post Office's regular television-telephone service between Berlin and Nuremberg, and for direct-vision relays of the Party rally from the Witzleben video station. The service was limited to two television-telephone offices in Berlin and one in Nuremberg, the cable being capable of handling only two 180-line pictures for the television-telephone. The cable itself, however, had been desired for the band needed for the 441-line pictures of television broadcasting. Germany used its service for propaganda only and had irregular programs.

In 1938, the country was using obsolete mechanical scanning equipment which England had discarded early in 1937. This was a type of mechanical flying-spot-of-light scanning system which British engineers listed as "backward." Television-telephone service was opened to the public. Receiving sets used were equipped with a large mirror for reflecting the image from vertically placed tubes. In 1939, the Nazis demonstrated television in Argentina. In the summer of 1939, the German P. O. reported it was preparing to construct new television stations in Hamburg, Nuremberg, Munich, and Vienna. In 1940, the radio industry was instructed to build sets of uniform standardization in the future.

In 1946, a new German iconoscope claimed to be ten times as sensitive as the standard video tube, was described in a report by the United States Office of the Publication Board, Department of Commerce. Increased sensitivity was said to be due to mosaic capable of storing images several seconds. It was said to be made of mica, with magnesium oxide coating, magnesium being evaporated on mica and oxidized by electrical discharge in a few millimeters of oxygen.

GETAWAY – an offstage means of descent from raised flooring sections within a set. Also, a passageway behind settings provided as a means of unobserved access to other settings or locations inside the television studio.

GHOST – an undesired duplicate image, usually a short distance toward the right from the unwanted image. It is due to reception of a reflected signal traveling over a longer path and, therefore, arriving later than the wanted signal. It is eliminated through the use of a directional receiving antenna adjusted to receive the signals over one path only or changing the location of the antenna. It is the result of multi-path reflections. The television broadcast reaches an antenna directly from the transmitter, but a fraction of a second later, one or more "echoes" arrive and are picked up. These echoes are caused by the reflection of the transmitted signal from such things as the sides of mountains or buildings to the antenna. Because of the indirect and longer path they are compelled to traverse, these echoes arrive shortly after the original signal. The effect on the screen is of one or more extra weaker pictures superimposed on the original picture in not quite the exact or same position, thus causing a blur or ghostlike extra-image. Also known as *ghost image*.

GIVE – direction to performers to get into their roles and perform.

GIVE CREDITS – name the source, ownership, or authorship of material used on the program.

GIZMO – in television anything for which a technical name is lacking or has been forgotten by the speaker.

GLASS – care must be exercised in selecting the glass for optical lenses in the cameras and cathode ray tube screens. Certain errors can be reduced.

by using glass of correct chemical composition. Quartz glass is used in the Iconoscope in case ultra-violet light is to be transmitted.

GLASS-TYPE TUBE – a vacuum tube or gaseous tube having a glass system envelope or housing.

GLOW LAMP – a gaseous tube having a glass envelope through which can be seen a glow due to ionization of the molecules of gas. A glow lamp converts the varying electrical impulses into light waves. Neon gas gives off a red glow; mercury, blue; and argon gas gives off a light purple glow. Synonym: Neon Cell; a glow tube. Formerly used in mechanical television systems and variable-density sound-on-film recording.

GLUCINUM – an old and now obsolete name for the metal, *beryllium*.

GOBO – a dark mat used to shield cameras from lights. Also, a light-deflecting wall board or similar material to direct light in the studio and protect the camera lens from possible glare. Also, a sheet of sound-absorbing material used to shield a microphone from sounds arriving in a certain direction.

GOULD TELEVISION SYSTEM – Early in 1931, Leslie Gould, an experimenter of Bridgeport, Conn., worked with spiral neon tubes and obtained some interesting results. He studied color television by using different-colored neon tubes to obtain different degrees of tone. In the Gould television receiver, use was made of a revolving neon tube and a drum which replaced the usual circular disc then in vogue, and stationary square-plate neon tube. The Gould neon tube was in the shape of a helix and had two complete turns. The tube was surrounded by a circular drum perforated with holes which corresponded to those in the usual disc. Both neon tube and drum were fastened to the hub of a motor which revolved in synchronism with the transmitting disc. Gould employed a small power oscillator to excite the neon tube. His images were received in orange and black of the neon and tubes instead of present-day black and white.

GOULD TELEVISION SYSTEM IN COLOR – Gould's television receiver for reception of images in color was fundamentally the same as the regular television receiver but differed in that special gas tubes were used instead of the usual orange-colored lamps (of his system). These were mounted on a six-inch drum, which revolved in synchronism with the disc. Three red and three green neon tubes were mounted on the drum, and excited from an oscillator, which in turn was modulated from the received signal. As the drum and disc revolved, the colors were blended together, giving the effect of reproducing the image in true color tones.

GRADUATED SCANNING – the scanning in which the width and/or spacing of the strips varies over the scanned area; usually the strips are finer and/or closer in the center of the field.

GRAHAM BELL'S CELL — a selenium cell developed by Graham Bell, famous inventor of the telephone, in 1880. It comprised a brass plate upon which a series of raised conical projections were formed. A second brass plate containing corresponding holes was brought into position so that the metal cones on the first plate nearly plugged the holes in the second plate. The remaining interstices (narrow spaces between two things, crevices) were filled with selenium.

GRAY SCALE — the colorless (achromatic) table or color scale from white through grays to black, the intermediate grays differing from each other only through a proportional admixture of white and black. For photographic purposes and printing, it is a ten-step transition from white through the grays to black. (See *television gray scale.*)

GREAT BRITAIN — The Television Committee which early in 1946 released its postwar report on Great Britain's video, starts its factual background of British television with the discovery of the principle of electro-optical methods of light control by Michael Faraday in 1835. Upon this principle "lies the basis of the science of television," the Committee stated. Campbell Swinton, in 1908, proposed the idea of using the cathode ray tube for a system of electrical transmission and in 1911 gave comprehensive and workable details of his scheme before the Rontgen Society. In essence, it was that which the British Broadcasting Corp. later developed and put to public use. Campbell Swinton's successor was John Baird, perhaps the greatest name in the history of English television. Baird's dogged persistence and enthusiasm aroused public interest and stimulated research as never before. In April 1925, he gave the first public demonstration at which crude images were transmitted between two machines. Nine months later at a demonstration to the Royal Institution, he showed moving human faces, not as plain black and white outlines, but with tone gradations of light and shade, sufficiently exact to be individually recognizable; progress was steady. In 1927 Baird transmitted images by telephone wires between London and Glasgow, a distance of nearly 400 miles; nine months later he succeeded in sending them by radio between London and New York; and in August 1928 he gave the first demonstration of color television. In September 1929, an experimental service of television broadcasts was begun by the Baird Co. and BBC, which in 1932 was entirely taken over by the BBC.

By 1936, improvement in quality had been so rapid — other laboratories had taken up intensive research — as to warrant a regular high definition service. It was a process perfected in the E.M.I. Laboratories at Hayes, Middlesex, which was eventually adopted by the BBC. The first public service of "high definition" television was inaugurated at the BBC television station at Alexandra Palace in November 1936. The transmissions were at first provided during alternate weeks by two rival systems, Baird and Marconi-E.M.I., but in February 1937, the Television Advisory Committee — which on the recommendation of the Selsdon Committee had been appointed by the Postmaster-General in 1935 to advise on the development of television — came to the conclusion that the Marconi-E.M.I. was the preferable system; thereafter that one alone was employed.

By 1939 the service had reached a high standard; the program technique had made great progress and the result was a service of considerable entertainment value. The number of television receivers in use by the public did not, however, rise appreciably above 20,000. Service was restricted to London. A demand for the extension of television service to the provinces became insistent; it was urged in Parliament, in the Press, and by the radio industry. The Selsdon Committee had envisaged the ultimate extension of a television service throughout the country, and in December 1938, the Advisory Committee reported that two years' experience of its operation in the London area justified the formulation of a plan for a service on a semi-national scale to bring television within reach of the majority of the densely populated areas of Great Britain. Certain technical problems involved in relaying television — whether by cable or radio relay• remained to be solved; but the main obstacle was that of finance.

On Sept. 1, 1939, the Alexandra Palace television station was closed for military reasons. During the war little progress was made in broadcast television. In September 1943, a Television Committee was appointed to prepare plans for the reinstatement and development of the television service after the war, to make provision for research and development; and to assist in guidance to manufacturers with a view especially to the development of the export trade. Before the war the Postmaster-General was responsible for television on behalf of the Government but the Committee recommended that the minister responsible to Parliament for sound broadcasting be placed in charge of television. The Committee also recommended that the 405-line system be restarted in London, that the system be extended to at least six of the most populous centers, and that studio programs be relayed by the provincial stations from the main center in London (Alexandra Palace) via either cable or radio, and that the BBC again should operate the television service. Theatre television was given the approval nod for "the existence side by side of two forms of entertainment (home and theatre) should, on the whole, prove mutually helpful . . ." Baird and the Scophony Co. were installing large screens in theatres for television. Proposals for 1 pound be charged each television "domestic viewer" to aid in financing the service, plus revenue from "theatre television licensees," were made. The Committee recommended that "the aim should be to produce an improved television system having a standard of definition approaching that of the cinema, and possibly incorporating color and stereoscopic effects . . ."

GREY SELENIUM – one of the many forms of selenium which is obtained as a grey-appearing mass by heating strongly red or vitreous selenium. When heated carefully it becomes light-sensitive.

GRID – an electrode mounted between the cathode and the anode of an electronic or radio tube to control the flow of electrons from the cathode to the anode. The grid electrode is usually either a cylindrical-shaped wire screen or a spiral of wire through which electrons readily move.

GRILLE – an arrangement of wood or metal bars which have been put across the front of a loudspeaker, usually in a radio receiver, to protect and beautify the cabinet design.

GRILLE CLOTH – a loosely woven cloth, stretched behind the loudspeaker grille of a radio receiver to keep dust and other substances out of the loudspeaker, as well as to hide the loudspeaker diaphragm. Sound waves travel unimpeded through this cloth.

GROUND – a conducting connection, between an electrical circuit, equipment, and the earth or some conducting body serving in the place of earth. Also means "earth." It is a technical term used in radio and television work and refers to a part of a circuit which is directly connected to the earth or to the metallic base of some device. A water pipe or some such arrangement, by which the receiver makes contact with the earth.

GROUND GLASS – glass in a camera viewing system on which the image is projected for viewing by the cameraman.

GROUND ROW – built, cut-out, or actual materials imposed before a mural background or painted drop to hide the point of departure between the actual depth in the front of the picture and the flat execution in the background; e. g., walls, stones, bushes, trees, grass, etc.

GROUND WAVE – radio waves which travel along the surface of the earth instead of going out up into the sky.

GROUND WIRE – the wire used to connect the ground terminal of a transmitter and receiver to a ground clamp or other grounded object.

GROUNDED – connected to the earth or some conducting body that serves in place of the earth. The British synonym is "earthed."

GUARD BANDS – the group of radio frequencies higher and lower than the transmitter carrier channel.

GUIDE SHEET – a schedule to set up the program routine. (See *cue sheet.*)

GUIDED WAVES – electromagnetic waves which are led or guided along conductors, or insulating surfaces such as coaxial cables or telephone wires.

GUN – a term often used to denote the circular anode, or positive charge plate of a cathode-ray tube. This anode possesses a central hole or perforation through which the cathode rays pass on their way to the screen at the end of the tube. Also, the assemblage of electrodes, comprising the cathode, anode, focusing and modulating electrodes from which the electron beam is emitted before being subjected to deflecting fields.

GUY WIRE – a wire used to support or brace a tower or pole from overturning. One end is firmly anchored to the earth or to some heavy object and the other end is attached to the upper end of a transmitting tower or receiving antenna system.

H

H-F – abbreviation for *high frequency.*

H - M - V TELEVISION SYSTEM – H-M-V is the abbreviation for "His Master's Voice," the motto, or catchphrase used by The Gramophone Co., Ltd., England. About 1931, this British concern announced a new mechanical television "movie" transmission and reception scheme in which the picture was scanned separately in five sections, the image currents caused the operation of five light valves (tubes) which modulated the light from an arc, yielding a large and brilliant reproduced image 20 by 24 inches on a screen. Briefly, the film was passed through an intermittent motion-picture projector of the standard type; and the light from it was reflected through a series of lenses mounted on a revolving drum, which, for every revolution it made, completely scanned the picture in five sections. The light reflected through the revolving lenses was thrown, in turn, upon five photoelectric cells, each taking care of a strip of the picture, having a width of one-fifth of the total. This arrangement enabled the output of five photoelectric cells, instead of the single cell normally used, to be utilized for controlling a brilliant light source at the receiver end. The output from each photoelectric cell was amplified by two tubes in the photo-cell rack; these signals in turn were amplified by five further amplifiers, having two tubes each, in order that the output from the photoelectric cells might have sufficient strength to pass down the necessary intervening channels. At the receiver was a special form of "phonic motor" on which was mounted revolving mirrors. They cast upon a translucent screen the light of the arc lamp, received through five light-modulating cells which corresponded to the five scanning channels.

HALATION – a distortion caused by the reflection of the image rays by the back of the screen. Such reflection blurs the picture and is usually caused by the fluorescent screen's being too thick. Also defined as the ring of illumination which surrounds the point at which the electron beam strikes the fluorescent screen.

HALF-LAP – a control technique by which two pictures in a dissolve or overlap are both held at maximum simultaneous definition (30 per cent each) so that both are visible to viewers.

HALFTONE – a method whereby photographs having various degrees of lights and shadows can be reproduced in ordinary printing, using a screen which gives fine or coarse dots. The screen or dots are graded as to size, or density so as to produce the highlights, middle tones and shadows of the picture.

HALLWACHS' EFFECT – name given to the discovery made by Hallwachs, a German scientist who in 1888 found that areas of certain metals, when illuminated by ultra-violet light, quickly loosen a negative electric charge which has been given to them previously. The scientist discovered this effect to be most pronounced with metals such as sodium, potassium, and rhubidium. Hallwachs' discovery was merely an extension of the Hertzian effect and led eventually to the construction of the photoelectric cell. (See *Hertzian effect.*)

HALO – the undesirable ring of light around the spot on the fluorescent screen of the cathode ray tube. It may be due to electrooptical aberration. Also secondary emission electrons may return to the screen and form a halo.

HAM – vernacular or slang for a person who operates and experiments with transmitters and/or other electronic equipment as a pastime or hobby and not for payment. Synonym: amateur radio operator. Also, slang for a "bad" actor.

HAND PROPS – movable materials of all kinds utilized by actors in portraying their roles. Also: any of numerous small items or stage properties used by the cast to dress a set.

HARD IMAGE – name applied to a picture on a video screen or elsewhere which bears excessive contrasts between its areas of light and shade.

HARD SHADOW – a single definite shadow, as opposed to multiple shadows.

HARD TUBE – name applied to a cathode-ray tube which is empty of any gas filling.

HARMONIC – a multiple of any particular frequency. Thus, the second harmonic of a fundamental frequency would be equal to two times that fundamental frequency.

HARMONIC DISTORTION – synonym for "wave form distortion."

HARMONICS – in electrical and radio circuits the fundamental current waves are usually accompanied by others whose frequencies are equal to some whole number multiple of that fundamental. These multiples are also called harmonics.

HAZELTINE LICENSED – radio apparatus which makes use of circuits or developments of patents owned by the Hazeltine Corp. (New York). To manufacture equipment under a license agreement with that firm.

HEADPHONE – a small telephone receiver held against the ear by a clamp fixed over the head. Used for private reception of radio programs, or for reception of signals which are too weak to provide loudspeaker volume. Also, used in television control rooms and on cameramen, lighting technicians on studio floors through which they give and receive instructions from director-to-cameraman; director-to-engineer, etc.

HEAD ROOM – the allowance of space or leeway between a performer's head and the actual top of any setting. It refers to the amount of upward camera movement possible without overshooting a set.

HEAVISIDE LAYER – a layer of ionized gas which scientists believe exists in the region between 50 and 400 miles above the surface of the earth, and which reflects radio waves back to the earth under specific conditions. Also known as the Kennelly-Heaviside layer. Charges in this layer are believed to be the chief cause of fading.

HEIGHT CONTROL – the knob in a television receiver which adjusts the picture size in a vertical direction.

HELIUM – a colorless, odorless inert gas discovered in the earth's atmosphere by the late Sir William Ramsay (England) in 1894. Helium is found in the ratio of one volume being present in approximately one million volumes of air. It is found in greater quantities in certain natural gases and minerals. Helium was used in certain electric discharge lamps as a substitute for neon. Helium lamps of this type glowed with a blue light and were utilized for television receiving purposes. It is from the Greek "helios" meaning "sun-in," the reference being due to the presence of helium gas in the sun.

HELIUM-MERCURY LAMP – a special type of electrical glow tube containing helium gas and mercury vapor at low pressure. It glows with a light rich in blue and green rays. It formerly was used in mechanical television. The Baird Co. (England) used this lamp in conjunction with a neon lamp as the illuminant in its experimental color television receivers.

HELMHOLTZ – See *von Helmholtz.*

HENRY – an electrical unit named for Joseph Henry. (See *Henry, Joseph.*) The induction of a circuit in which a current varying at the rate of one ampere per second induces an electromotive force of one volt.

HERTZ EFFECT – an electrical effect which forms the underlying principle of the photoelectric cell operation. Developed in 1888 by Heinrich Hertz, a German scientist, who found that when the ultra-violet light fell upon a spark gap in an electrical circuit, the spark was enabled to pass more easily than was normally the case. Also known as the "Photo-electric effect." (See *Hallwachs' Effect.*)

HERTZIAN WAVES – another name for the electromagnetic waves whose existence was predicted mathematically by J. C. Maxwell, discovered by Dr. Heinrich R. Hertz, and applied in practice by Marconi.

HETERODYNE – pertaining to the reception and amplification of radio waves by combining the wave received with locally generated current of different frequency, the amplitude being greater when they interfere or coincide, and the frequency lower (more like that of sound waves).

HETERODYNING – the process of changing the frequency of radio signals by combining them with the output of a radio-frequency oscillator.

HIATUS – usually, Summer hiatus; that is, the discontinuance of a program by an advertiser during the summer weeks while allowing him to keep control of the time period on any network. The advertiser, naturally, is obligated to resume his program in the fall.

HIGH BRIGHTNESS LEVELS – term to indicate those brightnesses that are sufficiently high for normal daylight vision.

HIGH DEFINITION – in television (or facsimile), the equivalent of high fidelity, in which the reproduced picture is composed of such a large number of accurately reproduced and individual picture elements that extremely fine detail in the image is clearly visible. The term high-definition picture originated when it became apparent that it was not only desirable, but also possible to obtain a picture having a much larger number of scanning lines and consequently higher resolution than previously thought feasible. Since then, the term has come to mean not only a picture with a large number of scanning lines but also with low flicker level, correct contrast, sufficient brightness, and high signal-to-noise ratio. In other words, a high-definition image is one having a high degree of excellence. That is, a picture at the receiver that is clear and sharp in detail.

HIGH FIDELITY – used to describe a sound reproduction of superior, but undefined quality. The term *high fidelity* as used at present in the general radio and sound reproduction field, has come to mean an extension of the audio range to the upper frequency limits of audibility of the human ear, as contrasted with a range limited to the usual 4000 or 5000 cycles. In reality, the term *high fidelity* is comparative, and it would be more correct to think of it as *higher fidelity*.

HIGH FIDELITY RECEIVER – a receiving set capable of reproducing audio frequencies in a range from 50 to about 8000 cycles or wider without distortion. A receiver which approaches the goal wherein the reproduced program cannot be distinguished from the original program. Usually used in reference to frequency modulation (FM) sets.

HIGH FREQUENCY – used to denote any frequency above the audible range, above ten kilocycles, but more especially those frequencies which are used for television and radio communication. Abbreviation: h-f.

HIGH - FREQUENCY (SHORT - WAVE) RADIO BROADCASTING – radio broadcasting on frequencies between three and 30 megacycles. (In this range, the frequencies from about four to 20 megacycles are most useful for long distance.)

HIGH FREQUENCY WAVES – See *frequency.*

HIGH HAT – a camera mount used on table tops or other such waist high objects.

HIGHER FIDELITY – See *high fidelity.*

HIGHLIGHT – the brightest part of a reproduced picture. Also, the emphasis on an object or scene by special lighting effects or painting to make them stand out from the rest of the picture. The lighting may be rim lighting, halo effects, etc.

HITCH HIKERS – advertising messages carried just after the conclusion of a specific program and promoting some auxiliary product of the program advertiser.

HOLD – a direction to a studio cameraman, ordering him to keep his camera where it is in readiness for the next shot.

HOLD CONTROLS – two manually adjusted controls on a television receiver that change the frequencies of the oscillators in the horizontal and vertical sweep circuits.

HOLLAND – Engineers of Philips Incandescent Lamp Works of Eindenhoven, in 1935, constructed the first iconoscope in Europe and began experimental transmissions with pictures of 180-line definition, and 25 frames per second. Later the quality of the picture was stepped up to about 450 lines. In 1938, that company built a portable transmitter, equipped with iconoscopes, and demonstrated television throughout the Netherlands and a number of other European countries, transmitting pictures of 450 lines and at times to 567. Philips, about 1938, developed the high-pressure mercury vapor lamp which gave off a very intense bluish-white light and was cooled by a circulating water system. Thus it was comfortable for studio use. The firm only engaged in manufacturing of equipment, except for experimental development work to test its own apparatus. The concern's television receivers had a picture screen of 14½ x 18 inches overall dimension. Broadcasting of television was done by two large private stations. With the invasion of the Netherlands by the Nazis, Dutch television came to a standstill.

HOOK – a merchandising term used in television and radio in reference to a stunt, novelty, contest, or other device intended to produce tangible evidence of audience attention.

HOOK-UP – a diagram giving circuit connections for a receiver, amplifier, or transmitter.

HORIZON – the apparent or visible junction of the earth and sky as seen from any specific position on or above the earth. It bounds that part of the earth's surface that is reached by the direct wave of a television or radio station. This is the scientific name for skyline.

HORIZON DISTANCE – the space between the furthest visible point from the antenna of the transmitter and the antenna itself. It is the distance over which the ultra high frequency transmission can be successfully received under ordinary conditions with the receiving antenna not elevated. The usual average television horizon distance is about 45 to 50 miles.

HORIZONTAL – on a level; in the direction of or parallel to the horizon, that is from left to right, or right to left, looking in any one direction.

HORIZONTAL CENTERING – adjustment of the picture position in the horizontal direction. This is done by a knob or control on the receiver.

HORIZONTAL CENTERING CONTROL – a device on a television receiver or cathode - ray oscilloscope which can be used to shift the position of the entire image horizontally in either direction on the screen.

HORIZONTAL FLYBACK – in a television system, the right-to-left return action from the end of one scanning line to the beginning of the next. Also called the horizontal retrace, or line flyback.

HORIZONTAL HOLD CONTROL – a control on the receiver used to adjust the horizontal sweep oscillator so that it will synchronize with the synchronizing signals in the received picture signal. It changes the frequency of the horizontal sweep oscillator in the television receiver.

HORIZONTAL RETRACE – See *horizontal flyback*.

HORIZONTAL SCANNING – term denotes the methods of scanning in which the scanning spot explores the picture or image to be televised in a series of straight or horizontal lines or sweeps. Used in television systems employing vertical scanning, interlaced scanning, and progressive scanning.

HORIZONTAL SWEEP – the scanning motion from left to right across a picture or scene being televised.

HORIZONTAL SYNCHRONIZING IMPULSES – The impulses transmitted after each line are scanned in a television system, in order to keep the transmitter in synchronism with the receiver. Also called line synchronizing impulse.

HOT BACKGROUND – the lighting of a playing area background is too strong, or is caused to be of high illumination. Usually, hot backgrounds are undesirable inasmuch as there is not sufficient light contrast between center ground and background, causing the two areas to blend and give a flat picture. However, a hot background may be desirable for silhouette and dramatic effects.

HOT CAMERA – The apparatus is energized.

HOT CATHODE – a cathode in which electron emission is produced by heat.

HOT-CATHODE TUBE – a vacuum or gaseous tube in which one of the electrodes, invariably the cathode, is electrically heated, usually to incandescence in order to produce electron or ion emission from that electrode. Generally named the "thermionic tube."

HOT LIGHT – a concentrated light used in the studio for emphasizing features and bringing out contours.

HOT MIKE – microphone is energized.

HOWLING – a general descriptive term used to imply any undesired sounds produced on, in or by a radio receiver, or audio reception of a television receiver.

HUM DISTORTION – produces a picture having wavy sides, due to poor filtering of the power line ripple. Good power filters and the use of 60 fields per second – where 60 cycle power line frequency is used – helps to eliminate this problem.

HUNTING – a term which in television means the up-and-down, or side-to-side movement of the image on the screen.

HYDROGEN – a colorless, odorless and inflammable gas, which, among other properties, has the distinction of being the lightest thing known. Slight traces of hydrogen gas were sometimes admitted into the neon lamps used in mechanical television systems in order to modify the glow produced by the lamps.

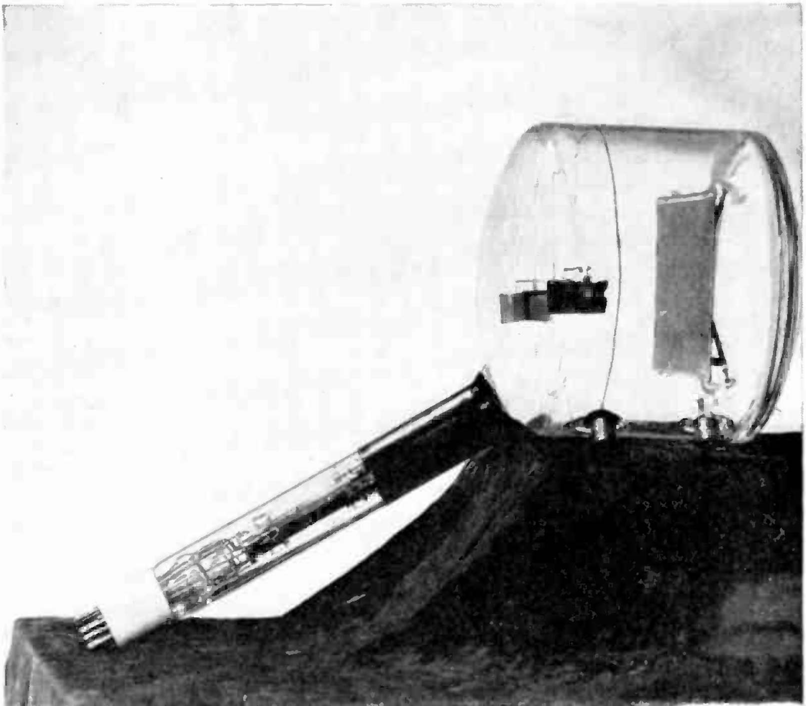
HYPO – alteration of a format, adding new talent, or otherwise changing a program in order to make it a more obvious or desirable attraction.

I

ID – station identification. Film ID – announcing that the program televised is or was reproduced from motion pictume film.

IRE – abbreviation for Institute of Radio Engineers.

ICONOSCOPE – a cathode-ray tube used in a television camera to convert an optical image into corresponding electrical impulses by scanning the image on a mosaic screen with an electron beam. Originally a trademark for a tube of this type developed by RCA. It functions by storing on a light-sensitive mosaic a charge image which is a replica of the optical picture of the scene being televised. The charge is removed point by point from the mosaic by a fine pencil of electrons which scans the stored image. The released charge forms the picture signal. The iconoscope is the core about which the RCA system of electronic television is constructed. This pick-up device, which approximates the human eye itself, is the result of Dr. V. K. Zworykin's experimental work. The



— *Courtesy RCA*

Iconoscope

word iconoscope is taken from the Greek word "icon" meaning "image"; and "scope" signifying "observation." It is also known as the "electric eye." In its application to television the iconoscope replaced mechanical scanning equipment and several stages of amplification. The whole system is entirely electrical without a single mechanically moving part. It consists of two principal parts enclosed in an evacuated glass bulb. The first is the photo-sensitive mosaic, consisting of a metal plate covered with a great number of miniature photoelectric cells insulated from the plate and each from the other. The function of the mosaic is similar to that of the retina of the eye. It transforms the energy of the light from the image into electrical charges and stores them until they can be transformed point by point into electrical impulses and transmitted. This transformation is accomplished by an electron beam scanner, the nerve of this electric eye. To complete the analogy of the iconoscope with the human eye, it may be said to possess an electrical memory because with a good dielectric the charges of the mosaic can be preserved for a considerable length of time. It serves the dual purposes of analyzing the visible picture projected on its mosaic into elements and produces electrical impulses for each of these picture elements.

Basically, the iconoscope is a vacuum tube in which are mounted a mosaic and an electron gun. The mosaic is a sheet of mica, a few inches square, on which have been deposited millions of tiny particles of silver sensitized with caesium. Each particle is insulated from its neighbor by the mica between. On the other side of the mica plate is a metallic coating. The picture is focused on the front of the mosaic by a suitable lens. Each tiny piece of silver is a miniature photocell and if it chances to be a part of the image which is light, it will lose electrons and acquire a slightly positive charge. On the other hand, its charge will be unchanged if it lies in a dark region. Thus, there is built up on the mosaic a pattern of electric charges in accord with the light and shade of the image. At the other end of the bulb is the electron gun. This is a device for producing a sharply focused ray of electrons directed toward the mosaic. The beam strikes the mosaic in an all-invisible spot. The beam is made up of negatively charged particles or electrons in motion and hence is a current of electricity. The electron beams must be made to sweep across the mosaic in lines and at the same time to move slowly from top to bottom. It must jump rapidly from the end of one line to start of the next and from bottom to top. Two pairs of electromagnets move the beam. One pair serves to produce lateral motion, the other vertical. Because the beam has no inertia, it can be moved at high speeds to scan the mosaic. The iconoscope is, therefore, a special sort of photocell which scans the image as well as converting it into electrical values.

ICONOSCOPE CAMERA – an electronic television camera using an iconoscope.

ICONOSCOPE MOSAIC – the photosensitive surface of the iconoscope.

ICONOSCOPE TUBE – See *iconoscope.*

IKE – colloquialism for iconoscope.

IKONOPHONE – an instrument used by the Bell Laboratories on April 9, 1930, at a special demonstration in which speakers at both ends of a telephone line or radio circuit saw images of each other while talking to one another. From the Greek words "icon" meaning image, and "Phonein," to speak. Hence, "the speaking image."

IMAGE – the picture or scene focused on the mosaic of the camera tube, or the picture reproduced electronically on the face of the picture tube. That is, an optical counterpart of an object, as a real image or virtual image. Also, a fictitious electrical counterpart of an object, as an electric image or image antenna. Also, the instantaneous illusion of a picture as it appears on a flat surface, the mosaic or a screen, is called the image. It is a transient formation of light impulses from the electron beam or vice versa. By means of secondary emission the intensity of the electron image can be increased. Television images consist of rapidly superimposed, individual frames, much the same as in motion pictures. In the case of motion pictures a group of time related stills is projected at a uniform rate, rapid enough to form a continuous picture through persistence of vision. By present methods each frame of a television image is built up element by element in some definite order, and these time-related frames are reproduced at a rapid rate. Optical images may be of two kinds – real or virtual. A real image is one which is formed by the convergence of rays which have passed through the image-forming device, usually a lens, and can be thrown on a screen, as in the camera and the optical projector. A virtual image is one from which rays appear to diverge. It cannot be projected on screen or on a sensitive emulsion.

IMAGE DISSECTOR – a cathode-ray tube for television cameras developed by Philo T. Farnsworth. It converts a scene into corresponding electrical impulses that form the video signal. (See *Farnsworth system.*)

Construction and operating principles are different from those of the iconoscope, but the image dissector serves essentially the same purpose of converting the scene into corresponding electrical impulses. Lenses are used to collect the light radiated from a scene to be photographed and the image is brought to focus on a photoelectric plate or "photo-cathode" in the "image dissector." An electron image is produced at the photo-cathode by the optical image upon which the camera is focused. After the "electron image" is formed, it is drawn from the cathode to an anode located in the same tube. Next the "electron" image is moved bodily, backward and forward, past a small aperture at a speed of 15,750 times per second. While this motion is taking place the image is also pulled up and down vertically 60 times each second. The result is a 525 line "electron image" with a repetition speed of 30 frames per second. Each tiny element (367,500 in number) that goes to make up the picture or image delivers its own signal impulse since the electrons composing it enter the aperture and strike the electron multiplier.

IMAGE DISSECTOR MULTIPLIER – a combination of image dissector and electron multiplier in one unit.

IMAGE DISTORTION – failure of the reproduced image in a television receiver to appear the same as that scanned by the television camera.

IMAGE DRIFT – a term referring to the drifting movement of the received image on a television screen which sometimes occurs in consequence of a slight lack of synchronization.

IMAGE-ORTH — abbreviation of image-orthicon.

IMAGE ORTHICON CAMERA — image orthicon television camera (RCA type TK-30A) weighing about 100 pounds complete, including the electronic view finder, and breaks down into several units for easy carrying. Its extreme sensitivity makes it possible to telecast a scene at incident light levels as low as one or two foot-candles with an F1.9 lens.

IMAGE RATIO — the ratio of the strength of a signal to its image. Used to indicate the selectivity of a receiver.

IMAGE RECONSTRUCTOR — the cathode-ray tube or other device employed in a television receiver to convert the video signals into an image of the original picture or scene.

IMAGE REPRODUCER — an image reconstructor.

IMPEDANCE — a circuit's seeming resistance to passage of alternating current.

IMPLOSION — a collapse in a tube.

IMPULSE — a sudden momentary increase in the current or voltage in a circuit.

IMPULSE SEPARATOR — in a television receiver the circuit that separates the horizontal synchronizing impulses in the received signal from the vertical synchronizing impulses.

IN THE MUD — slang for lack of definition or too little tonal volume.

INCANDESCENCE — the emission of light by a substance because of its high temperature, such as a glowing electric-lamp filament; or through ionization or other cause, such as the glowing gas in a vacuum discharge tube. In the case of solids and liquids, there is a relation between the color of the light and the temperature.

INCANDESCENT — glowing and giving off light due to heat.

INCANDESCENT LAMP — a lamp in which light is produced by heating some substance to a white or red heat, such as a filament lamp.

INCANDESCENTS — hot bright lights, similar to those used in stores, factories and homes, widely used in television studios.

INDIRECT SCANNING — scanning in which a narrow beam of light is moved across the area being televised and the light reflected from each illuminated elemental area in turn is picked up by one or more phototubes. Formerly used in mechanical television system.

INDOOR ANTENNA — a receiving antenna system located entirely inside a building, either under a rug, around the walls of a room, between the walls, or in the attic.

INDUCTUNER — a device which is said to extend the tuning range of an FM receiver to make available the sound channel of television, so that all new FM owners can tune in to the sound track of television programs and hear what is going on. Said to be in use in special high frequency radio receivers. Credit for the development is given to Paul Ware, a radio engineer; and the P. R. Mallory Co., who have developed commercially the device known as the Mallory-Ware Inductuner.

INDUSTRIAL TELEVISION – system wherein pictures and sound are carried by wires or by radio transmitters from one point to another for various commercial uses. Syn.: *Intra-Store television.*

INFRA-RED – rays or radiations which are not visible to the human eye but are so closely similar to visible light rays that they follow the same optical and electronic laws. The part of the invisible spectrum past the visible wavelength is known as infrared. These rays can be detected and measured with phototubes or certain photographic films in several ways and have an effect on the iconoscope, and the image-orthicon. The use of these rays permits pick-up of a scene or object in an apparently dark room. The human eye is insensitive to infrarad rays and, therefore, a person seated in a room which is illuminated by infra-red rays only will have a sensation of complete darkness.

INFRA-RED ELECTRON TELESCOPE – small, lightweight, infrared viewing device developed by scientists and engineers of the Radio Corp. of America. Heart of the apparatus is a small image tube utilizing many of the principles employed in electronic television systems, having a photosensitive surface, but especially sensitive to infra-red radiation. This instrument enables people using it to "see without being seen." People bathed in infra-red floodlights, are visible only to persons equipped with the infra-red-sensitive viewing instruments. The telescope consists of an objective lens for forming upon the sensitive cathode of the tube an infrared image of the scene being viewed, the tube itself, and the eye-piece. The tube consists of a semi-transparent photosensitive cathode which is ultrasensitive to infra-red radiation, an electrostatic lens system and a fluorescent screen.

INFRASONIC – frequency below audibility, that is below 15 cycles.

INKY – slang for an incandescent lamp.

INSULATION – any material or substance which has a sufficiently high electrical resistance to permit its use for separating one electrical circuit, part, or wire from others. Cotton, silk, baked enamel, mica, porcelain, rubber, and bakelite are a few of the common insulating materials used in radio and conductors.

INSULATOR – any substance through which a current of electricity cannot flow freely.

INTEGRATING CIRCUITS – circuits used to add up the energy of a number of repeated pulses. These circuits are used in the receiver for synchronization.

INTELLIGENCE SIGNAL — any signal which conveys information such as voice, music, code, television pictures, facsimile photographs, diagrams, written and printed matter.

INTENSITY — a general term used chiefly to signify the strength or value of a current.

INTENSITY MODULATION — the method of modulating the output current of a television transmitter by means of a variation in the intensity of the light reaching the photoelectric cell of the transmitter.

INTERCALATED FILM SCANNING — See *interlaced film scanning*.

INTERCALATED SCANNING — scanning consisting of traversing successive strips in different parts of the scanned area in an ordered sequence so that, if the total number of strips is divided into groups, the strips of each group form an orthodox discontiguous scan, the strips of different groups being interleaved.

INTERFERENCE — a variety of effects occurring when two or more trains either of light, radio or electrical waves arrive at the same point simultaneously and disrupt or tear the received picture, or mar the clearly received sound reception. One factor affecting the quality of the picture is man-made electrical noise or atmospheric static. Principal sources are unshielded diathermy machines and automobile spark plugs. Diathermy machines cause a herringbone pattern to appear in the picture; spark plugs cause specks to appear. Natural static has very little effect on ultra short waves and, therefore, causes no difficulty to television transmission.

INTERIOR RADIO BROADCASTING — national radio broadcasting intended to be received primarily within the boundaries of the country to which the originating station is located (as distinguished from colonial broadcasting).

INTERLACE — the process or technique of scanning in two sets of alternate lines of a television picture to reduce or eliminate flicker.

INTERLACED FIELD — interlaced scanning.

INTERLACED SCANNING — the method of electronic television scanning in which every other line of a frame is covered during one downward sweep of the scanning beam and the remaining lines are scanned during the next complete sweep. Also known as multiple scanning.

INTERLACING — the electronic television scanning system in which each picture is divided into two or more complete sets of interlacing lines to reduce or eliminate flicker. The odd numbered lines are sent as a separate field and the even numbered lines are then filled in or superimposed to create one frame of complete picture.

— *Courtesy RCA Victor*

Intra-Store Television, Gimbel's in Philadelphia

The present system of interlaced scanning is utilized on the 525-line definition picture used in the United States.

INTERMEDIATE FILM PROCESS — a process whereby the scene to be picked up is "screened" on an ordinary motion picture camera through the use of a special film. The film immediately passes through a developer, fixer and washing bath and is partly dried, and then passed to a telecine projector, where it is scanned. The process has been perfected to a point where there is a delay of only 60 seconds from the time the scene is taken until the film is being scanned and transmitted. This process is based on an interchange of patents between the Farnsworth Television Corp. and Fernseh, A. G., of Germany. (Also, see *spotlight method of transmission.*)

INTERNATIONAL RADIO BROADCASTING — radio broadcasting from one country intended for reception in one or more other countries.

INTERRUPTER DISC — a disc used in a mechanical system which had perforations or slots punched in it so that when the disc was revolved in the path of a light beam, the latter was broken up, or interrupted into pulses of light and darkness. (See *chopper wheel.*)

INTRA-STORE TELEVISION — the sending of television images from a studio within a store to receivers located throughout that (department) store that pick up and reproduce these images and sound. (See *intra-television system.*)

INTRA-TEL — abbreviation for intra-television system.

INTRA-TELEVISION SYSTEM — the wired system of television through coaxial cable and telephone wires, within a department store, industrial plant, factory, or warehouse, in which transmission is within the four walls and does not go over the air. Its purpose is to televise merchandise throughout the store and windows in order to promote the user's products which are being offered for sale.

INTRA-VIDEO SYSTEM – See *Telicor "Intra-Video" system.*

INVISIBLE RAYS – common synonym for infra-red rays of light, but also applicable to other invisible forms of radiation, such as ultra-violet rays, X-rays, etc.

ION – a charged atom, molecule, or radical whose migration effects the transport of electricity through an electrolyte or, to a certain extent, through a gas. Also, an electrified portion of matter of subatomic, atomic, or molecular dimensions. An atom with a positive or negative charge. An atom or molecule which has fewer or more electrons than normal. A positive ion is one which has lost electrons; while a negative ion is one which has acquired more electrons than normal. It is not material as is the atom. The ion is known as the smallest particle of negative electricity and may exist when atoms are not present.

ION BURN – a discoloration of the center of the fluorescent screen of a cathode ray tube caused by heavy negative ions hitting it. Syn.: ion spot.

ION SPOT – See *ion burn.*

IONIC BEAM – a term frequently applied to a beam of electronics, as in a cathode ray tube, but more properly to a beam of positively charged molecular particles.

IONIZATION – the process of producing ions, that is, the breaking up of a gas atom into two parts, a free electron and a positively charged ion. Ionization makes a gaseous tube more conductive than an equivalent vacuum tube.

IONOSPHERE – the region above the earth's surface, starting about 30 miles above the surface of the earth, in which ionization takes place, with diurnal and annual variations which are regularly associated with ultra-violet radiation from the sun, and the sporadic variations arising from hydrogen bursts from sunspots. Layers or regions possessing defined characteristics are known as the B., C., D., E., and F.-layers. Layers of highly ionized air in the ionosphere have the capability of bending or reflecting radio waves back to the earth. Reflection from the ionosphere makes possible long-distance reception of radio waves. Ionosphere layers are responsible for fading, skip distance, and difference between day and night reception.

IONOSPHERE STORM – interruptions and disturbances in the ionosphere due to a sudden burst of radiation of one kind or another from the sun, completely upsetting the normal structure of the ionosphere. It becomes very unstable – surges about wildly in the sky – becomes very weak in places

—and so the radio waves are very much disturbed in their progress through it. This is the reason for the "radio-blackouts" often experienced in short wave reception. Sometimes the waves return to the earth in a very erratic manner, such as to give rise to a weak and fading program in the receiver; sometimes, again, they go through the weak and patchy ionosphere—and the program disappears altogether.

IRIS—an adjustable opaque shutter on the television camera having a circular opening which is used to regulate the light admittance of a lens. Also, the colored portion of the front of the human eye, which, by contracting and expanding, controls the amount of light passing through the pupil of the eye to the retina.

ISOCHRONISM—the operating condition which is obtained when the reconstruction of the image and the scanning of the scene or object occur at the same rate. When two machines are operating or running at exactly the same speed they are described as running in isochronism. Although the machines may be in isochronism, they may still be out of step just as two runners' legs may be out of step although both pairs of legs are in stride at exactly the same speed and the feet of both hit the ground at the same instant. Similarly, two clocks may both keep perfect time, although the hands of one might be at one o'clock (1:00) and the other at one fifteen (1:15). Isochronism has been achieved in both examples. For synchronism to be achieved the two men would have to be what the military calls "in step," and the hands of both clocks would have to indicate exactly the same hour.

ITALY—In 1935. Italy had an experimental television station in operation in Milan which had two transmitters. Transmission was on a 180-line basis, 25 pictures per second. The receivers used were of the cathode-ray type. The Morelli Corp. was then considered the foremost company in the Italian television industry. Television experimentation, based on various mechanical systems, were conducted for a number of years. After the German-Italian Axis went into effect, German television activities were followed by the Fascists. The Fernseh Co. opened a Rome office. On July 22, 1939, Italy's first television broadcasting service began under the auspices of the Italian Broadcasting Corp. The transmitter was located at Monte Mario with a service area for a 405-line picture of about 30 miles from Rome.

J

J.I.C.—studio slang for "just in case."

JAMMING—intentional transmitting of radio waves in such a way as to interfere with the reception of signals from another station.

JAPAN—Mechanical scanning systems television experiments began about 1925. In late 1935, television activities were concentrated in the hands of Prof. Kenjiro Takayanagi, of the Institute of Technology of Tokio, who had developed his own system consisting of a combination Nipkow disc scanner in the studio, and a cathode-ray type of image reproducer at the receiver. This experimental station worked with 80 lines, 25 pictures per second. Very little is known to have been accomplished until Dec. 8, 1936, when the Government appropriated nearly 500,000 yen for television research, utilizing the RCA iconoscope system. On Aug. 25, 1937, the Nissan Television Kaisha (a firm) was organized by the Japan Industry Co. to operate patents of the Electrical & Musical Industry Co. of England. On Feb. 25, 1938, the Tokyo press reported the Japan Broadcasting Corp. would start television tests. On May 13, 1939, first television program for supposedly experimental purpose was broadcast from a newly built transmitter in the research labs of the Japan Broadcasting Corp., at Kamata, in the outskirts of Tokyo. In January, 1940, the Japan Broadcasting Corp. stated it would start a regular program telecasting schedule in the near future. With the war, video activities were halted.

JEEP – a wired television system, as opposed to broadcast. (See *intra-store television system*, which is the same as jeep television system.) Also, a small portable or very maneuverable piece of equipment used to describe intra-store television systems.

JENKINS' DISC – See *Jenkins' System*.

JENKINS-MOORE TELEVISION APPARATUS – Late in June 1925, in a laboratory in Washington, D. C., seven men watched the arms of a miniature windmill revolving on a small screen of white blotting paper. The real windmill was five miles away in Anacostia, D. C. The picture on the laboratory screen was being transmitted by radio through the intervening space. This was the first occasion on which actual television had been demonstrated or motion pictures had been transmitted by radio. Apparatus used was the Jenkins-Moore Machine. (C. Francis Jenkins and D. MacFarlan Moore.) A photoelectric cell turned the light and darkness of the image or photo into electrical energy. A lamp – the invention of Moore – acted as a lighting device at the receiver which took the currents after they had been amplified, and turned them back again into light and shadow. The picture was broken up into its component parts, but instead of into dots as had been done before, the picture was broken into lines. Each of the lenses swept out a line across the photograph.

JENKINS' SYSTEM – a mechanical television system developed and demonstrated by C. Francis Jenkins in 1925. The scanning apparatus employed was a prismatic disc; that is, a glass disc, the edge of which was ground into a prismatic section of varying thickness. Two of these discs were used, and the light passing through the varying prismatic edges was bent from side to side. By means of this contrivance, the rays of light from the image were passed on to the photoelectric cell, or to the viewing screen in the receiver.

JUMP WIRE – wire used to connect two points together temporarily.

K

K – the letter used to designate the cathode of a radio tube.

KC – abbreviation for kilocycles per second. (See *kilocycles.*)

KAROLUS CELL – a name sometimes applied to the Kerr cell.

KAROLUS LIGHT VALVE – This apparatus was based upon the invention of Dr. August Karolus of Leipzig, Germany. It was the heart of an intricate system of lenses, which was in front of a high intensity arc lamp similar to those used for the projection of motion pictures. The light valve is a delicate device used in place of a neon tube in a mechanical television system. It had to function with the utmost accuracy in order to permit the passage of light that corresponded perfectly with the impulses received from the television transmitter. These light emissions were passed on through lenses to a disc corresponding in size, design, and rate of rotation to a disc at the camera or originating point. Other lenses passed the light forward to the screen, on which the light impulses, at the rate of 40,000 per second, were painted on. Dr. Karolus not only modified but improved the Kerr Cell. (See.)

KAROLUS SYSTEM – devised by Dr. A. Karolus of the Telefunken Co., Germany, in which a phototube was employed at the transmitter for scanning. It was used principally for the televising of motion picture film. In this system the Nipkow scanning disc was replaced by a special type of disc having small slots made at equal distances around its circumference. A motion picture film was passed behind the slotted disc. The film was then scanned with the aid of a powerful beam of light which later passed through the slots in the disc, and then through the film, and finally was focused on to a special type of potassium photoelectric cell. In the Karolus receiver, use was made of the ordinary Kerr cell method of reception employed in conjunction with a mirror. This system was used chiefly in Europe.

KATHODE – (See *cathode.*) An old way of spelling "cathode."

KENNELLY-HEAVISIDE LAYER – a layer of ionized gas said to exist in the upper region between 50 and 400 miles above the surface of the earth. It reflects radio waves back to the earth, which it surrounds, under certain conditions, making possible long-distance reception.

KERR CELL – a chemical solution which changes its light transmission characteristics when electric fields are applied to the solution. An early form of a television reproducer system, now obsolete. Again, a transparent enclosure wherein the optical properties of a medium arc are modified by an electric field in such a way that when a beam of polarized light is passed through the cell after optical resolution, the intensity of the emergent light can be controlled by the field. Used in some mechanical video systems because it can be made to modulate a light beam with television signals. (See *double-image Kerr Cell;* also *Kerr, John.*)

KERR EFFECT – the rotation of the plane of polarized light under electromagnetic influence. The effect was first ascertained by Dr. John Kerr, who directed a beam of polarized light on to the highly polished end of a powerful electromagnet.

KERR'S APPARATUS – an early form of television or "seeing by electricity" developed by Dr. John Kerr. The transmitter consisted of a mosaic of selenium cells, the cells being connected to a corresponding mosaic of electromagnets on the receiver. The electromagnets had silvered ends and they were observed through an analyzing prism, being themselves illuminated by a strong beam of polarized light. Currents transmitted from the selenium cells operated the electromagnets and caused the plane of polarization of the light to be rotated thus making visible a crude reproduction of the image at the transmitting end when the bank of silvered magnet ends was viewed through an analyzing prism.

KEY – term referring to the character of a picture or image. A picture is said to be in "high key" when it has few gradations of tone and is lightly toned through. A "low key" image is one where the gradations of tone are all on the dark side. (Used principally in Great Britain. For American wordage, see *brightness, brilliance,* etc.)

KEY LIGHT – overall general illumination in a studio.

KEY STATION – the station at which the network television or radio program originates.

KEYSTONE EFFECT – a distorted field or background noticed in some instances with television images, where the opposite edges are not parallel.

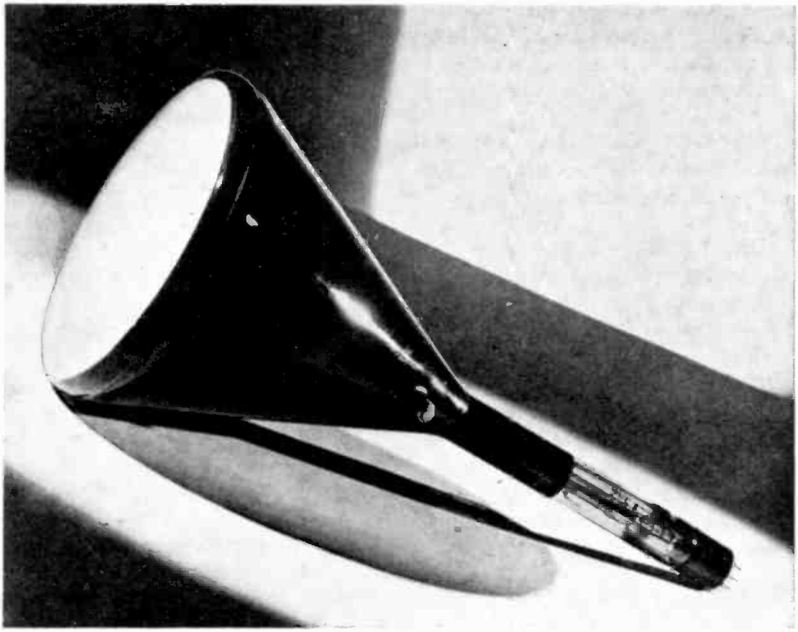
KILL – a director's or engineer's order in the studio to eliminate anything, such as "kill the light," "kill the picture."

KILO – prefix denoting 1000, used in the metric system.

KILOCYCLE – one thousand cycles per second. Abbreviated: kc.

KINE – colloquialism for Kinescope. (See *Kinescope.*)

KINEOPHONE – Thomas A. Edison in 1894 connected his phonograph with his "kinetoscope" and the combination was known as the "kinaphone." It had a peep hole projector into which the spectator peered. It was similar to the nickel-in-the-slot machines found in penny arcades of today. The music was supplied by the phonograph through the use of ear tubes. No attempt was made to synchronize the music and the picture.



— *Courtesy RCA*

Kinescope

KINESCOPE — a cathode-ray tube for television receivers. At its narrow end, there is an electron gun that produces an electron beam, and at its large end, a fluorescent screen; in between, a set of electrostatic deflecting plates or electromagnetic deflecting coils that cause the electron beam to move across the screen and reproduce thereon an image of the scene or subject originally televised. Originally a trade-mark for RCA tubes of this type. The kinescope is also known as the picture tube, and is used not only in television receivers but at monitor positions in control rooms at the studio. The function of the kinescope is to convert the electrical values back into light again.

The tube contains an electron gun producing a sharp beam of electrons — or a cathode ray — and also a grid for controlling the intensity of the beam. On this grid is imposed a voltage proportional to the output current from the iconoscope. If the spot scanned in the iconoscope is bright, the grid will permit many electrons to flow; on the other hand, if the spot is dark, the electron beam will dwindle. Thus, the intensity of the beam is controlled in accordance with the light values.

KINESCOPE GUN – an electron-optical system for producing a narrow pencil of electrons.

KLIEG LIGHT – a type of powerful incandescent lamp used for spotlighting and modeling. It is usually mounted on a mobile base.

KNOB – a round, hexagonal, or pointer shaped object attached to the end of the control shaft of a device to make it easier to change the position of the shaft by hand. The knob sometimes has a pointer or other position indicator.

KORN'S SYSTEM – the first practical system of phototelegraphy developed by Dr. A. Korn in 1904. A narrow beam of intense light was passed through a revolving glass cylinder on which was mounted a film negative. It was then reflected by a mirror on a prism and then on to the active surface of a selenium cell. In this way a fluctuating output current was obtained, the variations of light intensity impinging on the cell being created by the light differences in the negative on the revolving cylinder. At the receiver, the incoming pulsating currents were applied to a vacuum tube which glowed brightly or dimly in accordance with the fluctuations of the current. These variations in brightness were, by an optical arrangement, focused upon a sheet of photographic paper which was mounted on a glass cylinder which revolved in synchronism with the transmitting cylinder. In this manner, a replica of the transmitted image was slowly built up.

L

L-F – abbreviation for low frequency.

LS – abbreviation for long shot.

LAG – See *time-lag*.

LAG OF THE RETINA – See *persistence of vision*.

LAMP SCREEN – a type of television receiver screen consisting of a large number of small filament lamps arranged in mosaic formation on a large frame. By means of a special mechanism these lamps are lit in rapid succession by the incoming currents from the television transmitting station, thus giving a coarse, but at the same time, a brilliant reproduction of the original image. Used in old-fashioned mechanical systems.

LANGMUIR ARC – a type of arc lamp developed by Dr. Irving Langmuir of America, in which the light comes not from the crater of the carbon as was usual in most forms of arc lamps, but from the arc itself. Lamps of this type were used principally in television projection experiments both in transmission and reception.

LAP DISSOLVE — a control technique by which a picture held by a camera is made to merge with another camera-picture on the air. The term, derived from overlap dissolve, has come to mean, to hold both pictures at half-lap so that the montage can be seen by viewers before one or the other is gradually taken out. (See *oblique or diagonal dissolve*, and *lateral dissolve.*)

LAP MICROPHONE — a small microphone which can be attached to a lapel or pocket by means of a clip.

LASHING FLATS — fastening the flats together by their cords or lash lines.

LATERAL — situated on or at, or pertaining to, a side.

LATERAL DISSOLVE — a technique which involves both a camera setup and a control technique. One subject is held in the left field of one camera and a second subject or a different view of the first subject is held in the right field of a second camera. One picture is then dissolved in through the other on the air. The pictures may or may not be held at half-lap as desired. (See *dissolve, lap-dissolve,* and *oblique or diagonal dissolve.*)

LATERAL INVERSION — a defect in a reproduced television image, in that the condition of picture being sideways inverted, or reversed, the left side of the original appearing on the right side of the reproduction and vice versa. Lateral inversion appearing on television receiver screens is generally due to some mal-arrangement of the mirrors in an optical system.

LAVENDER RAYS — the name sometimes applied to the rays which lie at the beginning of the ultra-violet part of the spectrum or at the extreme visible end of the violet ray band of the spectrum which is adjacent to it. They are so named because of their color. Like the ultra-violet rays, the lavender rays are extremely active. Unlike the ultra-violet rays, the lavender rays will pass through glass rather freely. Certain types of photoelectric cells, such as the potassium cell, are very responsive to lavender ray stimulation.

LAYOUT — a diagram indicating the position of parts on a panel or in a chassis.

LEAD IN — that part or portion of an antenna system which connects the overhead antenna wire to the input of the receiver or to the disconnecting switches or instruments of a transmitter or its tuning house. That is, an insulated wire connecting the antenna to the receiver. Another name for the down-lead.

LEAD-IN INSULATOR — a porcelain tube inserted in a hole drilled through an outer wall or window frame of a house. The lead-in wire of the antenna is run through this tube.

LEAKAGE — undesirable flow of current through or over the surface of an insulating material. This term is also used to describe magnetic flux which wanders off into space without doing useful work.

LEBLANC'S THEORY OF SCANNING — In 1880, Maurice Leblanc developed the principle of scanning — a method of viewing successively individual picture elements. A scanning device divided a picture into lines and each line into tiny sections. Briefly, Leblanc's proposal was to break up a picture or image into tiny spots of varying shades of light and dark instead of trying to transmit an entire picture as G. R. Carey before him had attempted. He then sent the spots or dots, one after another, in a specific precise order. When they arrived at their receiving point they were reassembled in exactly the same order as they had been sent. This idea of breaking an image into minute segments is important, because, to date, it is the only practical way found to reproduce an image rapidly. It is not only the basis of present-day television transmission, but also the basis in printing.

LEG — a regional chain; for example, one link of stations in a network.

LEISHMAN CODE SYSTEM — In the early 1920's the Leishman Telegraph Picture Process was furnishing telegraph photo service to many newspapers of the United States that was distinctly a departure from anything introduced up to that time. The Leishman process in November, 1925 was the only one that would operate on a trans-oceanic cable. It consisted of the following steps: the picture sent was enlarged, usually to 18 inches square, and placed upon the surface of a so-called coding device. The latter was a board having two scales, one horizontal and the other vertical, the letters of the alphabet representing gradations of the scales. The coding board and photo being of the same size the outlines of the various tones comprising the picture (white, light grey, medium grey, dark grey, and black) were traced by means of movable arms and as this was done the positions of the tracing stylus were indicated on the two scales. There were more than 100,000 different positions possible on any picture and the readings on these scales indicated the movement of the stylus from one position to another. The readings on the scales were in the letters of the alphabet and were incorporated into a code message with letters that indicated the exact shade of the various parts of the picture. Each position of the stylus corresponded to a group of five letters, the first of which denoted the vertical position on the board; the second, the horizontal position; the third, fourth, and fifth, the intensity of the shading. At the receiving station, an operator had a similar coding board and recorded the series of letter combinations as points. These points were then connected by lines, which were never more than 1/32 of an inch out of the way, and the areas were shaded according to the code letter prescribed. Thus the picture was built up mechanically by the receiving operator and after final shading had been completed was reduced in proportion to about the size of the original photograph.

LEISHMAN DIRECT WIRE SYSTEM — About 1917, Leroy J. Leishman (See *Leishman code system*) explained his system for the transmission of pictures by electricity. The actual operation of his apparatus had never before been explained in detail to the general public. (He was careful to point out that "the telegraphing of pictures is not television; it does not make it possible to see the person to whom you are telephoning as that would necessitate the transmission of moving pictures or about 16 pictures per second. At the present time (1917) such a thing is impossible for both electrical and mechanical reasons. It is possible, however, to send and receive one picture in a very few minutes.")

He used a cylinder phonograph or dictating machine both at the transmitter and receiver, with both in perfect synchronism (with picture rotating on cylinder). The picture to be transmitted was first photographed through a screen, the function of which was to break it up into dots of varying sizes, thus producing a variation in the light and dark portions of the picture. A copper or zinc plate was then coated with a solution of glue, bichromate of ammonia and water. This was placed in contact with the developed negative and exposed to strong light. The bichromate of ammonia was the element acted upon. When the plate was washed, the part that had not received the light washed away, leaving the rest fixed to the plate. Upon heating, the gelatine picture tuned to a chocolate color. The plate was then rolled into a thin cylinder of the machine. The transmitting carriage consisted of an arm into the end of which could be screwed an ordinary phonograph needle which washed against the plate by a spring. A current passed between the needle and cylinder, covering every part of the picture. In this manner, the picture was transmitted. At the receiver, the current from the transmitting machine passed through the coils of the electromagnets on the receiving carriage. These attracted a very light armature, causing the sapphire or diamond in the forward end to press against the cylinder. This pressure made the recording. In this manner, all the dots on the sending machine were accurately reproduced on the paper at the receiver. The dots, since they varied in size according to light and shade of the picture, formed an excellent half-tone likeness of the original object.

LENS — a device employed to change the direction of the beams passing through it in a particular desired manner. An optical lens employs curved surfaces of a transparent material such as glass to act upon beams or rays of light while an electron lens employs either electric or magnetic fields acting on electron beams. Lens are used in television for the purpose of (1), to concentrate the light from the light source upon a small area as determined by the limits of the apertures in the scanning disc in the mechanical systems, and (2), to subsequently spread the bundle of rays to cover an area of the desired size in which the motion is to take place.

LENS DISC – a television scanning disc having a number of openings arranged in the form of a spiral, with a lens set into each opening, thus permitting a more intense illumination to be obtained, plus an enlarged picture, and allowing the reproduction upon a screen. This enables a large group to see the image. Used in some mechanical scanning systems.

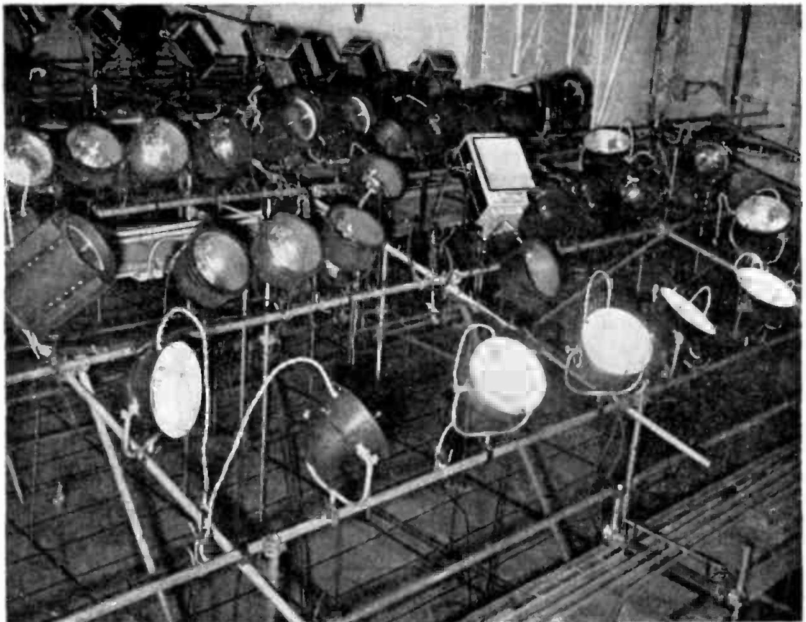
LENS DRUM – a device similar to a lens disc, except that the lenses are arranged on the surface of a rotating drum, the light being projected radially (spread-like rays of light). Also, a device for projecting a televised image on a screen. It consisted of a hollow metal drum having a number of holes perforated in spiral formation around it, each hole being provided with a small lens. A modulated light source was put in the center of the drum. The drum was revolved at constant speed, whereupon a televised image was thrown upon a neighboring screen. The lens drum was a development of the apertured drum. Used in mechanical systems.

LENS TURRET – an arrangement on a camera which allows several lenses to be mounted on the television camera at one time to facilitate rapid interchanging. It simply is a group of different lenses mounted on a rotating disc. By one movement of the disc the cameraman can switch from lens to lens in a matter of seconds – making possible a greater variety of shots on any given camera with a minimum effort, thus increasing its flexibility and stepping up production values without increasing the number of cameras or crew members on the floor.

LICENSES – rights to legally use or engage in the use of patents owned by another company or individual. For example, RCA licensees acquire rights to use developments, inventions, and patents owned by that firm. Also, Farnsworth has done considerable development work on television and holds many patents. It has license agreements with Philco Corp. and a number of other companies. Its license agreements with RCA provide for the use by each party of the invention of the other in the fields of television. The same situation holds true among other television companies.

LIESAGANG'S CELL – a very simple type of selenium cell devised in 1890. It consisted of a small sheet of glass which was heavily silvered on one side. Across the silvered side was scratched a thin line, the channel thus made being filled up with active selenium.

LIGHT – that radiant energy which, by its action on the organs of vision, enables them to perform their function of sight. It is the fundamental



— Courtesy CBS

Lights, Station WCBS-TV

"stuff" of television science. The form of energy emitted from all luminous bodies. Light is a wave motion which travels in straight lines and cannot penetrate opaque objects. Because of this, the curvature of the ether is a medium. Visible light and the various invisible rays are in principle just like wireless waves; that is, they are vibrations in the ether. The visible spectrum contains colors ranging from violet at the high-frequency end and passing to red at the low-frequency, and the entire range of colors passed through being violet, indigo, blue, green, yellow, orange, and red.

The older "Corpuscular" theories of light of Sir Isaac Newton and others supposed light to consist of a stream of minute particles of corpuscles which were shot off from the surface of the luminous body. An opaque object placed in the stream of particles stopped many of them, thus throwing a shadow. The present "undulatory" theory of light, originated by Young at the beginning of the 19th century, states that light is an undulatory or wave-like motion in the ether, this motion being created by the extremely rapid vibrations of the particles of the luminous body.

Light used in television production studios are of several different types: (1) Carbon arc lights are the brightest source of illumination available, can give a pure white light and have a high output of visible light in proportion to the wattage used. They have been standard equipment in motion-picture studios for decades; (2) Incandescent lights, similar to those in the majority of home lighting fixtures, have been widely used for television. They are easy to handle, noiseless, and comparatively safe from a fire prevention view, but the light from this type of lamp is weak at the blue-violet end of the visible spectrum and heavy at the red and infra-red end; (3) Mercury vapor lamp, developed by the General Electric Co., gives off almost no heat in the studio; a small glass cylinder about the size of a cigarette rated at 1000 watts, gives off 65 lumens per watt. The actual source of light is a drop of mercury in a tiny cylinder inside the cigarette-size tube. Because so much electricity is applied to so small an area, this lamp is water-cooled to keep it from cracking. A later type of mercury vapor lamp is air-cooled but considerably larger in size; (4) Fluorescent lamp is a long glowing cylinder widely popular in other fields besides television. This lamp gives off light almost as white as daylight.

LIGHT BRIDGE – a bridge or control board from which the ceiling and floor lights are remotely controlled and operated.

LIGHT CHART – a script or chart indicating the position of the lights and the level of illumination to be used for any given television scene or program.

LIGHT CONTROL – every television receiver requires some method of light control by means of which the electrical signals received from a transmitter can be made to vary the intensity of a source of light at the receiving end. These variations are then distributed over a surface by the scanning device to reproduce the picture. (See *discharge lamps, light control cells, Kerr cell, double-image Kerr cell, supersonic light control.*)

LIGHT CONTROL CELLS – a class of light control which uses a device that is independent of the light source, the luminous intensity remaining unaltered, and the modulation being accomplished by means somewhat analogous to the action of a shutter or diaphragm. Numerous types have been proposed: mechanical, optical-mechanical and electro-optical. However, because of the very high frequency response needed, only the electro-optical method need be considered and of these two, the Kerr cell and supersonic light control are of importance. (See *Kerr cell, supersonic light control, discharge lamps.*)

The history of electro-optical methods of light control dates back to 1845 when Michael Faraday discovered the rotation of the plane of polarization of polarized light when passed through a magnetically stressed section of heavy lead glass. Since that date many other media which exhibit the Faraday effect have been discovered and it was this scheme which was proposed by Paul Nipkow in his German patent for modulating a beam of light in conjunction with a scanning disc.

LIGHT CURRENTS – term sometimes applied to the fluctuating currents from the photoelectric cells of a television transmitter which are the electrical equivalents of the light and shade of the televised image.

LIGHT ELEMENTS – See *picture elements.*

LIGHT FLARE – a white spot in the television picture caused by a badly placed floor or spot light.

LIGHT LEVEL – the general intensity of illumination on a subject or scene measured in foot-candles.

LIGHT METER – a meter used to measure, in foot-candles, the light levels reflected by stage sets and performers' faces.

LIGHT - MICROPHONE – a once - popular but erroneous description which was sometimes used to designate a photoelectric cell.

LIGHT MODULATION – control of the intensity of light by electrical means such as the Kerr cell and crossed Nicol prisms.

LIGHT OPERATOR – the technician who directs the placement of lights as directed by a light chart during the televising of a program or series of programs.

LIGHT PENCIL – See *pencil of light.*

LIGHT PLOT – a cue sheet for lighting arrangement.

LIGHT RESISTANCE – a general term applying to any electrical device which on illumination, undergoes a modification in its electrical properties. All photocells are included under this general definition.

LIGHT SOURCE – the means for obtaining a high intensity illumination to be projected upon the object being televised. Any object, surface or substance that emits light is known as a light source. A lamp bulb in use, for example, is a light source. The sun, of course, is the most widely used light source. Luminiscent pigments are light sources for they emit light.

LIGHT-STORAGE SYSTEM – principle used in the RCA Iconoscope developed by V. K. Zworykin, and the Farnsworth Storage Tube invented by Philo Farnsworth. Charges are "saved up" because of all of the light falling on any picture element. This occurs during the time the cathode beam is traversing the remaining parts of the picture on the target. After each horizontal line and after each vertical frame of the picture, the electron beam travels back to its original position; to the left side of the picture or to the upper left hand corner. The back sweep is made at a greatly increased speed. Notwithstanding this speed, the beam's path, nevertheless, would produce a signal and mar the received picture. Therefore, at the end of each line and at the end of each frame, a "blanking signal" is created to erase this effect from the iconoscope during the return sweep, and sends out an impulse corresponding to black. This is the "negative" signal system used in cathode beam television. In other words, the perfectly white portions of the image send out no signal, but the darker portions send out one, the strength of it increasing with the degree of blackness on the part of the picture over which the cathode beam is traveling.

LIGHT VALVE – an apparatus whose transparency to light can be made to vary in accordance with variations in an externally applied quantity such as voltage, current, electric field, magnetic field, or electron beam. In earlier forms used in mechanical video systems, the total transparency was varied and a mechanical scanning disc employed to make the transmitted light fall on the correct elemental area of the reproduced image at each instant. The Kerr cell is an example of this type. The electron is quite invisible, but it is allowed to strike a fluorescent screen on the end of the tube. The spot of the fluorescent screen where the beam impinges glows in proportion to the beam intensity. The beam is also moved across the screen in lines, similarly to the iconoscope beam, by means of electromagnets, and as it does so, it paints a picture in spots of light. This is the reproduced picture seen in a television receiver.

The color of the image produced by the kinescope is dependent upon the material used for the fluorescent screen. Yellowish or greenish pictures were produced often in video receivers because the screens producing these colors were particularly efficient and easier to construct. However, today tubes are made which give a better black and white picture.

In direct viewing, the larger the picture wanted, the larger the kinescope must be. Projection is obtained from a small kinescope by optical means, but a brilliant image is needed to obtain a satisfactory degree of illumination of the enlarged picture. The projection-type tube is more expensive because of the high cost of the optical system and the high voltages which they require.

Kinescope comes from the Greek "kinema" meaning "motion." The kinescope is the heart of the RCA electronic television system, and complements the iconoscope and image-orthicon tube. The kinescope, also known as the electronic receiver tube, eliminated mechanical scanning devices. Consists essentially of several component parts: (1) a glass envelope, sealed for maintenance of a high vacuum; (2) a cathode from which the cathode rays, or electrons, are emitted; (3) a device for concentrating, controlling, and focusing of the electron beams. In the modern suspension light valve, however, the light transparency is varied from point to point by means of a scanning electron beam, so that a light beam projected through the valve will produce on the viewing screen the complete received image without employing moving mechanical parts in the television receiver.

LIGHTNING ARRESTER – a protective device used to sidetrack directly to the ground a discharge of lightning which strikes a transmitting or receiving antenna.

LIMITER – in a Frequency Modulation receiver, the section which removes Amplitude Modulation (AM) variations from the FM signal at the output of the I.F. amplifier, thereby limiting interfering noises.

LINE – a single horizontal scanning line across the picture containing highlights, shadows and half-tones. It is the horizontal path traced by a moving electron beam on the mosaic of a camera tube or on the fluorescent screen of a picture tube. In a receiver, the intensity of the beam or spot along this path is altered in proportion to the intensity of light and shadows of the scene being televised to create that portion of the picture. Also, a circuit or series of circuits connecting two sections of a broadcasting unit. Example: "Put a signal on the studio line." Also, a network.

Lines are traced, or scanned, by electronic action and each represents the exact degree of light or shadow occurring at every point along its path across the face of the picture. In the camera these lines translate their light - and - shadow values into terms of electrical energy suitable for transmission by radio carrier. In the receiver this process is reversed and electrical energy received by radio carrier is made to retrace the particular kind of line it describes on a viewing screen. Because picture quality improves as the number of lines used to record its detail is increased, present day television operates on a basis of 525 lines to each frame. This means that to transmit a single second of television 15,750 lines must be scanned at the sending location and a like number of lines must be recorded simultaneously to reconstruct the picture in each receiver.

LINE AMPLIFIER – amplifier that supplies signal to a transmission line.

LINE - BALANCE CONVERTER – an apparatus installed at the end of a coaxial transmission line to isolate the outer conductor from the ground. Also called the "bazooka."

LINE FLYBACK – in a television system, the right-to-left return motion from the end of one scanning line to the beginning of the next. Also called horizontal flyback or horizontal trace.

LINE FREQUENCY – the number of scanning lines traced in one second.

LINE-HOLD AND FRAME-HOLD – controls which normally alter the line and frame generated frequencies until synchronism is obtained.

LINE JUMP SCANNING – the same as interlaced scanning.

LINE OF FORCE – the imaginary "lines" along which the attraction of electric or magnetic force is applied. An expression used to visualize an invisible phenomenon.

LINE OF SIGHT – a straight, unobstructed path between two points.

LINE PICK-UP – transmission of signals by means of metallic conductors – coaxial cable or equalized telephone cables.

LINE RADIO – a system of communication devised by Major General George O. Squier which permits transmission of electromagnetic waves along a wire or conductor. Instead of the waves spreading out in all directions, as in ordinary broadcasting, the waves go along a predetermined path such as the conductor. Syn.: wired radio.

LINE REHEARSAL – a rehearsal of an oral role.

LINE SCANNING – a method of scanning in which the scanning spot repeatedly traverses the field of the image in a series of straight lines.

LINE SHIFT – the control which normally positions the picture so that it is centered within the vertical edges of the mask.

LINE SYNCHRONIZATION – synchronization of the line-scanning generator at the receiver with that at the transmitter so that the scanning spots at the two ends are in unison with each other throughout each line.

LINE SYNCHRONIZING IMPULSE – the impulse added to the television signal at the end of each scanning line for receiver-synchronizing purposes. Syn.: horizontal - synchronizing impulse. Also used in reference to vertical-synchronizing impulse.

LINEAR – a relation so that any change in one of the related quantities is accompanied by an exactly proportional change in the other.

LINEARITY – the uniformity of distribution of a regular pattern on a picture tube. Technically, the term refers to the straightness of a characteristic curve or a portion of that curve that shows the relation between two quantities of circuit factors.

LINEARITY CONTROL – a control in electronic television to adjust the scanning waves. In a receiver they are usually semi-adjustable controls inside the set. They may be top, bottom, right, and left linearity controls.

LINER – the lighter tones of grease paint normally used; high lights in character make-up.

LINK RADIO TIE-UPS – stations connected by an ultra-shortwave radio service, not audible to domestic sets, carried cross-country by line-of-sight relay installations, either attended or unattended.

LINK TRANSMITTER – a radio relay transmitter used as one means to achieve a television network. A "booster" for a remote pickup, from studio to the main transmitter.

LIQUID CELLS – name often given to light-sensitive cells consisting of two metal plates immersed in a special liquid. There are several types of liquid cells, one comprising two copper plates immersed in a weak copper sulphate solution. After the plates have been "formed" by remaining in contact with the solution for several days, a small current will flow in an external circuit connecting the two plates when one is illuminated, and the opposite has been kept in the shadow. On turning off the light, the current-flow will stop. M. Henri Becquerel discovered cells of this type, and hence they are sometimes termed "becquerel cells."

LISSAJOU SCANNING – See *continuous scanning*. Also, *spiral scanning*.

LITHIUM – a very light silvery metal, like potassium and sodium to which it is related, so soft it can be cut with a knife. Lithium metal has photoelectric properties, and is employed in the construction of the cathodes of certain photoelectric cells. Lithium photocells show an especial sensitivity to violet rays. Comes from the Greek "lithos" meaning a stone, a reference to its earthy sources.

LIVE – as opposed to film presentation.

LIVE TALENT – participants in a television program broadcast directly in the studio, as distinguished from motion picture film. It is the opinion of many television experts that film programs will constitute the bulk of broadcasting in video, for several reasons which include: (1) duplicates with sound on film can be made inexpensively; (2) film duplicates will enable a cheaper chain system, save telephone or coaxial charges now paid out; (3) the programs can be edited; (4) much of the technique and production apparatus of motion picture production companies can be utilized, thus slicing program costs; (5) letter-perfect reproductions requiring tremendous rehearsal time and costs can be eliminated; (6) the talent need not be compelled to follow a rigid schedule; (7) the production can be shot at the most convenient time and location; (8) subject matter of programs can be extended to include educational topics including travelogs, science, musical technique, etc., and (9) program libraries can be built up.

LIVE TALENT STUDIO – the locale in which live action is televised directly.

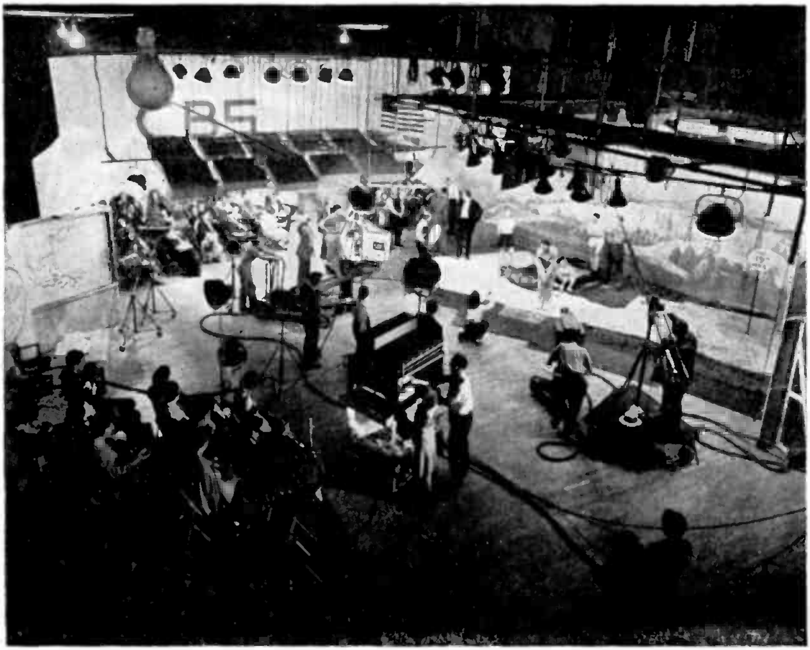
LIVE TITLES – tilting material which is photographed directly by the cameras in the studio rather than taken from slide film.

LOADSTONE – See *lodestone*.

LOCAL – restricted to local station as opposed to network; also, announcement of station identification.

LOCAL PROGRAM – a program originating at and released through only one broadcast station.

LOCK IN – when the televised picture is in proper synchronization.



— *Courtesy CBS*

Live Talent Studio

LODESTONE — a natural magnet. A magnetic ore of iron; anything that strongly attracts. Also, spelled "loadstone."

LONG SHOT — an establishing shot taken from a distance far enough away to include a complete view of the scene. Abbreviation: LS.

LONG WAVES — wave lengths longer than the longest broadcast band wave length of 545 meters. Long waves correspond to frequencies between about 20 kilocycles and 550 kilocycles.

LOOKSTENER — a name to describe a spectator or viewer of television suggested by *Dr. Alfred N. Goldsmith;* abbreviation for "look-and-listener."

LOOP — a circuit; a line.

LOOP ANTENNA — an antenna consisting of one or more complete turns of wire. It may be constructed into a receiving cabinet or separately mounted, and is usually tuned to resonance in a radio by a variable condenser. Loop antennas are used widely in radio-direction finding apparatus.

LORAN – The name Loran is derived from LOng RAnge Navigation and is descriptive of a system that enables a surface vessel or aircraft to determine its position by radio, without the need of radio transmissions from the craft itself. A complete Loran system consists of a number of pairs of pulse transmitters located on the coast-line and a receiver and indicator on the ship or airplane. As in radar, the Loran system repends upon the fact that radio signals travel with a constant velocity. The distance between the shore transmitter and the receiver, therefore, is directly proportional to the time required for the reception of the signal. Position is determined by comparing arrival times of received pulses of radio frequency energy with charts prepared for the particular area which correlate time and position.

LOSE THE LIGHT – term used in directing cameras; for example: "Move to your next position when you lose the light."

LOUDSPEAKER – an apparatus for converting audio frequency signals (electric currents) into sound waves.

LOW BRIGHTNESS-LEVELS – light that is insufficient for normal level vision, as for example, bright starlight. Phosphorescent light is of low brightness levels.

LOW-DEFINITION TELEVISION – television involving less than 200 scanning lines in an image.

LOW FREQUENCY – a frequency in the band extending from 30 to 300 kilocycles in the radio spectrum. FCC designation for the entire radio spectrum is as follows: vlf (very low frequency) 10 to 30 kilocycles; l-f (low frequency) 30 to 300 kilocycles; m-f (medium frequency) 300 to 3000 kilocycles; h-f (high frequency) 3 to 30 megacycles; vhf (very high frequency) 30 to 300 megacycles; uhf (ultra high frequency) 300 to 3000 megacycles, and shf (super high frequency) 3000 to 30,000 megacycles.

LUMEN – a unit of light energy. One lumen is the amount of light energy falling upon one square-foot of the inner surface of a hollow sphere having at its center a light source of one candle-power.

LUMINAIRE – the trade name of the General Electric Co.'s mercury-vapor ceiling light units. A luminaire is a complete lighting unit comprising a light source, together with its direct appurtenances, such as globe, reflector, refractor housing, and such support as is integral with the housing. Each luminaire can be rotated in the horizontal and vertical axis by means of small, built-in, electric motors which are controlled from a console on the lighting bridge outside the control room window.

LUMINESCENCE – a general term applying to the emission of light when excited by a beam of electrons of a source of radiant energy. Light is produced without the generation of heat.

Luminiscence is divided into fluorescence and phosphorescence. Expressed not quite exactly, fluorescence may be described as luminescence which stops almost instantly upon the withdrawal of the stimulus or excitation, whereas in phosphorescence, the luminescence persists. It is difficult to give a more exact definition since, to date, there is no generally acceptable criterion to distinguish between the two.

LUMINESCENT MATERIALS – See *phosphors*. Luminescent materials give out visible light when they are irradiated by (1) cathode rays (2) visible light (3) ultra violet (dark or invisible light) or (4) X-rays. Some give out light only while being irradiated. These are fluorescent. Some continue to give out light after the radiation stops. These are phosphorescent. While some of these materials occur in nature and were known centuries ago, they are rare and inefficient; that is, they give out very little light. It was only recently that they became more than scientific curiosities and attempts were made to make more efficient material in the laboratories for the many practical applications that began to arise.

LUMINESCENT PIGMENTS – When exposed to the invisible rays of so-called "black-light" (see), the luminescent pigments light up or "glow" at various levels of brightness – both high and low. At low levels, this luminescent light may be so dim that eyes have to become accustomed to the dark before it is visible, and then only at close quarters. Anyone out of the range of a comparatively few feet cannot see the lights. When exposed to stronger lights, the brightness of the luminescent "glow" is increased. Nature is full of luminescence. Eyes, teeth, and finger nails "glow," or fluoresce, when exposed to a "black" light. Hundreds of plant and animal organisms, for example, fireflies and glowworms, and many of the organic dyes, are capable of emitting visible light. Minerals, too, have luminescent qualities. Fluorescence is recognized generally as being characteristic of the mineral fluorspar. Willemite, a zinc silicate ore, is another famous fluorescent mineral. However, minerals as they occur in nature are of limited usefulness in the field of luminescence because they are generally deficient in other desirable properties. Dyes in most cases are too fugitive for prolonged outdoor use. Of all the luminescent materials, the manufactured luminescent inorganic pigments probably are the most useful from the standpoint of diversified application and desirable properties.

The base materials for these pigments are exceptionally pure chemical compounds, such as zinc sulfides, combinations of zinc and cadmium sulfides, and calcium and strontium sulfides, depending on which metal is predominant in each compound. In the manufacture of these pigments, an exceedingly small amount of other metal, such as copper, bismuth, silver, or manganese, is mixed with these pure compounds. The reason for including this metal is that none of these compounds – a pure zinc sulfide compound, for example, will have a brilliant luminescence by itself. But when a little activating metal is added, a compound can be made which "glows" very colorfully. That is why this additive metal is called the "activator." For those technically minded, it may be interesting to know what causes these pigments to luminesce, or glow. The scientific theory is that the electron is forced out of its normal position in the molecule by the radiant energy from a light source. When the electron returns to its proper place, energy is converted into visible light. Billions upon billions of electrons in motion at the same time produce a visible glow which is called "luminescence." Luminescent pigments, therefore, may be defined as those pigments which have the ability to absorb radiant energy from a light source and, after converting such energy to another form, re-emit it as a visible, colored light. The pigments swallow up one form of light and immediately or slowly re-emit visible light of a different color. A wide range of luminescent colors can be developed by variation in the manufacturing process. Some pigments have fluorescent properties only; that is, they glow only during the time of excitation. These are called "fluorescent pigments."

LUMINOUS – emitting or radiating light; shining.

LUX – a metric standard of illumination intensity. One lux is the intensity of illumination at the surface of an object set up by a standard candle placed at a distance of one metre (39.37 inches) from it. Derived from the Latin "lux", for light.

M

MBS – abbreviation for *Mutual Broadcasting System.*

MC – abbreviation for *megacycle,* one million cycles per second. Also, for *master of ceremonies.*

M C U – abbreviation for *medium close-up.*

M-F – abbreviation for *medium frequency;* a FCC designation for the band from 300 to 3000 kilocycles in the radio spectrum.

16 MM. – small size motion picture film, usually for home use.

35 MM. – standard motion picture size film.

MS – abbreviation for *medium shot.*

MAGNET – a piece of iron or steel which has the characteristic of attracting other pieces of magnetic material such as iron, and has the property of attracting or repelling other magnets.

MAGNETIC FIELD – a region in space surrounding a magnet or a conductor through which current is flowing. The magnetic field is created by the magnetic coils that are used to sweep the electron beam in accord with the synchronizing impulses received from the transmitter. Audio frequency currents flowing through the coils (called voice coils) make them move in and out, thereby causing the diaphragm to reproduce sound waves. The magnetic field is produced by a permanent magnet in p. m. dynamic loudspeakers, and, by an electromagnet in electrodynamic loudspeakers.

MAGNETIC FOCUSING — concentration of the stream of electrons emitted from the cathode into a narrow pencil, by means of a steady magnetic field directed axially along the direction of flow of the electrons.

MAGNETICS — that branch of science which deals with the laws of magnetic phenomena.

MAGNETISM — the property possessed by various materials, as lodestone and steel, of attracting and repelling each other according to certain physical laws; any kind of attraction or power to attract. Magnetism comes from the name of the Greek city-state, Magnesia in Asia Minor, where great quantities of magnetic ores were discovered. Although magnetism had been known to the Greeks centuries earlier, Socrates is known to have declared that lodestone not only attracts other rings but sometimes suspends a number of pieces of irons and rings from each other to form a long chain.

MAGNETRON — tube that creates the impulses sent out from radar. A new type developed at Columbia Univ. about May, 1946, was said to make possible a greater number of channels available for television microwave transmission.

MAGNIFIER — term sometimes used to designate the simple magnifying lens with which some television receivers are provided for the purpose of enlarging the received image.

MAGNI-SCALE — an object produced in larger than actual size in order to make clear and effective detail which would otherwise be incapable of effective television reproduction.

MAIN STUDIO — the main telecasting studio from which the greater portion of the local programs originate and from which a majority of station announcements are made of programs originating at remote points.

MAKE-UP — facial make-up, etc., on television performers.

MANUAL TUNING — tuning a radio receiver to a specific station by turning the tuning control by hand.

MANUAL VOLUME CONTROL — a control of volume, usually a variable resistor, which can be manipulated by the person operating the radio receiver.

MAN - MADE STATIC — high frequency noise signals which are produced by sparking in electrical apparatus or power lines and picked up by radio receivers, with the result that buzzing and crashing sounds are heard along with the radio program.

MARCONI-E.M.I. SYSTEM OF TELEVISION — was designed for transmission of 25 complete pictures per second, with each picture consisting of 405 total lines. The interlaced method of scanning was used. Flicker frequency was 50 per second. Used in England.

MASKING PIECE – a wall section arbitrarily included in a setting to provide a backing for acute changes in camera angles. Syn.: wall.

MAST – a vertical or nearly vertical metal pole used as an antenna, or a pole serving as an antenna support.

MASTER CONTROL – the technical direction center. (See *master control board.*)

MASTER CONTROL BOARD – board at which main controls of broadcasting are located.

MASTER TELEVISION STATION – a fully equipped video station capable of originating complex studio shows.

MECHANICAL SCANNING – use of a beam of light controlled by a rotating scanning disc, rotating mirror, or other mechanical apparatus, to break up a scene into a rapid succession of narrow lines as required for conversion into electrical impulses in a television system. Other devices used included mirror-drums, mirror-screws, and vibrating mirrors. It was the means in former years when mechanical scanning was popular, to produce a shutter effect so that the light projected from the light source upon the subject before the photoelectric cell was directed in such a way that it was cast upon a different segment of the subject in successive instants and in definite sequence. The most common method for providing the effect was to provide a metallic disc in which holes were arranged in a spiral with relation to the center of the disc. Another means was that provided by a drum in which the perforations were spiraled along the wall of the cylinder. Still a third method was the use of a vibrating mirror, the vibrations in this instance being controlled by an electrical apparatus. A fourth method was that in which the mirrors were acted upon a drum at predetermined angles so that the light was reflected to different portions of the subject from the mirror. A motor was the common propelling power for nearly any style of mechanical scanning. In mechanical television systems, the moving mechanical devices were employed at both the transmitter and receiver. The earliest means for obtaining scanning suitable for television mechanically was the Nipkow scanning disc. In its simplest form it was a perforated disc, having apertures spaced at equal angular intervals on a spiral.

MEDIUM CLOSE-UP – a waist-low camera shot, used for action scenes, when the faces of the performers are to be seen clearly. Abbreviation: MCU or Med. CU.

MEDIUM FREQUENCY – a frequency in the band extending from 300 to 3000 kilocycles in the radio spectrum. Abbreviation: *m-f.*

MED S – abbreviation: *medium shot.*

MEDIUM SHOT – a shot taken by

the camera from a middle distance, or from knee level to above the head of the subject. That is, after establishing the overall of the scene or subject, the eye would probably center on one specific section of it. In camera language, this is called the medium shot, and would be accomplished in one of two ways: (1) by dollying the camera into a closer position or (2) by switching to a second camera which either has a longer lens or is in a closer position.

MEGACYCLE — a measure of frequency; one million cycles per second.

MEMORY — Memory plays an essential role in television. At the transmitter there is physical "memory" or retentivity in the light-sensitive surfaces of the video camera, over which the fine pointing finger of the pick-up electron beam sweeps at a fast pace. At the receiver, physical "memory" is implanted in the fluorescent surface to retain the picture elements "painted" there by the invisible cathode beam which sweeps back and forth with incredible rapidity; this adds to the physiological memory of the retina of the human eye, which views separately each picture element as it is laid upon the screen, but retains them until the elements appear to the eye as a complete, integrated picture, an exact replica or reproduction of the distant original. (This, in electronic cathode beam systems.) In mechanical systems, physical "memory" also is utilized to retain for a brief time the shining record of an image's electrical counterparts. The effect is to briefly "fix" upon a screen the beams of light which are rapidly penciling the picture thereon. Thus is memory, or retentivity of light, an essential element in the actual television system.

"MEMORY" SCREEN — a fluorescent screen that has a relatively slow decay rate, so that one image is held over until the next appears. Developed by Du Mont engineers in 1940 to eliminate flicker. In the usual electron of that time, images appeared and disappeared almost in a flash, with the result that there was a noticeable flicker due to the intervening dark interval. With the "memory" screen the repetitive rate is 15 frames instead of 30.

MERCADIER'S CELL — an early form of sellenium cell, developed in 1881 by Mercadier. It consisted of two strips of brass foil having a layer of insulating parchment between them and rolled into a spiral, one surface of which was coated with fused selenium.

MERCURY — a silvery metal, liquid at ordinary temperatures and known as "quicksilver." Mercury gives off a vapor at ordinary temperatures and when subjected to a high electric potential at low pressures this vapor glows with an intense greenish-blue light. The "mercury-vapor" lamp was well known in the old days of mechanical television. Mercury vapor has been used in the place of neon gas as the illuminant in some color television systems.

MERCURY-HELIUM LAMP – See *helium-mercury lamp.*

MERCURY-VAPOR LAMP – a lamp consisting of a tube of fused quartz in which a little mercury has been confined. By passing an electric current through the mercury, it is vaporized and made to glow with a greenish light. It was used as a powerful illuminant in some television transmitting systems and other scientific purposes. Electric current vaporizes the mercury in a water-cooled tube, thus producing light without much heat.

MERCURY-VAPOR WATER-COOLED LIGHT – a source of light developed by the General Electric Co. and used for ceiling and floor lights in television studios.

METAL – an element which readily forms positive ions. Metals are characterized by their capacity and high thermal and electrical conductivity.

METAL-TYPE TUBES – a vacuum or gaseous tube having a metal envelope or housing with electrode connections being made through glass beads fused into the metal. Syn: all-metal tube.

METROPOLITAN STATIONS – stations designed primarily to render service to a single metropolitan district or a principal city and to the rural area surrounding such metropolitan district or principal city. Metropolitan stations may be assigned to television channels 2 through 13, both inclusive. The main studio for metropolitan stations must be located in the city or metropolitan district with which the station is associated and the transmitter must be located so as to provided the maximum service to the city or metropolitan district served. Metropolitan stations are limited to a maximum of 50 kilowatts effective radiated peak power with antenna having a height of 500 feet above the average terrain, as determined by methods prescribed in Standards of Good Engineering Practice (FCC) concerning television broadcast stations. (See *community station, rural station.*)

MICA – a transparent flaky mineral which splits readily into thin sheets and has excellent insulating and heat-resisting qualities. It was used in the employment of the construction of some type of selenium cells. It is used extensively to separate the plates of condensers, to insulate electrode elements of vacuum tubes, and for many other insulating purposes in radio apparatus.

MICRO-LAMBERT – a unit for measuring the intensity of light, used principally to express low intensities. One footcandle equals 1076 microlamberts. A full moon at zenith probably produces a brightness on a white surface of about 20 microlamberts. The brightness of luminescent pigments is usually measured in microlamberts. (See *footcandle.*)

MICROLUX – a unit employed in the measurement of extremely minute illumination intensities. A microlux is one-millionth of a lux. (See *lux.*)

MICRON — a term measurement of very short lengths used in expressing the wave-length of light. A micron is a thousandth of a millimetre. Commonly used in expressing the size of microscopic particles. Individual crystals of fluorescent zinc and zinc-cadmium sulfide pigments range from 0.5 to 5 microns in size, while phosphorescent pigments range from 5 to 40 microns, being considerably larger than the fluorescent particles.

MICROPHONE — a device for interpreting sound waves in the form of a varying electrical impulses so that there is a particular electrical impulse corresponding to every sound. Colloquialism: *mike.* The microphone contains some form of flexible diaphragm which moves in accordance with sound wave variations. This movement, in turn, generates a minute voltage which is fed to the input of an amplifier where it is amplified many times. The microphone becomes the sound pick-up device that functions to transform energy from acoustical to electrical form and, therefore, is one of the most important instruments in any electrical system that transmits, records, or amplifies sound. When the human ear is investigated, it is found that sound has acted like ripples of water in a pool after a stone has been thrown into it. When the soundwaves reach the eardrum, they make it vibrate. The eardrum passes the vibrations along until they reach sensitive nerves. These nerves convert the vibrations into nerve currents and send them along to the brain where they are "heard." Television "hears" in exactly the same manner but uses a metal ear known as the "microphone." The "eardrum" of the microphone is a thin ribbon of a metal alloy called duralumin. Thinner than tissue paper, it is about one-ten thousandth of an inch thick. It is so delicate that when sound vibrations pass it in the air, the ribbon vibrates with them, like an eardrum. Back and forth it moves, vibrating in perfect harmony with the soundwaves. The metal ribbon is suspended between two magnets, and hangs right in the middle of many lines of magnetic force. When it vibrates back and forth, in harmony with the soundwaves in the air, it breaks through lines of force and generates an electric current in the ribbon. It is amplified and strengthened many millions of times before it is ready to be radiated out through the air from the transmitter. After leaving the amplifiers, the electric impulses travel through another wire to the transmitting station and then through the air to the receiver. The term "microphone" was coined by Sir Charles Wheatstone in 1827. (See *Wheatstone, (Sir) Charles.*)

MICROPHONE BOOM — an adjustable crane or arm which suspends the microphone above the playing area being televised. It is usually out of camera range and, therefore, not seen in the received picture.

MICRO-RAYS — See *micro-waves.*

MICROVISOR — obsolete term, used to designate the assembled group of photoelectric cells in the video studio before which the subject or scene has been placed and upon which varying light reflections were impressed to create an electric current. The photoelectric cells were used to compensate for the small amount of energy that each cell generated as well as to give depth to the picture. The name was also applied to the pick-up apparatus whether it consisted of a single photoelectric cell or group of cells.

MICROWAVE – radio waves of extremely high frequencies, having wave-lengths of less than one meter, or greater than 300 megacycles. Technically they are called ultra-high frequencies or micro-rays. The layman refers to them as tiny waves, and that, too, is correct. Physicists term them Quasi-optical because of their close relationship to light. They call for simple, inexpensive compact apparatus and comparatively low power. A remarkable fact is that they do not fade and carry the voice clearly.

MIDDLE BREAK – Station identification in or near the middle of a program.

MIDDLE GROUND – descriptive term to describe the playing area of a stage set as against the foreground or background.

MIDDLETON'S INSTRUMENT – a television apparatus first experimentally shown by its inventor before the Cambridge Philosophical Society on March 8, 1880. The transmitter consisted of a mosaic or bank of small thermoelectric couples connected up to a similar mosaic of couples on the receiving instrument. A crude illuminated image was projected upon the transmitting mosaic and the minute thermoelectric currents thus set up generated heat in the receiving couples. The radiant heat was manifested by means of reflection from a special form of mirror.

MIHALY – see *von Mihaly*.

MIHALY TELEVISION SYSTEM – D. von Mihaly invented an early system of mechanical television which was produced by the Telehor Co. of Berlin, Germany, in 1931. (See *von Mihaly*.)

MIKE – colloquialism for microphone.

MIKE AND IKE – studio terminology for the microphone and television camera.

MIKE TECHNIQUE – The ability of a performer to control his or her voice in relation to the microphone to obtain effective and desired results.

MILLILUX – a unit used in the measurement of small illumination intensities particularly in television research. One-thousandth of a lux.

MILLIMICRON – a term used for expressing small wave-lengths of light. One thousandth part of *micron*.

MINCHIN'S CELL – an electrolytic type of selenium cell first built by Professor Minchin, an Irish physicist, in 1895. It consisted of a short length of aluminum wire, flattened and selenium-coated at one end and enclosed in an open-ended glass tube, which latter was immersed in oenanthol (an organic liquid), in close proximity to the platinum electrode. This cell produced its own current when properly adjusted and illuminated.

MINIATURE – a small scaled setting or display generally used to establish a locale; a maquette.

MIRROR DRUM – a scanning device for low definition television using mirrors and rotated at high speed. Now obsolete. Formerly used in mechanical systems which are no longer popular. The apparatus consisted of a drum carrying a number of tangential mirrors, situated at short angles to one another, and arranged in such a manner that when the drum turned it reflected the rays of light and made them travel in a series of lines so that an image could be scanned. L. B. Atkinson is credited with inventing the device in 1882. His apparatus was placed in the London Science Museum. The principal advantage of the mirror drum was that it permitted a more intense spot of light to be focused upon the subject.

MIRROR EFFECT – a form of reversed image which formerly occurred on the television receiver screen, the televised picture sometimes appeared with the left and right sides of the original transposed, thus giving rise to the mirror effect. Mirror-drum receivers which had been carelessly or incorrectly adjusted were prone to give rise to this type of reversed picture.

MIRROR SCANNING – A method of mechanical scanning which eliminated the use of a scanning disc was developed by L. Weiller in 1889. He invented a wheel or drum upon whose circumference was arranged a series of mirrors, each placed at a different angle so that when the mirrors were revolving a light beam could be projected by reflection in a series of lines sweeping over the object field. He used a selenium cell at the transmitter and the same type of a drum to recreate the picture, ingeniously using a gas flame as the source of light thus causing it to glow brightly or dimly as a result of a magnetically-operated diaphragm which controlled the pressure of gas.

MIRROR SCREW – a rapidly revolving stack of narrow steel strips, assembled flat-wise with polished light-reflecting ends. The image was received by gazing directly at the mirror faces as they flashed by, each reflecting its own line portion of the picture light rays, picked up by each mirror from its own section of a vertically elongated, gas-filled glow tube, which fluctuated in response to each electric impulse as received from a similar image - scanning device, and photocell, at the transmitter. The mirrors were arranged on a frame in the form of a screw spiral. Unlike the mirror-drum the mirrors were not separately tilted in relation to one another, the directing of the light spot on the screen or object which was being televised being effected by the suitable and exact positioning of the mirrors on the spiral. The mirror-screw did not reflect the light as did

— Courtesy BBC

Mobile Station, with control room and scanner in the foreground; power generator van is in the background

the mirror-drum. It was, however, more compact. It is now obsolete.

MIRROR-WHEEL — See *mirror drum.*

MIXER — a control enabling the television director to use various cameras at will and to superimpose, if desirable, the picture from one camera upon the picture of a second, as well as to fade out at will. The mixer unit not only permits the director or producer to obtain highly original and tricky effects but is invaluable in televising a sports event such as football, swimming, baseball or parades and enables the use of several cameras at various points of vantage by quickly changing or switching from one camera to another and thus show any part of the telecast at will.

MIXING SIGHT — process of using motion picture shots as background for live performers. On the television receiver they come out as one completely-combined picture.

MOBILE STATION — a television station operated at a movable location (mobile unit) as an automobile, ship, train, airplane, etc.

MOBILE UNIT — field equipment mounted on trucks and generally used only in such vehicles. In effect, it is a television station on wheels. It relays picture and sound back to the main transmitter so they can be broadcast to the receivers.

MODEL — a small scaled execution of a television set used in planning camera movements or stage setups. Also called "model set." Again, to move expressively before the camera, as in the case of fashion shows.

MODELED DETAIL – mouldings, pilasters and superficial decoration actually executed in relief to maintain the impression of realism despite changes in camera approach.

MODELING LIGHT – a light source so situated and of such intensity as to bring out the contours and volume of a subject. The direct opposite of "flat light."

MODULATE – To vary, as to vary the amplitude or frequency of an oscillation in some characteristic manner. In television the aerial radiation is modulated or formed to correspond to the image by a succession of video impulses.

MODULATE LIGHT – light that has been made to vary in intensity in accordance with variations in an audio-frequency or code signal or at regular rate produced by a rotating or vibrating shutter.

MODULATED ARC – the Baird modulated arc, shown for the first time publicly at the British Association meeting in the section devoted to Mechanical Aids to Learning in September 1931, made it possible to obtain a brilliantly illuminated image which could be projected successfully onto a large screen.

MODULATED WAVE – a radio wave which varies either in frequency (frequency modulation) or in amplitude (amplitude modulation) in accordance with the wave form of the intelligence signal being transmitted.

MODULATION – the process of putting the audio or video signals or impulses on the carrier wave for transmission through the ether. Two types of modulation are used: (1) Amplitude Modulation, AM; and (2) Frequency Modulation, FM.

MODULATION GRID – an electrode, interposed between the cathode and focusing electrodes in a cathode ray tube, to control the amount of emission and thereby the brilliance of the spot. This controlling effect is produced by altering the voltage of this grid with respect to the cathode.

MODULATOR – a grid or other device to which a varying potential was applied in order to produce a modulating action on the intensity of the beam. The modulator is the part which controls the high frequency alternating currents in the antenna, and modifies them to represent intelligence.

MOLECULE – the smallest integral part of any substance. The molecule in turn consists of small particles called atoms. No matter the substance, solid, gas or liquid, it is composed of minute particles, called molecules, which is the smallest integral part of matter, irrespective of form. There are as many different kinds of molecules as there are kinds of matter (matter is anything acted upon by gravity). Gas, liquids, and solids constitute matter.

MONAURAL — one-eared; having only one ear.

MONITOR — an apparatus for the purpose of reproducing television images and sound so that such reproduction does not interfere with the regular transmission. Used in control rooms to check the quality of the transmission and for quickly locating faults in the channel.

MONITOR OPERATOR — the individual generally stationed in the control room of a television or radio station, who monitors the programs and makes technical adjustments where and when necessary.

MONITOR TELOPTICON — a small device, now obsolete, which in mechanical television systems transferred the impulses to the light valve, where the light was broken up to produce an image that corresponded in every detail to the scene, or object being televised.

MONITOR TUBE — a cathode ray tube at the television transmitting station to verify the quality of the picture being broadcast.

MONITORING — the process of watching or listening to a transmitted program for technical reasons, and controlling at the transmitter, the picture shading and other factors of scene and sound.

MONKEY CHATTER — garbled speech or music heard along with a tuned-in program. This type of interference happens when the side frequencies of an adjacent channel station beat with the desired station signal.

MONOCHROMATIC — consisting of only one color. At present, television is primarily monochromatic — its pictures are in shades of gray and white.

MONOCHROME TRANSMISSION — the transmission of television signals that are reproduced in graduations of one color only. At present the pictures received are in shades of gray and white (so-called black and white).

MONOCULAR — one-eyed, having only one eye. Television is monocular and monaural. As a result, it does not have the three-dimensional perception of the human system. These deficiencies are partly compensated for by careful camera manipulation and lighting in the video and by the judicious handling of aural or acoustic perspective in the audio. Television is less effective than the average human ear-eye combination in that it does not see and hear as clearly and cannot reproduce the same degree of visual definition and aural quality.

MONOSCOPE — a special television camera tube designed to produce a simple picture or pattern used for testing purposes. Also called "monotron," "phasmajector," etc. This tube resembles the iconoscope in make-up but in place of the mosaic it has a target upon which is printed the image whose video signal it is desired to reproduce. The tube is used to provide a satisfactory signal source for television receiver test purposes during those occasions when there is no television program on the air.

MONOTRON – See *monoscope*.

MONTAGE – a series of three or more pictures achieved by superimposing one camera image over another by means of dissolves. It is the art of arranging pictures or sound in such a sequency that an extra effect is achieved through association of ideas. It is the most powerful technique used in motion pictures for adding suggestion to the screen. It is the suggestion of idea, such as the closeup of a plate of food with a shot of a child's face looking down on it so that the spectators can see that the child is hungry. Syn.: superimposure.

MOORE LAMP – a special type of neon lamp used in the Jenkins television system. Invented by Dr. D. MacFarlan Moore. It consisted of a neon tube, two electrodes which were placed concentrically and separated by a glass cylinder, an arrangement which enabled the glow discharge of the lamp to be concentrated about the center of the positive electrode, thus permitting a brighter source of light to be obtained.

MOSAIC – in television, the light-sensitive surface or plate mounted in the iconoscope and orthicon (camera tube). The picture is imaged upon it and scanned by the electron gun. In one form it consists of millions of tiny silver globules on a sheet of ruby mica, with each globula treated with caesium vapor to make it more sensitive to light. Its counterpart in a film camera is the photo-sensitive emulsion of the film. The term is also applied to the test pattern placard on which camera is focused for testing purposes. The mosaic is in the form of a surface being a number of little pieces fitted together like the tiles on the bathroom floor.

MOSAIC SCREEN – a screen in which are imbedded photoelectric particles insulated from each other and which change light energy into electrical energy.

MOSER'S THEORY – a theory of light-sensitivity of selenium first announced by Moser in 1881. This theory suggested that the effect was brought about by heat which rendered more complete and effective the contact between the selenium element of the cell and its electrodes. The theory was found untenable.

MOTION PICTURES – a moving picture film. Colloquialism, "movie"; film.

MOTION-PICTURE PICKUP – the use of a television camera to pick up scenes directly from motion-picture film.

MOVING-TAPE TRANSMITTER – a modification of a film transmission devised by video engineers for the purpose of sending printing characters. The messages were printed on a tape by means of a special typewriter, after which they were televised. However, it is not applicable to sending of images.

MUFFS – colloquialism for headphones or earphones used in television studios.

MUGGING – overemphasis or exaggeration of either action or wordage.

MULLER POLYFACED MIRROR DRUMS – one small drum rotating at high speed to obtain horizontal sweep, the other, larger and turning more slowly, for moving the rapidly sweeping light beam more slowly up and down on the screen at the picture-frame frequency. Used in mechanical systems, now obsolete.

MULTI-CHANNEL SYSTEM – a system of television transmission in which the image signal is divided into a number of relatively narrow bands in the frequency spectrum by means of filters. Each band is transmitted over a separate channel, and all are recombined at the receiving end.

MULTI-CHANNEL TELEVISION SYSTEM – See *three-channel television system.*

MULTIGRAPH TRANSMISSION – the condition in which the radio signal from the transmitter travels by more than one route to a receiver antenna usually because of reflections from obstacles. This condition usually results in ghost pictures.

MULTI-IMAGE – See *ghost.*

MULTIPACTOR – an electron multiplier tube developed by Philo Farnsworth.

MULTI-PATH REFLECTIONS – See *picture ghosts,* and *multipath transmission.*

MULTIPATH TRANSMISSION – the condition in which the radio signal from the transmitter travels by more than route to a receiver antenna usually because of reflections from obstacles. This condition generally results in *ghost pictures.*

MULTIPLE LIGHT-BRUSH SYSTEM – system of television developed by Dr. E. F. W. Alexanderson, using mechanical scanners. The projector reflected a cluster of seven lights on the screen and when associated mirrors on a drum revolved, the spots of light gyrated to cover the entire screen with light that "painted" the picture. He demonstrated his system in St. Louis on Dec. 15, 1926.

MULTIPLE RELAY – more than one relay station.

MULTIPLE SCANNING – expression formerly used in reference to television systems using two scanning devices, such as two mirror-drums, reflecting the televised picture on the screen. The purpose of these methods was to increase the intensity of the illumination on the screen. That is the repeated scanning of a television image by two or more scanning beams. Synonym: interlaced scanning.

MULTIPLEX RADIO TIME MODULATION – or Pulse Time Modulation. Abbreviated: PTM, is a system capable of transmitting simultaneously a number of telephone or telegraph channels on micro-wave frequencies. This system can also transmit simultaneously the sound and picture channels of a television program. The pulse time method of modulation consists of emitting short pulses of high frequency radio energy. These pulses are of constant amplitude and at the same carrier frequency. Modulation is effected by transmitting a synchronizing or "marker" pulse at fixed times and following this pulse with the "signal" pulse at variable time intervals. The position of the "signal" pulse at any given time depends on the modulation to be transmitted. At the receiving end, the time of arrival of the signal pulses with regard to the marker is reconverted into the corresponding amplitude of the modulating signal. In effect, the PTM system chops the signal to be transmitted into small bursts which occur at such a rate that the ear is unable to detect the interruptions. This is similar to a motion picture where the spectator watches a screen which is completely dark during a large portion of the time a film is being shown, and yet the eye does not detect the dark intervals.

MULTI-SPIRAL DISC – mechanical type of scanning disc perforated with more than one spiral series of apertures. Discs of this type were produced by several inventors. Some of them, as the Sanabria disc, gave rise to a scanning principle in which the image was scanned in non-adjacent rows.

MURAL BACKGROUND – a photographic enlargement of an exterior or other scene as a background or as a breaking for practicable openings in a set to give the impression that the photographic scene actually exists in the studio.

N

NAB – abbreviation for National Association of Broadcasters.

NBC – abbreviation for National Broadcasting Co.

NARROW ANGLE LENS – lens with narrow angle of projection, that is, it picks up a small section of a set at a specified distance.

NATIONAL ASSOCIATION OF BROADCASTERS – an organization operated by and for the benefit of American radio broadcasting station owners. Headquarters in Washington, D. C.

NATIONAL BROADCASTING CO. – an American corporation organized for the purpose of providing radio and television programs to the owners of radio and television receivers throughout the United States. It is a subsidiary of the Radio Corp. of America. Headquarters are in New York City, at 30 Rockefeller Plaza. The firm owns and operates Television Station WNBT. Key radio station is WEAF in New York. Abbreviation: NBC.

NATIONAL RADIO BROADCASTING – radio broadcasting intended to be received primarily in territory of the country in which the originating station is located. (The term "territory of the country" includes possessions whether or not connected by land with the country, e. g., Hawaii and Netherlands East Indies are considered as part of the territory of the U. S. A. and the Netherlands, respectively.)

NATIONAL TELEVISION SYSTEM COMMITTEE – a group of individuals or committee organized in the United States in 1940, consisting of representatives of all American companies and organizations interested in television. It formulated a set of television standards that were found acceptable to the majority and approved by the Federal Communications Commission.

NATURAL COLOR TELEVISION – See *color television.*

NAUMANNITE – a rare mineral containing selenium, chiefly in the form of selenide of silver. It was so named in honor of its discoverer, Dr. C. F. Naumann, a German mineralogist.

"NEAR" ULTRAVIOLET LIGHT – that portion of ultraviolet light nearest the visible portion of the spectrum. It contains some visible light of the shortest wavelength. (See *ultraviolet light.*) Popularly known as "black light", because the major portion is invisible to the eye.

NEGATIVE GHOST – ghost images in which the black and white areas are reversed.

NEGATIVE IMAGE – an image resembling that shown by a photographic negative, for example, one in which the light parts of the original picture are dark and the dark portions of the original are light. It is the opposite to a positive image. Some video receivers will give rise to a negative image on the screen when a maladjustment or fault is present in the electrical circuit of the receiver.

NEGATIVE LIGHT MODULATION – in television, a method of transmission in which a decrease in scene illumination causes an increase in the radiated power of the transmitter. Also known as negative modulation, and negative transmission.

NEGATIVE MODULATION – See *negative light modulation.*

NEGATIVE TRANSMISSION – the term "negative transmission" means that a decrease in initial light intensity causes an increase in the transmitted power. (See *negative light modulation, negative modulation.*)

NEMO – broadcast originating in some location other than in the television studios.

NEON – a colorless odorless gas present in extremely small proportions in ordinary air, one volume of neon being present in nearly 90,000 volumes of air. For electrical purposes, neon is manufactured by selective distillation of large quantities of liquid air. Discovered by Sir William Ramsay.

NEON BULB – a glass tube filled with neon gas and containing two insulated electrodes. This bulb was used in mechanical television systems since neon bulb illumination followed the impressed signal without much lag.

NEON CELL – a cell which converts the varying electrical impulses into light waves.

NEON-MERCURY LAMP – a type of gas discharge lamp containing neon gas and mercury vapor under low pressure. Lamps of this nature formerly used in mechanical systems gave a high-efficiency glow discharge, particularly when the lamp was made so that the glow was confined to a small area.

NEON TUBE – In the late 1920's and early 1930's, the neon tube gave the amateur television experimenter a means of conducting his work at a moderate cost. For several dollars, it was possible for him to purchase a neon tube with an inch-square plate, to produce an image of similar size, scanned by a pinhole disc, which he viewed through a magnifying lens. Receivers of this type were marketed, in actuality, to the public by the Jenkins and "American Baird" companies during that period. Reception was greatly improved when the neon "crater" tube was developed. This had a tiny "crater" of brilliantly glowing ionized gas, bright enough to project a picture a few inches square when used with a scanner in which lenses replaced the pinholes, to pass more light. William H. Peck, using this principle, was able to show pictures 2 by 3 feet.

NETHERLANDS – See *Holland.*

NETWORK – a number of associated broadcasting stations connected by radio or telephone lines so that all can broadcast the same program simultaneously.

NETWORK SHOW – a television or radio program produced in one or more main studios and broadcast simultaneously over two or more stations that are interconnected by telephone lines to form a network.

NEWSCAST – a television or radio broadcast of the latest news and commentaries of the analyst interpreting the news.

NEWSCASTER – individual who has edited and reads the latest news reports going out via the airwaves. Called a commentator if facts are interspersed with personal opinions and interpretations.

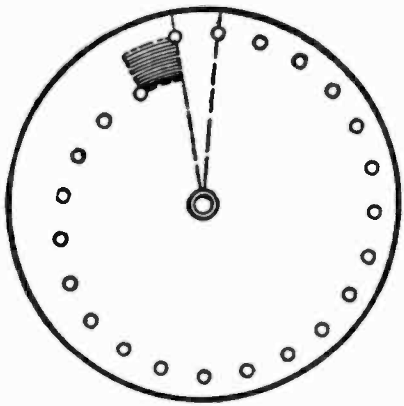
NEWTON'S DISC – a disc of cardboard or other material around which have been painted in equal sectors the colors of the spectrum – violet, indigo, blue, green, yellow, orange and red. When the disc is rapidly rotated the various colors blend together, forming under ideal conditions, a white appearance, or rather a greyish-white rather than pure white. Newton's disc served to illustrate the fact that white light is a composite of all the colored rays of the spectrum.

NEWTON'S RINGS – term applied to rings of colors which appear when two ordinary flat surfaces of glass are pressed together. The name is after Sir Isaac Newton who conducted many experiments with the phenomenon. They are due to the light-interference effects of a thin layer of air existing between the two surfaces of glass which are not perfectly flat. If they were flat the rings would vanish. The production and disappearance of Newton's rings form a very delicate optical test for perfect flatness which was formerly used in the making of "optical flats" for the construction of mirrors and color-filters of extreme accuracy in television and other scientific purposes.

NICKEL — a silvery - white metal, which, although hard, is malleable and ductile. It is slightly magnetic. In television and radio construction, nickel is used widely for the making of "metalwork" of cathode-ray tubes, neon lamps, valves, and other similar devices.

NIGHT ERROR — mistake in direction determination due to the movements of the Heaviside - Kennelly Layer, particularly at night.

NIPKOW DISC — a flat circular plate having one or more spirals around the outer edge with successive openings located so that rotation of the disc provides scanning of small elementary areas of an image in correct sequence for a mechanical video system. Invented by Paul Nipkow, Polish scientist, in 1883. Although he never built the apparatus, he filed an application for a patent in Germany which he allowed to lapse for lack of funds. His disclosure of the scanning-disc principle was a great step forward at that time toward realizing practical television by transmission of successive picture-element values. It spurred numerous other workers to further successes — experimenters who used such a scanning disc with various modifications.



The Nipkow scanning disc. Each hole scans one progressive path as indicated

NOCTOVISION — a video system employing invisible rays, usually infra-red, for scanning purposes at the transmitter to give the equivalent of seeing in the dark. This system was invented by J. L. Baird in 1926. The person or scene to be televised was placed before the transmitter in a darkened room and then his features or the scene was flooded with infra-red light to which the subject's eyes were practically insensitive so that, at the most, all he could see was a slight dull-red glow. The subject was scanned in the usual manner by the mechanical revolving disc or mirror-drum, the infra-red rays being picked up by the photoelectric cells of a special pattern which were highly sensitive to infra-red rays. In this way, a person seated in apparent darkness was televised and made to appear on the receiving screen as though he had been subjected to normal white light illumination.

NOCTOVISOR — term used by the Baird Co. to denote its infra-red ray television transmitter. (See *noctovision.*)

NOISE — an unwanted signal interference picked up by the receiver, such as short wave diathermy or radio frequencies from adjacent channels. Also, as background, the effect on the television picture of random disturbances such as those arising from thermal agitation in vacuum tubes in the television amplifying system, thus resulting in a grainy texture in the video image.

NOISE FILTER — an apparatus which is inserted between a wall outlet and the power cord of a radio receiver to block noise interference which might otherwise enter the receiver.

NOISE - REDUCING ANTENNA SYSTEM — an antenna system in which the only part capable of picking up signals is the antenna proper which is erected high enough to be out of the noise - interference zone. The lead-in is a special shielded cable or twisted two-wire line which can pass through the interference zone without picking up noise signal.

NON-CONDUCTOR — any material which offers very high opposition to the flow of electricity. An insulating material.

NONDIRECTIONAL — the ability of an antenna to receive signals equally as well from all directions.

NON-FOCAL PLANE — the non-focal plane class of scanning device comprises those apparatus in which the function of the moving elements in the mechanical system is to deflect a beam of light for traversal purposes in some plane spaced from the moving elements. This is exemplified by mirror-drums, pairs of mirror-polyhedra, lensed discs, and drums and the mirror-screw.

NON-MAGNETIC — materials which are not affected by magnetic fields. These include brass, copper, glass, paper and wood.

NON - SEQUENTIAL SCANNING — scanning consisting in traversing successive strips in different parts of the scanned area in some arbitrary sequence until the whole area has been explored.

NONSTORAGE CAMERA TUBE — a television camera tube in which the picture signal is at each instant, proportional to the intensity of the illumination of the corresponding elemental area of the scene at that instant.

NONSYNC — See *nonsynchronized.*

NONSYNCHRONIZED — an effect which is not directly caused by a particular action seen in the video, but which is motivated by the inner meaning of a production suggestion through the use of sound without source, for example, whistling without seeing the whistler . . . suggesting menace, etc. . . . crunching on gravel suggesting nearness of another person, etc. . . . Also, not in synchronization of receiver with transmitter.

NOODLE – to play a few bars of background music or improvisation, usually behind titles – known as "noodling."

O

OBJECTIVE – that lens in an optical system which first receives light or the equivalent electron lens in an electronic system.

OBLIQUE – between the horizontal and the vertical; slanting as a line; deviating from the perpendicular.

OBLIQUE ANGLE – an angle less or greater than a right angle, as an acute or obtuse angle.

OBLIQUE DISSOLVE – See *diagonal dissolve*.

OBSERVER – name formerly suggested for a television spectator or viewer, as most descriptive, since observation is the function of both the eye and ear. Not accepted for wide usage.

OBSOLESCENCE – out of use, worthless in present-day standards.

OBSOLESCENCE-FREE – not liable to become out of date because of new developments or inventions.

OFF CAMERA – that camera not feeding the transmitter line.

OFF-SCREEN VOICE – the voice of an individual not showing in the television picture. Generally used for narration, announcements, etc.

OFF-THE-CUFF – This designation is used in connection with program productions to mean that the actions being televised have not been rehearsed or given preliminary camera preparations. Most on-the-scene-action events such as sporting events, news events, etc., are produced off-the-cuff.

OFFICE SET – a conventional arrangement of furnishings and wall units suitable as a stage setting for a news commentator or interviewer.

OHM – the unit of electrical resistance; a resistance such that a one-volt addition to the potential produces one ampere of current.

OHMAGE – the ohmic or electrical resistance of a conductor.

OHM'S LAW – the most important law in electricity. Theoretically, it defines resistance and conductance in terms of current strength and electromotive force in terms of current and resistance.

OLEO – a painted backdrop.

ON - THE - AIR – program is being transmitted over the air.

OPAQUE – not transparent and, therefore, not passing light rays; not passing any form of radiant energy.

OPERATOR — an individual whose duties include the operation, adjustment, and maintenance of a television or radio transmitter, or other communication apparatus.

OPTICAL BALANCE — a method for increasing the depth of focus of any camera lens, whether still or motion picture or television camera. Developed by Stephen E. Garusto of the United States, and demonstrated in New York in August of 1944. The three-dimensional effect is gained through a "supplement" to the camera lens which will work just as well for live telecasts, either studio or outside pickups, as for film programs.

OPTICAL CHARACTERISTICS — Television, like motion pictures, depends for its animated reproduction upon a common and well-recognized optical characteristic, persistence of vision. This is the condition which causes the human eye to retain its impressions of any scene for a trifle of a second after the actual scene has been removed. Its simplest demonstration is the continuous circle of light seen when a glowing cigarette is whirled rapidly in the darkness.

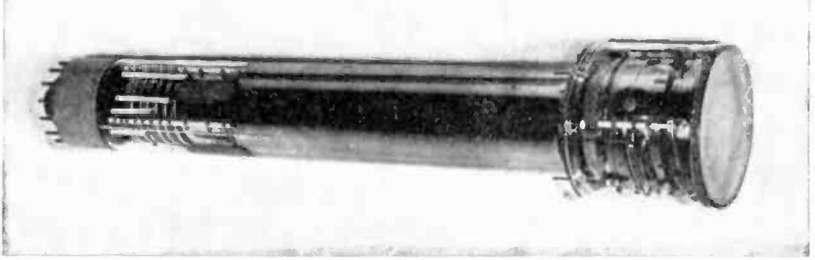
OPTICAL ILLUSION — an object appears large or small, near or distant, according as the rays from its opposite borders meeting at the eye, form a large or a small angle; when the angle is large, the object is either large or near; when small, the object must be small or distant. By reason of irradiation in the eye, the sun appears larger than it would if illuminated by a fainter light and a man in a white suit appears larger than he would if he wore dark clothes. The persistence of impressions on the retina for a fraction of a second after the object which produced the impression has been removed, produces another class of illusions. (See *persistence of vision*).

OPTICAL LENS — the lens focusing the image of the scene to be televised on the light-sensitive plate of the camera tube.

OPTICAL PROJECTION — a method of producing on a screen a magnified illuminated image of a small picture. The earliest means of optical projection was the magic lantern, said to have been invented in the first half of the seventeenth century and which since has been greatly modified and perfected. The source of light was in the heart of the lantern, and was either a limelight or an electric light. The rays were thrown through a powerful lens or series of lenses known as the condenser, and as they converged they were received by a second system of lenses, the relative positions of which were altered to suit the distance and size of the screen.

OPTICAL VIEW FINDER — the device on a video camera which permits the cameraman to frame and focus accurately the desired section of the scene to be televised.

OPTICS — that branch of science which deals with the phenomena and study of light and vision. It includes the origin, behavior and effect of light



— *Courtesy RCA*

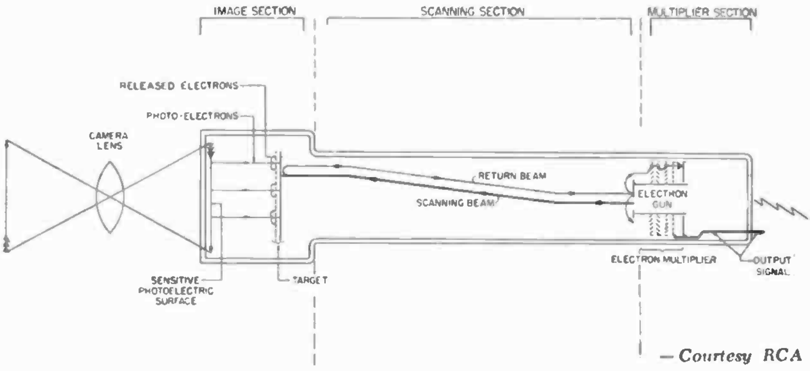
Orthicon

at different frequencies. Electron optics deals with the behavior of an electron beam under the influence of varying electrostatic field. This action is similar to the behavior of light in a lens system.

OPTIMUM VIEWING DISTANCE — For home television, the optimum viewing distance from the screen is probably of the order of four times the screen height. Less detail results in unsatisfactory viewing conditions as regards image structure; the scanning lines become visible and bothersome. Greater details (that is, more lines), permit closer viewing distances, with satisfactory characteristics.

ORIGIN DISTORTION — a type of image distortion which is set up on the fluorescent screen of some low-voltage cathode-ray tubes under certain conditions. Bright cross lines appear in the center of the screen. Since modern tubes are of the vacuum type and magnetic deflection is used this problem is not important.

ORTHICON — an improved camera tube of extra-light-sensitivity, developed by RCA, used in field equipment for outdoor pickups. It makes possible transmission of scenes which previously could not be picked up, and enables the television "eye" to see anything that the human eye can see. Twilight scenes, or illumination by candlelight or matches are made visible through this highly-sensitive camera. It is more sensitive than the iconoscope. Orthicon is more or less an abbreviation for "orthiconoscope" — which is the full name of the camera tube. This development of a new storage-type pickup tube was announced in the early months of 1939 by H. Iams and A. Rose. The orthicon displays no spurious signal and there is accordingly no background shading defect to be compensated. Its storage efficiency is 100 per cent as compared to the storage efficiency of the iconoscope which was put at from 5 to 10 per cent. It employs low-velocity electrons for scanning.



— Courtesy RCA

Orthicon Tube

ORTHICON CAMERA — pick-up camera employing the *orthicon tube.* Generally referred to, however, as "orthicon."

ORTHICONOSCOPE — See *orthicon.*

ORTHOCRON — an improved form of the iconoscope, the RCA *camera tube.*

ORTHODOX SCANNING — this consists in traversing an area in adjacent parallel rectilinear strips, starting at one corner and progressing steadily to the diagonally opposite corner.

OSCILIGHT — the vacuum tube in the Farnsworth system. The system comprises this vacuum tube having an electron gun and a fluorescent screen, positioned in a focusing and deflecting coil system. In all, it is a cathode ray tube used for camera purposes.

OSCILLATE — the condition under which the electrons flowing in the tuning circuit of the receiver cause it to become a transmitter of radio waves.

OSCILLATION — the back and forth surge of an electric current or electrons in a circuit.

OSCILLATOR — any nonrotating device for setting up and maintaining oscillations of a frequency determined by the physical constants of a system, such as a vacuum tube, spark or arc generator. A test instrument for generating an audio-frequency signal at any desired frequency for test purposes.

OSCILLATOR SCANNING — a system of scanning in which the scanning spot moves repeatedly to and fro across the image so that successive lines are scanned in opposite directions. After each complete oscillation the light spot shifts laterally thus enabling a new area of the picture to be scanned.

OSCILLOGRAM — name given to the wave-like pattern, representing the graphical form of an alternating current, which is traced out by the light spot on the fluorescent screen of a cathode-ray oscillograph tube.

OSCILLOGRAPH — an instrument for producing or recording photographically a curve representing the waveform of a varying current or voltage. (See *cathode-ray tube, oscilloscope.*)

OSCILLOSCOPE — an apparatus or test instrument for showing visually on the screen of a cathode ray tube the wave-form of a rapidly varying quantity such as an alternating voltage. The instrument shows the graph on the screen without producing a record of it. Several engineers use the terms oscilloscope and oscillograph interchangeably. (See *oscillograph.*)

OUTDOOR ANTENNA — an elevated wire erected outside the house. It should be elevated as highly as possible above obstacles such as buildings, trees, and carefully insulated from the earth.

OUT OF FRAME — the state of a televised image when, as seen on the screen of the receiver, is divided horizontally or vertically; that is, the two portions of the image appear in opposite positions. The image is correctly "framed" by the manipulation of a small control which influences the synchronizing gear of the receiver.

OUTPUT — the useful electrical energy delivered by a radio receiver a. f. amplifier, electrical generator, or other signal or power source.

OVERLAPPING SCANNING — in this system, the strips are wider than their spacing allows, resulting in overlapping of the edges of adjacent strips.

OVERTONE — In a complex tone, any of the components above the fundamental frequency.

OXYGEN — Colorless, odorless, life-giving gas which constitutes about 23 parts by weight of the earth's atmosphere. Small traces of pure oxygen were sometimes introduced into certain types of photoelectric cells in order to modify their response to light action. Caesium-oxygen cells, for example, were especially sensitive to red light.

P

PTM — abbreviation for pulse time modulation.

PADS — electrical apparatus used to reduce the level of picture or of sound.

PAN — to tilt or otherwise move or sweep a television camera vertically up and down or horizontally from left or right to keep it trained on a moving object or secure a panoramic effect (from panorama). Pan means to "turn." A pan shot moves in the horizontal. (See *panning.*)

PANCHROMATIC – a substance sensitive to all wave-lengths with the visible spectrum although not uniformly so. The term is used in studying cathode ray screens.

PANCHROMATIC FILM – film that is sensitive to light of all colors and which reproduces all colors in their true gray scale values.

PANNING – moving a television camera in either horizontal or vertical planes or a combination, to keep a moving object in the picture or secure a panoramic effect. (See *pan.*)

PANORAMA – a view in all directions; a scene that moves before one's eyes; a great painting of scenes made to move past the spectator. Panoramic is the adjective form.

PANORAMIC CAMERA – a camera with a revolving lens to take an extensive lateral view.

PANORAMIC RECEIVER – a radio receiver that permits continuous observation on a cathode-ray tube screen of the presence and relative strength of all signals within a wide frequency range and below the frequency to which the receiver is tuned. Used in communications for monitoring a wide band, for locating open channels quickly, for indicating intermittent signals or interference, or for monitoring a frequency-modulation transmitter.

PANORAMING – See *panning*.

PANTELEGRAPH – name given to an early picture-transmission device demonstrated in 1856 in England by Abbe Caselli, an Italian. Caselli's pantelegraph was a modification of the chemical telegraph recorder, a metal stylus at the receiving end tracing out a pattern or a drawing on a paper sensitized by potassium cyanide. This apparatus was in actual operation between Paris and Amiens, France, between the years of 1865 and 1869.

PARABOLA – a special direction microphone mounting used to pick up crowd noise, orchestral music, etc.

PARALLEL METHOD OF TRANSMITTING VISUAL INFORMATION – a method wherein it is necessary to provide a separate communications channel for each picture element and cause each channel to respond only to the changes of its particular picture element. It is only practical when the number of picture elements in the image is small and when the distance of transmission is short enough to make feasible the great number of separate circuits needed. The animated electric signs in which bulbs are used for picture elements, each wired to a separate circuit, is the only practical application of the parallel method of transmission. For pictures containing 100,000 picture elements or more, which is typical of modern television work, it is obviously impractical to provide the necessary number of individual circuits for parallel transmission. The alternative is to employ one communication channel and to send the picture-element impulses one after the other in orderly sequence at a very rapid rate. This is the so-called *successive method of transmission*. It is used universally in television and in the simpler processes of still-picture transmission by wire-photo and radiophoto systems.

PARAMOUNT PICTURES, INC. – motion picture producing concern which is participating in the development of television through financial interests in Allen B. Du Mont Laboratories, and the Scophony Corp. of America. It also operates, through subsidiaries (Television Productions, Inc., Hollywood, Cal.) television broadcast stations in Hollywood (W6XYZ) and Chicago (WBKB).

PARTIAL IMAGE – In present-day electronic television, a partial image is almost impossible. If the synchronizing is off, a jumble of streaks will result. A partial image, however, may occur if fly-back time is too large (much larger than 15 per cent of the horizontal scanning time).

PATENT – a document conferring on an inventor for a specific number of years, the exclusive right to make, use and sell his invention in practical form. It is based on evidence of priority of creative conception, protects from the date the patent is allowed by governmental consent, but does not protect during the period a patent is pending or before an application is made.

PEAK – maximum amplitude of sound in electrical energy formed while flying through a circuit.

PEAK POWER – the term "peak power" means the power over a radio frequency cycle corresponding in amplitude to synchronizing peaks.

PEAKING – a technique of increasing the response of amplifiers at some particular range of frequencies.

PEAKS – the distortion resulting when the amplitude is too great for the apparatus.

PEDESTAL – the solid base on which a camera may be mounted. Such a base is equipped with small casters so that the pedestal and camera may be moved about easily and quickly from position to position. Also, the constant voltage value existing in a television signal just before and after transmission of synchronizing impulses. The pedestal is the pulse which "blanks out" the undesirable signals produced by the return line in the kinescope.

PEDESTAL LEVEL – normal black level. (See *transmission standards.*)

PENCIL OF LIGHT – name given to a narrow beam of light ray which diverges from or converges to a point or area. The "flying" spot of a disc television transmitter was, for example, created by a pencil of light.

PENTODE – a vacuum tube having five electrodes. Ordinarily these will be the cathode, control grid, screen grid, suppressor grid, and anode.

PERAMBULATOR – name of apparatus upon which the television cameraman rides. It can be moved near or farther away from the scene as desired.

PERFORATE – to pierce through; to make holes. In mechanical television, discs containing small grounded transparent dots which give the appearance of holes and permit passage of light. (See *Nipkow disc.*)

PERIODICITY – rhythmic activity. (See *frequency.*)

PERIPHERAL – situated or produced around the edge.

PERSISTENCE – an operating characteristic of a phosphor used in the luminescent screen of a cathode-ray tube, indicating how fast the radiated light disappears after the excitation is removed. If the rate of the decay is very quick, appearing instantaneous to the eye, the phosphor is fluorescent. If the decay is slow enough to show a noticeable persistence of radiated light after excitation is taken away, the phosphor is phosphorescent.

PERSISTENCE CHARACTERISTIC – an important operating characteristic of a phosphor is its persistence characteristic. When the excitation is removed from the phosphor, the radiated light does not immediately disappear, but decays according to an exponential law. If the rate of decay is very rapid so that the effect on the eye is practically instantaneous, the phosphor is fluorescent. If the decay is slow enough to show a perceptible persistence after the excitation is removed, the phosphor is known as phosphorescent.

PERSISTENCE OF THE SCREEN – Once a fluorescent material is bombarded by an electron stream, it will continue to glow even after the electron stream has moved away or has been discontinued. It is possible to make phosphor materials which will glow as long as one minute after excitation, but these materials are unsuitable for cathode-beam tubes. In television, it is desirable to use materials which will fade out quite rapidly after the excitation has been removed. The glowing of the screen after removal of excitation is referred to as the "persistence of the screen." The persistence characteristic of a fluorescent screen is highly desirable in that it aids the persistence of vision of the human eye, thereby reducing flicker and helping to maintain screen brilliancy.

PERSISTENCE OF VISION – the visual effect by which humans continue to see an object or image for a fraction of an instant after it has vanished. This phenomena makes it possible to see true continuous motion by watching a series of individual pictures produced on a television or motion picture screen. Persistence of vision is employed in the movies by advancing film at a speed which causes either 16 or 24 individual pictures, or frames, to fall upon the screen every second. Thus the lingering impression of each still picture bridges the gap between pictures and the presentation blends into a continuous animated scene. Television employs the same technique — rapid presentation of a sequency of individual pictures seen as one continuous animated picture. This illusion is made possible by normal persistence of vision and is aided by the so-called *storage effect* in the picture tube of the television camera. In television 30 frames per second are used instead of 16 and 24 in the movies. Persistence of vision is due to the fact that there is an actual sluggishness in the eye or time lag in the action of the retina and optical nerve.

PHASE — a term used to designate the time relation between the maximum points of two recurrent electrical quantities.

PHASE DISTORTION — distortion of received signals due to unequal phase shifts (see) occurring in a circuit for different components of the frequency band being handled. Phase distortion is highly important in television although not ordinarily so in radio.

PHASE MODULATION — a means of modulating a carrier-frequency current by causing the phase of the modulated signal — with respect to the unmodulated carrier — to vary from instant to instant in accordance with the audio-frequency or other modulation signal. The power output of the transmitter is constant at all times, resulting in comparatively high efficiency.

PHASE SHIFT — a condition in television reception in which, owing to stray circuit capacities in the receiver, the fluctuations in the voltage do not keep in step with those ordinarily transmitted, particularly at low and high frequencies. This results in some of the details of the televised picture being received at a later instant of time than the remainder of the picture, thereby setting up a displacement or distortion of the televised picture. (See *ghost; phase distortion.*)

PHASE SWINGING — lack of synchronism throughout the individual cycles of the frame frequency generators at the transmission and reception ends of a video system causing the received image to wander over the screen.

PHASING — that process by which the forming of the image is synchronized. In the old mechanical television receivers, phasing was accomplished manually. In contemporary television receivers, the scanning is synchronized automatically with the transmitted signal.

PHASMAJECTOR — a special vacuum tube used to produce a television signal from a fixed image for test purposes. The image is printed on the signal plate inside of the tube. Also called monoscope, monotron, etc.

PHILLIPS (Eindenhoven, the Netherlands) — name of one of the world's largest manufacturing radio-television organizations, located at Eindenhoven. Subsidiary company in America is North American Philips which has built a number of projection tube television receivers for home installations.

PHONE — a headphone, abbreviation for telephone.

PHONIC DRUM — an early synchronizing device employed by television workers in the pioneering days. Invented by M. la Cour. The phonic drum consisted of a hollow drum made of wood or some non-magnetic material such as aluminum or copper, on the outer edge of which was fixed at regular distances apart, a series of iron strips. Caused to rotate in close proximity to the poles of an electromagnet which was fed with alternating or fluctuating current, the phonic drum could be used as a simple type of synchronous motor.

PHONOGRAPH — the modern name for the gramophone. Strictly speaking it refers to the Edison phonograph. However, today it is recognized to be a device for converting mechanical vibrations into sound waves. The electrical phonograph contains a motor which derives its power from an electrical source; the mechanical phonograph utilizes a hand-wound type of mechanical motor. These phonographs are used in console combinations containing units for television reception, radio receptions, and a phonograph or record player. Commonly referred to simply as a "record player." Also, victrola, which is the trade name of a phonograph manufactured and sold by the RCA Victor Division of the Radio Corp. of America.

PHONOGRAPH PICKUP — an apparatus or device used to change variations in a phonograph-record soundtrack to a fluctuating electric current.

PHONOMETER — an instrument for measuring the number or force of sound waves.

PHONOSCOPE — an instrument which represents sound as vibrations in visible form; a device for testing the strings of musical instruments.

PHONOVISION — a system in which the picture-forming signal was recorded on a disc and later reproduced, enabling the recorded image to be made visible in a television receiver. The process was invented by J. L. Baird. The word was coined by the Baird Co. of London, England, to designate the process by which the televised picture or image might be stored up in the form of a phonograph record and subsequently used as often as desired. In the phonovision system the electrical impulses from the transmitting photocells were led to a recording pickup which traversed a wax blank on an ordinary recording machine. In this way the varying electrical pulses were stored up in the form of variations of the groove. When it was desired to reproduce the image or picture thus "bottled or storaged up," the record was played over with a pickup, the output current from which, after being amplified, was led to a neon lamp in front of which revolved a scanning disc. A spectator glancing through the disc would see a reproduction of the original image. Phonovision, at the present time, is still merely a scientific curiosity, but it undoubtedly has many interesting possibilities.

PHONOVISOR — name of recording

machine which fed the signals to the electrically-operated cutting stylus of a recording machine and caused it to cut a record of the scene on the surface of a wax master disc mounted on a turntable driven through gearing by the same motor which drove the scanning disc. From the wax master, permanent discs were made in the usual manner. (See *phonovision.*)

PHOSPHOR – a photo-sensitive material used in the luminiscent screen of a television picture tube or cathode-ray tube. Zinc silicate, zinc sulphide, and cadmium tungstate are examples. In television work, a phosphor is used in producing the mosaic in iconoscopes, orthicons, and kinescopes. The mosaic or screen serves to convert the energy in a scanning electron beam into the light which makes up the reproduced picture. Phosphor is the generic name for any fluorescent substance used for coating the screen of a cathode ray tube.

PHOSPHORESCENCE – the property of continuing to give off a faint light in the dark *after* exposure to light rays (distinguished from fluorescence. (See *afterglow and fluorescence.*)

PHOSPHOROSCOPE – a device for measuring phosphorescence; also, a toy consisting of various glass tubes filled with phosphorescent material, each emitting a different colored light.

PHOTICS – the science which treats of light.

PHOTOCATHODE – a cathode that emits electrons under the influence of radiant energy such as light. Used in phototubes.

PHOTOCELL – contraction for *photoelectric cell.*

PHOTOCONDUCTIVE CELL – a light-sensitive cell whose resistance varies with the illumination on the cell. The selenium cell is an example. Photoconductive cells are usually called photoelectric cells or photocells (see) as they are true cells.

PHOTO-CONDUCTIVITY – the property possessed by certain properties, such as selenium, of varying their electrical conductivity under the influence of light.

PHOTOELECTRIC – the property of certain substances of giving off electrons or creating an electric potential under the influence of light. A photoelectric cell is a device which gives a varying electric current in response to the variations of the light rays falling upon it. Selenium is no longer used in television work as its action is considered too sluggish. Photo is derived from the Greek word "phos" meaning light, while "electric" is from the Greek "elektron" and the Latin "electrum" meaning amber. Thales of Miletus was the first to notice that when amber was rubbed it became capable of attracting light bodies such as bits of paper or straw. It was the first electrical phenomenon produced by man. Sometimes called "photocell."

The photocell, a device for changing light intensity of color variations to corresponding electrical energy, differs from the ordinary radio type vacuum tube which emits electrons because the cathode element is heated. Photo - active substances depend on electron emission caused by peculiar reaction of certain metals when in the presence of light rays. These metals include caesium, lithium, potassium, and sodium. Usually the hydrides and oxides of these metals are used. The sensitivity to different colors and the general reaction characteristics of any substance depends on the emitting material used as the cathode, whether the cell is of the vacuum type or contains a small amount of some special gas. Under ordinary conditions, when a piece of photoelectric active metal is exposed to light, the emission of the electrons is held back by the large atoms of the gases forming in the atmosphere. But if the metal is placed in a vacuum and a beam of light is permitted to strike the metal, the electrons will be thrown into the surrounding space. The number of electrons emitted will be proportional to the intensity of the light. Stronger light will cause a greater number of electrons to be emitted.

PHOTOELECTRIC CELL – a general term applicable to any cell whose electrical properties are affected by illumination; a device which converts variations in light into corresponding variations in voltage or current. Often called photocell. These terms should not be used for phototubes because they are vacuum tubes and not cells.

Photoelectric cells are of two kinds: (1) the emission type and (2) the photronic or self-generating type. Essentially the photoelectric cell consists of a cathode with a photosensitive surface, and an anode to collect the photoelectrons emitted when light falls on the cathode. When this cathode is illuminated, photoelectrons are emitted, and the emissions are in proportion to the intensity of the light. The cell is connected with a battery of sufficient voltage so that the emitted electrons from the cathode may be "drawn off." The photosensitive elements are exceedingly active chemically, readily combining with oxygen. So in practice, they are enclosed in a tube containing an inert gas, or vacuum. When the cathode of a photoelectric cell is exposed to a light source, there are electron emissions from it, and these emissions are in proportion to the varying intensities of that light source. For convenience and to avoid ambiguity, cells are classified as (1) photoconductive; (2) photo-emissive; and (3) photo-voltaic.

PHOTOELECTRIC CURRENT – a current of electrons emitted from the cathode of a phototube under the influence of light.

PHOTOELECTRIC EFFECT – the emission of electrons from a body due to electromagnetic radiation (visible, infra-red, or ultraviolet light), incident on the surface of the body. For a given material, the emission occurs only for a particular band of wavelengths of the incident radiation. For a given wavelength of incident radiation, the rate of emission of electrons is proportional to the radiant flux. With the electronic theory, the photoelectric effect is the very basis of electronic television. It has been found that light falling upon certain metals gives the roving electrons of those metals sufficient energy to escape the boundaries of their atoms, and the emission or escape, of these electrons, and their subsequent passage through a conductor, constitute the photoelectric current. This is the theory upon which the photoelectric cell works, for the emissions and subsequent photoelectric current are proportional to the amount of light falling upon the cell. The emission of electrons under the action of light dates back to observations made by Heinrich Hertz in 1887 on the fact that electrical discharges were facilitated if the negative electrode of the spark gap was irradiated with ultraviolet light. The following year, Wilhelm Hallwachs undertook a systematic examination of the effect observed by Hertz and concluded that negative electricity leaves a body which is illuminated by ultra-violet light. Elster and Geitel continued the work still further and gathered material on the rate at which charges left different metals, and upon the relationship between the wavelength of the incident radiation and the rate of transfer of charge. With the discovery of the electron the nature of the phenomenon was revealed.

PHOTOELECTRIC EMISSION – the phenomena of electrons being emitted from certain materials when they are exposed to light. (See *photo emission.*)

PHOTOELECTRIC MATERIAL – a substance or material that will emit electrons when illuminated in a vacuum. Examples are barium, caesium, lithium, potassium, rubidium, sodium, and strontium.

PHOTOELECTRIC TUBE – a phototube.

PHOTOELECTRICITY – electricity produced by the action of light.

PHOTOELECTRONICS – the science dealing with the interactions of electricity and light, especially with those which involve free electrons.

PHOTOELECTRONS – electrons ejected from the surface of a body by the action of incident light.

PHOTO-EMISSION – the emission of electrons from the surface of a body, usually an electro-positive metal, under the influence of light.

PHOTOFLOOD LAMP – an incandescent lamp which uses excess voltage to give brilliant illumination for television and photographic purposes. It is only good for several hours.

PHOTOGRAM – transmission of a photograph in code via telegraph.

PHOTO-LUMINESCENCE – scientific term which denotes the emission of light from a substance under the action of light. The term is a general one, including all cases of fluorescence, and phosphorescence.

PHOTOMETER – apparatus or device used in measuring light intensities.

PHOTOPIC VISION — daylight vision; the human eye can see in normal daylight. (See *eye.*)

PHOTOTELEGRAPHY — transmission of photographs or other single images over a radio or wire communication system by scanning the picture into elemental areas in orderly sequence, converting each area into a proportional electric signal, transmitting the signals in sequence and reassembling them in correct order at the receiving apparatus. Known also as facsimile, telephoto, wirephoto, etc.

PHOTOTUBE — a vacuum tube in which the electric emission is produced directly by radiation falling on the cathode (an electrode). Also known as the light-sensitive tube or photoelectric tube.

PHOTO-VOLTAIC CELL — cell in which a potential difference is actually generated by the cell. Cells of this type are generally subdivided into two groups: (1) electrolytic and (2) electronic.

PHOTRONIC CELL — a type of photoelectric cell in which the sensitive surface, under the influence of light, generates sufficient current to flow through an external circuit connected up to the cell. This general type of photoelectric cell is also known as the self-generating cell. Photronic cells are more sensitive than the emission types of photoelectric cells.

PICKUP — an apparatus that converts sound, scene, or other forms of intelligence, into a corresponding electrical signal, such as a television camera, phonograph pickup, or microphone. The principal pickup devices are the Iconoscope, Orthicon and Dissector tubes. Also, a program which is televised directly at a scene of action such as an athletic event, political convention, fire, etc.

PICKUP DEVICE — same as pickup.

PICTURE — the image telecast, but generally used with reference to the image as subject matter with form and content.

PICTURE BOX — separate television video receivers without sound apparatus.

PICTURE-CHASING CIRCUIT — a circuit, used in conjunction with intermediate film-scanning systems, in which the film is continuously moving.

PICTURE ELEMENT — any one of the large number of uniformly minute areas of light or shade which constitute the basic structure of the television image. The more picture elements (dots) there are in any image or photograph the finer will be the detail. Also called "picture point."

PICTURE FREQUENCY — the number of complete pictures that are scanned per second in a television system. It has been standardized at present to 60 half-pictures or 30 complete pictures per second in the United States. This figure was selected for American television primarily because most of the electric current supply is 60 cycle. In England, where the current is 50 cycle, the television system has 50 half-pictures interlaced to form 25 complete pictures per second. The number of pictures which has been found satisfactory is determined by the rate required for smooth reproduction of motion and unobjectionable flicker. The motion pictures have established a projection rate of 24 pictures per second, although each picture is interrupted during the time interval when it is thrown on the screen so that the flicker frequency corresponds to 48 pictures per second. For brighter pictures, a higher flicker frequency is needed in order to avoid eyestrain and since television pictures are often brighter than motion pictures, a flicker frequency of 60 is desirable so 30 pictures per second are transmitted. (See *frame frequency.*)

PICTURE LINE STANDARD – number of horizontal lines scanned per second for each image or frame. The present American television standard is 525 lines per image. (See *line.*) The first television images in 1928 produced by mechanical scanners, consisted of 60 horizontal lines, insufficient to show much picture detail. In 1931, the scanning of lines was raised at first to 120, and later to 240 (with the advent of the iconoscope) in 1933. The picture quality was raised to 343 lines in 1936; and to 441 in 1939. In 1941, the present system of 525 horizontal lines went into effect.

PICTURE NOISE – interference signals causing spots of light and other irregular patterns on the receiver picture.

PICTURE POINT – (See *picture element.*)

PICTURE RATIO – the relation of the height to the width of a television image. It is the English name for the "aspect ratio." Used widely in television.

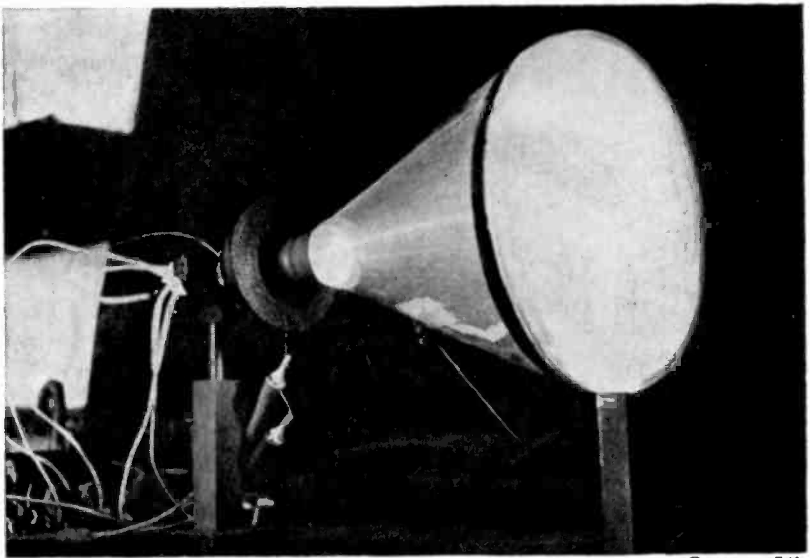
PICTURE RECEIVER – a receiver for television pictures only, having no facilities for receiving the associated sound. A set must receive both picture and sound in order to be called a television receiver according to the Radio Manufacturers Association's specifications for television sets.

PICTURE RECEIVER WITH SOUND CONVERTER – a receiver for video images having an incomplete sound channel which requires the use of a suitable auxiliary sound receiver.

PICTURE SIGNAL – the electrical impulses resulting from orderly scanning of successive elemental areas of a picture or scene by a television camera.

PICTURE SYNCHRONIZING IMPULSES – the impulse that controls the time at which the scanning beam in a television receiver returns from the bottom of the reproduced image to the top for the start of a new vertical sweep. (See *line-synchronizing impulse.*)

PICTURE TRANSMISSION – the electric transmission, either through



— *Courtesy Life*

Picture Tube

space by radio or wires, of a picture having a graduation of shade values.

PICTURE TUBE — the image-reproducing electronic tube in a television receiver, consisting of a funnel-shaped glass structure having at its narrow end an electron gun that produces a beam of electrons. Vertical and horizontal deflecting plates or coils cause this beam to move back and forth and up and down on the fluorescent screen at the large end of the tube and produce there a reproduction of the scene being transmitted. Used by several receiver manufacturers to describe the receiving television tube in contradistinction to the name coined by RCA: "Kinescope."

PICTURE WIDTH —control which normally adjusted the width of the picture to fill the mask breadth.

PIEZOELECTRIC EFFECT — the effect whereby pressure on certain kinds of crystals produces an electric current. Use is made of the peculiar properties of crystals in a chemical compound known as Rochelle salts.

PILOT LAMP — a miniature bulb mounted on the panel of a radio receiver to illuminate the tuning dial, or mounted on the panel of other radio apparatus to indicate when the apparatus has been tuned off.

PIPE – a colloquial term meaning coaxial cable or telephone line. To illustrate: "Place the picture on the pipe."

PIPE LINE – a long metal tube having at its center a conductor supported by insulators. It is used as a transmission line for television and radio signals. (See *coaxial cable, coaxial line, concentric line,* etc.)

PIPED PROGRAM – See *piped service.*

PIPED SERVICE – wired television to theatres exclusively.

PLANE-O-SCOPE – a flat surface picture tube which presents an undistorted picture regardless of the angle from which it is viewed. Developed by the Philco Corp. at Philadelphia.

PLASTIC – a molded material used in the construction of different structural shapes for cabinets and radio parts. The materials come in various colors, characteristics and types. It is an excellent insulating material and has a smooth glossy finish which requires little or no finishing or polishing after molding.

PLASTIC EFFECT – a fault in a reproduced video image due to phase distortion; it gives a distorted three-dimensional appearance.

PLATE NEON LAMP – English name applied to a neon lamp or tube in the glow which appeared at the surface of a rectangular metal plate. Neon lamps of this type, of which there were many varieties were mainly used in mechanical television receiving systems.

PLATTER – a phonograph record or transcription.

PLAYBACK – a recorded repeat performance from a disc. Also, the playing of a new recording.

PLAYING AREA – the physical space or area in a television studio occupied by a stage in which a scene is enacted.

PLUG – a credit or mention of program material or of the sponsor's (advertiser's) product.

PLYWOOD – a board consisting of a number of thin layers of wood glued together so that the grain of each layer is at right-angles to that of its neighbor. Used in the construction of wooden cabinets which encase many television receivers.

POINTILLAGE – a painting technique used in television, and stage painting, to build up a simulated plasticity on a plain surface.

POINT NEON LAMP – a type of neon lamp in which the glow was concentrated upon a very small surface. In some lamps, the glow was concentrated into an area having a diameter of little more than a millimetre. Lamps of this type in mechanical television systems provided a light source of high efficiency for certain video uses.

POINT SCANNING – the transmission of points of light instead of sweeping out strips.

POLAND – In January, 1937, the Polish Radio Co. and State Institute for Telecommunications announced plans for an experimental television station in Warsaw. The roof of the Prudential Building, highest in that city, had been leased. But World War II prevented construction of the station.

POLARITY – in a radio part or circuit, the quality of having two opposite charges, the negative and the other positive. In a magnetic circuit or part, the quality of having two opposite poles, the North and the South.

POLARIZATION – applied to light rays, the term denotes the cutting off of all rays in a beam of light except those which vibrate in one plane. Light consisting of these one-plane vibrations is said to be "polarized," and, in such a state, it possesses peculiar properties of its own. Light rays are generally polarized by passing them through certain crystals, such as Iceland Spar, which effect the process automatically. Polarization is the modification of the condition of light in such a way that the vibrations have a definite form also, a term usually applied to the position of the transmitting antenna, that is horizontal or vertical. The receiver antenna should correspond in most instances to that of the transmitter. At the present time, horizontal polarization is standard.

POLARIZE – to cause vibrations of light to be affected in a particular way; to give opposite magnetic properties to two ends of a bar; to give unit of direction to.

POLE – one end of a magnet; one electrode of a battery.

PORTABLE – able to be carried; easy to handle.

PORTABLE RECEIVER – a completely self-contained receiver (usually, radio) having the loud speaker, all necessary batteries, and a loop antenna built into a compact carrying case. Terminals are sometimes provided for external antenna and ground connections.

PORTABLE UNIT – television field equipment which can be installed where desired. Usually consists of numerous "suit case" size pieces of equipment.

POSITIVE IMAGE – the picture as it is normally seen on a video screen. A photograph or any other type of illustration is also a positive image, the lights and shades of it being a true or approximate reproduction of the original. A positive image, as its name implies, is the opposite image. (See *negative image.*)

POSITIVE LIGHT MODULATION – occurs when an increase in initial light intensity causes an increase in the transmitted power.

POSITIVE TRANSMISSION (MODULATION) – in television, a method of transmission in which an increase in scene illumination results in an increase in the radiated power of the transmitter.

POSITIVE VIDEO SIGNAL – a

video signal in which increasing amplitude corresponds to increasing light-value in the transmitted image. White is regarded as 100 per cent, and the black level made about 30 per cent of the maximum amplitude in the signal.

POTASSIUM —an alkali metal having photosensitive characteristics, used on the cathodes of phototubes when maximum response is wanted to blue light.

POTASSIUM IODIDE — a white crystalline substance which liberates free iodine under the influence of an electric current. This electro-chemical action was made use of in several systems of phototelegraphy, or picture transmission. A moving metal stylus was made to traverse a sheet of potassium iodide-treated paper, which was wrapped around a revolving cylinder and liberated free iodine in the pores of the paper in accordance with the fluctuating currents derived from the transmitting end of the instrument, thus, in this manner building up a replica of the original image in brown iodine.

PRACTICABLE — real, actual, or meant for actual practical use, as opposed to simulated, painted or "faked" detail in a scene, or detail which is installed in a setting for purely decorative purposes. For example, a window may be added to an interior setting for architectural balance only, and may, therefore, be constructed or installed without consideration of actual usage; but if the window is to be opened for a definite scene, it is so constructed and becomes a "practicable" unit.

PRISM — a piece of optical glass or other transparent substance having a triangular cross-section used to reflect or refract light rays. Also used in the spectroscope, for splitting up rays of light into their component colors. This proves that white light is made up of several colors. The violet light is refracted more in passing through the glass than the other colors, since it has the shortest wave length. The red rays are bent least in passing through the prism. The separation of composite light into several colors is known as dispersion.

PRISM DRUM — a mechanical scanning apparatus consisting of a series of prisms mounted on a rotating drum.

PROCESS—See *process shot.*

PROCESS SHOT — a scene projected through a translucent screen which is televised as a background for action on the set. This eliminates the need for an actual painted setting. Sometimes a motion picture traffic scene is made background adding hustle and bustle to the televised area.

PRODUCTION — the building, organizing and presentation of the television program.

PRODUCTION DIRECTOR — the individual in charge of the studio program.

PRODUCTION FACILITIES — all the physical and material requirements of a television program including scenic design, construction and execution, painting, art work, wardrobe, make-up, properties, titling and special effects, both visual and aural.

PRODUCTION FACILITIES DEPARTMENT – group set up to create all the requirements of a given production idea and to assemble all required materials, such as sets, furnishings, properties, titles, effects, costumes, etc., and to supervise and coordinate all physical staging activities during rehearsals and broadcasts.

PROGRAM – a schedule of events; a plan of action; a list of items in an entertainment with names of actors, singers and speakers. Also, a performance. Kinds of programs that can be televised are threefold: (1) Studio presentation with live talent. That is anything which can be enacted indoors with good lighting. (2) Outdoor events. It is technically possible to televise anything which can be photographed with a camera. (3) Sound motion picture film. Any sound movie film can be run through suitably designed television cameras and the film broadcast, both picture and sound.

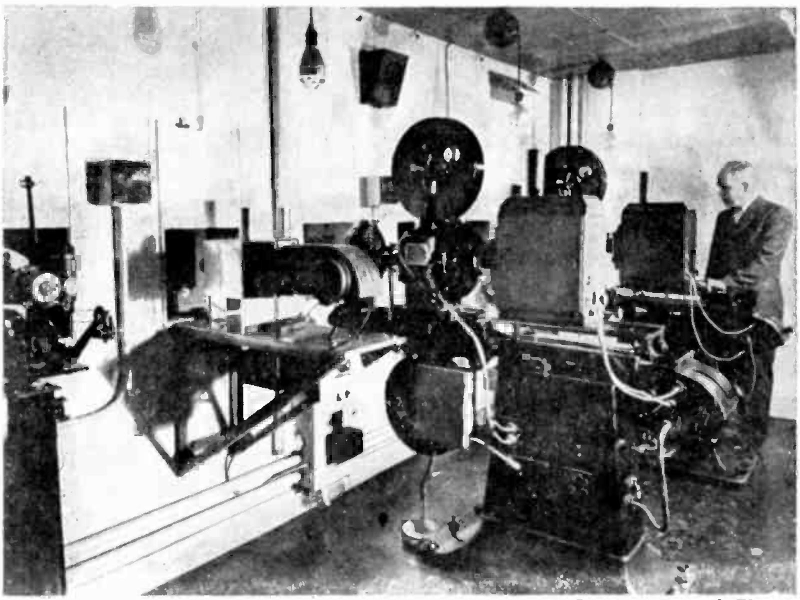
PROGRAM RATINGS – an arbitrary rating system adopted by the television broadcasting stations to obtain the spectator or receiver viewer's reactions to various programs.

PROGRESSIVE SCANNING – in television, a scanning process in which successively traced horizontal lines are adjacent, so that all picture elements are scanned during one vertical sweep of the scanning beam. That is continuous strips of the scanning field are traversed in order.

PROJECTION – process of throwing or carrying an image to a screen where it can be enlarged or made to be seen by greater numbers of spectators.

PROJECTION CATHODE-RAY TUBE – a cathode-ray tube designed to produce an intensely bright but comparatively small picture which can be projected on to a large viewing screen by an optical system consisting of lenses or a combination of lenses and mirrors. Serious attempts were made before World War II, notably in England, Germany and Holland, to project the cathode-beam image upon a screen. The original, most simple method, was to apply a very high voltage to the cathode beam, thus impelling the electrons at terrific velocity against the fluorescent surface. The resultant brilliant picture was projected through a large lens upon a screen. Two examples of theatre-screen television installations will illustrate. The Baird projection system, installed for many weeks in several London movie houses, used a 3.2x4 inch image, a cathode spot less than 0.004 inches in diameter, a beam current of one milliampere, produced by 40,000 volts on the final anode. The picture was projected by an exceptionally fast (f:1.4) lens upon a screen 12x15 feet in size. Two complete projector units were installed, maintained continuously in operation, but only one image was projected at one time, the lens being arranged to be slipped into position before either tube as desired. A single high-voltage rectifier was provided capable of supplying 10 milliamperes at 60,000 volts. The total electrical consumption was two kilowatts. All the equipment except the projector tube was located below the theatre auditorium. The two long projector tubes and lens were placed in a safety cabinet in the center aisle of the theatre.

Quite similar results were obtained in the theatre installations by the Scophony mechanico-optical receiver system. Here the light beam from a high intensity arc was projected through a highly ingenious supersonic light valve, invented by J. W. Jeffree, which stored up in liquid form, picture element images, projecting as many as 50 or more of them simultaneously along a single scanning line upon the screen. An effective split-focus optical system projected this complex beam of modulated light upon a screen 10 x 12, placed about 20 feet in front of the projector, located on the stage behind the screen.



—Courtesy General Electric

Projection-Room Equipment

The projector had a wide diffusing angle and was claimed to involve only a small loss of light. (See *direct-viewing; Scophony System.*)

PROJECTION RECEIVER — a television receiver incorporating a principal of optical projection, as distinguished from a direct-viewing video receiver. The picture is reproduced on the large-sized projection screen rather than upon the face of the cathode-ray tube.

PROJECTION ROOM EQUIPMENT — assorted cameras used to project motion pictures onto the transmitting equipment, then through the air to the television receivers.

PROJECTION TELEVISION — a system of enlarging television pictures by a combination of lenses and mirrors that enable the picture to be projected on to a large-sized screen. It has long been known that aspheric surfaces in combination with either spherical or aspherical mirrors could be arranged into optical systems of high-aperture and high definition. Astronomers made use of this principle in an arrangement consisting of a spherical mirror and an aspherical lens; although, prohibitive costs and obstacles in constructing such systems prevented their wide usage. In the search for efficient optical systems for projecting television images originating on the cathode ray tube screens, the principle of reflective optical systems was made the subject of deep study and experimentation which resulted in the development of a number of reflective optical systems suitable for projecting video images with diagonals ranging from 25 inches to 25 feet. RCA systems consist of a spherical front surface mirror and with an aspherical lens, positive in the central portion and gradually changing into negative near its periphery. The gain in illumination on the viewing screen is about six or seven to one when compared with a conventional f.12 lens. The quality of the pictures obtained is comparable with images produced by conventional projection lens.

The problem of projecting images originating on the screens of cathode ray tubes has received a great deal of attention in recent years. The light emitted by the screen of a cathode ray tube follows very closely the law of perfectly diffusing surfaces. When a projection lens such as the conventional motion-picture projection lens is used to project a cathode ray tube onto a viewing screen, the overall efficiency of such a system is extremely low. Baird and Scophony in England and Phillips in Holland, before the last war, built relatively small projection tube television receivers for home installations. Phillips Lamps, Ltd., of London marketed the typical projection-type receiver for the home which may be described as follows: the projected image was reflected from a mirror in the lid of the cabinet onto a flat etched glass screen, the etched surface being protected from dust and dirt by enclosures between two sheets of glass. A great deal of light was lost because of the number of glass sheets involved. The projection screen automatically rose into its correct position when the cabinet lid was lifted. (DuMont later used the same principle in a direct-viewing television receiver. See *DuMont*.) A 25,000-volt supply operated the Phillips' four-inch diameter projection tube. Completely screened magnetically, the tube was mounted with a projection lens in the gimbals to facilitate optical centering of the image on the projection screen. Beam-focusing and deflection in horizontal and vertical directions were accomplished entirely by electromagnetic means, rather than electrostatic.

PROJECTION TUBES – See *Projection cathode-ray tube.*

PROJECTOR – a motion picture or slide projector; a device which concentrates luminous flux within a small angle from a single axis.

PROMPTER-SCREENS – black "box-on-wheels" used on television sound stages, the front of each contains a ground glass screen about three feet square. On the screen the performer's lines are projected from a roll of script so that the actor can "read" his lines and next action step, in case of a lapse of memory.

PROPAGATE – to extend through space, as light.

PROPERTIES – all physical materials used in a scene, or utilized by the performers in portraying their characterizations, such as furnishings and decorations. That is, all physical items of the show or program, excepting the costumes and scenery, required for performer action or to furnish the stage set. (See *props.*)

PROPS – abbreviation for "properties."

PROTON – one of the positively charged particles which, together with electrons (negatively charged particles), make up the structure of the atom.

PROVISIONAL CUT – a cut in a television program planned in the event something unexpected happens. For example, in the timing of a program, to avoid sudden curtailment of the original time allotment on the air due to a runover from a previous program or an unexpected news announcement, as in the case of the attack on Pearl Harbor.

PULSE – a single disturbance that is propagated as a wave or electric current but has no cyclic characteristics.

PULSE-MODULATED WAVES – recurrent wave trains in which the duration of the trains is, in general, short compared with the interval between them. Used extensively in radar work.

PULSE-TIME MODULATION – a type of radio transmission in which the carrier consists of pulses, with the time interval between pulses being varied in accordance with modulation. The system is intended for the ultra high frequency bands where it can advantageously use the wide channels available there. It enables improved signal-to-noise ration. Abbreviation: t-m. and PTM. (See *Multiplex Radio Puse Time Modulation.*)

PULSED LIGHT MOVIE PROJECTOR – Bursts of light which "live" for five hundred millionths of a second are used in a new movie projector developed by General Electric Co. and announced on April 22, 1946, to improve the televising of film for broadcast purposes. This illumination is "pulsed," like radio waves in radar, and made to expose the movie film to the television at precisely the right moment for maximum efficiency. A mercury capillary lamp is used instead of the conventional arc or incandescent source. The lightning-fast "on-off" operation of this light provides its own shutter and eliminates the motor-driven disc shutter used in present-day movie projectors. D. E. Norgaard, General Electric electronics engineer, developed the new unit.

PUMP – a slang term meaning to create or generate. Such as, "pump me a picture on the transmitter line."

PUNCH – to read lines, play music, etc., with pep and vigor, drive and force.

PUPIL – the circular aperture in the center of the iris of the human or animal eye which has the appearance of a dark spot and through which light passes on its way to the retina. (See *iris.*)

PUSHBUTTON CONTROL – control of motors and other electrical apparatus by means of relays and associated starting devices actuated through auxiliary circuits that open and close through the medium of pushbuttons.

PUSHBUTTON TUNER – a tuning unit which automatically tunes a radio receiver to a station where the button assigned to that specific station is pressed.

PYE TELEVISION SYSTEM – Pye, Ltd., Radio Works (Manufacturer), Cambridge, England. Before the war, in England, it was necessary to have within a transmitting station two distinct single purpose units, one to transmit the picture and the other to broadcast the sound. It followed that the public had to have, either as separate sets or housed in one cabinet, a video (vision) and a sound receiver. The postwar Pye system makes it possible now for a televised program to be effected by a single transmitting unit, and what is still more important, the television home receiver now can be made to receive both the sight and sound.

When a Pye television transmitter is in operation, there are short intervals of time during which no signals are being broadcast. These intervals occur during the time that the spot which traces the picture is returning to its starting point preparatory to making another line, and each represents rather more than 1/10th of the total transmission time. Each of these idle periods lasts for 10 millionths of a second and there are just over 10,000 of them during each second. It is now possible to use the television transmitter during idle periods to transmit the sound program. This is done by taking a "sound" snapshot of the sound part of the program whenever the transmitter is not transmitting the vision part of the program. By using television of the present definition (Great Britain's), 10,125 of these "sound snapshots" can be transmitted per second.

The process is similar to that of taking moving (motion) pictures when 24 snapshots are taken of a moving scene every second and the moving scene reconstructed by passing these snapshots at the rate of 24 per second through a motion-picture projector. In the same way, if the "sound snapshots" are passed into a suitable receiver at a rate of 10,125 per second the original sound program can be recovered. The "sound snapshot" is really a pulse similar to a radar pulse, which is sent out by the video transmitter and the width of which is made to vary according to the sound that has to be transmitted. With the new Pye system in operation this modification to the transmitted wave form would enable both the video and sound to be transmitted on a single carrier with a single aerial system. The pulse would be separated from the video program in the television receiver and the variation in its width would be made to operate the loudspeaker.

Advantages of this system as given by Pye spokesmen include: (1) The possibility of interference in the television receiver between the sound and the vision (video) would be eliminated; (2) It would be simpler to make an efficient television aerial; (3) Less frequency space would be needed for each television transmitter because it would no longer be necessary to provide separate frequencies for the vision (video) and sound transmitters; (4) It would be possible to incorporate automatic gain control, insuring that the picture would be held steady even during severe fading of the signals; (5) It would give a clearer reception of the television sound program in localities removed from the transmitting station because there should be less noise and interference. (See *radar pulse technique system for television.*)

Q

QUALITY — the degree of faithfulness in the reproduction in a television image or sound program. Also, the general description of freedom from various types of acoustic distortion in a sound-reproduction system. (See *high-fidelity.*)

QUARTZ — mineral found in hexagonal crystals in nature and having piezo-electric properties that are highly useful in radio. Those crystals from which slabs are cut for radio oscillators, are transparent and practically colorless. Quartz freely transmits ultraviolet light. Selected specimens of quartz are, therefore, often ground into lenses to be used for purposes in which the free transmission of ultra-violet light is essential. It is a common form of silica and is also known as Rock Crystal.

QUARTZ CRYSTAL — the mother crystal of quartz, as found in nature, having a hexagonal cross-section coming to a point at one end and a broken base where it was split away from the rock formation in which it grew. Also, a crystal unit in the shape of a thin slab or flat cut from a quartz crystal and selectively ground to a thickness which will make it vibrate at the desired natural frequency when supplied with energy. It is used to control the frequency of a vacuum tube oscillator stage in a transmitter and for other purposes.

QUASI-OPTICAL — refers to the horizon range characteristic of a television broadcast. Suffix derived from the Latin, meaning "as if it were."

R

RCA — abbreviation for Radio Corp. of America.

RCA LICENSED — manufactured under a licensing agreement that allows the use of patents controlled or owned by the Radio Corp. of America.

R-F — abbreviation for radio frequency.

RF PICKUP — radio frequency transmission of a video or audio signal.

RID — abbreviation for Radio Intelligence Division of the Federal Communications Commission, set up to police the entire radio spectrum and take appropriate action against unlicensed radio stations, as well as monitor licensed stations and intercept foreign broadcasts.

RMA — abbreviation for *Radio Manufacturers Association.*

RMA STANDARDS — In order to have successful television reception, the receiver must be interlocked (be in phase) with the transmitter. This synchronization must be standardized for a radical change in transmission practice may make all existing television receivers obsolete. Therefore, a set of standards have been worked out by the Radio Manufacturers' Association. These standards are sufficiently broad to permit improvements in the future, and yet guarantee the purchasers of video receivers years of service and the possibility of receiving all television programs broadcast within range.

RADAR — a general term originally applied by the United States military forces to an ultra-high frequency equipment for radio detecting and ranging apparatus for the purpose of locating unseen enemy ships and planes in near or distant areas. It is based on the principle that ultra high frequency radio waves travel at a specific speed and are reflected from objects they encounter. The waves are radiated as beams by a directional antenna array that can be swept through space at all angles and the reflected wave is picked up by an ultra high-frequency receiver. The elapsed time between transmission and reception of a wave pulse is measured electronically to give the distance range to the reflecting object. This apparatus has been used as a means of automatically controlling range and lead-angle of gun-fire. It also was used to get a signal from the moon. Also known as "radio locator."

A radar system consists, in its basic form, of a transmitter, receiver and a common antenna. Pulsed radio energy, generated by the transmitter, is radiated by the antenna. In the space between pulses, the receiver is operating to detect any radio frequency energy returned as an echo by reflection from some object in the path of the radar beam. These radio echoes are then converted into a visual signal on the radar scope, giving a graphic presentation of range and bearing. This process is repeated continuously so an image remains on the screen at all times any object is within range of the radar beam.

Interest in radio detection as a military device can be dated from communications experiments carried on by two civilian scientists working for the United States Navy, Dr. A. Hoyt Taylor and Leo C. Young. In the autumn of 1922 they observed a distortion or "phase shift" in received signals due to reflection from a small wooden steamer on the Potomac. The principle of pulse ranging was first used in 1925 by Dr. Gregory Breit and Dr. Merle A. Tuve of the Carnegie Institution for measuring the distance to the ionosphere, which is the radio reflecting layer near the top of the earth's atmosphere. In the summer of 1930, Dr. Taylor and Mr. Young made the important observation that reflections of radio waves from an airplane could be detected. As a result, in November, 1930, the Director of the Naval Research Laboratory submitted to the Navy Department a detailed report on "Radio-Echo Signals from Moving Objects." Subsequently Young proposed that an attempt be made to get the transmitter and receiver into the same ship. After much experimentation, a radar set, built at the Naval Research Laboratory and operating on a wave length of a meter and a half, was installed on the USS NEW YORK in December, 1938. The army's first pulse radar was designed as a complete anti-aircraft detector system at the Signal Corps Laboratories early in 1936. A radically improved form of transmitter tube was developed later and a complete set demonstrated to the Secretary of War in November, 1939 showed a range of more than 100 miles against bombers.

Working independently, the British had made a somewhat parallel investigation. At the end of 1934, the Air Ministry had been so impressed with the inadequacy of visual and acoustic means of detecting the approach of hostile aircraft that they set up committees for the scientific survey of air defense. In 1935, in the radio department of the British National Physical Laboratory there was conceived the idea that, since airplanes reflected enough energy to disturb radio reception, they might be detected and located by an improved apparatus of the kind built to receive radio echoes from the ionosphere. The demonstrations by the radio research staff held such obvious promise that in December, 1935 a decision was made by the

Air Ministry to establish a chain of five stations on the east coast of England. This was the first operational radar system installed anywhere in the world.

RADAR PULSE TECHNIQUE SYSTEM FOR TELEVISION – Recently announced system by Columbia Broadcasting System engineers which may result in the transmission of both the picture signal and the sound signal on one frequency instead of two frequencies as at present. This makes it possible for a television station to eliminate one of the two transmitters now necessary. The system involves transmitting the sound portion of television programs in pulses or snatches during the brief intervals now used at the end of each scanned line for transmission of essential synchronizing pulses. This would be done without interfering with the synchronizing process.

Persistence of hearing, the phenomenon used in International Telephone & Telegraph Co.'s pulse-time modulation system, is what permits interruption of the sound program 15,750 times a second. Each of these interruptions last long enough for transmission of the detail in any one line of the present 525-line black and white television image that is repeated 30 times a second. The technique is logical because persistence of vision is already being used to make the eye perceive a complete television picture although only one dot where the electron beam strikes is being activated at any given instant. Elimination of the separate sound-program transmitter reduces the initial investment of a television station by as much as $25,000. (See *Pye television system.*)

RADIAL – spreading, like rays of light.

RADIAL SCANNING – consists in traversing a strip forming a diameter or circular area to be scanned, and then orienting the strip about its center so that the consecutive strips trace out different diameters of the same area.

RADIANT ENERGY – energy transmitted by electromagnetic waves. Heat, light, radio, and cosmic rays are forms of radiant energy differing chiefly in frequency and wave length.

RADIANT HEAT – heat communicated to a body by radiation. It is transmitted by electromagnetic waves of a similar nature to light waves but having a greater wave length.

RADIATE – to emit rays of heat or light. To give forth, diffuse.

RADIATING CIRCUIT – any circuit capable of sending forth power in the form of electromagnetic waves into space, especially the antenna circuit of a radio transmitter.

RADIATION – energy emitted in the form of electromagnetic waves. These include, in the order of increasing wavelength, cosmic rays, gamma rays, X-rays, ultra-violet radiation, light, infra-red radiation, heat rays and radio waves. That is, also, the process wherein the transmitting antenna system of a television or radio station converts the output of the transmitter into radio waves which travel away from the station through space.

RADIATOR – that section of an antenna from which the radio waves are actually emitted.

RADIO – the art of communication through space by means of radio waves, that is, without the use of connecting-wires. The speech or music is transformed at a broadcasting (or transmitting) station into electromagnetic waves which in turn are imposed on a carrier wave and carried through the air to a receiving point or station (receiver) where the electromagnetic waves are reconverted into sound waves. Travel of radio waves through space (space radio) is implied by the term radio. Radio waves that are guided by conductors are known as "wired radio." Formerly synonymous with "wireless." More broadly, a series of communications carried on between a broadcasting station and a number of receiving stations through the medium of ether, whether the communication be in the form of speech or music. Refers to sound transmission only as opposed to television which includes both sound and sight.

RADIO BLACKOUT – See *ionosphere storm.*

RADIO BROADCAST – a program of music or voice and other sounds sent from a radio transmitter for consumer reception.

RADIO BROADCASTING – same as radio broadcast.

RADIOCAST – a term formerly used instead of "broadcast." To transmit speech, music or other sound intelligence via radio.

RADIO CHANNEL – a band of frequencies or wave lengths having sufficient width to allow its usage for radio communication. The width of the radio channel depends on the kind of transmission and the tolerance for the frequency of emission. (See *television channel.*) The "space" in the radio frequency allocated to each station or service. In present television standards a channel is six megacycles wide.

RADIO CIRCUIT – a radio system for carrying out one communication at a time in either direction between two points; an arrangement of parts and connecting wires for radio purposes.

RADIO COMMUNICATION – the transmission of intelligence through space without the use of intervening conductors or guides by means of electromagnetic waves of wavelength greater than that of radiant heat. Also, a receiving set capable of picking up radio waves and reproducing the intelligence they convey. Synonymous with "receiver."

RADIO CORPORATION OF AMERICA (RCA) – Prior to and during the first World War, the United States depended largely upon British cables and foreign-owned wireless stations for communication with many important parts of the world. Great Britain was the communication center of the world. The war revealed to Americans that radio offered a new and competitive system, a starting opportunity for dissemination of intelligence. Development of radio would give the United States preeminence in radio communication, independent of other countries.

To accomplish this, RCA was organized by the General Electric Co. as a result of suggestions by officials of the U. S. Navy. Arrangements were made to acquire the assets of the Marconi Wireless Telegraph Co. of America. A charter was granted RCA under the corporation laws of the State of Delaware on Oct. 17, 1919. The business and property of the American Marconi Co. were acquired by RCA on Nov. 20, 1919. On Dec. 1, 1919, RCA began business as an all-American organization. Its charter provides that no person shall be eligible for election as a director or officer of the corporation who is not at the time of such election a citizen of the United States. The charter also specifies that the corporation may, by contract or otherwise, permit such participation in the administration of its affairs by the Government of the United States as the board of directors deem advisable. A clause in the charter provides that at least 80 per cent of the RCA stock outstanding shall be held by citizens of the U. S.

The first chairman of the board of RCA was Owen D. Young; the first president, Edward J. Nally; David Sarnoff was commercial manager.

RCA today includes the parent company; RCA Victor Division (manufacturing subsidiary); National Broadcasting Co., Inc.; RCA Communications, Inc.; Radiomarine Corp. of America; RCA Institutes, Inc., and RCA Laboratories. Headquarters of the corporation are in the RCA Building, 30 Rockefeller Plaza, New York City, popularly known as "Radio City." Ownership of RCA is widely distributed among approximately 222,000 stockholders, in every state of the Union. No person of record holds as much as one-half of 1 per cent of the stock. Less than 6 per cent of the stock is held by foreign stockholders.

RCA's pioneering work has made many of the foremost contributions to world - wide radio communications. High on the list of developments is the electronic system of high definition television. Pursuing original investigations in the ultra-high frequencies, new applications have been made in the spectrum of tiny waves, including uses in television, radar, and in automatic radio-relay stations. Research in television, which led into the realm of electron optics, has brought numerous revolutionary developments. NBC owns and operates television station WNBT in New York. The transmitter and aerial atop the Empire State Building have been operated by NBC since 1931. RCA reported spending $10,000,000 on television research up to 1946; NBC spent an additional $2,500,000.

RADIO ENGINEERING — science which deals with the design, construction, and maintenance of apparatus used for radio communication. This definition includes television which is simply radio engineering extended to handle picture signals.

RADIO FREQUENCY – a frequency, usually higher than those corresponding to normally audible soundwaves and lower than the frequencies corresponding to heat and light waves. The term applied generally to those frequencies used for radio communication. Abbreviation: r.f. The present practicable limits of radio frequency are roughly 10 kilocycles per second to 2,000 megacycles per second.

RADIO FREQUENCY ALTERNATING CURRENT – alternating current that makes thousands of changes in the direction of current each second.

RADIO FREQUENCY AMPLIFIER – a vacuum tube amplifier stage to provide amplification at radio frequencies.

RADIO FREQUENCY SPECTRUM – all of the wavelengths or frequencies that may be used for the transmission by radio of energy or intelligence.

RADIO LINK – the transmission of a sound or television program between specific points by means of radio rather than over telephone lines or special transmission lines.

RADIOLOCATION – British equivalent of "radar." It involves determination of the position of a distant object or reflecting surface by a method involving the use of reflected radio waves.

RADIOMAN – specifically, a radio operator. Opposed to radio technician, who services and maintains a radio equipment and is generally called a "radio serviceman."

RADIO MANUFACTURERS ASSOCIATION – a trade group, consisting for the most part of equipment manufacturers, who set up minimum standards for transmitting and reception apparatus. Abbreviation: RMA. Their work also involves the standardization of sizes and designs of radio parts, marking on parts, radio terms and definitions.

RADIONICS – system embracing radio and devices operating on principles of radio and radio tubes, coined by Commander Eugene McDonald, president of Zenith Radio Corp., Chicago, Ill., as diametrically opposed to "electronics" although basically they both refer to the same fields and items and are synonymous. Trademark term used by the Zenith Radio Corp. From the Latin "radiatus," which is past participle of "radiare" meaning "to emit rays from" which in turn is derived from "radius" meaning "rod" or "ray." The word ion comes from the Greek "ion," present participle of "ienai," meaning to wander or go. The literal translation of "radionics, therefore, is "wandering" or traveling radiations.

RADIOPHOTO – RCA Radiophoto had its inception in 1923. At that time, David Sarnoff predicted the successful transmision and reception of pictures by radio, a prophecy which was fulfilled in the opening of commercial service in 1926. In succeeding years, the process of Radiophoto was developed by RCA engineers from the

— *Courtesy General Electric*

Radio Station, showing studio building and antenna

early systems of hot wax, hot air, ink stream and dot recording into the far more accurate system of linear recording on film.

RADIOPHOTOGRAM – a photograph transmitted by radio.

RADIOPHOTOGRAPHY – transmission of photographs by radio. Sometimes applied to systems employing a wireless communicating channel. (See *facsimile.*)

RADIO RECEIVER – an instrument

which amplifies the radio frequency signals, separates the radio frequency carrier from the intelligence signal, amplifies the intelligence signal additionally in most cases, and then converts the intelligence signal back into the original sound waves. Also known as "radio set," "radio chassis."

RADIO RECEPTION – reception of programs, messages, music or other intelligence by radio.

RADIO RELAY – sending intelligence via radio from one point to another.

RADIO RELAY STATIONS – automatic stations which pick up radio signals from one direction, amplify them and rebroadcast them to another point at a distance. In 1923, the Radio Corp. of America began development of a radio relay station at Belfast, Me. Its purpose was to intercept long wave transoceanic telegraph signals at a location where directional reception would reduce interference from summer lightning storms and to relay the intercepted signals on another frequency on the Riverhead receiving station for transfer to New York. The relay transmitter was designed to handle several telegraph signals simultaneously. This station was operated experimentally for about a year until it was replaced with a commercial receiving station connected with New York through wire lines. In 1924, a supplementary relay transmitter completed at Belfast relayed the first broadcast programs from London to New York for rebroadcasting. In the meanwhile, RCA and its associated companies carried forward a program of development designed to create a system of television. Eventually this program had made enough progress to justify the creation of an experimental broadcasting station at the Empire State Building in New York. It had become apparent, by this time, that television networks for carrying programs from city to city would eventually be needed. In 1932, NBC and RCA, in cooperation with General Electric Co. and Westinghouse undertook development of a relay station to carry experimental television from New York to Camden, N. J. It was demonstrated successfully in 1933. At that time television had reached the point where 120 lines per frame could be used.

RADIO RELAY SYSTEM – communication by radio through directed radio beams at ultra-high frequencies operating simultaneously in both directions and relayed at stations spaced at an average of about 30 miles along specified routes.

RADIO SET – a radio receiver, a transmitter, or a combination of the two.

RADIO SPECTRUM – the entire range of frequencies in which useful radio waves can be produced. Classified into seven bands by the Federal Communications Commission in the United States. They include: (1) very low frequency (vlf), 10 to 30 kilocycles; (2) low frequency (lf), 30 to 300 kilocycles; (3) medium frequency (mf), 300 to 3000 kilocycles; (4) high frequency (hf), 3 to 30 megacycles; (5) very high frequency (vhf), 30 to 300 megacycles; (6) ultra high frequency (uhf), 300 to 3000 megacycles, and (7) super high frequency (shf), 3000 to 30,000 megacycles. Each band starts just above its lower limit and includes its upper limit.

RADIO STATION – the complete assembled equipment for the transmission and/or reception of radio-telegraph or telephony, together with the structures or buildings housing it.

RADIO TECHNICAL PLANNING BOARD – Early in 1943, a committee composed of representatives of the Radio Manufacturers Association, and the Institute of Radio Engineers established the RTPB. Its purpose was stated as follows: "The objectives of the RTPB shall be to formulate sound engineering principles and to organize technical facts which will assist in the development, in accordance with the public interest, of the radio industry and radio services of the nation, and to advise Government, Industry and the People of its determinations. Such activities shall be restricted to engineering considerations."

Sponsors were nonprofit associations and societies which had an important interest in radio and which indicated a willingness to cooperate in achieving the objectives of the RTPB. Contributing sponsors included: Aeronautical Radio, Inc.; American Radio Relay League; FM Broadcasters, Inc.; National Association of Broadcasters; International Association of Chiefs of Police; Institute of Radio Engineers; American Institute of Electrical Engineers; Radio Manufacturers Association; National Electrical Manufacturers Association; The Telephone Group; Association of American Railroads, and Television Broadcasters' Association.

Noncontributing sponsors included: International Municipal Signal Association; National Independent Broadcasters; Society of Television Engineers; Society of Motion Picture Engineers; Edison Electric Institute, and Cab Research Bureau, Inc.

The total personnel of the RTPB and its constituent panels was over 600. Staff of the original RTPB included: Dr. W. R. G. Baker, General Electric Co., chairman; Dr. Alfred N. Goldsmith, independent consultant, vice-chairman; Bond Geddes, RMA, treasurer; L. C. F. Horle; W. B. Cowilich, IRE, secretary; Mrs. Martha Kinzie, General Electric Co., assistant secretary. Thirteen panels and chairmen of each included the following: Panel 1, Spectrum Utilization, Dr. A. N. Goldsmith, independent consultant, chairman (Scope: The analytical study of the factors pertinent to the most effective use of the transmission medium). Panel 2, Frequency Allocation, Dr. C. B. Jolliffee, RCA, chairman (Scope: The allocation of frequency bands to services on the basis of propagation and equipment characteristics, with due respect to military requirements, public interest and past practices). Panel 3, High-Frequency Generation, Roger Wise, Sylvania Electric Products, Inc., chairman (Scope: The status and probable progress in the development of electronic tubes and the necessary associated equipment for increasing frequency of generation and operation). Panel 4, Standard Broadcasting, Howard S. Frazier, NAB, chairman (Scope: The review and further development of standards with reference to broadcasting on medium frequencies). Panel 5, FM Broadcasting, C. M. Jansky, Jr., Jansky & Bailey, consulting engineers, chairman (Scope: The review and further development of standards with reference to broadcasting in the frequency band of 30 to 300 mc). Panel 6, Television, D. B. Smith, Philco Co., chairman (Scope: The review and further development of standards with respect to television). Panel 7, Facsimile, J. V. L. Hogan, Faximile, Inc., chairman (Scope: The review and further development of standards with respect to facsimile). Panel 8, Radio Communication, Haraden Pratt, Mackay Radio & Tel. Co., chairman (Scope: The review and further development of standards with reference to radio communication). Panel 9, Relay Systems, E. W. Engstrom, RCA, chairman (Scope: The review and further development of standards with reference to radio relay systems). Panel 10, Radio Range, Direction and Recognition, E. M. DeLorraine, Federal Telephone & Telegraph, chairman (Scope: The development of standards with respect to radio range, direction finding, recognition, and locating systems). Panel 11, Aeronautical Radio, D. W. Rentzel, Aeronautical Radio, Inc., chairman (Scope: The review and further development of standards with reference to aeronautical services). Panel 12, Industrial, Scientific and Medical Equipment, C. V. Aggers, Westinghouse Electric Co., chairman (Scope: The study of the necessary characteristics of industrial, medical, and scientific equipment with particular reference to potential radio interference and the development of appropriate standards therefor). Panel 13, Portable, Mobile, and Emergency Service Communications, Prof. D. E. Noble, Galvin Manufacturing Co., chairman.

RADIO TECHNICIAN – a serviceman qualified to repair and maintain radio apparatus. Sometimes known as a radioman but more often merely as "serviceman." (See *radiotrician.*)

RADIOTELEPHONY – two-way communication (telephony) carried on by means of radio waves without connecting wires between stations. (See *radio.*)

RADIO TRANSMISSION – the sending of signals through space at radio frequencies by means of radiated electromagnetic waves.

RADIO TRANSMITTER – an apparatus for producing radio-frequency power, for the purpose of producing a signal.

RADIOTRICIAN – trademark name applied to a person who has received training in radio from the National Radio Institute, a private school.

RADIOTRON – trademark name used for a thermionic vacuum tube made by the Radio Corp. of America.

RADIO TUBE – general term covering any type of electron tube used in electronic apparatus.

RADIOTYPE – a machine perfected about the summer of 1944 which looks and operates like a standard typewriter but which sends, receives, and prints messages at the rate of 100 words per minute and up, and will be utilized in future radio repeater circuits linking television stations throughout the United States. The device was the result of more than ten years of research work by engineers of the International Business Machines Corp. under the direction of Thomas J. Watson, president, and Walter S. Lemmon, general manager of the radiotype division.

RADIOVISION – an early name for television, rarely used today.

RADIO-VISION – another spelling of radiovision.

RADIOVISOR – a former trade name for a television receiver. In Great Britain, a name adopted for photoelectric illumination controls, photoelectric burglar alarms, and similar photoelectric relay devices.

RADIO WAVE – a combination of electric and magnetic fields (electromagnetic wave) varying at a radio frequency, and capable of traveling through space at the speed of light and able to carry intelligence. It is produced by feeding the output of a radio transmitter to the transmitting antenna, and may carry modulation. Originally known as the "Hertzian wave." Radio waves go around the curvature of the earth, over and behind mountains, through buildings and so on. But the radio waves at television frequencies behave more like light, act somewhat as does a powerful searchlight. They do not follow the earth's curvature very well or go behind a mountain or through brick walls. Therefore, they are limited by obstacles on the earth's surface and conversely the transmission will be more effective if the antennas are located as high as possible. Radio waves at television frequencies follow line-of-sight from the transmitter to the horizon; that is, the distance at which the earth and sky appear to merge when viewed by the human eye (usually 35 to 45 miles normal distance). The radio waves exhibit properties of both electricity and magnetism, and consist essentially of two parts: (1) the ground wave which travels along the earth, and (2) the sky wave which travels through the air (ether).

RAIN – finely divided vertical interference patterns in a television image on the receiver.

RAKE – a term used in connection with stage scenery. To rake a set or flat means to shift its position or angle of alignment for more suitable stage set placement.

RANGER FACSIMILE SYSTEM – Captain Richard Ranger, on May 7, 1925, demonstrated his photoradio or picturegram facsimile system when he sent war game pictures and maps 5,136 miles in 30 minutes from New York to Honolulu. A photographic film revolved on a glass cylinder over which played a powerful needle or pencil of light. The black detail of the picture checked the light passage and the lighter areas let it get through. This light of varying intensity fell upon a photoelectric cell which transformed the light into electrical impulses so controlled that the pattern of the original picture was kept at the distant receiver. In short, the picture was first traced in light which was then converted into electrical current. The current was then amplified a few million times and broadcast. At the receiver, the radio signal was intercepted and converted again into electrical current, which operated a pencil of light that resketched the picture on a paper wound around a cylinder revolving in step with the one at the transmitter.

RASTER – a term applied to the group of lines appearing on the cathode ray tube in the absence of an incoming video signal. Again, the pattern of closely spaced parallel lines formed on the fluorescent screen of a cathode ray tube when the frame and line-scanning currents or voltages are applied simultaneously, as for reception of the picture. The image is formed by modulating the brightness of the different parts of the raster. Or to put it simply, the building up of scanning lines.

RATCHETING – formation of the raster in such a manner that the deflection of the spot in the vertical (frame-frequency) direction remains unwavering during the scanning of each line, being altered during the flyback periods of the line frequency.

READY – a direction to a cameraman, instructing him to line up his camera for the following shot.

REAL IMAGE – an optical counterpart of an object, produced on a surface at which lightrays converge after passing through a lens.

REBROADCAST – to repeat an original broadcast program. Generally used over a network to those stations located in areas where the time element differs.

RECEIVER – the complete apparatus needed for receiving radio waves and converting them back into original intelligence such as pictures and/or sound. In general, the equipment for the reception of any incoming electrically transmitted signals or intelligence. The major subdivisions of the television receiver can be listed as follows: (1) Receiving antenna; (2) Ultra-high-frequency input circuit. One or more stages of radio-frequency amplification may be included in this circuit; (3) First detector and oscillator; (4) Intermediate amplifier; (5) Second detector; (6) Video amplifier and d-c reinsertion circuits; (7) Kinescope; (8) Synchronizing selector circuits; (9) Deflection generator; (10) Audio system, and (11) Voltage supplies. (See also *radio receiver*.)

RECEIVING ANTENNA – an antenna used for the reception of television and radio signals. It serves to convert the arriving electromagnetic waves into corresponding modulated radio-frequency currents that flow through the antenna circuit.

RECEPTION OF SIGNALS – Reception of television signals is accomplished by means of a receiver equipped with an audio system capable of responding to both low and high frequencies with equal fidelity. Otherwise, the receiver is identical with one designed for the reception of voice except that it must tune to resonance with transmission frequencies used for television which are higher than those designed for voice broadcast.

RECORD – a disc or circular plastic compound made of shellac and a filler for vinylite substance. The term strictly applies to any sound record from which the original sounds can be reproduced on a record player whenever desired.

RECORDER – a machine for registering sound either magnetically, photographically or on wax. Pictures and printed matter, transmitted by radio, are reproduced on paper by a facsimile recorder.

RECORDING – the science, art, or practice of registering wave-forms arising from sound sources, so that they may be recreated at any arbitrary subsequent time, with allowance for delay necessitated by processing.

RECORDING HEAD – the electromechanical apparatus to which modulation currents are applied to operate the cutting stylus in a wax recorder. Also, the registering device, containing magnetizing coils and pole-pieces, through which magnetic tape is drawn in magnetic recording.

RECORD PLAYER – a motor-driven turntable and a crystal or magnetic phono pickup used for converting a phonograph record into audio frequency signals. These signals are fed into the audio section of a radio receiver or into a separate audio amplifier for additional amplification before being reproduced as sound waves by a loudspeaker. Then the amplifier and loudspeaker are built into the same cabinet with the record player, the combination then called an electric phonograph. It may also be a hand-operated phonograph. The apparatus is also built into a combination which in addition to a television receiver contains a radio chassis.

RECTILINEAR SCANNING – the process of scanning an area in a predetermined sequence of narrow parallel strips.

RECURRENT VISION – name given to the phenomenon of an image recurring one or more times to the eye after the actual light rays have been cut off from the object. (See *persistance of vision.*) Recurrent vision was first noted by Young in 1801 who observed that after an object had been intensely illuminated by an electric spark, the image recurred to the eye several times after the spark had passed; the image became fainter with each successive recurrence.

RED-CONSCIOUS – said of an electron camera which is unduly sensitive to light of long wavelengths.

This results in inartistic enhancement of the relative brightness of areas of the image which are red. (See *refraction.*)

REFLECTION – the return or change in direction of particles or waves after impinging on surfaces, such as reflection of light, sound waves, radio waves, or electron streams. It has been found that interference patterns on television reception invariably exist except where the terrain is open and flat and are frequently caused by reflections from relatively nearby objects. In many cases they are so severe that excellent signals will be received in "live spots" whereas several feet away from these spots no signal can be heard or seen. Reflection is said to be "irregular" when, as in the case of light reflected from a whitewashed wall or white sheet or piece of white paper, the reflected rays do not travel back in an orderly manner, but are broken up and scattered by the reflecting surface. Reflection is said to be "regular" when, as in the case of a mirror, the light rays are reflected back in an orderly and unbroken manner. Reflection is a very important factor in television science for the reason that most of the light dealt with in the televising of an image is of the reflected variety.

REFLECTION FACTOR – the extent to which a surface reflects light. In daylight, white paper has a reflection of about 80 per cent, while gray, yellow, blue and red papers have reflection factors of about 65, 60, 40, and 20 per cent respectively.

REFLECTIVE OPTICS – in television, a system of mirrors and lens used in projection receivers, such as the RCA Schmidt system uses.

REFLECTOR – additional antenna elements used in an antenna system to reduce the pickup of signals from one direction and to increase the pickup from the opposite direction. In a directional antenna system, the reflector is the rear portion and is not generally connected with the remainder of the antenna. Also, any surface is a reflector as it throws back some of the light falling on its surface.

REFRACT – to deflect from a straight line, as a ray of light; to determine how much the eye refracts light.

REFRACTION – the change in direction (bending) of a ray of light, heat, sound, or a radio wave or other radiant energy passing obliquely from one medium to another, in which the velocity of propagation is different. Thus, light rays are bent in passing from air to water. The angle between the direction of a refracted emission and the normal to the refracting surface is called the angle of refraction. When light passes obliquely from a medium of lesser to one of greater optical density, it is bent towards the perpendicular, and conversely, when light passes from a denser to a rarer medium, it is bent away from the perpendicular to the surface.

REFRACTOMETER – a device used to measure the amount of refraction.

REFRACTOR – an apparatus, usually of prismatic glass (clear glass fabricated as a series of prisms), which redirects the light of a lamp in a desired direction principally by refraction.

REFRANGIBLE – term meaning "refractable," that which may be bent or turned aside. Light rays are capable of greater bending, being more refrangible than those at the red end of the spectrum.

REFRINGENT – changing the direction of light.

RELAY – to send by a series of carriers or agencies from one point to another.

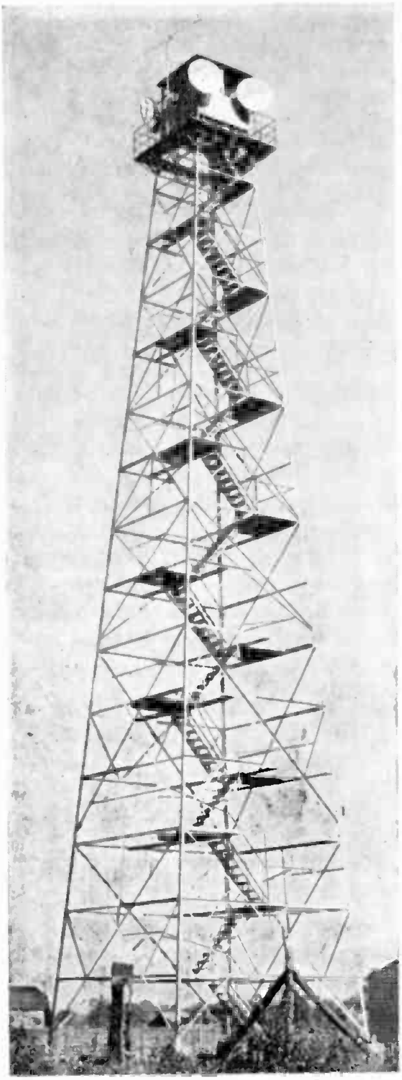
RELAY BROADCAST STATION – a station licensed to transmit where wire facilities are not available, programs for broadcast by one or more broadcast stations, or orders concerning such programs. Also known as "relay station."

RELAY INTERNATIONAL RADIO BROADCASTING – in which the material (intelligence or program) is transmitted by point-to-point radio from the originating station to a broadcasting station in another country.

RELAY POINT – location of the relay transmitter.

RELAY STATION – (See *relay broadcast station.*) Generally a radio frequency transmitter located at a remote point from the main transmitter that rebroadcasts television or other radio programs in order to increase the service area; that is, relay the signal to a more distant point. A chain of low power television stations separated 20 or 30 miles connecting two widely separated points used to pass a television program over a greater distance than can be covered by one station, even a high power one. Television radio relays and coaxial cable systems for chaining programs have been in operation for a number of years in the United States. The 1940 Republican National Convention held in Philadelphia was brought to television receiver owners in New York City over the Bell System coaxial cable, a distance of about 90 miles. A two-jump television relay network between New York City and Schenectady, N. Y., has been in operation a number of years. This network consists of a main hop from the Empire State Building in New York City to a pickup station in the Helderberg Mountains near Schenectady, and from there to a nearby broadcast transmitter, a distance of approximately 127 airline miles.

Since 1941 Philco Corp. engineers have operated a two-stage television relay system between New York City and Philadelphia. New York telecasts are relayed by a booster station located at Mt. Rose, N. J., to Philco's video station WPTZ in Philadelphia for rebroadcast to sets in that area. Another multiple-relay television network was demonstrated by Philco engineers between Washington, D. C., and Philadelphia. It was considerably more elaborate than others previously



—Courtesy RCA Victor

Relay Station

demonstrated and consisted of four jumps of approximately 40 miles each from the Capital to the Quaker City. A total of six transmitters handled the television program as it originated in Washington. The transmitting and receiving equipment were as follows: starting at Washington, D. C., to Arlington, Va., to Odenton, Md., to Havre de Grace, Md., to Honeybrook, Pa., and then to Philadelphia. The sites at which the towers were erected were chosen with the idea of having each location in direct view of the relay point on each side and which gave a minimum terrain clearance of 100 feet at any point along the path. The principal reason for the selection of sites to give a minimum of 100-foot terrain clearance, was to make possible the use of frequencies above 1,000 megacycles in future experimental work and not be bothered by power absorption by objects along the transmission path. The towers are within relatively close distances to power line facilities so that all four of the relay points can be operated from commercial power. Emergency gasoline power generating equipment also is available at each point.

The television relays mounted on towers look like lighthouses and are entirely automatic. These pick up the signal on one carrier frequency and rebroadcast it on another frequency. With such an arrangement of relays, television will undoubtedly be sent from city to city so that a whole nation can be conceivably connected for the interchange of television programs, spaced 25 miles apart.

RELAXATION OSCILLATOR — a type of circuit which oscillates periodically. Used to generate scanning voltages.

RELAY TRANSMITTER — a radio frequency transmitter located at a distant point from the main transmitter used to pass the television program on from one station to another outside the range of the original station. Usually placed between two stations. Also called "repeater station."

RELEASE — studio expression directed by producer to studio personnel indicating end of the broadcast and the fact that the station was no longer on the air.

REMOTE — a broadcast originating at a point outside the studios proper, generally utilizing special telephone lines to the studio master control.

REMOTE CONTROL — the control of a device from a distant point. Also, producing a television or radio program at some remote point, relaying it to the studio on a wire or short-wave channel and controlling it entirely from the studio.

REMOTE PICKUP — picking up a program with cameras and microphones at a distant point away from the studios and transmitting it to the studio or main transmitter over telephone lines or over a short wave radiolink. Usually televised by studio aboard a mobile unit (automobile, boat, airplane).

REMOTE PICKUP COMMERCIAL — by use of a portable pickup camera and transmitter units, the commercial may display a product in actual use, on sale or being demonstrated, as in a fashion show, cooking school, sewing class, etc.

REP — a station's or network's sales representatives in out-of-town territories.

REPEATER — a radio relay transmitter for boosting or amplifying signal strength in a radio link between stations of a network. Also called "tower repeater stations."

REPEATER STATION — a combination radio transmitter and receiver, usually unattended and automatic, used to relay a program from one station to another by radio when the distance is too great for reliable service between the stations directly. Generally employed at frequencies above 100 megacycles. Also known as a "booster station" and "relay transmitter."

REPRODUCER — See *reproducing device.*

REPRODUCING DEVICE — a device such as a television receiver which changes electric currents to a form which the senses may perceive. (Syn.: *reproducer.*)

RESOLUTION — the sharpness or degree of reproduction of the detail of a scene after transmission through an electron system, optical system, or complete television system. Resolution is of vertical and horizontal types and bears distinctly different relations to the mechanism of transmission. Vertical resolution depends only upon the number of lines making up the scanning pattern and upon the size of the scanning spots. The nature of the communication channel in practice plays no direct role in determining resolution vertically. Horizontal resolution, on the other hand, depends upon the channel and upon the spot sizes and shapes. It is related to the number of lines only through the need of a particular rate of repetition of the pattern.

RESOLVING POWER – the ability of the eye or of a lens to determine detail. In reality, it is the measure of the distinctness with which the images of two point sources of light may be separately detected. The resolving power of the eye is lessened by intermittent lighting and also by feeble illumination – facts which must be considered in the design of an efficient television reception screen.

RESONANCE – the condition of two vibrating bodies when the natural frequency of one body is equal to the frequency of the other vibrating body. In the radio receiver, when the natural frequency of the tuner is the same as the frequency of the transmitting station, the two are in resonance.

RETENTIVITY OF LIGHT – synonymous with memory.

RETINA – the membrane at the back of the eye, upon which the objects viewed are focused by the lens of the eye. The retina is made up of a very fine mosaic of exceedingly minute cells – the rods and cones – which are filled with a purple dye which is bleached under the influence of light. This bleaching action is communicated to the brain along the optic nerve, there giving rise to the sensation of light. From the Latin "rete," meaning a "network." (See *rods and cones, visual purple.*) The retina, composed of the thousands of tiny light-sensitive cells, connected each with the brain by a separate nerve fiber, so that each small part of the scene observed is carried to the brain separately and there reassembled into a composite picture. The telephone, first electric carrier of the voice, was modelled, so far as the diaphragm was concerned, upon the construction of the human ear. Reasoning logically from this imitation of nature, Ayrton and Perry in 1880 concluded that an electrical system of sight could be assembled using the human eye as a model.

G. R. Carey in Boston, and Ayrton and Perry in England, proposed to build a large mechanical eye, using a plate of selenium cells as the sensitive retina. From each of these tiny cells an electric wire, or nerve was led to a corresponding spot on the receiver, or brain. As the image was to be focused by the lens on the selenium plate, each separate wire was to carry its own electrical impulse, depending upon the amount of light shining upon its original selenium cell. Magnets connected to each of the small sections of the receiver plate were to regulate the amount of light upon each section, according to the electrical current carried to it by its individual wire, and thus the identical composition of light and shade would be crudely built up at the receiver plate. Although made up of tiny spots of different light intensity, when viewed at a distance the eye would detect only the total effect, thus creating an intelligible image. This crowded maze of connecting wires, however, made the machine cumbersome and clumsy and impracticable for communication over great distances.

RETRACE – the return path of the electron beam in the fluorescent screen of an electronic tube formed as the cathode ray beam moves back to its starting point (of the next line or field). Also known as retrace line, or return trace. Usually the view is blocked out during the return trace. (See *fly back.*)

RETRACE LINE – See *retrace.*

RETURN FLATS – narrow scenery flats added to the sides of a stage set to extend or confine the background so that cameras shooting at angles will not get off the set background in the picture. Return flats are also used to add depth to some architectural features of stage sets, such as a window return or a mantel breast return. These flats are placed in back of the window or mantel.

RETURN TRACE – See *retrace.*

REVERBERATION – a succession of echoes, caused by repeated reflections of sound in a large room or enclosure. This "persistence of sound" can be cut down or eliminated by acoustically deadening all flat surfaces in the studio – particularly the walls, ceiling and where possible the floor and scenery. Another way to suppress unwanted sound is to place the microphone very close to the source of the sound, so that a greater volume of direct sound will reach the microphone and the indirect or reflected noise becomes less noticeable.

REVERSED IMAGE – A reversed image on the screen of a television receiver can manifest itself in two variations. It may take the form of a negative image, similar to that found in a photographic negative, in which the white parts of the original picture appear black and vice versa. Or the image may be laterally reversed; that is, one in which the right side of the original appears on the left side of the television screen and the left side of the original is on the right side of the screen, this type of reversed image giving rise to the term "mirror effect." Reversed images in video reception are nearly always associated with faulty adjustments, either electrical or mechanical, of the apparatus, and are remedied without much difficulty.

RIGNOUX AND FOURNIER TELEVISION SYSTEM – The earliest television researchers tried to produce an artificial eye (along the lines suggested by G. R. Carey) by substituting selenium for visual purple and constructing an artificial retina out of a mosaic made with selenium cells. For nerve filaments they substituted wires which connected each cell to a shutter that took the place of the brain.

Each shutter was arranged to open when light fell upon the specific cell connected to it. As each shutter opened, it permitted a spot of light to fall upon a screen at the receiver. In this manner, each selenium cell controlled a spot of light, the picture being produced by a mosaic formed of these spots.

Apparatus modelled along these lines was actually made by Rignoux and Fournier when in 1906 they constructed a machine which was constructed only to demonstrate the principle, and made no claims towards being a device which would actually accomplish television. The transmitter consisted of a wall covered with 64 fairly large selenium cells. From each of these ran two wires to the receiving screen which consisted of 64 shutters, each being controlled by its respective cell. When any given cell at the transmitter was brilliantly lighted, it sent a strong current over the two connecting wires to the receiver, where it caused the appropriate shutter to open so that light from a small lamp could shine through on to the corresponding section of the receiving screen. By covering the transmitting wall with large stencils, and shining a powerful light on to the wall, images of the alphabet were transmitted so that they were recognizable at the receiver. That is, the light from behind the shutters reproduced the pictures. The idea of separating images into small elements, and converting the illumination of each element into the electrical current, and sending each through a separate wire, was considered good, but led to a very elaborate and cumbersome system. To transmit an image of good receptive quality, numerous pairs of separate wires would have been required, which naturally was impracticable. To simplify the problem, Paul Nipkow in 1884 had proposed that instead of sending all the elements of the image at once, to transmit the picture point by point or to scan the image. This suggestion simplified the problem greatly since it enabled the transmission of an image over a single wire or over a single communication channel. This was accomplished by Nipkow's scanning disc.

RIDE GAIN – the studio engineer is said to ride gain while controlling increases or decreases in program volume.

RIM LIGHTING – corrective lighting within the camera to reduce bottom flare in the picture. Again, spotlighting from the back to bring individual subjects out of the background by virtue of their brightness; that is, "rim light" around the edges of the subject.

RING MIKE – microphone installed over the ring at boxing and wrestling matches to pick up referee instructions and ring sound.

RING TELEVISION – system of airborne television in which the equipment used includes a special radio-electronic camera that can be moved with the freedom of an ordinary newsreel camera. It is the most powerful of airborne equipment having a range of over two hundred miles when broadcasting at an altitude of 15,000 feet. It was carried in a Martin JM-1 airplane, powered with P & W engines, which maintained an average cruising speed of 200 miles an hour. Two cameras were carried, one in the nose bombardier nacelle and one in the waist of the fuselage. Developed by the Radio Corp. of America in conjunction with the United States Navy, and announced publicly on March 21, 1946 at the Anacostia Naval Air Station, Washington, D. C. The use of "Ring" television "heralds a new era of combat reconnaissance because it can flash battle actions back to central headquarters, where commanding officers previously were forced to rely upon verbal reports to determine the course of action to be taken," the Navy Department announced in making the system known. "An entire beachhead, for example, could be relayed by television to show the actual scene of battle to the officers controlling the attack strategy." Future uses: for military combat reconnaissance.

ROBINSON SYSTEM – See *sound on video system.*

ROBOT TELEVISION TANK – a radio controlled tank, in which there is no living person, containing operated from a distance, a television transmitter housed in a shell-proof turret made of case-hardened steel, that can withstand everything but the heaviest shell. The operator, several miles back at headquarters, sees on his screen exactly the terrain over which the Robot tank will travel. Conceived theoretically by Hugo Gernsback in *Radio-Craft*, April, 1945 as another possible project of "things-to-come."

RODS AND CONES – anatomical expression formerly used to denote the exceeding minute cells which comprise the active surface of the retina of the eye. Spaced over the retina of the eye there are approximately five million of these cells, each of which is filled with a light-sensitive pigment (visual purple). The rods or rod-like cells, are sensitive to low intensity illuminations, the cones or cone-shaped cells being sensitive to average and high-intensity illuminations. The rods and cones are not situated equally in all areas of the retina, there being a superabundance of cones towards the center of the retina. Hence, the retina is more sensitive to average and high illumination intensities at its center than it is at its margins. (See *retina, visual purple.*)

ROLL IT – a cue to start the film projection.

ROSING'S APPARATUS – an early form of television apparatus, first developed by the Russian, Boris Rosing, in 1907. He used in his transmitter an arrangement of revolving mirrors which threw an image of the scene or subject to be televised on to the surface of a selenium cell. The pulsating current from the selenium cell was transmitted along a wire to the receiving instrument in which it charged up a series of condenser plates, which exerted a deflecting action upon a beam of cathode rays in a cathode-ray tube. Rosing's television receiver constituted a very early use of the cathode ray as a practical means of television. (See *Rosing, Boris.*)

ROTARY BEAM ANTENNA — a highly directional short wave receiving or transmitting antenna system mounted on a high pole or mast in such a way that it can be rotated to any desired position either by hand or by an electric motor drive.

ROTHSCHILD TELEPHOT SYSTEM — In 1907, patents were issued in the name of Sidney Rothschild, of New York, on a system which caused a light controlled composite background to vary the intensity of electrical currents flowing over a wire, and caused these currents to control the intensity of light at the receiving station. This light was caused by an appropriate mechanism to produce a moving luminous spot of varying intensity in such a manner as to reproduce a facsimile image disposed adjacent to the aforesaid background at the transmitting station. At the sending station he would have had a subject whose picture was transmitted through a lens, the rays of which fell on a selenium cell, after passing through a belt which was rotated at high speed. This belt had a number of longitudinal slots disposed crosswise. A revolving cylinder was provided with a series of slots, each adapted to register with one of the sections of a further selenium cell. In this manner, the inventor expected to cut up the variious points of the image and transmit the impulses. At the receiver, he had a revolving wheel and another rapidly moving belt which also had longitudinal slots. By means of a light source which was an incandescent lamp, the light rays passed through the revolving wheel and slotted belt. The light rays thus were cut up exactly in the same manner as those of the transmitter. These light rays fell through a lens and then were projected on the screen where the picture was supposed to reproduce.

ROUTINE — a rehearsed act, a specialty number.

RURAL STATIONS — television or radio broadcast stations which serve an area more extensive than that served by a Metropolitan station, and predominantly rural in character. Channels 2 through 13 are available, with service area of rural stations being determined by the Federal Communications Commission. (See *metropolitan station, community station.*)

RUSSIA — Television experiments began in 1934 using a mechanical scanning system which was raised to 240 lines in 1936. In 1937, Russia bought RCA television equipment for a Moscow television center. Experimental telecasts continued until the outbreak of the War. At present Moscow television works on a system of 343 lines with a definition considerably lower than England's 405. However, Mr. Novakovsky, chief engineer of Moscow Television, according to British Broadcasting Corp. sources, "expects to switch over to an entirely new plant with a definition of 625 lines."

Present indications are that the extensive research carried on during the war to improve the technical efficiency of radio and signal equipment for military communications will yield big dividends in the Soviet television field.

There was a recent demonstration in Moscow of an all-electronic cinema-television projector which casts an image of three dimensions on a mirror-like screen of some 2,000 microscopic lenses. Inventor Sergei Ivanov explained that the image is depicted at different angles by employment of a special stereoscopic system which throws six to eight pairs of pictures onto the screen at once and foreshortens them at various angles. Installation of the Ivanov system in the Palace of Soviets, long under construction in Moscow, is planned.

While television operations in Moscow are based on American equipment and methods, Leningrad has developed a center of strictly Russian activity in this field. This has been largely due to the fact that an Institute of Telemechanics and similar scientific bodies in that city have long been doing experimental work in the radio field. The Institute for Television, established in Leningrad in 1935 is Russia's Television Laboratory. This institute designed the country's first ultra short wave transmitter. The following year Leningrad's Institute of Telemechanics developed cathode television systems, first of 60 and then of 180-line definition.

S

SE – chemical symbol for selenium.

SHF – abbreviation for superhigh-frequency, the band from 300 to 30,000 megacycles in the radio spectrum.

SMPE – abbreviation for Society of Motion Picture Engineers.

SANABRIA-HAYES TELEVISOR – About 1928, M. L. Hayes, and U. A. Sanabria, two Chicago engineers, built a television apparatus that reproduced a very clear and brilliant image. An intense beam of light from an arc or incandescent lamp passed from right to left, through a whirling perforated disc, the successive beams of light falling on the subject's face. As the reflected light beams fell on one of the four huge photoelectric cells, observed in the cabinet directly in front of the subject, minute photoelectric currents were produced by the cell or cells affected by the reflected light beam at any particular instant. These weak currents from the photoelectric cells were then highly amplified by a vacuum tube amplifier. When the amplified photoelectric cell currents emerged from the last stage of the amplifer this current was connected to a neon tube which was placed behind a second revolving perforated disc. This receiving disc was rotated at exactly the same speed as the transmitting disc by a synchronous motor. The reproduced image was observed by looking through a diaphragm in front of the whirling perforated disc at the spot where the neon tube light was situated. As the constantly changing picture image currents arrived at the neon tube, the latter instantly regulated the amount of light given off in simultaneous fashion. The transmitting and receiving disc each had a similar spiral of holes in them so that when a disc made a revolution, the spiral of perforation had succeeded in completely scanning the image to be transmitted.

SANABRIA SYSTEM – a method of television transmission and reception developed by Ulysses A. Sanabria, of Chicago. The transmitter operated by scanning. The receiver by means of a special type of neon lamp, could throw an image of considerable size upon the screen.

SATELLITE – a smaller television station that is tied in with respective regional networks by taking the network programs from the nearest relay station and rebroadcasting them through their local facilities. The satellite station will also produce and televise its own programs, mainly film, under local sponsorship, independently of the networks. Such a station may serve a community outside the service area of a master station.

SAVE THE LIGHTS – order to switch off the lights. Also: "douse it."

SAWTOOTH – a wave of electric current or voltage employed to control scanning.

SCAN – to examine point by point, as in converting a scene or image into a methodical sequence of elemental areas.

SCANNING – the process of successively analyzing, according to a predetermined method, the light values of picture elements constituting the complete picture area in a television or facsimile system or reproducing the corresponding elements at the receiving end. This process of electronic analysis of the optical image, focused upon the mosaic of the iconoscope or cathode ray tube is accomplished by means of a moving electron beam by means of a moving electron beam. A series of parallel horizontal lines are traced from left to right in sequence from top to bottom in the manner of reading a page of print, or a typewriter impressing letters on a piece of paper. Scanning changes the light and shadows of a scene into electrical impulses to form the image on the receiver tube. The cathode-ray beam scans the mosaic in the iconoscope and the fluorescent screen in the kinescope. Scanning means "exploring."

Scanning in a transmitter is the process of analyzing the scene or object into picture elements or elementa areas. In a receiver, the process of scanning is building up the image from picture elements or elemental areas. Scanning may be accomplished mechanically but at the present time the electrical scanning method which has been found superior is used. There are several different methods of scanning. Any convenient method of selection may be used so long as the same sequence is followed in both the transmitter and receiver. A great many of them have been proposed and tried. The one universally adopted in television is known as "linear scanning."

The word "scanning" arises from its similarity to the manner in which a reader scans a page of printed type. The eye begins at the upper left-hand corner of the page, travels along the first line of type until it reaches the right-hand edge of the page. Then the eye rapidly reverses its motion and returns quickly to the beginning of the next line where it resumes its slower left-to-right motion, traveling to the end of the line, then back, and so on. A very similar motion is used in television scanning. Every other line or row in the pattern is scanned during the first scanning period. At the conclusion of the second scanning period, each point of the image has been scanned only once, but the eye has received two light impressions from the picture area. The picture-repetition rate has thus been effectively doubled, and the picture information remains unchanged. This is the method known as the "interlaced scanning" system and is generally employed in the television systems standardized throughout the world, because it has proven to be highly effective in reducing flicker to a point where it is undetectable under most ordinary conditions.

There are different methods of scanning. (See *Orthodox Scanning, discontiguous scanning, overlapping scanning, graduated scanning, bilateral scanning, non-sequential scanning, sequential scanning, intercalated scanning, scattered scanning, consecutive intercalation, simultaneous intercalation, zone scanning, zig zag scanning, continuous scanning, lissajou scanning, spiral scanning, radial scanning, point scanning, unorthodox scanning.*) (Also see *transmission standards, color television* for color scanning.)

SCANNING APERTURE – a hole in a scanning disc through which the scanning beam passes.

SCANNING BEAM – the beam of light or electrons which scans a television image.

SCANNING BY MIRRORS – See *mirror scanning*.

SCANNING COIL – an assembly of four coils used to control the path of an electron beam.

SCANNING DEVICE – there are two principal groups of scanning devices, known as (1) focal-plane; and (2) non-focal plane, which are distinguished in the following way. The focal-plane class of scanning device is characterized by the fact that an element moves in the scanning area itself; this is illustrated, for example, by scanning discs, drums, band, etc., in which an aperture or the point of intersection of two apertures moves in an area upon which an optical image has been focused at the transmitter or behind which a modulated light source has been placed at the receiver. The non-focal plane class of scanning device comprises those devices in which the function of the moving elements is to deflect a beam of light for traversal purposes in some plane spaced from the moving elements. This is shown by mirror-drums and the mirror-screw. Thus in a focal-plane scanning system, the scanning elements move substantially within the visual focal-plane of the eye through a lens or lens system. The non-focal plane systems, on the other hand, move in a plane substantially remote from visual focal plane.

SCANNING DISC – a carefully balanced rotating metal disc having one or more spirals of holes near the center of the disc, used to break up a scene into elemental areas at a television camera or to reconstruct an object in a video receiver of a mechanical system. The holes in the disc sometimes contain lenses. (See *Nipkow disc.*) The scanning disc acts as a shutter and cuts off the beam from the light source which is being projected at a predetermined sequence. The scanning disc was invented and named by Paul Nipkow, in 1884.

When the disc was placed between a lamp and an object, and then slowly rotated, the light shone through one hole at a time. Thus was produced a moving spot of light over the person or objects to be televised. The spiral of holes was so arranged that when the disc was rotated the first spot light travelled across the top of the object. As this spot passed off at the right, the following spot appeared at the left of the scene, just below the path followed by the first spot. Each succeeding spot moved just below the one before it, and the last spot covered the base of the scene pictured. When the disc had turned once, every small element of the object had been illuminated in turn by the narrow beam of light from the lamp. As the scanning disc was turned faster and faster, the moving spot covered the image more rapidly, until the spot appeared as a series of lines across the scene. Because of the characteristic of sight known as persistence of vision (see), the eye was unable to distinguish between individual stimuli unless separated by a certain length of time. Thus, as the successive appearances of the spot became more rapid, they seemed to merge and took on the form of a series of lines covering the object from top to bottom. Even more rapid revolutions of the disc caused the lines themselves to merge, until the entire scene appeared to be illuminated by a continuous square of light.

SCANNING FIELD – the area explored by the scanning apparatus both at the transmitting and receiving ends.

SCANNING HOLE – See *scanning aperture*.

SCANNING LINE – a single continuous narrow strip containing highlights, shadows and half tones that is determined by the process of scanning. It is one line from left to right of the picture being transmitted. Syn.: *picture strip*. Other factors being equal, the greater the number of lines, the more detail in the received image.

SCANNING METHODS — See *scanning.*

SCANNING SPOT — the area viewed at any one moment by the pickup system of a television camera or facsimile scanner. That is the small light spot which, by one method or another, sweeps continuously over every portion of the picture or image to be televised, thus enabling the picture to be split up into a large number of small areas or picture elements. Other factors being equal, the smaller the scanning spot, the finer in detail will be the received image, for a small scanning spot will enable the light and shade (the detail) of the image to be picked up and transmitted with precision, a task which became more and more difficult with increase in size of the scanning spot. Syn.: *tracing spot, exploring spot.*

SCANSION — the operation of scanning.

SCATTERED SCANNING — that system in which the number of light strips in each object is relatively small, so that each group cannot by itself be said to constitute a scan, while the number of groups is relatively large.

SCENE — the momentary image received or taken by the camera which is televising.

SCENE DOCK — a storage chamber or room for stage flats.

SCENIC ELEMENTS — See *construction units.*

SCENIST — a word recommended in 1931 to describe television technicians at the transmitter. That is the men who operate the television transmitter and put the television scenes on the air. Now obsolete.

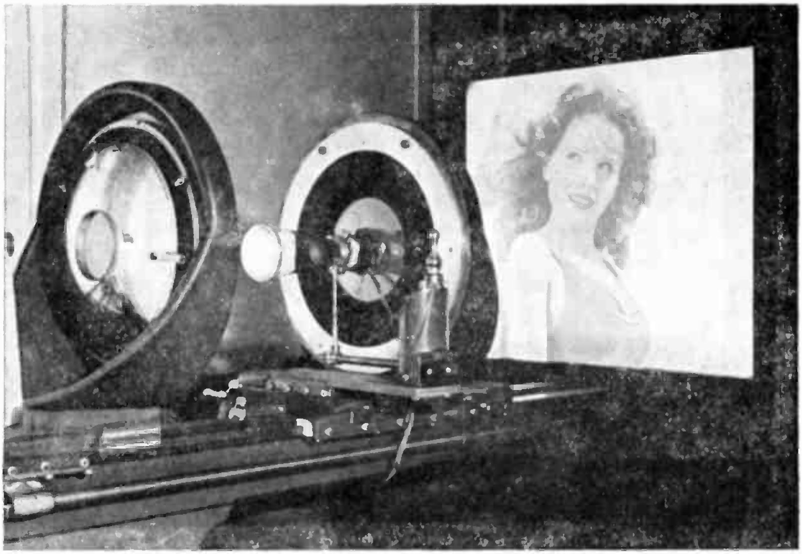
SCHEMATIC — a circuit diagram which shows electrical connections of a radio device by means of symbols which are used to represent the various component parts.

SCHMIDT OPTICAL SYSTEM — a principle of optical projection used in some projection-type television receivers. Essentially the system consists of a spherical mirror which reflects the light from the projection kinescope onto a viewing screen, an aspherical lens element being placed at the aperture of the mirror to correct the aberrations of the system. Such an optical system makes possible many times more efficient utilization of the light from the kinescope and brings projection television well into the realm of the practical.

SCLEROTIC — the outer coat of the human eye which completely surrounds it, and which, at the front of the eye, has a white opalescent appearance, thus giving rise to the "white of the eye." From the Greek "skleros," meaning "hard."

SCOOP — multiple lighting units in the studio.

SCOPHONY CORPORATION OF AMERICA — supersonic and Skiatron Television Systems. Scophony of America has concentrated on develop-



— *Courtesy Life*

Schmidt Optical System

ing two television receiving systems which though based on different physical phenomena, both employ the two principles of light modulation and optical storage. The first is the Supersonic System. It is based on the diffraction of light by supersonic waves in a liquid. An active liquid column of two inches accommodates about 250 picture elements. Since a column of this or even a greater length is utilized, it can be seen that the supersonic light modulator permits a storage or simultaneous representation of several hundred picture elements. Television pictures of theatre size were shown commercially regularly with great success in London movie theatres and also experimentally in a New York theatre, before the war.

The second method using the principles of storage and light modulation is the Skiatron. It consists substantially of a special type cathode-ray tube with a screen of a material exhibiting the property of "electron opacity," that is, the normally transparent material can be rendered more or less opaque by the electrons of an impinging cathode-ray beam. This interesting electron opacity effect which occurs in various ionic crystal materials, for instance, of the alkali-halide class, had been for many years a scientific curiosity, until Dr. A. H. Rosenthal, of the Scophony Laboratories, by experimental and theoretical investigations declared that it had very desirable qualities for television and other applications.

According to Dr. Rosenthal, "Generally speaking, any intelligence traced upon the electron opacity screen by a cathode-ray beam is represented thereon by temporary local changes in its optical properties, such as its transparency, its reflective power, its refractive index, etc. Therefore, these traces can be made visible in various ways by illuminating the screen, apart from the previously described projection method which is only one of the various applications embodied in the Skiatron patent group of Scophony." The Skiatron represents a cathode-ray controlled light valve and thus is a purely electronic system. It employs the principles of light modulation and high optical storage and Scophony's Dr. Rosenthal declared there is much reason to expect that this system may ultimately acquire great importance both for theatre and home television.

An additive successive color method, it was indicated, can be easily based on the Skiatron and Supersonic methods. The Skiatron method, it is claimed, can also provide a subtractive color television system. This is based on the fact that the color centers or opacities have different colors for different crystal materials. Present color motion picture and photography processes are based on subtractive methods like Technicolor and Kodachrome. Many far-reaching improvements have been and are being made on these methods.

Panel 6 on Television, of Committee 3, Radio Technical Planning Board, at a meeting held on Feb. 25, 1944 at the Hotel New Yorker, New York City, passed the following resolution: "In the absence of adequate technical information on recent developments in the Scophony system and in view of the technical material on this system which was published before the war, it is the opinion of this committee that our present knowledge of the Scophony System does not justify any change in television standards now being considered nor any delay in arriving at such standards."

SCOPHONY TELEVISION SYSTEM — a mechanical television developed in Great Britain, utilizing the light-storage phenomenon of a supersonic light valve and ingenious optical and mechancial methods that provide large bright pictures suitable for theatre installations as well as home television receivers. The apparent screen brightness is multiplied several hundred times because several hundred picture elements are projected simultaneously. The system is said to have been invented by G. W. Walton and developed and merchandised by Scophony, Ltd. The image to be transmitted projected to a specially constructed "stepped" or echelon, prism or reflector, which so displace the image laterally that the picture was spread out into a continuous line. This line was then scanned by means of some vibrating light spot, the picture elements thus created being passed through the photoelectric cell and transmitted in the regular manner. At the receiver a line of light was created and modulated in exact accordance with the incoming current impulses derived from the transmitter. By means of another stepped prism or mirror-reflector this line of light was built up into a reproduction of the transmitted picture.

The principles used in the Scophony system were quite different from those ordinarily used in television practice. In the Scophony mechanico-optical receiver system a light beam from a high-intensity arc was projected through a highly ingenious supersonic light valve which stored up in liquid form picture element images, projecting as many as 50 or more simultaneously along a single scanning line upon the screen. An efficient split-focus optical system projected this complex beam of modulated light upon a screen placed about 20 feet in front of the projector, located on the stage behind the screen. The projector had a wide diffusing angle and was claimed to involve only a small loss of light. A complete Scophony receiver for home use was said to contain 39 tubes.

Instead of projecting a single spot of light at one time on the viewing screen, the Scophony receiver stored up the incoming signal impulses and, keeping a number of them in a row, projected that row upon the screen to form a large part of one line of the picture. These picture elements remained stationary on the screen as the scanning proceeded. The beam of light from the light source was focused upon a transparent container filled with a liquid and a quartz crystal at the bottom. This functioned as a light control, the incoming television setting up vibrations in the quartz crystal which traveled upwards through the liquid. This produced regions of different densities in the liquid, each region corresponding to the light value of a picture element; all these regions traveled upwards at the same rate of speed, which corresponded to the rate of horizontal scanning. An image of the liquid container was projected upon the television screen horizontally after being reflected from two mirror drums, one rotating at a much slower rate of speed than the other. If the drums were stationary, the image of the liquid container would fall along one line of the picture, with the light and dark regions in the image traveling toward the left because of the vibrations traveling upwards in the container. With the drums rotating, however, this movement of the light and dark regions of the image to the left was counteracted, and these appeared to stand still while each new impulse received created a vibration at the bottom of the container. This added on to the right side of the group of picture elements on the screen until the line was completed. The effect was the same as if a large part of a line of the image were being produced at the same time, thus greatly increasing the brightness of the image.

SCOTOPIC VISION – night vision; the human eye is able to perceive in the dark. (See *eye*).

SCRAMBLED TELEVISION – term for television reception which would be "rented out" to the consumer; a system requiring special receivers using special devices known as keys or unscramblers which would be inserted into home receivers enabling the piecing together of images on the set otherwise not obtainable. This is not an actuality as yet but has been proposed by at least one American television company (Scophony Corp. of America) as a way of eliminating advertising and commercials from the television airways. In other words, the service would parallel the present-day telephone service, wherein the subscriber would pay so much rental each month and for the installed receiver get specially prepared programs sans commercials from one specific company on specially-built receivers. The idea was not received very favorably by American industry well aware that the American public prefers to get its entertainment free (as on radio).

SCREEN – the chemically treated or coated surface on the inside of the large end of a cathode-ray tube. It becomes luminous where the electron beam of the tube impinges on it. Also, a retractable screen or wall screen used in conjunction with the projection-type receiver. In mechanical scanning systems the screen is a white reflecting surface.

SCREEN SIZE – usually refers to the size of the picture as thrown on a motion picture or similar screen. (See *projection television.*)

SCREEN-SIZE TELEVISION – The late John Logie Baird, of England, and E. W. Alexanderson and Ulysses A. Sanabria of the United States, had early successes with large-image television. Sanabria used lens discs with a "neon arc" light and "interlaced scanning"; Baird, a mirror drum, with a Kerr cell and arc light. The same sort of light source and modulator was used by Alexanderson.

SCREEN TELEVISION – the projection of television pictures upon a large screen. The optimum viewing of screen depends upon detail and size of the image. The best viewing distance is said to be about four times the picture height, at which time the image occupies optimum field of view. In 1927, the American Telephone & Telegraph Co. showed screen television by a method which consisted of a screen built up from a continuous neon tube, different areas of which were activated in sequence by means of a commutator. Later, another method was demonstrated by the General Electric Co. in which screen television depended upon the projection of a spot of light on to a screen, the spot of light being made to traverse the screen by means of one of the regular forms of scanning device. J. L. Baird in England and the Telefunken Co. also used the same spot-of-light system.

SCRIPT – the manuscript or written form in which a television program is enacted. This includes continuity and dramatic score.

SCRIPT GIRL – the director's assistant in matters of script preparation, clearance, editing, etc., and prompter in rehearsals.

SCRIPT PROGRAMS – programs using spoken words as opposed to music.

SECONDARY ELECTRONIC EMISSION – means that the electrons which are excited by the action of the televised scene, sporting event, or theatrical production, are not the ones that go over the wires to the television screen. Each of these primary electrons acts as a missile to put two or more secondary electrons into action. Thus, by a buildup of several stages of amplification similar to those used in any radio set, a little light becomes a lot of light.

SECONDARY EMISSION – emission of electrons from a cold electrode when it is hit or bombarded by high-speed electrons.

SELECTIVITY – the ability of a circuit or a complete receiver to discriminate between the transmissions of differing frequencies. That is, the degree to which a radio receiver is capable of reproducing signals from one station while rejecting signals from all other stations on adjacent channels.

SELENIUM – a chemical element having marked photosensitive properties. Its resistance varies inversely with illumination. It is used in photoconductive cells and in some types of photovoltaic cells, as well as in some dry-disc rectifiers.

In a little terminal station for the Atlantic cable on Valentia Island off the southwest coast of the Irish Free State (then part of Ireland) in 1873, a young telegraph operator in the employ of the Telegraph Construction Co., named May (first name unknown) was puzzled by the peculiar behavior of some selenium resistances with which he was working. For some unknown reason the current in the resistances varied, although he made no changes in the circuit. He chanced to notice that as more light from the sun, shining at intervals through the window on his apparatus, fell upon the selenium the current increased. This accidental discovery of the unique property of selenium, by which it could vary the passage of a current through it as the light was varied, began a whole series of investigations from which emerged the present-day systems of transmission of light by electrical signals.

The name selenium was given by its discoverer, Jons Jacob Berzelius, Swedish chemist, in 1817. Selenium is from the Greek "selene" meaning "the moon." Paul Nipkow later combined a light-sensitive selenium cell with a new device of his own design which he called a "scanning disc." As indicated by its name, this disc scanned or looked-over the object to be transmitted and sent the resulting dissected image over a wire to the receiver.

SELENIUM CELL — a photoconductive cell consisting of a small amount of selenium between suitable electrodes. The resistance of the cell decreases when the amount of illumination on the cell is increased.

SELF-INDUCTION — the property of a coil, corresponding to mechanical inertia, whereby it tends to keep out a current coming in, and once in, to prevent it from discontinuing; in short, to oppose any current change through it.

SELSYN — abbreviation for "self-synchronizing."

SENLECQ'S APPARATUS — See *telectroscope*.

SENSITIVITY — the ability of a television or radio receiver to reproduce weak signals with satisfactory intensity or volume. Also, a control on British television receivers located in positions other than in the front.

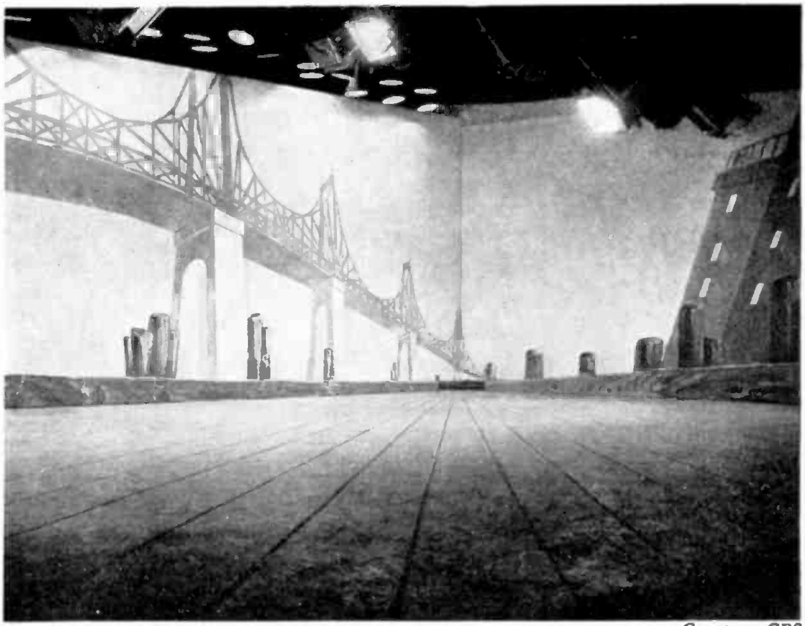
SEQUENTIAL SCANNING — scanning in which the spot travels over each line in the same direction, returning swiftly from the end of one line and the start of the next.

SERRATED PULSE — a horizontal or vertical synchronizing pulse divided into a number of small pulses each of which acts for the duration of half a line in a television system.

SERVICE AREA — that area surrounding a broadcasting station in which the signal is strong enough for satisfactory reception at all times, and not subject to objectionable interference or fading. The primary service area of a broadcast station means that area in which the ground wave is not subject to objectionable interference or fading. The secondary service area means the area served by the sky wave and not subject to objectionable interference. The signal is subject to intermittent variations in intensity. The intermittent service area means the area receiving service from the ground wave but beyond the primary service area and subject to some interference and fading.

SERVICE BAND — a band of frequencies allocated by the Federal Communications Commission to a given class of radio service. The high frequency and ultra-high frequency carrier waves assigned to television travel in straight lines, similar to light, and as they reach the horizon they keep on going off into space, leaving the earth. They do not bend to any appreciable extent to follow the curvature of the earth as ordinary radio carrier waves do. Therefore, television transmitters are generally built on the tallest building, highest hill or mountain in the area to be served. The service area covered by a television station may extend as far as 65 miles in any direction, depending upon the height of nearby buildings and upon the topography of the surrounding country. Generally, however, the service area is within a radius of from 30 to 50 miles.

SET — the term referring to a television or radio receiver, or a stage set.



— *Courtesy CBS*

A Stage Set

SET UP — to install a receiver in a studio. To install equipment for a broadcast using portable equipment.

SHADING — the process of correcting the light distribution in the picture produced by the television camera. This is part of the station monitoring job. (See *shading signal.*)

SHADING GENERATOR — the series of electrical circuits that create the wave shapes used in shading.

SHADING SIGNAL — In a television camera, the signal that serves to increase the gain of the amplifier in the camera during those intervals of time when the electron beam is on an area corresponding to a dark portion of the scene being televised. (See *shading.*)

SHADOW BOX — corresponds to a motion-picture optical printer. This device has several stages, each of which can be used for flat or three-dimensional objects such as moving title cards, puppets, animated maps, product displays, and even close-ups of live performers. Each stage is separately lighted and controlled by standard dimmers. A simple system of two-way mirrors is used to connect the stages visually and make possible dissolves, cuts, fades, and superimposures within the box itself. Only one camera is required to make the pickup of the various stages. Thus an inexpensive shadow box will do the work of several expensive cameras without tying up more than one.

SHADOWGRAPHS — wireless television silhouettes demonstrated by J. L. Baird in England and C. F. Jenkins in the United States in 1925.

SHADOWING — simulating by paint treatment or exaggerating a natural shadow which cannot be effectively created through the use of lighting alone.

SHARPNESS OF DIRECTIVITY — the extent to which the radiating or receiving properties of an antenna are concentrated within certain angular limits.

SHARPNESS OF TUNING — a term practically synonymous with selectivity but referring more directly to the change in the circuit adjustment necessary to alter the signal strength from its maximum value to a negligible one.

SHIELD — a metal can, electric or magnetic screen placed around a radio part to prevent its electric and magnetic fields from affecting nearby parts or to prevent other fields from affecting it.

SHOOTING SCRIPT — the completed version of the television script, including all camera shots and cues used in the actual program.

SHOOTING OFF-OVER — taking in areas in a given camera shot beyond the horizontal or vertical limits of an established setting. Masking walls (pieces) may be provided to correct this difficulty.

SHORT CIRCUIT — a low-resistance connection, usually accidentally occurring between the two sides of a circuit or between any two circuit terminals and often resulting in excessive currentflow and damage to some parts.

SHORT WAVE(S) — a general term usually applied to wavelengths shorter than broadcast-band wave lengths of 200 to 500 meters, corresponding to frequencies higher than the highest broadcast-band frequency of about 1000 kilocycles. Although known for many years, it was not until June 1924 that it attained general acceptance among world radio authorities. That recognition was won in a dramatic demonstration by the late Dr. Frank Conrad, assistant chief engineer of Westinghouse Electric Co. and one of a group of Americans attending a conference of international communications experts in London to consider a radio link between Europe and South America. After lengthy discussions of an ultra-long wave link, Dr. Conrad invited several delegates to his hotel room, where using the curtain rod as an antenna he had a colleague—a former wireless operator—copy telegraph news sent by shortwave from Pittsburgh. Informed the following day by the still-amazed operator-delegate of the sensational test, the conference thereafter decided to build a shortwave link and out of this recognition came the general acceptance responsible for all modern shortwave radio.

SHORT-WAVE CONVERTER — a radio apparatus or device which may be connected between a broadcast receiver and antenna system to obtain reception of higher-frequency stations which the receiver could not otherwise receive.

SHORT-WAVE TRANSMITTER — a radio transmitter that radiates short waves ordinarily shorter than 200 meters.

SHUTTER — an apparatus or device that prevents light from reaching the light-sensitive surface in an ordinary television camera except during the instant of exposure.

SIDE BANDS — those groups of frequencies higher and lower than the carrier that contain the intelligence that is being transmitted and produced by modulation.

SIGHT — the sensation produced when light waves impinge on the photosensitive cells of the eye.

SIGNA — any form of intelligence transmitted by radio wave or wire communication.

SIGNAL — any form of intelligence transmitted by radio wave or wire communication. There are two signals involved in transmitting a television program—the video or picture signal, and the audio or sound signal. Each signal, therefore, contains the electrical impulses which represent the sound or picture elements being transmitted.

SIGNAL GENERATOR — a test instrument used by radio servicemen to produce a modulated or unmodulated radio frequency carrier signal having a known radio frequency value, sometimes also at a known voltage. It is used as a signal source during the alignment of a radio receiver and when hunting for the defective part in an improperly operating receiver. An all-wave signal generator has several ranges, and, therefore, can be set to any carrier frequency which an all-wave receiver can receive.

SIGNAL-TO-NOISE RATIO — the ratio of the intensity of a wanted signal at any point to the intensity of noise signals at that same point. The higher the signal-to-noise ratio, the less noise there is to interfere with the reception.

SIGNAL TRACING — a radio receiver servicing technique which involves tracing the progress of a radio signal through the entire receiver, stage by stage, while the receiver is in operation. Measurements are made during this procedure by a special-tracing test instrument indicator showing when the defective part or stage has been reached.

SIGN OFF — the required technical

through any medium which possesses the ability to vibrate; the traveling vibrations are called sound waves.

SOUND AND VISION ON THE SAME CARRIER — Pye Radio, Ltd., of Cambridge, England, has developed and demonstrated a new system of sound transmission wherein the sound intelligence is transmitted on the same carrier as the vision (video). This system has been primarily designed to function with the standard British system operating with a definition of 405 lines per completed picture and scanning 25 pictures per second, thus giving a line frequency of 10,125 cycles per second. In this new system of sound transmission the audio program is carried by a series of pulses inserted into the waveform. These pulses are "snapshots" of the sound program to be transmitted. The sound pulses are inserted during the line synchronizing pulse of the television waveform and are carried through the field synchronizing interval at the correct positions relative to the line synchronizing edges. From the above it can be seen that the repetition frequency of the sound pulses is equal to the line frequency of the television system. Perhaps the most attractive feature of the Pye sound system is the great reduction in ignition interference as compared with amplitude modulation. In previous television receivers it was necessary to separate, by means of filters, the video and sound programs, and to route them to the respective receivers. Due to the limitation of the filters this separation was not always good enough, particularly under strong signal conditions, and a certain amount of interference between the sound and video was noticeable. Mutual interference between the sound and video programs is eliminated in this system for the trouble disappears when the separate sound channel is dispensed with. (See *Sound on Video System.*)

SOUND CHANNEL — the sound channel is the band used for audio transmission in connection with the television program. The sound carrier is 4.5 mc above the video carrier.

SOUND EFFECTS — various devices used on television and radio programs to produce life-like sound imitations.

SOUND FILM — motion picture film having a sound track at one side of picture frames, for simultaneous reproduction of the sounds that are to accompany the film. A beam of light projected through the sound track is modulated at an audio-frequency rate by the variations in the width or density of the track, and these modulations are converted into audio-frequency signals by a phototube.

SOUND GATE — the mechanical device through which film passes in a sound-film projector for conversion of the sound track into audio-frequency signals that can be amplified and reproduced. In a television camera for pickups, a sound gate is used to obtain the sound accompaniment for the movie being televised. An exciter lamp, lens assembly, and phototube are associated with the sound gate.

SOUND MAN — studio technician who creates either manually or by recordings the sound imitations desired on a program.

"SOUND ON VIDEO" SYSTEM — a proposed system of television for putting sound on the same carrier as the picture and synchronizing sounds, submitted by James E. Robinson of Buffalo, N. Y., in 1944 to the Radio Technical Planning Board's Committee 3, Panel 6, on Television. Mr. Robinson, when he submitted his system to RTPB, was described as a tool designer for the Metallizing Service Co. of Buffalo, N. Y. He proposed to transmit the audio signal on the same carrier as the video and synchronizing signals. The last 4 per cent of the scanning period was devoted to the transmission of the audio signal. Thus the audio signal would be transmitted 3.4 per cent of the time.

From the equipment viewpoint Robinson instead of using square wave blanking or keying signals to switch from video to audio and back to video, proposed to use special cathode ray tubes. At the transmitter he proposed to use an iconoscope and a special cathode ray tube. The plate on the iconoscope would be completely swept in 96 per cent of the forward horizontal trace period and overswept during the remaining 4 per cent of the period. The special cathode ray tube would have a target at the extreme righthand of the horizontal sweep. The electron beam in the special cathode ray tube would be modulated by impressing the audio signal on the control grid. The iconoscope plate and cathode ray tube target would be connected in parallel and the same horizontal sweeps used on the two tubes. Thus, the desired combination of video and audio signals would be obtained. At the receiver, he proposed using a special kinescope with a narrow target along the righthand edge of the picture to pick up the audio signal. Robinson claimed to have built experimental equipment to demonstrate his system and to have operated the system at video and audio frequencies but not at radio frequencies. He stated he would present a demonstration of his method to members of RTPB. However, he never did. On Feb. 25, 1944, Panel 6 on Television of Committee 3 on Review of Old Standards and Proposed New Standards, Radio Techical Planning Board, stated, "the material submitted by Mr. Robinson does not justify any change in television standards now being considered nor any delay in arriving at such standards." (See *sound and vision on the same carrier.*)

SOUND PICKUP — a general term for a part of a sound-reproducing system, such as a microphone, the soundhead in a projector, or a reproducer of phonograph recordings.

SOUND RECORDING — the practice of registering sound on a disc so that it can be reproduced at some subsequent time and be of further practical use. (See *recording, recorder.*)

SOUND SENSATION — the sensation produced in the human brain by a sound wave acting on the ear or by sound vibrations acting directly on the bones of the head.

SOUND SIGNAL – See *signal*.

SOUND SNAPSHOTS – See *Pye television system*.

SOUND TRACK – that section of a sound movie film containing the variable-width or variable density pattern representing the sound accompaniment of the film.

SOUND WAVE – a traveling wave produced by vibrations in an elastic medium at a rate that are audible.

SOURCE – a term sometimes used to describe the part which is supplying electrical energy or radio signals to a circuit.

SPACE – the whole extent of the universe within which all matter and all bodies exist, as, the moon is in space, the stars are in space, etc. The continuous and boundless extension considered as a vacuous entity in which extended things may exist and move; the distance between points or objects, whether regarded as filled or unfilled. Also, usually refers to the space in the frequency spectrum.

SPACE RADIO – travel of radio waves through free space; see "radio."

SPACE SHARED – term referred to a channel in which two or more relay links operated at the same frequency, but in which the relay links operated in different directions, as, for example, East to West and North to South.

SPARKLE DUST – a term used to designate any iridescent powder, such as glass, mica, or tinsel.

SPECIAL EFFECTS – graphic material introduced into a studio presentation, particularly animated titles, miniatures, mechanical gadgets, etc. Camera or lighting tricks used to create or build-up specific illusions.

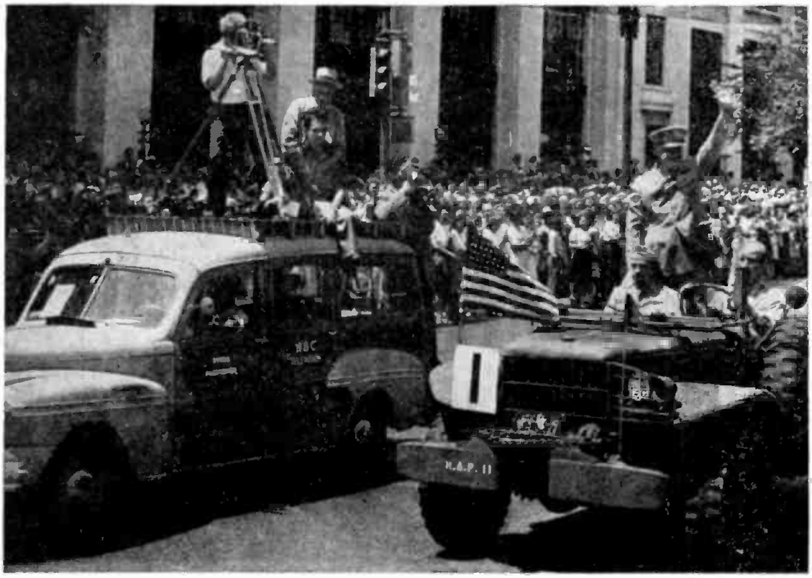
SPECIAL EVENTS – programs not regularly scheduled, but because of news, feature, or other timeliness will make dramatic presentations. Usually picked up by the mobile equipment units.

SPECIFIC LIGHT – highlight and shadows used to create the feeling of dimension in a television image.

SPECTAUDITOR – radio viewer or set-owner, a person who is a spectator at a television receiver. This word was coined and suggested by George B. Cutten when he was president of Colgate Univ.

SPECTRA – plural for *spectrum*.

SPECTRUM – a band or range of frequencies; that is, in reality the entire range of electromagnetic radiations, beginning with the longest known radio waves and ending with the shortest known cosmic rays. Light, the visible portion of this great spectrum, is located half-way between the two extremes. The spectrum of visible light consists of a band of color changing from violet at one end to deep red at the other, just as in a



— *Courtesy NBC*

Special Events Telecast: Gen. Eisenhower's welcome upon his return from the E.T.O.; Washington, D. C., Fall, 1946

rainbow. Also, all the frequencies used for a particular purpose. Thus, the radio spectrum extends from about 15,000 cycles to over 30,000 megacycles. The term is also used to denote an optical spectrum, its visual or photographic observation, and the precise determination of wavelengths. The chief means of obtaining an optical spectrum are the prism and the diffraction grating. The colors of the spectrum are seven in number. In order they are violet, indigo, blue, green, yellow, orange, and red. Beyond the violet and red ends respectively, are the ultra-violet and the infra-red rays, both of which are invisible to the human eye. It is from combinations of the various colored rays of the spectrum that all kinds of visible light are made up. The exact constitution of the light used is very often a matter of greatest importance in television technique. From the Latin "specere," meaning "to see." (See *channel, television channel.*)

SPEECH — the fundamental method of communicating thoughts, which consists of regulating the pitch and intensity of voiced sounds and intensity of unvoiced sounds, by the larynx, and in modifying spectral content of these elementary sounds by posturing the cavities of the mouth assisted by the nasal cavities.

SPEECH FREQUENCY – an audio frequency in the range from about 100 to 2000 cycles, which includes all components considered vital for intelligibility of oral utterances (speech).

SPEED – the rate of performance of an act; the maximum relative aperture of a lens; the ratio of the distance covered by a moving body to the time taken, either in a straight line or continuous curve. Uniform speed is a theoretical conception approached only in astronomical bodies. A practical uniform speed is a matter of approximate inference and is always an average speed. Units of speed are feet per second, miles per hour, knots, and similar expressions. Speed is also the angular velocity of an electrical machine, generally expressed in revolutions per minute. The speed with which a wave travels depends upon the nature of the medium.

SPEED CONTROL – controls on a television receiver, sometimes called the hold controls, which can be adjusted to hold the received image in horizontal and vertical synchronization.

SPHERICAL ABERRATION – a general term for image defects that are due to the spherical form of a mirror or lens. These defects cause a blurred image because central and marginal rays are brought to different focal points by the lens or mirror. Common types of spherical aberration are astigmatism and curvature of field.

SPIRAL SCANNING – a scanning system in which the traveling light spot, starting at the center of the picture to be televised, describes an expanding spiral outwards to the borders of the picture, and having arrived there, traces a contracting spiral until it reaches the center once again. This succession of expanding and contracting spirals is performed with great rapidity by means of a centrally mounted mirror. Used in mechanical television systems.

SPIROIDAL SCANNING – synonym for spiral scanning. (See *spiral scanning.*)

SPLIT FOCUS – adjusting the focus of a television camera midway between two subjects when one is in the foreground and the other in the rear. This is generally done in two shots to give both subjects equal dramatic value.

SPLIT-PICTURE – term referring to conditions in a television receiver, when due to faulty synchronization adjustment, the received image is split down the middle and displaced to both sides.

SPONSOR – the advertiser who pays the cost of the television program in the interest of promoting his product.

SPONSORED PROGRAM – a program, or series of telecasts, the cost of which have been assumed by an advertiser.

SPONTANEITY — naturalness. The key word of television's unique appeal is spontaneity. The fact that it is possible to bring events into the home while they happen, without delay, with no extraneous interpretations or editing, lends a quality to the art that no other means offers. In television, each spectator at the receiver can see what is going on and form his or her own visual impressions.

SPORADIC E LAYER — that portion of the normal E-layer in the ionosphere that sometimes breaks away and exhibits special erratic characteristics.

SPOT — the visible point of light formed by the cathode-beam as it strikes the fluorescent screen of the receiving tube. Also, a commercial announcement or short program ordinarily broadcast from only one station at a time, often from a transcription.

SPOT ANNOUNCEMENT — a short sequence normally placed between two program acts.

SPOTLIGHT — a lighting apparatus which directs its output onto a relatively concentrated area of a scene, performer, or stage set. It is generally used for rimming or highlighting, or other special effects or purposes.

SPOTLIGHT PROCESS (for transmission of studio-scenes) — one of two methods used for the transmission of studio scenes in The Baird Television System. The spotlight process was applicable to close-up and three-quarter length pictures of one or two persons, and scanned the scene to be transmitted by causing a projected spot of light to traverse the subject in a series of lines and frames in the usual manner. Light reflected from the subject was allowed to fall on photoelectric cells, the output of which was fed to the control room. A small separate studio, 10 feet by 15 feet, was set apart for the television of pictures by the spotlight process, and equipped with microphones to pick up the accompanying sound. (See *intermediate film methods.*)

SPOTS — spotlights.

SPOTTINESS — bright spots scattered irregularly over the reproduced picture in a television receiver, due to man-made or static interference entering the television system at some point.

SQUEALING — a condition in which a high-pitched note is heard along with the received radio program. It can be due to interference between stations or to a number of other causes.

STACK — slang for "antenna." For example: Up the "stack."

STAGE BRACES — supports for stage flats used in erecting scenery.

STAGE FURNITURE — special hardware used on scenery to allow speedy assembly.

STAGE LEFT — the actor's left side. Example: He exits stage left.

STAGE RIGHT — the actor's right side. Example: Move stage right.

STAGGERED — In television terminology this expression referred to the arrangement of the holes in the mechanical system's scanning disc. The holes were set in the disc at equal intervals and were "staggered" by being placed in successive concentric circles so they formed a portion of the spiral.

STAGING COORDINATOR — supervisor of production facilities on one program in charge of construction, transfer and assembly of settings, and all mechanical and physical materials. He is directly responsible for the operation of the carpentry and property personnel.

STAGING PLAN — a scaled print or plan of the studio or stage floor upon which are imposed indications showing the location of the walls, doorways, settings, furniture, sound effects, orchestra, the disposition of various properties, and working areas. The staging plan is a prerequisite to all developments, scenic execution, set dressings, and camera movement planning and is used by the producer-director to plot physical action and business before rehearsing in an actual setting.

STANDARD — serving as a test or measure for others; conforming to established custom, measure, style, set patterns or Governmental minimum acceptances.

STANDARD ATMOSPHERE — an effect in the troposphere which consists of a bending of the radio waves toward the earth. Thus, instead of traveling in straight lines as they would in free space, the waves follow paths which are curved toward the earth.

STANDARD BROADCAST BAND — the band of frequencies extending from 550 to 1600 kilocycles, both being the carrier frequencies of the broadcast channels.

STANDARD BROADCAST CHANNEL — the band of frequencies occupied by the carrier and two sidebands of a broadcast signal, with the carrier frequency at the center. Channels are designated by their assigned carrier frequencies. Carrier frequencies assigned to standard broadcast stations begin at 550 kilocycles and are in successive steps of ten kilocycles.

STANDARD BROADCAST STATION — a station licensed by the Federal Communications Commission for the transmission of radio-telephone emissions primarily intended to be received by the general public and operating on a channel in the band extending from 550 to 1600 kilocycles.

STANDARD LONG SHOT — See *establishing shot.*

STANDARD TELEVISION SIGNAL — a signal which conforms with the television standards.

STANDARDS OF TELEVISION TRANSMISSION — Standards for television transmission are needed in order that receivers may be built suitable for reception from any one or all transmitters. Television standards have been subjected to analysis, study, and test over a long period of time. Starting early in 1936, committees of the Radio Manufacturers Association actively studied, and through their members, tested systems and components basic to standards of television transmission. Conclusions were arrived at by these RMA groups, and standards were agreed upon and submitted to the Federal Communications Commission. The FCC set up a committee of its members to make a study of television and a report was prepared late in 1939. Two public hearings were held before the FCC early in 1940. At these hearings, those most responsible for the research and development that had produced television urged that it be allowed to proceed in an orderly fashion. Others, including some who participated in the RMA work, urged that all was not ready, particularly in the matter of standards. Television could not cast off its cloak of "Experiment" and begin its more grown-up steps leading to a mature public service.

During the latter half of 1940 an industry committee was formed under RMA sponsorship in cooperation with the FCC. This was known as the National Television System Committee and was made up of representatives of many phases of industry concerned with television. This committee was asked to make a thorough review and study of the technical problems and was charged with the responsibility for formulating a set of standards to be proposed to the FCC. The report of NTSC was made to the FCC in January, 1941. Hearings before the FCC were made during March of the same year. The report of NTSC included standards which were based upon the earlier RMA standards with some slight modifications. A change was adopted for FM in place of AM for the sound, but no final specifications for picture synchronizing was included. During May, 1941, the FCC announced that the NTSC standards had been officially adopted and that commercial television broadcasting based on these standards would be allowed on and after July 1, 1944. Frequency assignments began with channel No. 1, at 50-56 megacycles, and extended to channel No. 18 at 288-294 megacycles. At about that time the course of the war began to exert an increasingly profound influence on possibilities for any new or expanded service and as a result, television broadcasting did not get under way.

In 1942 plans were laid for a re-evaluation of all radio services. An organization to do this was suggested by Lawrence Fly, then chairman of the FCC, and sponsored by the major professional and industrial groups concerned with radio matters. This became known as the Radio Technical Planning Board. The television panel reaffirmed the NTSC standards and refined some of them and adopted a definite synchronizing standard. Broadly, it was the recommendation of the RTPB that television be allowed to move forward using the standards which the board adopted and using channels in the radio frequency spectrum between 50 and 300 mc. The RTPB also recommended that provisions be made immediately for experimental work in the frequency spectrum between 460 and 1000 mc, providing specifically for commercial operation later incorporating color television and other advances in techniques which would have to be worked out. In extensive hearings before the FCC starting on Sept. 28, 1944, matters relating to the use of the radio spectrum were fully reviewed. However, the FCC disregarded the recommendations of the RTPB on television allocations in the spectrum and accepted recommendations of plan No. 3.

STAND BY – instruction to a cast or crew that the program is about to go on the air.

STANDBY – anything or anybody held in reserve to be used only in an emergency.

STATIC – unwanted noise heard in a radio receiver because of atmospheric or diathermic electrical disturbances. Static appears on the television screen as specks in the picture. Actually there is little static interference on the ultra-short waves used by television, and it is usually man-made such as automobile spark plugs or diathermy machines. Static is caused by sunspots, lightning, electric razors in operation, dial telephones, etc.

STATION – an operating locale, wherein an assembly of radio and television transmitting equipment, including the transmitting equipment, are located.

STATION BREAK – a cue given by a station originating a program to network stations signaling that it is time for individual stations to identify themselves to their own local audiences.

STATION LICENSE – a license issued by the FCC authorizing construction and operation of a television or radio station under specified conditions.

STATION SETUPS (broadcasting studios) – Television's technical staff at the broadcasting studio is a tightly organized unit that includes (1) cameramen; (2) microphone boom operator; (3) lighting engineer; (4) video and audio control engineer; (5) technical director; (6) and various individuals concerned solely with the transmission of image and sound signals. Close organization is imperative; when the staff goes into action any failure of coordination, instantaneously, reflects itself in the technical quality and hence the artistic appeal of the television presentation. There can be no retakes in "live" television; the first chance on the air is also the last.

The nerve center of the television production, however, is outside the bounds of the studio proper. In the control room, directly adjoining the studio and located at an elevation of about ten feet above the studio floor, sit several men directing all activities on the set. Here are the program director, his technical director seated side by side at a desk commanding a view of the monitoring kinescopes in the wall directly in front of them. Here are also the sound control and image control engineers, one acting as a "sound mixer," the other maintaining close watch over the contrast range and overall illumination in the pictorial output of each camera. The unifying link between cameraman and technical director, program director and stage manager, and sound control technicians and microphone boom operator, is the private telephone line. The control room staff is provided with a series of monitoring kinescopes, which reproduce the images actually being registered by the respective cameras. The first shows the picture actually in the outgoing channel; that is, the image being broadcast from the transmitter. The second monitoring kinescope, immediately to the right of the first, is a preview instrument reproducing, at the desire of the director, the picture being registered by either the remaining, or two remaining cameras on the studio floor. In this manner, the director may call for changes in composition, focus, and angle up to the instant the camera is switched into the outgoing channel. The third monitoring device is put at the disposal of the video control engineer so that he may make shading adjustments in any of the images being picked up in the studio.

There is also the film scanning room where film of both standard thirty-five-millimeter and sixteen-millimeter sizes may be run off. In this manner film sequences may be inserted into live talent productions so that the spectator is unaware of the transition from one medium to another. Beyond these rooms, and linked to them by coaxial cable, lies the equipment room, filled with amplifiers and containing the vital synchronizing generators. Another cable circuit carries the sight and sound signals from the studio via the control room to the transmitter for radiation over the entire service area, extending anywhere from 45 to 60 miles in all directions depending on the location of the particular location.

STATIONARY MIRROR - DRUM – a television scanning device developed by Denes Von Mihaly, a Hungarian television experimenter. It consisted of a circular frame around the inside of which were arranged a series of mirrors. A beam of light was reflected around these stationary mirrors from a revolving mirror set in the center of the drum.

STEPHENSON-WALTON TELEVISION PROCESS – About 1925, W. S. Stephenson and W. G. Walton, both of the General Radio Co., London, disclosed they had done a great deal of research in the matter of transmission of pictures by radio, and described their apparatus. The method they used was "by causing apertures formed by intersection of slots arranged around a periphery of two discs to traverse the picture." These discs "were rotated in the same or opposite directions, according to the number and disposition of slots used and the relative speeds of the two discs." They also brought out their three-color method of reproduction, in which they used three light-sensitive cells each of which responded only to one color. At the receiver, there were three light control shutters, each actuated by currents from one light-sensitive cell only. The shutters passed the light only of one of the three colors which were mixed and then shown on the screen.

STEREO TELEVISION – abbreviation for stereoscopic television.

STEREOSCOPE – an optical instrument designed to give a mental impression of a three-dimensional scene through a viewing of two properly prepared pictures or photographs.

STEREOSCOPIC – having a three-dimensional character.

STEREOSCOPIC EFFECTS – people with perfect eyesight have an impression of stereoscopic relief, depth or distance, when they view an object or scene, and that effect is brought about quite naturally by the combination of the separate images seen by our individual eyes.

STEREOSCOPIC TELEVISION – television in which the reproduced image appears as three-dimensional in a pictured similarity of the original subject. As attempted by the Baird Co., in England, in 1928, a form of stereoscopic television was achieved by the use of a dual scanning system and of two entirely distinct transmitters, the two images thus transmitted being viewed at the receiver and through a stereoscope apparatus. Stereo television without the use of glass was demonstrated by Baird, in design, but it has not yet arrived at the practicable stage. Using a mechanical system of scanning, the scanning disc was provided with a double spiral, so that two scannings were obtained at the same time. One scanning gave a picture as seen by one eye, and the second scanning gave a picture as seen by the other eye. The final result was to give depth and distance to the picture.

STEREOSCOPY – Looking through special eyepieces, the observer sees, not a flat photography, but figures and objects standing out in relief as in the actual scene. During the war Baird developed stereoscopic television to where he applied it to the cathode tube and by combining it with color, transmitting was able to show television in complete natural color and full stereoscopic relief. This was demonstrated to the scientific press in 1941. Stereoscopy is the impression gained of depth and solidity due to the fact that our left and right eyes see each a slightly different picture of the same object. In stereoscopic television two images are sent out by the transmitter, one being a picture of the scene as viewed by the right eye, the other a picture of the scene as viewed by the left eye. These pictures appear on the receiving screen in very rapid succession and are reviewed through an optical device which enables the right eye to see only the right eye picture and the left eye only the left eye picture. In one form of the device the optical arrangement is contained in the receiver and no glasses or eyepieces are necessary.

STILL – photographic or other illustrative material which may be used in a television broadcast.

STIXOGRAPH – the name given to an elongated or ribbon-like development of an image being televised. In this special apparatus, the stixograph was made to move over the scanning aperture of the machine by means of an extremely light-moving optical part, thus presenting the image in successive stages. Motion picture film could be taken by an application of the stixograph method, the images being spread out into a continuous ribbon on a film of narrow width which moved through the projector at a comparatively slow speed. An English invention.

STOCK SHOTS – film shots taken of people, objects or places, as they made news, or special portions of motion pictures, which have been filed for special purposes. These shots can be used for pictorial value or story emphasis in televising studio programs.

STORAGE BATTERY – one or more secondary or storage cells connected together usually in a series.

STORAGE CAMERA – an electronic television pickup, in which the picture is projected optically on the mosaic electrode of a cathode-ray tube and is scanned by an electron beam to convert the optical image into corresponding electrical impulses. Also called an *iconoscope.*

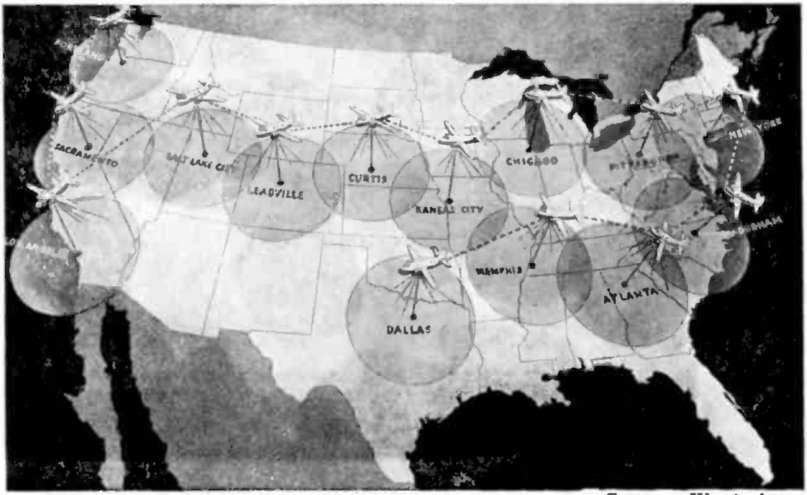
STORAGE CELL – a secondary cell – more specifically – one of the cells of the ordinary automotive storage battery, delivering a voltage slightly higher than two volts and capable of being recharged.

STORAGE TUBE – first conceived by A. A. Campbell Swinton in 1911 but found impracticable at that period. In 1933 V. L. Zworykin published the first description of a successfully operated television transmitting tube employing both charge storage and cathode-ray beam scanning. This was termed the iconoscope, and in Great Britain, the Marconi E.M.I. Co. developed a similar device, known as the "Emitron Camera Equipment" which was used by the British Broadcasting Corp. at the Alexandra Palace station for daily television service prior to the last war. (See *storage camera; storage-type tube.*)

STORAGE-TYPE TUBE – a television cathode-ray camera tube similar to the iconoscope, in which the image is projected on a photosensitive plate and elemental areas of the plate build up their charges gradually until discharged by the moving electron beam. Each area thus develops a picture signal that is proportional to the illumination.

STRANDED WIRE – a wire which consists of a number of finer wires twisted together.

STRATOSPHERE – atmospheric region above the tropopause and whose



— *Courtesy Westinghouse*

Stratovision: a diagram

maximum height varies between 25 and 30 miles up from the earth.

STRATOVISION — a proposed system of airborne network television whereby programs originating on the ground are relayed to airplanes circling in the stratosphere which in turn transmit the video over huge areas. One stratovision plane would serve an area of approximately 103,000 square miles. A development of Westinghouse Electric Corp. and the Glenn L. Martin Co., plane builders. Credit for the system is given to Charles Edward Nobles. The word stratovision is compounded from "stratosphere" and "television."

STRAYS — electromagnetic disturbances that affect reception but are not produced by radio transmitting systems.

STREAKING — a spurious image in a television picture normally of reversed color, which appears to the right of the real picture. It is generally caused by poor low-frequency response in the camera circuits.

STRESS — any force causing distortion of the shape of an object.

STRETCH — on a television program: to stall for time; to delay.

STRIKE — to dismantle a stage setting. (See *strike set.*)

STRIKE SET — same as *strike.*

STROBOSCOPIC EFFECT — the eye can distinguish a single scanning line if blinked quickly. This stroboscopic effect makes the line scanned during the instant the eye is blinked stand out during the rest. Horizontal scanning makes this effect less noticeable than vertical scanning.

STUDIO — a room, chamber, or an auditorium, especially built for the production of television and radio programs. The studio is constructed with special acoustical fittings such as soundproof walls, ceilings, and heavy drapes, etc., to deaden unwanted noises and echoes — and contains properly equipped microphones, studio lights, and an associated control room.

STYLUS — the cutter in a phonograph or recorder recording-head; its point is shaped to remove a thread of wax from a blank as it revolves, thus making the record. Generally constructed of sapphire.

SUBSCRIPTION BROADCASTING — See *subscription television*.

SUBSCRIPTION TELEVISION — (See *wired television.*) Television broadcasts that would be received only by those subscribing to a paid specialized service. A private television service along the lines of the present-day telephone service, in which receivers would be "tuned in" to special broadcasts or telecasts without "commercials" or "advertising plugs." (See *scrambled wire service.*)

SUCCESSIVE METHOD OF TRANSCRIPTION — the employment of one communication channel and to send the picture-element impulses one after the other in orderly sequence at a very rapid rate. This is the so-called "successive" method of transmission and is widely used in television and in the simpler processes of still-picture transmission by wire-photo and radio-photo systems. The effectiveness of the successive method of transmission rests on the very fortunate property of the eye, persistence of vision. If the eye was instantaneous in its action, the successive method would fail, since the eye at the receiver would then see each picture element individually and separately. It is fortunate, therefore, that the impression made by any one picture element persists in the eye for a small fraction of a second. During the interval of persistence of this one element, all the other elements are presented successively to the eye in their proper position. In effect, the eye acts as though it were seeing all the elements at once, and the simultaneous aspect of direct vision is thus recreated artificially.

SUDS SCENARIO — slang for radio daytime serial.

SUNSPOTS — Radio waves are susceptible in some way to the sun's complexion. When the sun is mottled, and pitted with sunspots, higher frequencies have to be used; when it is clear and bright the lower frequencies prove best and are more reliable in their performance. The sunspots are an indication of the general activity of the sun. When it is active and the sunspots numerous, then it radiates more ultra-violet light than when it is relatively inactive and the sunspots are far and between. The sunspots have another effect also. It has been sometimes noticed that when a sunspot crosses the center of the sun, or shortly after that event, the short-wave signals become weak and fluttering; and at times disappear altogether. Sometimes they continued this behavior for a week at a time, making communication extremely difficult. Long-distance short-wave transmission has in fact been found to suffer from this deficiency; it is subject at times to interruptions and disturbances owing to what are called "ionosphere storms." These storms are assumed to be produced by a sudden burst of radiation of one kind or another from the sun, completely upsetting the normal structure of the ionosphere. It becomes very unstable – surges wildly about in the sky, becomes very weak in places – and so the radio waves are much disturbed in their progress through it. This is the reason for the "radio blackouts" often experienced by short-wave listeners. Sometimes the waves return to earth in a very erratic manner, such as to give rise to a weak and fading program in the receiver; sometimes they go through the weak and patchy ionosphere and the program disappears altogether.

SUPERAUDIBLE – having a frequency above the range of audio frequencies – above approximately 20,000 cycles.

SUPERAUDIO FREQUENCY – a frequency above that of audible sound and, therefore, above approximately 20,000 cycles.

SUPEREMITRON CAMERA – a modification of the emitron television camera (British) in which greater sensitivity is obtained by separating the function of charge storage from that of photoelectric emission. An optical image is projected on a continuous photosensitive screen, and the electron emission from the back of this screen is focused electromagnetically onto a mosaic screen that is scanned by an electron beam as in the original emitron cathode-ray tube.

SUPERHETERODYNE RECEIVER – a type of radio receiver in which the incoming modulated radio frequency signals are amplified a small amount in the preselector, then fed into the frequency converter section (consisting of the oscillator, mixer, and first detector) for conversion into a fixed, lower carrier frequency called the intermediate frequency value of the receiver. The modulated intermediate frequency signals are given very high amplification in the intermediate frequency stages, then fed into the second detector for demodulation. The resulting audio signals are then amplified in the conventional manner by the audio amplifier, then reproduced as sound waves by the loudspeaker.

SUPERHIGH FREQUENCY – a frequency in the band extending from 3000 to 30,000 megacycles in the radio spectrum.

SUPERIMPOSED – placed over or above. Synonym: superposed.

SUPERIMPOSITION – the overlapping of an image produced by one camera with the image from another camera — a blending or merging of images to any desired amount. Two cameras are turned on instead of one; it is possible to use three cameras. BBC reported quadruple exposure pre-war.

SUPERIMPOSURE — a special effect in which the images from two or more cameras occupy the screen simultaneously. Synonym: montage. (See *superimposition.*) A double exposure of one picture atop another for special effects on television.

SUPERPOSED — synonym: superimposed.

SUPERSONIC — a frequency just above the audible range; that is, above about 20,000 cycles. Also called ultrasonic.

SUPERSONIC COMMUNICATION — communication through water manually keying the sound output of echo ranging equipment used on vessels.

SUPERSONIC FREQENCY — See *supersonic.*

SUPERSONIC LIGHT CONTROL — See *supersonic light valve.*

SUPERSONIC LIGHT VALVE — the heart of the Scophony System of Television consisting essentially of a quartz crystal placed in the center of a container filled with a liquid such as carbon tetrachloride. The crystal is excited at a high frequency in the range of about 10 megacycles, in such a way that compressive waves are set up in the liquid and make the liquid act somewhat like a diffraction grating. Light projected through the cell produces a series of finely illuminated lines on the screen. When the crystal is modulated also with video frequencies these lines are broken up into light and dark picture elements constituting the reproduced picture. In this system, several hundred picture elements are projected simultaneously, as compared to the cathode-ray systems, where only one element is projected at a time. (See *light control cells.*)

SUPERSONIC TELEVISION SYSTEM — See *Scophony Corp. of America.*

SUPER-SYNC — a radio signal transmitted at the end of each scanning line which synchronizes the operation of the television receiver with that of the television transmitter.

SUPERTONIC — synonym for *supersonic.*

SUSPENSION LIGHT VALVE — a thin cell consisting essentially of extremely small particles suspended in a solution enclosed in a flat thin chamber of transparent material placed against the face of the cathode-ray tube. The action of the scanning beam varies the transparency of each elemental area of the cell in accordance with the picture signal intensity in the television receiver, so that a light beam projected through the cathode-ray tube and light valve produces the received picture on a screen.

SUSTAINING PROGRAM — a program presented by the station or network without a sponsor or advertising message.

SWEDEN – In 1930 J. L. Baird's company demonstrated television in a Stockholm motion picture house. In 1935, Svenska Radio A.B. built a television transmitter in Stockholm and daily telecasts were made during the Yuletide holiday season. In 1938, Philips of Eindenhoven, Holland, held a television showing for several weeks. The Swedish Board of Telegraphy, Kungliga Telegraffstyrelsen, announced that television broadcasting would commence as soon as possible. But economic difficulties made that announcement a bit premature. The advent of the war in 1939 stopped all thought of television for the time.

SWEEP – term used to describe the uniform motion of the electron beam across the face of a picture or camera tube.

SWINTON TELEVISION SYSTEM – The Englishman, A. A. Campbell Swinton, saw the television possibilities of the cathode-ray oscillograph. He proposed that two magnetic fields be introduced into the tube, at right angles to each other; thus one field deflected the electron stream leaving the cathode from right to left horizontally, while the other field deflected the electrons up and down. This was the same movement later used in scanning by mechanical methods. Although he did not build a television apparatus, a few years later the inventor gave very concrete suggestions as to how the cathode-ray tube could combine in one unit both the scanner and the photoelectric cell instead of the two different mechanisms used up to this time for these purposes. In the Campbell-Swinton cathode-ray tube which acted as the transmitter – later known as the camera tube – the image to be televised was focused upon a light-sensitive plate inside the tube. This plate was made up of rubidium cubes, insulated from each other and each corresponding to a picture element. The electron beam, its course directed by the two magnetic fields, was made to scan this image upon the rubidium plate. This electric impulse varied in strength with the light striking the rubidium cubes. The impulse became the television signal, representing the electrical equivalent of the light value of the picture element, and was conveyed to another cathode-ray tube which was to be used as a receiver. In the receiver-tube, there was no mesh screen or plate, but, instead a fluorescent surface on the inner side of the flared end of the tube. The incoming signal determined the strength of the electron beam leaving the cathode, while two magnetic fields moved the electron beam in scanning sequence over the fluorescent surface. Thus an image was reproduced on the surface of the receiving cathode-ray tube, as a result of the quick-moving electron beam activating spots on the fluorescent surface. Although modern television owes its achievement to the researches of many different and distinguished researchers, it is interesting to note that the system of television employed by the British Broadcasting Corp in England was developed along the fundamental lines first suggested by Campbell Swinton.

SWITCH – a control technique. The instantaneous cutting from one camera to another, in order to get a change of camera angles. (See *cut.*) Also, a mechanical device for opening and closing an electrical circuit, or for changing the connections between parts or circuits.

SYMBOL – a simple design used to represent a radio part in a schematic circuit diagram. A letter used in formulas to represent a particular quantity.

SYNCHRONISM – the condition in which receiving and transmitting devices in television, facsimile, printing telegraph or other similar systems are operating at the same speed and in a similar manner. The term signifies the exact coincidence of events in time. From the Greek "syn" meaning "together"; "chronos," meaning "time," and "isos" meaning "equal."

SYNCHRONIZATION – the process of maintaining one operation at the transmitter in step with another at the receiver. That is, maintaining synchronism between the scanning motions of the electron beams in the camera tube and in the cathode ray tube in the receiver.

SYNCHRONIZING BAND – the black band running across the top of the picture in images received by the Baird television system (England). This represented the regularly recurring absence of transmitting light owing to those periodic moments of time being occupied by the transmission of the synchronizing impulses which maintained the transmitting and receiving motors in step with each other (mechanical system).

SYNCHRONIZING IMPULSE (or pulse) – an impulse transmitted at the start and/or end of each frame and scanning line, to assist in the synchronization. Also, one of the pulses added to the video output signal of a television camera for the purpose of synchronizing television receivers with the transmitter.

SYNCHRONIZING MODULATION – the range of modulation depth reserved for the synchronizing impulses, as distinct from that for the picture signal.

SYNCHRONIZING OF IMAGES – maintaining the correct timing and thus space relationships between parts of the reproduced images in a television system.

SYNCHRONIZING SIGNALS – special signals sent out by a television transmitter and between successive lines and fields to keep the scanning motions of television receivers in step with that at the transmitter.

SYNCHRONOUS – running at the same speed as some assocated machine.

SYNTHETIC DISTORTION – Painting technique used to impart seeming irregularity to lines and surfaces which in reality are smooth and rectilinear.

SYSTEM — a general term covering the entire complex of apparatus involved in the transmission and reception of television and/or radio. (See *mechanical system; electronic system.*)

SZCEZPANIK'S APPARATUS — an early form of television apparatus, invention of Jan Van Szcezpanik (before 1900). The object to be televised was reflected by means of a combination of vibrating mirrors on to the surface of a selenium cell, the current pulsations from which, after transmismision by wire, operated a magnetic system in the receiver which controlled a moving light spot. This apparatus, however, was little more than a shadowgraph device.

T

T-ANTENNA — an antenna comprising a top conductor with a vertical downlead attached at the center.

T. B. A. — abbreviation for Television Broadcasters Association.

TCU — tight close-up.

T. D. — abbreviation for technical director, the station staff member who assists the director in the control room.

T. R. F. — abbreviation for tuned radio frequency.

TABLE MODEL RECEIVER — a radio receiver having a cabinet of suitable shape and size to permit placing it on a table.

TAG LINE — a climax of a dramatic or comedy sequence.

TAKE — to televise a sequence for transmission, that is, a picture or scene held by a television camera. Also, a scene so televised or filmed. Again, a command to switch a camera on the air.

TAKE IT AWAY — the cue from the studio engineer to the engineer of the succeeding program. Also, the notice that the program is being broadcast.

TALK BACK — phone circuit from director to announcer on a broadcast originating in some other location than the television studio.

TALKER ECHO — an echo which reaches the ear of the talker only.

TARGET — the electrode, or part of an electrode, on which cathode rays are focused and from which x-rays are emitted. In a Farnsworth dissector tube for a television camera it is the electron-collecting electrode. This term denotes the fluorescent screen of a cathode-ray tube which, when subjected to a bombardment of electrons, each impact of an electron produces a flash of flurorescent light on the screen.

TEAR OUT — breaking up a section of the televised image because of maloperation of the synchronizing system in the receiver.

TEARS — the horizontal disturbance in a video picture due to noise which makes the image seem to tear apart.

TECHNICAL DIRECTOR – the director of all technical facilities and operations—including lighting, cameras, sound—in a studio production.

TELAUTOGRAPH – a writing telegraph instrument, in which movement of a pencil in the transmitting apparatus varies the current in two circuits in such a way as to cause corresponding movements of a pen at the remote receiving instrument. Also called a telewriter.

TELAUTOGRAPHY – the transmission of images by telegraphic means over wires or by radio. This name, now obsolete, was used by Ribbe in 1904 to describe television.

TELE – from the Greek "tele" meaning "afar," "at a distance." A prefix used in the construction of compound terms, e. g. television, sight from afar: telephone, a voice from the distance. Also used as an abbreviation for "television."

TELECAMERA – a television camera used to convert scenes into corresponding electrical impulses.

TELECAST – a television broadcast, that is, a broadcast of sight and sound. According to John Martin, executive assistant to Dr. Peter Goldmark of the Columbia Broadcasting System, the word "telecast is never used because it is not correct. If it is used, it is done so by amateurs who know not the difference. It is not used technically but frequently by reporters and editors." However, the word "telecast" has generally been accepted as a synonym to television broadcast and has become part and parcel of television vocabulary in the last few years.

TELECASTING – broadcasting a television program.

TELECHROME – an arbitrary scale of neutral values supplemented by warm or cool secondary or tertiary colors; a pigment prepared especially for decorating video settings. Telechrome has two specific purposes: (1) to imitate or simulate all colors, and (2) to eliminate the excessive use of black (in greys) by substituting a neutral, composed of two complementaries, to achieve a grey tonal value equivalent to the color as it occurs in nature. Also, name of invention by the late John L. Baird of Great Britain. This device eliminates the revolving disc and lenses previously necessary for color and stereoscopic pictures now appear directly upon the screen of the cathode-ray tube, so that color and stereo television can be received on apparatus as silent and efficient as the prewar black-and-white receivers. The telechrome differs from the black-and-white cathode-ray tube in having two cathode-ray beams and a transparent double-sided screen. The front of the screen is colored blue-green and the back red, one cathode-ray beam produces a blue-green picture on the front surface and the other a red picture on the back surface, the two bending to give a picture in natural colors.

TELECINE – a general term used in operations involving the sending of motion picture film in television.

TELECINE PROJECTOR – a motion-picture projector and associated apparatus used for the televising of motion-picture film. (See *telecine*)

TELECINE ROOM – special rooms or smaller studios in which the motion picture film is projected, fixed, and stored.

TELECINE TRANSMISSION – a program of motion pictures.

TELECINE TRANSMITTER – an apparatus used for the transmission of motion picture film by means of television. It consists of an ordinary motion picture film projector working in conjunction with a special form of television transmitter.

TELECINEMATOGRAPHY – scanning of cinematographic (motion picture) film to derive television signals. Also designated: television cinematography.

TELECOMMUNICATION – any communication of information, in verbal, written, coded or pictorial form, transmitted by electrical methods whether by wire or radio.

TELECTRIC – pertaining to the electrical transmission of sounds.

*TELECTROSCOPE – a form of picture-transmitting apparatus developed by M. Senlecq of Ardres in 1877. The picture to be transmitted was projected on to a glass screen in a camera-like apparatus, and later traced over by a moving selenium point, the variations of light and shade in the projected image varying the resistance of the selenium stylus and so causing corresponding variations in the transmitted current, which, at the receiver reproduced a semblance of lights and shades of the original image by electromagnetic instruments. Senlecq's "telectroscope" resulted in the construction of numerous inventions using similar principles. At a later date, Senlecq developed a much more complicated image-sending apparatus based on the use of batteries of selenium cells. He used a large number of wires between the transmitter and receiving point, as at that time wireless did not exist. Synonym: telephotograph.

TELECTROSCOPY – an electrical transmission of pictures. Term is now obsolete. Used to describe television, which word had not yet been coined. Used in the late 19th century.

TELEDIFFUSION – wired wireless.

TELEFUNKEN RADIO SYSTEM – a system of quenched spark radiotelegraphy which used a spark gap consisting of a series of metal dics slightly separated from each other.

TELEFUNKEN SYSTEM – The Telefunken Co. of Germany in the early 1930's used the Weiller mirror-wheel, on which the little mirrors were fastened on the periphery of a large wheel. The intention was to make a dot-shaped source of light radiate on these individual mirrors.

TELEGENIC – having an attractive

appearance when seen on a television receiving screen.

TELEGRAPH — a combination of devices for the conveying of messages over any distance by means of electrical impulses sent along special overhead wires or underground cables.

TELEGRAPHOSCOPE — an instrument used for transmitting pictures by telegraph.

TELEGUESTS — special participants on regular television programs; brought in for one specific occasion as a guest performer, quiz participant, comedian, special one-time singer. Also, television participants in stock companies who make overnight jumps from city to city. Synonym: telestars.

TELEHOR — an early form of television apparatus for small pictures designed by Denes Von Mihaly in 1922. This was a mechanical scanning device using vibrating mirrors. Mihaly's "Telehor" consisted basically of two small mirrors suspended by means of two very fine wires and which were made to vibrate within a powerful electromagnetic field. The image was scanned by means of these mirrors, and the light impulses eventually were passed on to a selenium cell. The "Telehor" was a very complex instrument, impracticable outside the laboratory and was finally abandoned by its developer.

TELEHOR TELEVISION SYSTEM — In 1931, the Telehor Co. of Germany worked out a television system in which mirrors were used instead of scanning holes in the revolving disc as had been done up to that date. With this system the observer was able to view the image directly in the mirrors instead of projection as with the Weiller mirror-wheel used in other systems only a projection was possible with direct observation being excluded. (See *Telefunken system*). The inventors of the Telehor system conceived the idea of setting several circular glass discs side by side on a shaft, polishing off a part of the periphery parallel to the axis, and silvering it (as a mirror) and then turning the individual discs a little with relation to one another. The intention was to make a dot-like source of light radiate on these mirrors.

TELE-IMAGE — a single image in television.

TELEKINO SYSTEM — a system of color television from colored motion picture film developed experimentally some time ago in the United States by Ahronheim. By means of a color-filter disc geared to the scanning disc, the various colors of the picture to be transmitted were sorted out and made to impinge upon a bank of photoelectric cells, each of which possessed a selective response to one color only. At the receiver the picture was projected and viewed through a similar color-filter disc, resulting in an approximation to the original colors on the original object televised.

TELELOGOSCOPY — a term applied to the television transmission of printed characters on a moving tape or band. Developed in August 1929, the specialized form of equipment, scanned the long narrow tape by rectilinear scanning. A source of light had its beam condensed by a lens on to a right-angled prism mounted inside a hollow drum. This drum had a spiral of holes pierced through the side (apertured drum scanner) and each pencil of light emerging from the drum holes was focused on the moving tape. One or more photoelectric cells then picked up the light reflected from the printed strip and converted it into television signals. The entire apparatus was developed and constructed primarily for the transmission of unorthodox characters such as Chinese, Japanese or Siamese, or printed matter by radio when fading makes Morse transmission difficult.

TELEMECHANICS – the science of operating distant machines by wireless.

TELEMETER – an instrument for determing the exact location of and for measuring the distance to a removed point or object; also, an electrical measuring device which records the measurements at another distant point.

TELEMOBILE – an apparatus built of hard aluminum which is compact, mounted on wheels, and contains everything needed in way of television control equipment, amplifiers, power supplies for two cameras and feeds directly into the transmitter. Also contains complete monitoring equipment, cathode-ray oscillographs and picture-viewing tubes. For use in television studios, and can be transported and operated in a small panel truck or station wagon. Devised by Klaus Landsberg, director of W6XYZ Television Productions in Hollywood, Cal.

– Courtesy Station W6XYZ

Telemobile

TELENEWSREEL – trade name used to denote newsreel pictures sent via television.

TELEOPTICON – a descriptive name once suggested by Dr. E. F. W. Alexanderson of the General Electric Co. to describe a television receiver. The name was not widely accepted and is practically never used. Also, used to denote "projector of films," but rarely in use.

TELEPANTOSCOPE – an apparatus similar to the iconoscope except that the scanning motion of the cathode ray beam is in one direction only, for example, the line-scanning direction. The frame-scanning is accomplished by mechanical means.

TELEPHONE – a series of devices for the conveyance of speech over a distance through the use of audio-frequency variations in the current sent along special overhead wires or underground cable.

TELEPHONOGRAPH – a phonograph, attached to a telephone receiver, which records messages on a record.

TELEPHONT – See *Sinding-Larsen Optical System.*

TELEPHONY – the art or process of reproducing sounds at a distance. That is, the transmission of speech-currents over wires by means which enable two persons to effectively speak to one another at any distance. The complexity of the contemporary telephone system is not due so much from the difficulty of providing a duplex channel for speech, but in the arrangement of speedy and economical connections of any pair of telephone consumers on instantaneous demand.

TELEPHOT – early name of an apparatus or machine, enabling one person to see another person while talking on the telephone. Quite a number of telephots have been imagined, described, and patented. Few, however, actually appeared—most of them existed only on paper. One of the first was described by the Frenchman, d'Ardres in 1877; another by W. E. Sawyer in 1880; next came the Shelford Bidwell machine of 1881; one by L. Weiller in 1889; as well as those of Jan Von Szcezpanik, and that of Dussaud of 1898. None of these were of practical value. Others included that by Sidney Rothschild, 1907; M. E. Belin apparatus, 1907; Kruh, 1910; Gustav E. Hoglund, 1912; A. C. and L. S. Anderson, 1912; Stille, 1915; Boris Rosing apparatus of 1915, and Alf Sinding-Larsen's instrument of 1916.

TELEPHOTO – an apparatus for transmitting pictures by electricity to distant points. This early television device used a tuning-fork control which operated vibrating mirrors acting on the scanning beam of the transmitter.

TELEPHOTO – transmission of photographs or other single images over a telegraph system by scanning the picture into elemental areas in orderly sequence, converting each area into a proportional electric signal, sending the signals in sequence and reassembling them in correct order at the receiver. Synonym: facsimile, phototelegraphy, or wirephoto. (See *telephotography*).

TELEPHOTO LENS – lens of very narrow angle and long focal-length used to provide large size images at extreme distances.

TELEPHOTOGRAPH – See *telectroscope.*

TELEPHOTOGRAPHY – reproduction of photographs or other pictures at a distance by means of radio or wire communication. Usually shortened to telephoto. Also, that branch of photography which involves the use of a camera with a lens analogous to a telescope, so that very distant scenes can be registered either on plates or by motion pictures or by television.

TELEPIX – vernacular or slang for "television pictures."

TELERAMA – early name for television.

TELERAN – a new system of air navigation—(a contraction of TELEvisio-Radar Air Navigation) recently developed by engineers and scientists in Camden, and Princeton, N. J. Teleran collects information by means of radar equipment on the ground, collates it with meteorological, geographical and control data and transmits a television picture of the assembled information to a television receiver on the airplane. On the kinescope of his television receiver, the pilot sees a picture showing the position of his airplane and of all other aircraft at his altitude, superimposed upon a terrain map complete with route markings, weather data and unmistakable visual instructions pertaining to his flight.

TELERECEIVER – a television receiving set.

TELESCENE – a single scene in television.

TELESCOPE – an optical device for making distant objects appear closer to the viewer. It consists of an arrangement of lenses or mirrors by which the light is brought to a focus, and the image there being magnified.

TELESCOPY – an obsolete name for television used up to 1908. Used by the British Patent Office until that year. Denoted the electrical transference of images to a distance within the visual retentivity period.

TELESEER – a television spectator; suggested by Lee De Forest, famous scientist. Synonym: televiewer. (See *televisioner.*)

TELESET – trade-name of Allen B. Du Mont Laboratories, Inc., for home television receivers.

TELESITE – name given to a location in an industrial plant or department store which contains an intra-television or intra-store television system. Usually, a booth containing one or more video receivers for viewing by spectators. First coined by RCA-Victor officials for the Gimbel, Philadelphia, intra-store television demonstration in 1945.

TELESTARS – principal performers on a television program. The star participants, i. e., leading man or lady, the hero or heroine.

TELE-THEATRE – a special theatre suggested for actual theatrical performances which are picked up by television cameras and conveyed (or transmitted) via a wire network radiating to all parts of the country.

This pickup would go to audiences sitting in local theatres in the areas covered by the wire network.

TELETOPICS – films produced especially for television. These are silent films recorded, for the most part, with a 35-mm camera. The sound channel is "dubbed" in during the broadcast of the film by an announcer who reads the description into the microphone as the film progresses and through the use of phonograph records for musical effects. These programs cover a wide variety of subjects from demonstrations of sporting goods to travelogues. The cost of producing such film is cheap as compared to Hollywood productions and serves the purpose of short presentations on a variety program.

TELETRICIAN – trademark name applied to a person who has received training in television operation and servicing from the National Radio Institute, a privately-owned trade school in the United States.

TELETRON – a cathode ray tube especially developed for synthesizing television images, either for direct viewing or for projection, tradenamed by Allen B. Du Mont Laboratories, Inc. Used in receivers.

TELETUBE – an amplifying tube in television.

TELETYPE – a certain make of a telegraphic teletypewriter; use of a teletypewriter.

TELEVIEW – to witness a scene by means of a television system.

TELEVIEWER – one who witnesses television via a video receiver. Also, tradename of a contemplated magazine.

TELEVISE – to photograph a scene or set for broadcasting. This term, however, does not include the broadcasting of the scene or set. The proper term for television which is received in the home or similar setting and broadcast is "television broadcast".

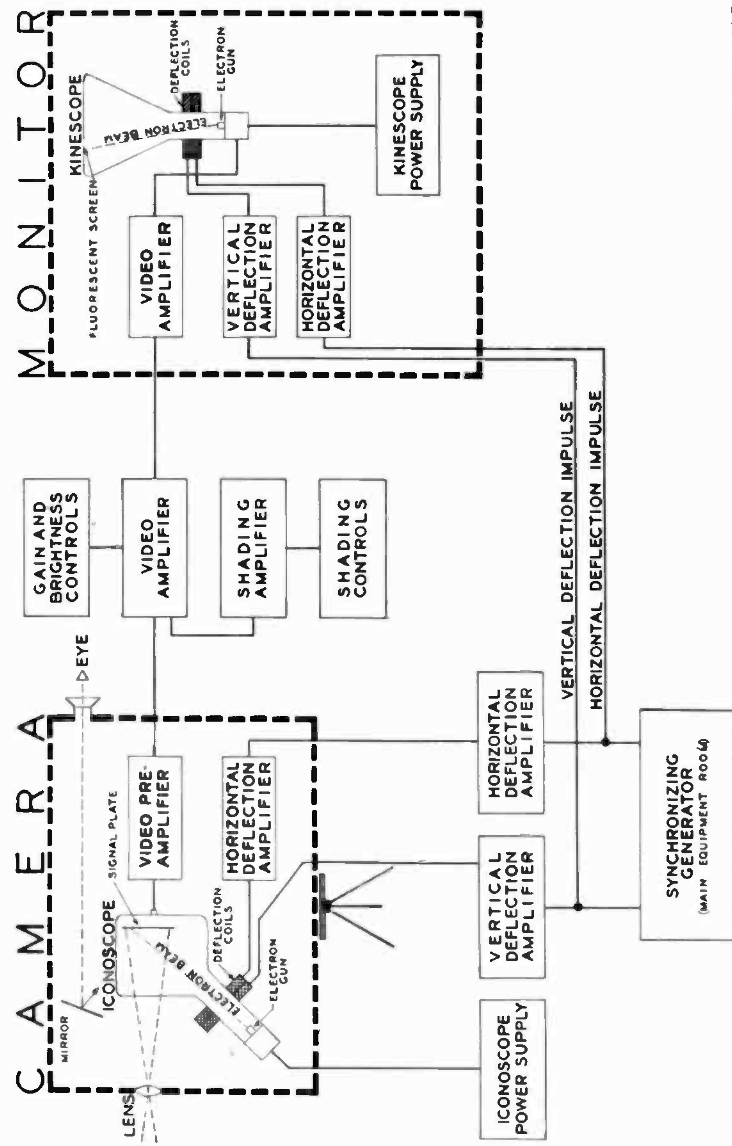
TELEVISER – name of a video magazine published in New York; also, refers to television receiver.

TELEVISOR – the television camera.

TELEVISING – the process of camera-shooting and telecasting a program.

TELEVISION – The transmission and reproduction of a scene or object by any device or apparatus that converts light rays into electrical impulses in such a way that they may be sent (transmitted) and then reconverted by a receiver into visible light rays forming an image or picture. Television is derived from the Greek word "tele" meaning "at a distance," and the Latin verb "videre" meaning "to see."

Television, technically, consists of three processes: (1) At the transmitter, analysis of a scene or picture into a sequence of tiny elements of various light values; translation of these elements, one after another into electrical impulses of corresponding values; and amplification of these tiny electrical impulses many millions of times. (2) Transmission of



—*Courtesy NBC*

Television: how it works

the sequence of impulses in some manner by radio or wire to a distant receiver. (3) At the receiver, these electrical picture-element impulses which have become weakened are absorbed in a sequential order as sent out. There, they are amplified once again many millions of times, after which they are translated back into corresponding light elements, which are spread over the surface of a screen, in the same manner and location as in the original image. Finally, the integrated effect is visualized as one complete picture upon the screen.

Television does not attempt to provide a lasting record of what it analyzes. Rather it provides a fleeting stimulus to the eye of the observer who is gazing into the receiver. Television, in reality, is the art of instantaneously producing at a distance a visible image of actual or recorded scenes by means of an electrical system of communication. The principal difference between facsimile radio and television lies in the high speed with which television pictures must be transmitted. Present television practice calls for the transmission of 30 complete pictures per second, since this many visual impressions are required to give the human eye the illusion of uninterrupted motion.

Before August, 1900, there was no such word as "television." Such words were used as "telescopy," "electrical telescope," or "telectroscopy." Several people have claimed to be the first to coin the word. These included a Frenchman named Perski. In preparing some material listed in the "Annexes, Congrès Internationale d'Electricite," for Aug. 18-25, 1900, Perski seems to have coined the French word, télévision, in its modern meaning. Another, an unnamed examiner at the British Patent Office in 1911, in forming a search file devoted to the subject (as a branch of copying telegraph) re-coined it in its anglicized form. Still another, Hugo Gernsback, then editor of *Radio News* and now publisher of *Radiocraft*, an American radio publication, in print declared he was the first to coin the word in an article which ran in December 1909, of Modern Electrics. The article was entitled "Television and the Telephot." Later, however, he retracted his claim.

When compared to standard radio, the first and most obvious difference is the technical difference, for even though television and radio programs are broadcast in the same way, television uses two complete transmission systems—one for sight and one for sound—while radio requires only one. See television systems, television history, television transmitters, television transmission, etc.

TELEVISION BROADCAST BANDS – the several groups of channels, each containing a number of megacycle channels, that have been assigned by the Federal Communications Commission to television broadcast stations. Actually, the term "television broadcast band" means those frequencies in the band extending from 44 to 216 megacycles which are assignable to television broadcast stations. These frequencies at present are 44 to 50 megacycles (Channel No. 1), 54 to 72 megacycles (Channels 2 through 4), 76 to 88 megacycles (Channels 5 and 6) and 174 to 216 megacycles (Channels 7 through 13).

TELEVISION BROADCAST STATION — a station licensed by the FCC for the transmission of visual images of moving or fixed objects and associated sound, for reception by the general public.

TELEVISION BROADCASTERS ASSOCIATION, INC. — an industry trade group consisting of America's leading television broadcasting organizations, radio manufacturers, theatrical and film groups, advertising agencies interested in the advocacy and progress of television, mainly from the transmission and program viewpoints. Abbreviation: TBA.

TELEVISION CABLE — cable capable of transmitting frequencies sufficiently high to accommodate television signals without being weakened.

TELEVISION CAMERA — a pickup device used in a television system to convert into electrical signals the optical image formed by a lens. The television camera has three important functions: (1) It must be a viewing apparatus, capable of forming an image of the scene before it. (2) It must be an image analyzer, capable of dissecting the image into picture elements. (3) It must be a photoelectrical conversion device, capable of generating a chain of electrical impulses that correspond to the picture elements.

TELEVISION CAMERA TUBE — an electronic (cathode-ray) tube used to convert the light and shade of a scene into electrical signals. (See *Camera Tube.*)

TELEVISION CHANNEL — a band of frequencies 6 megacycles (6000 kilocycles) wide, available for assignment to a single television broadcast station. (See *channel, spectrum, television broadcast channel*).

Allocations for present-day television channels in the radio spectrum were made on Jan. 19, and June 27, 1945. Television was assigned 13 channels between 44 and 216 megacycles, and high frequency experimental television was assigned space between 480 and 920 megacylces (less 508 megacycles temporarily). Allocations were made in the following manner: Television Channel No. 1, 44-50 mc.; No. 2, 54-60 mc.; No. 3, 60-66 mc.; No. 4, 66-72 mc.; No. 5, 76-82 mc.; No. 6, 82-88 mc.; No. 7, 174-180 mc.; No. 8, 180-186 mc.; No. 9, 186-192 mc.; No. 10, 192-198 mc.; No. 11, 198-204 mc.; No. 12, 204-210 mc.; No. 13, 210-216 mc.

Channels 2 through 5, and 7 through 13 are available for assignment to radio services other than television upon showing that no mutual interference will result.

With these frequency allocations, it is possible to operate a maximum of seven commercial television stations in one city. Four can operate in the six channels below 100 mc. and three in the six channels available between 174 and 216 mc. One of the FCC regulations governing television is that stations serving the same area will not be assigned channels adjacent in frequency. This is to prevent signal interference. The alternate unused channels, nevertheless, can be assigned to stations serving other cities or areas adjacent to the larger centers of population.

TELEVISION CINEMATOGRAPHY – In a paper presented before the American Society of Cinematographers on Aug. 30, 1937, the following rules for television cinematography were advanced:

1-Illumination, composition, contrast, and exposure should be used as required for clear pictorial definition as is usual in general photography. In motion picture photography, extremes in lighting and other factors are employed for dramatic effect. Dark low-key lighting is used to produce a depressing audience reaction to tragic sequences. Such practices may be employed to a limited degree in television technique, but they must be modified or the result at the receiver will be unsatisfactory.

2-Detail should be carried in the half-tones. The object of main attention must be portrayed in this manner. For example, the outline of a man in a black tuzedo is lost against a black-ground drape.

3-Achieve "checkerboard contrast." This is a form of composition based on knowledge that the whole field of view is broken into alternate dark and light areas.

4-The overall contrast range should be kept small.

5-Maintain action. Television as a medium requires a faster tempo than the screen. Attention may be diverted from the home receiver by household interruptions. Therefore, the plot and characters must carry the dramatic story forward at an interesting pace.

6-Employ lap dissolves, quick fades, or change instantaneously from scene to scene. Long fade-outs may give the audience the momentary impression that something has gone wrong with the television receiver.

7-Use medium or light density prints with black frame lines. Dark prints are definitely inferior to lighter prints from the same negative.

TELEVISION CONNECTION – terminals provided at the input of the audio-frequency amplifier in an ordinary radio receiver to allow using the receiver to reproduce the sound portion of a television program. The audio-frequency signal is obtained from a television receiver having no audio-frequency channel.

TELEVISION-CONTROLLED MACHINE GUN – remote-controlled robot machine gun, not personally served by a gun crew, but indirectly, from a safe distance. A television transmitter is set up right behind the machine gun. Thus the transmitter will view or scan the field immediately in front and to the sides of it. Somewhere in the rear is located the television receiver and electric power unit with its generator which supplies the necessary current for the television transmitter and receiver, as well as the power for remote control of the machine gun. A relay of several transmitters and machine guns is suggested. Another of "things-to-come" projections by Hugo Gernsback, engineer, publisher and editor. Not actually ever used; purely theoretical.

TELEVISION ENGINEERING – that phase of radio engineering which deals with the theory and practice of transmitting television programs and accompanying sound through space and receiving such programs with appropriate equipment.

TELEVISION EYE – popular name sometimes applied to the light-sensitive cell of a television transmitter.

TELEVISION FILM SCANNER – In March, 1939, Columbia Broadcasting System announced a new type film scanner developed by its chief engineer, Dr. Peter Goldmark, which transmitted motion pictures without distortion or loss of definition, as simply as projected in a theatre. The film was made to pass continuously downward before a scanning aperture and lens system and then causing an electronic scanning beam to move upward at exactly the same speed so that a stationary electronic image resulted. A slotted rotating disc was placed between the film and a number of lens segments. This acted as a shutter and gave light to only one of the segments at a time. The result was that 60 separate stationary frames per second could be produced from film which was originally photographed at 24 frames per second, although the speed of action on the receiving screen was not changed in the least. Moreover, the received images would have even illumination and great contrast and character. The continuous motion film scanner, said to be the first machine using this principle to be developed anywhere in the world, had been used for test purposes in the CBS television labs for a year and one-half before the announcement, according to CBS spokesmen.

TELEVISION GRAY SCALE – the scale, which indicates the resolution of colors in costumes, scenery, and performers' faces into corresponding gray values in black-and-white television and has a shorter contrast range than in most other photographic media. It may vary from a five-step gray scale of white, light gray, medium gray, dark gray, and black, to more sensitive brilliance of the various gray values, depending upon light source and equipment factors, to approach the ten-step transition—from white through the grays to black—of the photographic and printing gray scale. (See *gray scale.*)

TELEVISION PICTURE TUBE – a cathode ray tube in which a picture being transmitted is recreated by a moving beam of electrons.

TELEVISION RECEIVER — a receiver having complete channels for the reception of the television image and associated sounds. Standards established by the Radio Manufacturers Association state that a set receiving pictures only must be termed a picture receiver.

Television receivers are of two types: the direct-viewing, and projection-type. In the direct-viewing the face of the cathode-ray tube is the screen for the televised image. The largest size to date (1948) is about 20 inches square. Because the majority of tubes are mostly rounded, there is some distortion. The projection-type is just what its name implies. The image is projected (thrown) on the wall, or on a mirror attached within the set and then relayed to the screen. Since there is no apparent tube roundness on the screen, there is no distortion from that source. Syn: teleset.

— Courtesy New York Herald-Tribune and General Electric

Television Receiver

The two radio signals which carry the picture and sound from the transmitter are received on the same antenna and are separated inside the receiver. One signal operates the loudspeaker, which reproduces the sound picked up in the studio. The other actuates a huge electronic tube, called the picture tube. This is the action that brings sight from a distance right into the home receiver. Upon reaching the television receiver, the picture-carrying radio signal is amplified and fed into the picture tube, where a beam of electrons scans the viewing, or screen, end of the picture tube in exact synchronism with the electron beam in the studio camera. The viewing end of the picture tube is coated with fluorescent material, which glows when struck by the electron beam. The glow varies according to the strength of the beam, which is itself constantly varying as the incoming signal varies. Thus, each individual point on the end of the picture tube glows with a different intensity, and because of this, the picture is made up of points of light and shadow just as in the original scene. From the technical viewpoint this is television. It is the system in use today and there is no indication that it will be very much different in the near future.

TELEVISION RESONATOR — a former crude television device, invented by the late Dr. E. E. Fournier d'Albe in which the image to be televised was broken up according to its lights and shades into areas of different musical frequencies. This was effected by a band of perforated paper which was wound up in front of the picture. The intermittent light thus produced was concentrated upon a selenium cell, the output current from which was then transmitted to the receiving apparatus. At the receiver the incoming signals were turned into sound by means of a loudspeaker. The loudspeaker note was analyzed by means of a composite "television resonator" which consisted of a specially designed rectangular box having a reed of silvered mica at one end. The reed, vibrating in virtue of the resonance of the box, reflected a light spot on to a screen, the position of the light spot varying in accordance with its degree of vibration, which in turn was dependent ultimately upon the amount of light and shade "picked up" from the picture at the transmitting end. In this manner, a crude reproduction in coarse patches of light and shade of the original image was obtained at the receiver.

TELEVISION SYSTEMS — In television image-reproduction devices, as in telecameras, two alternative scanning methods are important. The earlier historically is the mechanical method which utilized a rotating scanning disc. The discs may have been any of the forms used in the corresponding forms of the television camera with limitations, such as low optical efficiency and the cumbersome mechanical apparatus needed for high-speed, high-definition reproduction of a large number of scanning lines. The scanning-disc motion was synchronized with that of the disc at the transmitter. The light source used was one the intensity of which could be varied electrically; two common types were the gas-discharge lamp and an incandescent or arc lamp fitted with a Kerr-cell light valve. The modulated light from the source was passed through the apertures in the scanning disc and directed to the eye of the viewer directly, or to a viewing screen. The principal electrical difficulty lays in controlling the light source at a rate of 6,000,000 light variations per second, necessary for a high-definition image. The optical difficulty arose from the fact that the total light available was that passing through each scanning aperture. This light was spread (inasmuch as its effect on the human eye was concerned) over the entire area of the reproduced picture. The apparent brightness of the source must be X number of times that of the desired brightness of the image, where X is the number of picture elements. It is obvious that very intense sources must be used for picturers containing 200,000 elements. In practice, only the arc lamp—exposed or enclosed in a glass tube—proved practical for high-definition work. (See *Scophony System*.)

The poor optical efficiency and other limitations of mechanical image-reproduction systems have given an outstanding advantage to the electronic method so widely in use today. This uses a cathode-ray tube incorporating and electron beam and a fluorescent screen. Cathode-ray image reproduction is, in fact, the only system used at present throughout the world for high-definition work (excepting the Scophony system). The electronic system is truly electrical, employs only electronic devices, and is without a single mechanical moving part. Inside the television camera in the studio is a special electronic tube (called the iconoscope) which changes the picture viewed by the camera from light into electricity. This is the heart of the system—the device that spells the difference between modern television and mechanical television. Within the tube is a plate of mosaic that is sensitive to light because it is covered with myriads of tiny photo-electric cells. As light from the viewed scene falls on each tiny cell, it sets up an electrical charge in proportion to the amount of light striking it. The charges are removed from the plate cells by means of a very thin beam of electrons shot from an electron gun in the neck of the tube. This electron beam scans the mosaic in a series of horizontal lines, covering the whole area of the plate 30 times per second. (Which means that each element of the image is scanned by the electron beam 30 times per second in order to eliminate noticeable flickering and to avoid the effect of jerkiness when rapidly moving objects are televised.)

As each tiny element of the mosaic is struck by the electron scanning beam, it gives up its charge, which is sent over a cable to the control room. From there it is transmitted by radio waves to the television transmitter. The sound, which accompanies the television picture, is picked up by a microphone and carried by wire to the control room. It, also, is sent by radio waves to the transmitter. Then both sight and sound are broadcast together to the video receivers throughout the area served. The sound is transmitted by frequency modulation while the pictures go out by amplitude modulation. (AM) The two radio signals which carry the picture and sound are received on the same antenna and are separated inside the receiver. One signal operates the loudspeaker, which reproduces the sound picked up in the studio. The other actuates a huge electronic tube called the picture tube. This is the action that brings sight from a distance into the direct view of home spectators. Upon reaching the television receiver, the picture-carrying radio signal is amplified and fed into the picture tube, where a beam of electrons scans the viewing, or screen, end of the picture tube in exact synchonism with the electron beam in the studio camera. The viewing end of the picture tube is coated with fluorescent material, which glows when struck by the electron beam. The glow varies according to the strength of the beam, which is itself constantly varying as the incoming signal varies. Thus, each individual point on the end of the picture tube glows with a different intensity; and because of this, the picture is made up of points of light and shadow—just like the original scene. From the technical viewpoint, this is television. It is the system in use today; and there is no indication that it will be very different in the very near future.

The transmitting tube is usually called the iconoscope in the RCA electronic system, and the receiving tube is called the kinescope. (see) Fundamentally, the ideal skeleton television in order to produce a high-definition picture must have the following seven elements: (1) pickup amplifier; (2) video amplifier; (3) radio transmitter; (4) radio receiver; (5) receiver amplifier; (6) viewing device, and (7) synchronizing equipment

TELEVISION TELEPHONE — an experimental system inaugurated in the United States in the early days of mechanical television by means of which two telephone users both saw and heard each other. The telephone cabinets were illuminated by arc lights, the television controls were situated at the rear of the cabinet and under the supervision of a special operator. (See *telephot.*)

TELEVISION TRANSMISSION — Into the aerial of a television or radio transmitter runs a powerful alternatting current—a current which flows first in one direction, then reverses and goes back very rapidly, back and forth many times a second. Most electricity in American homes runs on an alternating current. Light current generally alternates at 60 cycles—back and forth 60 times each second—too fast for the eye to notice. In some country areas, however, the current alternates at 25 cycles per second, and at the slower speed a decided flicker in the light can be seen. The current in the aerial of a television or radio station alternates much more rapidly, depending on the frequency (rapidity of current alternation) for which it is adjusted. For example, if a station is listed on the radio dial at 88, or 880 kilocycles—and as kilocycles means thousand—then it is understood that the antenna current alternates 880,000 times a second in that station. Television transmitters are tuned to even higher frequencies and alternate still faster. The word megacycle means a million cycles, or 1000 kilocycles, and if a television station is tuned to 60 megacycles, its antenna current oscillates 60 million times per second. The alternating current, therefore, in the antenna is very powerful. As a result, there are powerful lines of electro-magnetic force spreading out in all directions from the antenna. When the current flows up into the aerial, though, maybe alternating back and forth at the rate of about 60,000,000 cycles per second, the lines of force spread out. Then, when the current reverses, these first lines of force collapse and are sucked back. A new set shoots forth to replace them. This process occurs every time the current changes its direction or about 60 million times per second. These magnetic waves travel through the air for many miles and are used to carry the program to the receiver.

TELEVISION TRANSMISSION STANDARDS — the standards which determine the characteristics of the television signal as radiated by a television broadcast station. Television transmission standards as promulgated by the Federal Communications currently in effect, follow: (1) The width of the television broadcast channel shall be six megacycles per second; (2) The visual carrier shall be located 4.5 megacycles lower in frequency than the aural center frequency; (3) the aural center frequency shall be located 0.25 megacycles lower than the upper frequency limit of the channel; (4) the number of scanning lines per frame period shall be 525, interlaced two to one; (5) the frame frequency shall be 30 per second and the field frequency shall be 60 per second; (6) the aspect ratio of the transmitted television picture shall be four units horizontally to three units vertically; (7) during active scanning intervals, the scene shall be scanned from left to right horizontally and from top to bottom vertically, at uniform velocities; (8) a carrier shall be modulated within a single television channel for both picture and synchronizing signals, the two signals comprising different modulation ranges in amplitude; (9) a decrease in initial light intensity shall cause an increase in radiated power (negative transmission); (10) the black level shall be represented by a definite carrier level, independent of light and shade in the picture; (11) the pedestal level (normal black level) shall be transmitted at 75 per cent (with a tolerance of plus or minus 2.5 per cent) of the peak carrier amplitude; (12) the maximum white level shall be 15 per cent or less of the peak carrier amplitude; (13) the signals radiated shall have horizontal polarization; (14) a radiated power of the aural transmitter not less than 50 per cent or more than 150 per cent of the peak radiated power of the video transmitter shall be employed; (15) variation of output—the peak-to-peak variation of transmitter output within one frame of video signal due to all causes, including hum, noise, and low-frequency response, measured at both synchronizing peak and pedestal level, shall not exceed 5 per cent of the average synchronizing peak signal amplitude; (16) black level—the black level shall be made as nearly equal to the pedestal level as the state of the art will permit. If they are made essentially equal, satisfactory operation will result and improved techniques will later tend to the establishment of the tolerance if necessary; (17) brightness characteristics—the transmitter output shall vary in substantially inverse logarithmic relation to the brightness of the subject. No tolerances are set at this time.

TELEVISION TRANSMITTER — The radio apparatus used the transmission of both the visual (picture) and aural (sound) signals of a television program. A visual transmitter transmits the visual signal only, while an aural transmitter transmits the aural signals only.

TELEVISIONER — name for television spectator suggested by the late Dr. Michael I. Pupin.

TELEVISOR — early name for the apparatus used in a mechanical television system for scanning the object or scene being transmitted. Also known as "Visionette," a trade-name, no longer used.

TELEVIST — suggested name for a user of a television receiver, proposed by Orrin Dunlap, Jr., advertising and publicity director, Radio Corp. of America.

TELICON "INTRA-VIDEO" SYSTEM — On March 20, 1946, the Telicon Corp., New York City, manufacturing concern of radio and television receivers, and crystals, announced it had mastered the problem of installing adequate television receiving antennas in apartment buildings, a heretofore bottleneck in big city multi-family apartment houses. Named the "intra-video" system, plans call for the erection on the roof of an apartment building, *only* as many separate antennas as there are television stations serving that area, for instance, at the most seven in the New York area. The antennas are then coupled with the distribution system. Each antenna is optimally located and made as directional as required for ghost-free reception of the station towards which it is directed. A variety of novel antennas have been designed to suit the conditions of each location in size and required directivity. The antennas are each connected to a radio frequency booster amplifier. Each amplifier is built as a plug-in unit for quick replacement and is said to occupy less than 30 cubic inches of space. One amplifier of similar design is added to cover the whole FM band. All these amplifiers and their electronically regulated power supply are to fit into a case resembling a moderate-sized fuse box to be mounted on the wall of the top floor of the building. The whole equipment is said to require no more attention than the lights on the staircase. By means of a specially developed reactive network, the output of all booster amplifiers is fed without interaction into a single coaxial cable. This cable, flexible and less than ¼ inch thick, is completely screened against interference and is claimed to have low losses. A single cable, or a few branches in very large buildings, will be installed to feed any desired number of apartment-outlets. The system has been patented (U. S. Patent No. 2394917), Feb. 12, 1946 The inventor is Dr. Heinz E. Kallman.

TELORAMA — early name for television by Dr. D. McFarlan Moore, American scientist. The term is now obsolete.

TERMINAL — a point to which electrical connections are made.

TEST PATTERN — a geometric design used in testing the quality of the image transmission and usually identified with specific stations as a "symbol or trademark."

TETRODE – a four-electrode vacuum tube. Ordinarily, these electrodes will be the cathode, control grid, screen grid, and anode.

TEXTURE – a feeling of depth and irregularity imparted to a plain surface through the use of paint or other decorative techniques. (See *pointillage.*)

THEATRE TELEVISION – pictures conveyed to the theatre over wire lines rather than by radio on to a standard motion picture screen. The audience may see news events as they are happening in place of the newsreel which presents only what took place days before. Also, projection-type television shows for exclusive use in motion picture theatres, using "timely" news events which have been put on film for showing at times convenient to the main feature; and also, spot coverage direct-from-the-scene-of-action, as in the case of sporting events such as football games, baseball, basketball, or fights. Again, actual on-the-scene spot coverage of fires, parades, political conventions, speeches by political and other leaders, etc.

THERMION – an electron or positive ion emitted from a heated body as from the hot cathode of a thermionic vacuum tube. Boris Rosing first suggested the cathode beam as a means for tracing upon the fluorescent-coated end of the Braun tube the details of electrically transmitted images in television. Lacking the all-essential three-element amplifier tube, this ingenious suggestion was doomed to remain unrealized for many years. The electron beam or ray in the cathode-beam tube is a narrow pencil of negatively charged particles or electrons, which, under the influence of heat, exude from the outer surfaces of the hot cathode. For this reason, these electrons are sometimes called "thermions."

THERMIONIC – pertaining to emission of electrons by heat.

THERMIONIC EMISSION – the emission of electrons from hot bodies. The rate of emission increases rapidly with temperature. Also known as the Edison effect or Richardson effect.

THERMIONIC TUBE – a vacuum tube in which one of the electrodes, invariably the cathode, is electrically heated, usually to incandescence, in order to cause electron or ion emission from that electrode. Sometimes called hot-cathode tube.

THERMIONIC VALVE – British designation for "thermionic vacuum tube."

THERMIONICS – that branch of physics dealing with phenomenon due to emission of electrons by heat.

THREE-CHANNEL TELEVISION SYSTEM – In the Bell System Technical Journal, July 1930, Dr. Herbert E. Ives, research department, Bell Telephone Laboratories, described a three-channel apparatus which his firm had constructed. Prisms were placed over the holes in a scanning disc to direct the incident light into three photoelectric cells. The three sets of signals were transmitted over three channels to a triple electrode neon lamp placed behind a viewing disc also provided with prisms over its apertures so that each electrode was visible only through every third aperture. An image of 13,500 elements was thus produced. For the successful operation of the multi-channel system, as it was named, it was imperative to have very accurate matching of the characteristics in the several channels.

THREE-DIMENSIONAL TELEVISION – Leslie Gould, Bridgeport, Conn., inventor, about early 1931 developed a panoramic or three-dimensional television system. A cone containing a synchronous motor rotated a horizontal rod, on each end of which was mounted a scanning device or "electric eyes." These electric eyes each contained a photoelectric cell surrounded by a scanning drum, which passed the light rays from the scene, point by point in a vertical line, to a sensitive surface of the cell. The result was that the images within range of the photoelectric cells were scanned spirally, from every direction, in the course of one rotation of the rod. It was possible to use more than two electric eyes but a separate channel or waveband was required for each transmission. At the receiver, the reproducer would be composed of a radio receiver and a rotating vertical drum, inside of which would be mounted two neon tubes. One of the tubes would give out red light, and the other green, corresponding to the two pickups of the transmitter. The combination of the two colors would approach the natural light-values of the scene. Since the neon tubes revolved in one direction, and the diagonal slots in the other, the reproduced image was also scanned spirally, and the result would be a television image which could be seen from several angles, standing out as if it were in the round. The effect described by the inventor was that of viewing (a prizefighting ring) from any desired angle, just as if it were reduced to the compass of the outer scanning drum of the television reproducer. No evidence has been found to prove that apparatus for such a system has ever been developed. (See *Gould, Leslie.*)

THREE-WAY (usually written: 3-way) – a camera shot of three people.

TIGHT CLOSE-UP – See *big close-up.* Abbreviation: TCU.

TILT – a camera technique by which additional portions of a scene's area are shown by aiming the camera vertically (up and down).

TILTING – a vertical sweep of the camera which follows the object being televised.

TIME - LAG – this term, usually in television terminology, is applied to light-sensitive cells and signifies the lapse of time between the impact of the light ray on the cell and the setting up of the electrical effect which results. Also, to the time intervening between the cessation of the light action and that of the electrical effect. Selenium cells have an appreciable time-lag. Photoelectric cells, on the other hand, are devoid of time-lag, being instantaneous in action. Hence they are used exclusively for practical television purposes. Abbreviation: lag.

TIME WAVE – foreseen by Orrin E. Dunlap, Jr. as "a television eye (camera) focused on the face of a master clock at the Naval Observatory in Washington . . . when the owner of a television receiver wants the correct time he will merely turn the dial to that wave length and the face of the clock will be right there visually to announce its own story. . . . England may have a television time camera trained on the face of Big Ben atop the House of Parliament, and so the famous timepieces will be given new long distance range. Millions will see their hand brush away the minutes instead of a few who pass the street."

TINT VIDEO – slang for "color television."

TITLE ARTIST – artist or draftsman who prepares titles, cards, signs, title backgrounds, maps, special displays, slides, etc.

TITLE SLIDES – slides, either drawings or on film, which announce the title and credits of a program.

TITLES – any titles used on a program; can be motion picture film, cards, slides, etc.

TONE – a musical sound. The quality or general character of a reproduced radio program as it affects the human ear. That is, the sound resulting from the mixture of air waves of different frequencies.

TONE CONTROL – a circuit control sometimes provided on a radio receiver to permit strengthening of the response at either low or at high audio frequencies at will, so as to make the reproduced radio program more pleasing to a particular audience. The circuit which is electrical usually consists of a fixed condenser and rheostat.

TONGUING – boom shot. The camera head may be raised or lowered and swung out to right or left on a boom. Can only be accomplished when the camera is mounted on a mobile boom or dolly involving complete movement of the camera.

TOP LIGHT – light from the region of the ceiling.

TOWER – a tall metal structure used as a transmitting antenna, or used with another such structure to support a transmitting antenna wire.

TOWER RADIATOR – a tall metal structure used as a transmitting antenna.

TOWER REPEATER STATIONS – (See *repeater; also radio relay.*) Plans for the trial of a system of inter-city radio relay links of a "new type" between New York and Boston were announced in the summer of 1944 by the American Telephone & Telegraph Co. Later plans by International Business Machines Corp. and the General Electric Co. proposed a series of repeater stations placed 28 to 30 miles apart atop high steel towers. Each channel thus created would be 20 megacycles wide (20 times as wide as the whole broadcast program spectrum of the United States) located between 2000 and 2300 megacycles in the very high frequencies where no regular service has ever operated before. Special radio vacuum tubes, it was indicated, will be available for such experimental work. Atop each tower the transmitter - receivers for very high frequencies would be housed in weather-proof boxes. They might possibly be unattended stations, visited perhaps once monthly, or thereabouts, for maintenance purposes. The towers would be turned on and off automatically, by clock works or wire signal from headquarters. Each station would have a series of "parabolic" or "horn" type antennas – one for reception, the other for transmission – to aim the signal directly towards the next tower in the system, and so on.

TRACKING – a term used to indicate that all of the tuned circuits in a receiver follow the frequency indicated by the tuning dial pointer as the receiver is tuned over its entire tuning range.

TRANSCRIPTION – high fidelity recordings utilized for broadcasting purposes; electrical transcriptions of complete programs are often recorded for future reuse.

TRANSFORMER – an electrical device consisting of two or more separate coils, insulated from each other, used to transfer electrical energy from one circuit to another. Also to transfer electrical energy at various voltages.

TRANSLUCENT SCREEN – a screen which permits light to pass through it.

TRANSMISSION – the conveying of electrical energy over a distance; the dispatching of a signal, message or other forms of intelligence by means of wire, or radio-telegraphy, telephony or facsimile.

TRANSMISSION BAND – the band in the frequency spectrum over which minimum attenuation of currents is desired, depending on the type of transmission and the speed of the desired signals.

TRANSMISSION LINE – a system of conductors, usually two, to the antenna, or from the antenna to the receiver where the separation between them is considerable. Used to transfer signal energy from one location to another or to transmit current over long distances for power purposes. Transmission lines from the transmitter to the antenna are also called "feeder lines." Television, today, is thought of as the transmission of light-modulated electric signals through the air by radio. Such a transmission involves the production of an electromagnetic radio wave called a carrier wave, similar to that which transmits radio programs, and modification of this carrier wave by the sequence of electrical impulses comprising the television signal. The carrier wave is then said to be modulated by the television signal, which can be taken off the carrier wave by the proper receiving device.

TRANSMITTER — the associated apparatus used for generating as well as amplifying a radio-frequency signal, modulating this carrier signal with intelligence, and radiating the modulated radio-frequency carrier into space as radio waves. The function of the radio transmitter is to excite the medium between stations by means of electric currents which in some way represent the intelligence to be transmitted. The function of the receiver is to detect these disturbances in space, translate them back to electric currents like the ones at the transmitter and then to convert the currents to the form of intelligence which they were made to represent at the transmitter. The fundamental parts of the transmitter are the generator, the modulator, and the antenna. The generator generates the particular form of electric currents needed; the modulator controls these currents to represent the intelligence to be transmitted; and the antenna radiates the modulated currents, or their effects, into space. As a rule, a 4 kilowatt transmitter will service 30 miles. A 40 kilowatt will service 50 miles. If a 4 kw is not sufficient to serve a concentrated area the use of a satellite station can be used in addition to the transmitter.

TRANSMITTING AND RELAYING — Within each television camera tube is a glass miniature of the Big Dipper. The images of the performers focus on a photo-sensitive plate at the "dipper's" back. There they are converted into a series of electrical impulses. These impulses travel to the control room through a thick cable snaking across the floor. There the engineers monitor the impulses which make up the picture and the sound, and both are carried instantly by very short radio waves to the main television transmitting station where they are broadcast. Home receivers pick up the waves with a cathode-ray picture tube which looks like a bulging glass funnel, closed at the large end. In the home telereceiver, the picture flies through the stem of the tube in a beam of electrons that plays across a fluorescent screen at the closed end of the funnel. There the electrical impulses are converted again to the varying degrees of light that form a picture on the screen of the television set. The sound is reproduced by the loudspeaker which is built into the home receiver.

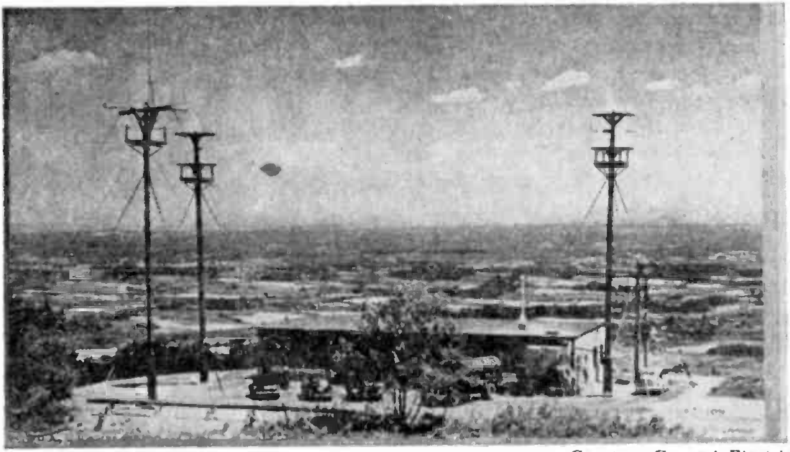
TRANSMITTING STATION — the location at which the transmitter, transmitting antenna, and associated transmitting equipment of a radio system are grouped.

TRANSPARENCY — illustrative or written material executed on a transparent surface through which background material of various types may be seen as the transparency is photographed by the television camera.

TRAP — a circuit used to reject unwanted signals.

TREBLE — a term sometimes used to designate high audio frequencies.

TREBLE TONE — the tone resulting when high frequencies are predomi-



— *Courtesy General Electric*

Transmitter Station, W2XB

nant. Also known as "high-pitched" or "soprano tone."

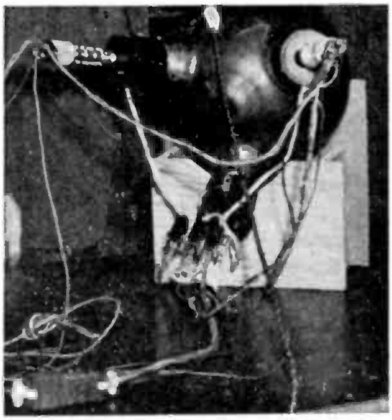
TRICHROMATIC — means three-colored. Trichromatic television is now an accomplished fact.

TRICHROMOSCOPE TUBE — A color receiving tube which has a 12 inch diameter face and employs three guns. Fluorescent material may be coated on three faces of the small pyramids to procure colors of red, blue, and green respectively from the three electron guns. The pyramidal structure is reduced in practice to something like 100 pyramids per inch in order that the color elements will be smaller than the line widths used in scanning. The Trichromoscope tube may be employed with either simultaneous transmission color systems or sequential transmission color systems, giving the highest brightness with the simultaneous system. It provides the advantage of direct viewing in full color by all-electronic means. Additional tubes of the Trichromoscope type are being constructed, using the triangular pyramid structure impressed directly on the glass at the front of the tube. With the pyramidal impression, it is a simple matter to settle the phosphors in turn on the three sets of faces corresponding to red, blue and green, respectively.

TRIM — See *dressing*.

TRIMMER — an apparatus which allows a resonant circuit to be tuned over a limited frequency range.

TRIODE — a three-electrode vacuum tube containing a cathode, an anode and a control electrode.



— *Courtesy DuMont Labs.*

Trichomoscope Tube

TRIPLE SCANNING — a system by which the image to be televised is scanned three times by means of a disc contained three sets of scanning holes, the series of holes being covered with red, green and blue color-filters respectively. Such a triple scanning disc was used in conjunction with the Baird experimental system of color television before World War II.

TRIPOD — camera mount.

TROPOSPHERE — that part of the earth's atmosphere from the earth's surface to about six miles up. In the troposphere, the temperature generally increases with altitude, clouds form, and convection is active. There is an effect in the troposphere which takes place in what has been referred to as the "standard atmosphere," which consists of bending the radio waves toward the earth. Thus, instead of traveling in straight lines as they would in free space, the waves follow paths which are curved toward the earth.

TRUCK — to follow in parallel motion with a figure in motion; for example, to follow an individual walking down a street. (See *dolly; truck shot.*)

TRUCK SHOT — a camera technique by which a line of performers, such as a chorus-line, or a scene is covered by dollying the camera along the line of subjects or along the scene while the camera is on the air. (See *dolly, truck.*)

TUBE — a vacuum tube, so designated because it is often a tube-shaped glass or metal envelope. It may be gaseous or a photoelectric cell used in any radio or electronic circuit or apparatus.

TUBE TESTER — a test instrument used to test the condition of radio tubes.

TUNER — the device in a radio receiver which selects a radio wave of a certain frequency and rejects all others.

TUNGSTEN — a pure metal used in radio chiefly for the filaments and other elements of radio tubes.

TUNING — adjusting all tuning circuits in a radio transmitter or receiver simultaneously for optimum performance at a desired frequency. Also, the ability of a radio set to receive one station only at one time.

Again, the pitch adjustment of one note to another or to a specified frequency of oscillation.

TUNING CONTROL – the control knob that adjusts all tuned circuits of a receiver simultaneously for reception of a desired sound or television program.

TUNING EYE – a cathode ray tuning indicator tube.

TUNING-IN – adjusting the tuning controls of a radio receiver to obtain maximum response to the signals of the station it is desired to receive.

TUNING INDICATOR – a device which shows when a radio receiver is accurately tuned to a radio station.

TUNING-OUT – the opposite of tuning-in; for example, the adjustment for minimum response to be consistent with acceptance of another.

TUNING SYSTEM – The tuning system consists of two essential parts: (1) a coil of wire; and (2) a condenser. The coil provides a means of receiving the electrical impulses imparted to the antenna by the radio waves. It accomplishes this by inductance. The condenser serves as a storage place for electric charges and its ability to store them is called capacity or capacitance. The mutual action of the inductance and capacitance results in the setting up of oscillations in the tuning circuits.

TURKEY – slang expression for a program that is a "flop" or failure.

TURN – one complete loop of wire, in a coil; or wire around the coil form.

TURNSTILE ANTENNA – one or more layers of crossed horizontal half-wave antennas appropriately excited and arranged on a mast. Used in high-frequency systems including television where a symmetrical pattern of radiation is desired.

TURNTABLE – the electric or spring motor-driven rotating table on which the record is placed in an electric phonograph, record player, or sound recorder. In a sound recorder, the motor-driven rotating table on which the disc is placed to be cut.

TWO-BAND RECEIVER – a radio receiver having two reception ranges.

TWO-SHOT – a close-up or medium shot holding two persons, usually head and shoulders only, as the subject. Or a camera shot of two objects.

U

UHF – abbreviation for ultra high frequency.

ULTRA HIGH FREQUENCY – a designation by the Federal Communications Commission of any frequency above 300 megacycles or higher. Waves in this portion of the spectrum are called microwaves. Abbreviation: uhf.

ULTRA-RED RAYS – another name for infra-red rays. (See *infra-red rays.*)

ULTRA-SHORT WAVES – a general term applying to radio waves shorter than 10 meters in wavelength (above 300 megacycles in frequency). Waves shorter than one meter are generally called micro-waves. (See *ultra-short frequencies.*) Used for transmission of television programs. The first public demonstration of ultra - short - wave transmission was given on April 29, 1932, from a transmitter on the Baird premises in Long Acre, London, England, to a receiver installed in the Selfridge Department. The transmissions have the advantage in that they allow high-definition pictures to be transmitted.

ULTRASONICS – name given to a branch of acoustics dealing with sound vibrations, the frequency of which reaches and exceeds 20,000 cycles per second. Sounds of such a frequency are inaudible to human ears. The ultrasonics found application in the British Scophony system of television based upon modulation of ultrasonic waves in liquids. Syn.: supersonics.

ULTRAVIOLET LIGHT – radiant energy of shorter wavelength than visible light. (See *near ultraviolet light.*)

UNMODULATED – without modulation. The radio frequency carrier signal alone, as it exists during pauses between station programs.

V

V.F. – means *video frequency.*

VHF – abbreviation for *very high frequency.*

VLF – abbreviation: very low frequency.

VACUUM – an enclosed space from which practically all air has been removed. A vacuum or lack of air must be created in tubes to prevent the cathodes from burning out and causing the electron beam to behave erratically. Even the best obtainable vacuum, however, has some gas present and, of course, the corresponding pressure.

VACUUM TUBE – a device consisting of an evacuated enclosure containing a number of electrodes between any two or more of which conduction of electricity through the vacuum or contained gas may take place. Vacuum tube is, therefore, a general term covering all tubes – phototubes, cathode-ray tubes, mercury-vapor tubes, gas tubes, thermionic tubes, high-vacuum tubes, glow tubes, X-ray tubes, etc. The understanding of vacuum tube operation is important in television since these tubes form the backbone of all television (and radio) circuits. The basis of all vacuum tubes' operation, whether rectifiers or multi-purpose tubes (in glass or metal envelopes) is electron emission. Electrons are emitted from an electrically heated filament or from a cathode placed over this filament and insulated from it. This later type of emission is termed "indirect." Some substances are far better emitters than others. Coating a poor emitter with an oxide of certain metals may raise the emission a thousand times.

The vacuum tube as it is known today grew out of a great number of discoveries and inventions. Before 1883, Elster and Geitel, experimenting with electrical phenomena, found that if a wire filament like the filament in an electric-light bulb was heated red-hot by connecting it with a battery and passing a current through it, and if a metal plate was held near it, the plate became electrically charged. If the plate was connected to the filament by a wire, a current flowed in that wire. They also found that this charge was more pronounced if the filament and the plate were in a bulb from which the air had been removed, or in other words, if the filament and plate were in a vacuum.

In 1883, Thomas A. Edison discovered that when an additional electrode was put within an incandescent lamp and this electrode was connected to a positive potential of a battery with respect to the filament, a current passed through the circuit. This was actually a simple vacuum tube of the diode type. It contained but two elements, the cathode to emit and the plate (anode) to receive the electrons. Under the influence of a positive potential applied to the plate, electrons will flow from the cathode to the positive plate. An increase in the plate potential will increase the plate current. From a heated cathode many electrons are emitted forming a cloud around it. If a negative potential is applied to the plate, the electrons around the cathode will be repelled back into the cathode and no current will pass between these elements. If, however, the plate becomes positive with respect to the cathode, the electrons around the cathode will be attracted to the plate, since unlike charges attract and current will pass. In a rectifier, if an alternating current is applied during the positive cycle, current will flow, but not during the negative. In this manner the alternating current will be rectified into pulsating direct current. Therefore, Edison really discovered that if the plate is given a positive potential with respect to the filament, a current will flow through the space between the plate and the filament, and if the plate is given a negative potential with respect to the filament, no current will flow. This flow of current through space is known today to be a discharge of electrons or negative charges of electricity. This phenomenon is called the "Edison Effect."

In 1889, Sir J. J. Thomson explained that the Edison effect was caused by small particles of electricity passing from the filament to the plate. These particles of electricity or electrons are negatively charged.

Vacuum tubes are better known as "radio tubes." The vacuum tube is used, among other things, to put the television signal on the carrier wave at the transmitting station and to take it off the carrier wave at the receiver. The process of putting the signal on the carrier is called modulation, while taking it off the receiver is known as demodulation or detection.

VALENSI TELEVISION SYSTEM — M. Valensi, chief engineer of the French Post Office about 1927, had the idea of utilizing the cathode ray for television apparatus. In his system an image to be transmitted could be a lantern slide in a lantern, or an opaque subject, drawing, postal card, watch, etc., placed in an "opaque object" lantern. There was nothing special about the projecting lantern. It contained two arc lamps which could be made as powerful as desired, casting the greater part of their light on the object whose image was to be transmitted, and this image, strongly illuminated, was formed at an exact place between two stroboscopic discs.

VALVE – the term used in Great Britain to designate a vacuum tube.

VARIABLE - SPEED SCANNING – See *velocity modulation.*

VARIETY PROGRAM – productions devoted to specialty acts.

VAUDEVISION – used to describe the possibility of using the same performers or acts on different television station broadcasts at different times, as in the case of old-time vaudeville where actors and skits, or short shows, were booked in various theatres across the nation.

VELOCITY MODULATION – a method of modulating the output current of a television transmitter by means of which the scanning spot moves quickly over the dark portions of the picture to be televised and slowly over the bright spots of the picture. It is applicable to cathode-ray systems of television only. Syn.: variable-speed scanning. In velocity modulation the brightness of the trace on the fluorescent screen of the tube is governed by the rate at which the beam sweeps across it and a retardation in speed will thus give a brighter line. In velocity modulation, electrons are sent out in bunches instead of a steady stream. This literally lifts the radio ceiling, making possible up to 5000 megacycles (5,000,000,000 cycles) per second.

VERICON TELEVISION PICKUP SYSTEM – a system developed for automatic operation under a wide range of conditions exhibited by Remington Rand, Inc., at the Institute of Radio Engineers Conference in January, 1946.

VERTICAL ANTENNA – a single vertical metal rod, suspended wire or metal tower used as an antenna.

VERTICAL CENTERING – adjustment of the picture position in the vertical direction; the control which regulates the picture vertically on the screen of the receiver tube.

VERTICAL HOLD – See *framing control.*

VERTICAL HOLD CONTROL – the control used in a television receiver to regulate the field rate of the scanning to that of the transmitter.

VERTICAL SCANNING – term refers to the scanning methods in which the light spot, beginning at the bottom right-hand corner of the picture or image to be televised, covers it rapidly in a series of vertical traces or "sweeps," each successive sweep of the scanning spot being to the left of the previous one. Vertical scanning was employed before the war by the Baird Co. in its BBC transmission in England. Vertical scanning is interlocked with horizontal scanning, and, of course, in the receiver depends on the incoming synchronizing impulses.

VERTICAL SWEEP – the downward movement of the scanning beam from top to bottom of the picture being televised.

VERTICAL-SYNCHRONIZING IMPULSE – See *line-synchronizing impulse.*

VERY-HIGH-FREQUENCY – refers to the frequency in the band extending from 30 to 300 megacycles in the radio spectrum. Abbreviation: *vhf.*

VERY-LOW-FREQUENCY – a frequency in the band extending from 10 to 30 kilocycles in the radio spectrum. Supersonic frequencies are in this frequency range but are not in the radio spectrum because they are not electromagnetic waves. Abbreviation: *vlf.*

VESTIGIAL SIDE BAND TRANSMISSION – the system of transmission wherein one of the generated side bands is partially attenuated at the transmitter and radiated only in part.

VIDEO – pertains to the picture signals or sections in a television system. From the Latin "video", meaning "I see." Also, commonly used interchangeably as a synonym for "television." Strictly defined as "pertaining to the transmission of transient visual images." Used to designate sight broadcasting as opposed to sound broadcasting.

VIDEO FILM – motion pictures used in television broadcasts.

VIDEO FREQUENCIES – frequencies existing in the output of a television camera as a result of scanning the image to be transmitted. Abbreviation: *v.f.* Also called "visual frequencies." This term corresponds to audio frequencies in the case of telephonic transmission, namely, any of the modulating frequencies present in a television picture signal.

VIDEOGRAPHER – a television cameraman.

VIDEO SIGNAL – the picture signal in a television system. This term is usually applied to the signal as it exists at the output of the television camera, before the addition of the synchronizing pulses. Synonym: picture signal. The video signal is the combination of two sets of signals, the camera impulses and the synchronization impulses, so that they may be transmitted over one communication channel.

VIEW FINDER – the optical or electronic equipment used in focusing a television camera.

VIEWING DISTANCES – See *optimum viewing distance.*

VIEWING LENS – lens on a camera used solely for viewing the field of action by a cameraman. This is generally a simple double-convex lens which is placed in front of the scanner and which suitably magnifies the received image or picture.

VIEWING MIRROR — a mirror arranged at an angle in the lid of one type of television receiver which reflects the image formed on the screen-face of a vertically-mounted picture tube so that the image can be seen by the spectator seated in front of the receiver. Used in indirect-viewing receiving sets.

VIEWING SCREEN — the medium that converts the useful energy of the electrons in the beam of a cathode-ray tube into visible radiation. The screen usually consists of a coating of fluorescent material on the inside surface of the large end of the cathode-ray tube.

VIEWS — the scene being televised.

VISEUR — name suggested to describe a television spectator or viewer of a video receiver; rarely, if ever, used. (See *observer, televist.*)

VISIE - TALKIE — word coined by "Grego Banshuk," which when unscrambled spells 'Hugo Gernsbak", to which add the letter "C" and you have the name of Hugo Gernsback, editor - in - chief, *Radio Craft* magazine. Visie-talkie (April 1945 issue, p. 416) is described as a portable television handset over which one can talk and see at a distance. A counterpart of the walkie-talkie and the handie-talkie — vision is added. "Of importance is the development of non-scanning television which will simplify television to a greater extent than has been possible to the present" (another of Mr. Gernsback's things-to-come" predictions).

VISEOGENIC — suitable, artistically, for television transmission.

VISION — the sense of sight; act of seeing; that which is seen.

VISION FREQENCY — the frequency of any single frequency component of the electric wave produced by a scanning device.

VISION MODULATION — the modulation of the carrier effected by the picture signal, as distinct from that reserved for the synchronizing impulses.

VISIONETTE — name given to device which reproduces light impulses at the receiver and in which the observers see the picture. This term is now obsolete. Synonym: televisor.

VISIOTELEPHONY — term for two-way television whereby two people speaking to each other from any distance may see each other at the same time on image-speaking telephones. (See *telephot.*)

VISUAL ACUITY — generally in television, poor illumination at the camera-point; that is, in the studio, the visual acuity or sharpness of the object (clarity of vision) decreased, owing to the iris of the eye expanding in order to admit more light and so, in consequence of the larger aperture, made it more difficult for objects to be finely focused on the retina. In television reception under low intensities of illumination the factor of visual acuity is often an important one. Recently, invention and development of the RCA orthicon camera made visual acuity possible even with the poorest of lighting because of the camera's ability to pick up the image by the rays of an ordinary match, infra-ray lighting, or candlelight. (See *orthicon camera.*)

VISUAL ARTS – pertaining to the science of sight. Television has been classified as one of the visual arts by Dr. Alfred N. Goldsmith. Other visual arts are still-picture (photography); and motion picture photography.

VISUAL BROADCAST SERVICE – the service rendered by stations broadcasting images for public reception. There are two classes of stations recognized in the visual broadcast service, namely, (1) television broadcast station, and (2) facsimile broadcast stations.

VISUAL CARRIER – the carrier which carries the video signal. Also see *transmission standards.*

VISUAL COMMERCIAL – a sales message delivered by a performer, who through repeated performances, becomes identified in the viewer's mind with the product advertised.

VISUAL FREQUENCIES – frequencies existing in the output of a television camera as a result of scanning the image being transmitted.

VISUAL PERSISTENCE – See *persistence of vision.*

VISUAL TELEGRAPHY – all experiments in connection with television before the advent of radio were considered from the point of wire transmission and were referred to as "visual telegraphy."

VISUAL TRANSMITTER – the radio apparatus employed for the transmission of the picture (visual) signal as distinct from the sound transmitting equipment. The complete equipment for both visual and aural signals is known as a television transmitter.

VISUAL TRANSMITTER POWER – the peak power output when transmitting a standard television signal.

VOLT – a unit of electromotive force, the "pressure" of electricity. Usually described as "the practical unit of vlotage." (See *voltage.*) Named for Alessandro Volta, famous inventor.

VOLTAIC CELL – a simple primary cell consisting of two different metals, usually copper and zinc, immersed in weak acid solution which acts with unequal effect on the two. The electrical potential varies with inequality of action, determining the strength of current set up in the cell. The metals are called electrodes; the acid, the electrolyte.

VOLTAGE – the electrical pressure that causes electrons to flow in a conductor; the pressure which produces electric current.

VOLUME – in general, the intensity or loudness of the sound produced by a loudspeaker or headphone.

VOLUME CONTROL – a resistance device, usually a rheostat (a variable resistor) which controls the volume of the radio signal coming out of the earphones or loudspeaker.

VON ARDENNE TUBE – a special type of cathode-ray tube named after the inventor, Baron Manfred von Ardenne, which gave a sharper spot image than the other existing tubes during the time he experimented. (See *von Ardenne.*)

VOX POP – any spontaneous interview which is transmitted over the air.

W

WALK THROUGH – a rehearsal without cameras, normally conducted on the set.

WALL TREATMENT – technique used to simulate various surfaces on the walls of a setting; for example, stucco, brick, stone work, wallpaper, etc.

WALTON-STEPHENSON TELEVISION SYSTEM – See *Stephenson-Walton*.

WARNING LIGHTS – red and green lights associated with each camera in the television studio to warn the cameramen and program participants that a camera is about to go on the air (green light) or that the camera is on the air (red light). The camera with the green light is often termed the "preview light."

WASH-TUB WEEPER – slang for a radio daytime serial.

WATT – the practical unit of electrical power.

WAVE – a wave is energy traveling through a medium by means of vibrations from particle to particle. The wave which is "a propagated disturbance" is usually periodic, such as a radio or sound wave.

WAVE ANTENNA – a form of directional receiving antenna consisting of a long wire running horizontally in the direction of the arrival of the incoming waves, at a small distance above the distance of the ground. The receiver is connected to earth through a terminating resistance. Also called a beverage antenna.

WAVE BAND – a band of frequencies, such as that assigned to a particular type of radio communication service (television).

WAVE LENGTH – the distance, measured radially from the source, between two successive points in free space at which an electromatic wave has the same phase. It is the distance, in other words, between one crest of a wave and the next crest.

WAVE TRAP – an apparatus or device sometimes connected to the antenna system of a receiver to reduce the strength of signals at a particular frequency, such as at the frequency of a strong local station which is interfering with reception of other stations.

WEB – a network of broadcasting stations (usually radio).

WEEKLY RATING REPORT – a query – usually a postcard attached to a return-free-card, asking television owners or spectators to give their opinions or rate the specific programs of the week.

WEILLER DRUM – name sometimes given to the television mirror-drum (in a mechanical system); named for its inventor.

WHIP – a very fast pan used to blur the scene by the very speed of turning, and achieving the same effect obtained if one looks to the right and suddenly snaps his head around to the left.

WIDE ANGLE LENS – lens having wide angle of view; that is, lens which can pick up broad areas of a set at a short range.

WIDTH – adjustment of the image size horizontally. Width of the television broadcast channel is six megacycles per second. (See *transmission standards.*)

WIDTH CONTROL – the control that adjusts the width of the pattern on the screen of a cathode-ray tube in a television receiver or oscilloscope.

WILLEMITE – a natural mineral consisting mostly of zinc silicate which is a very effective fluorescent material for cathode ray working. The mineral was so named by its discoverer for Wilhelm I, King of the Netherlands.

WINDSHIELD – a perforated metal cover fitted over the microphone to protect it from drafts caused by powerful air conditioning systems used to remove heat caused by studio lights.

WINGS – the sides of a television set normally out of range of camera or viewers – off stage.

WIRE – a metallic conductor having essentially uniform thickness, used chiefly to provide a path for electric currents between two points. It may be bare or covered with an insulating material such as enamel, cotton, linen or silk.

WIRE COMMUNICATION – the transmission of pictures, sounds, writing, signs and signals of all kinds by aid of wire, cable, or other similar connection between the points of origin and reception of such transmission.

WIRE NETWORK INTERNATIONAL RADIO BROADCASTING – in which the material (intelligence or program) is transmitted by wire from the originating station to a broadcasting station in another country.

WIRE TELEGRAPHY – the electrical transmission of signals.

WIRE TELEPHONY – transmission of human speech over wire; e. g., telephone.

WIRED RADIO – the art of communication through means of modulated carrier currents guided deliberately by conductors instead of being sent through the air as radio waves. Telephone wires are the most commonly used means of sending "wired radio."

WIRED TELEVISION – See *subscription television.*

WIRELESS – direct telegraphic electric wave communication without the use of wires to carry the electric impulse. Synonym: radio. The British use the term "wireless" instead of radio. Used in the United States principally to specify a special designation to distinguish from the actual meaning of "radio," as for example, "wireless record player." Energy is radiated into space in every direction by a sending antenna, and a small amount of it is gathered in by the receiving antenna. This causes the receiving circuit to oscillate, if it is tuned or adjusted to the same natural frequency as that of the radiation it is to receive. No wires are used. (See *Marconi*.)

WIRELESS PHOTOGRAPH – See *wirephoto*.

WIRELESS TELEPHONY – transmission of vocal messages without use of wires, by radio.

WIREPHOTO – a photograph or other images transmitted over a telegraph system by scanning the picture into elemental areas in orderly sequence, converting each area into proportional electric signal, transmitting the signals in sequence, and reassembling them in correct order at the receiver. Also called *facsimile, phototelegraphy, telephoto,* etc.

WOMP – a sudden surge in signal strength which results in a flare-up of light in the picture.

WOOF – telephone slang used by television engineers to signify "okay and goodbye."

X

X'S – disturbances caused by static.

Y

YOKE – a set of coils used around the neck of a cathode-ray tube to produce horizontal and vertical deflection of the electron beam. Used for electromagnetic deflection. (See *deflection yoke*.)

Z

ZIGZAG SCANNING – consists in scanning an area with an oscillatory motion of the spot or element, so that consecutive strips are traced in opposite directions and/or consecutive tracings commence from opposite sides of the scanned area.

ZINC PHOSPHATE – a combination of zinc and phosphoric acid. It has been used as an active material for the preparation of cathode-ray fluorescent screens owing to its strong fluorescence under the influence of the rays. However, its effects are marred by the persistent after-glow which it produces.

ZINC SILICATE – a combination of zinc oxide with silica. It occurs naturally in the form of the mineral Willemite (see). It is a creamy-white powder and one of the best fluorescent materials known for the making of fluorescent screens of cathode-ray tubes. Under the influence of the rays, it glows with a green tint, although this coloration is greatly affected by the presence of impurities in the material.

ZINC SULPHIDE — a white powder which, when suitably prepared, is strongly fluorescent under the influence of cathode rays. Zinc sulphide fluorescent screens glow with a bluish light. Formerly, screens of this material were characterized by a certain amount of objectionable "after-glow." By using specially treated zinc sulphide in the preparation of the screens, however, this disadvantage has now been practically eliminated.

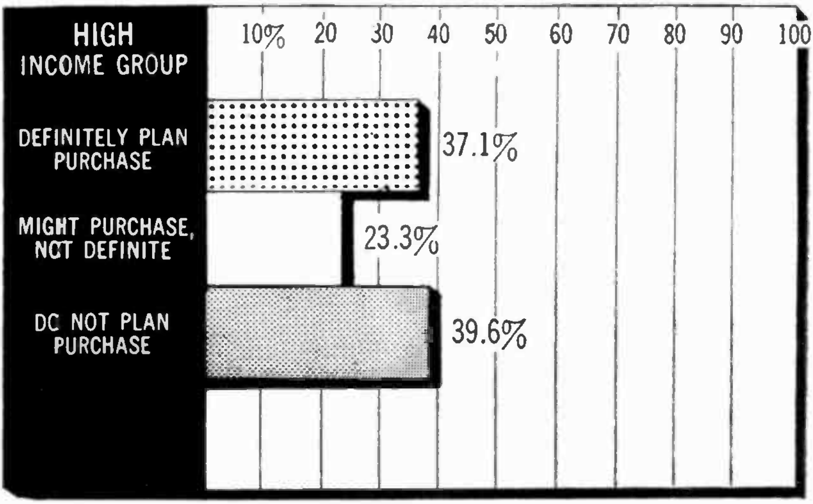
ZONE SCANNING — See *zone television.*

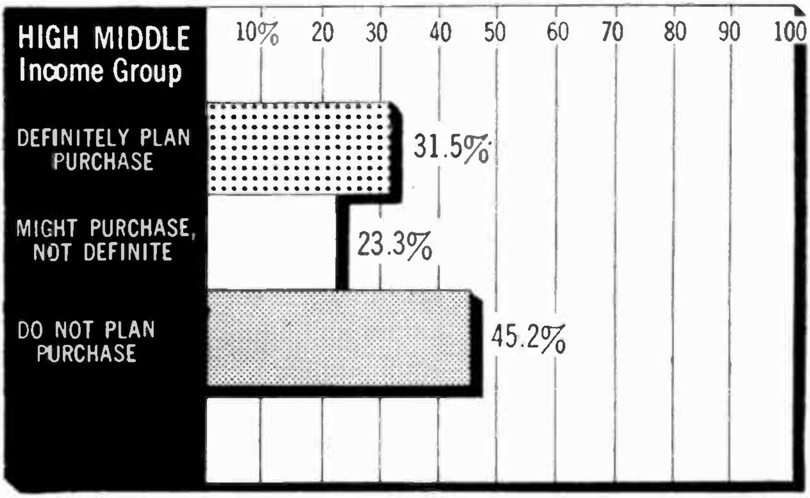
ZONE TELEVISION — a system of television in which different parts or zones of the image were scanned by separate devices and separately transmitted to the receiver, where they were combined. This system, now obsolete, was used in the earlier days of television and was first demonstrated in the Baird Laboratories in London, in January, 1931. At this demonstration images of eight people were projected onto a small glass screen and then they were split up into three sections and transmitted side by side. On this occasion the scene transmitted was not scanned by a rapidly moving spot of light but was illuminated by ordinary floodlighting such as was used on a theatrical stage. The three adjacent areas were carefully phased so that they would build themselves into a composite picture thus enabling the screen to be very large. Baird's system, in splitting up several areas or zones, sent each separately and received each separately, aimed at large images. Zone television was originally said to have been developed by the Gramophone Co., Ltd., in Great Britain. This system divided the picture into five separate portions or zones, each of which was scanned separately and then televised through separate channels. The picture zones were then assembled together into a completely televised image by the receiving apparatus.

ZOOGYROSCOPE — a television apparatus demonstrated by E. J. Muybridge of San Francisco, Cal., on May 5, 1880, which reproduced the first photographic, life-size moving pictures (of a running horse); as well as the new "electrical railway" which Thomas Edison was then testing.

ZWORYKIN SYSTEM — an electronic system utilizing cathode-ray tubes, the *iconoscope* as the transmitting tube; and the *kinescope* as the receiving tube.

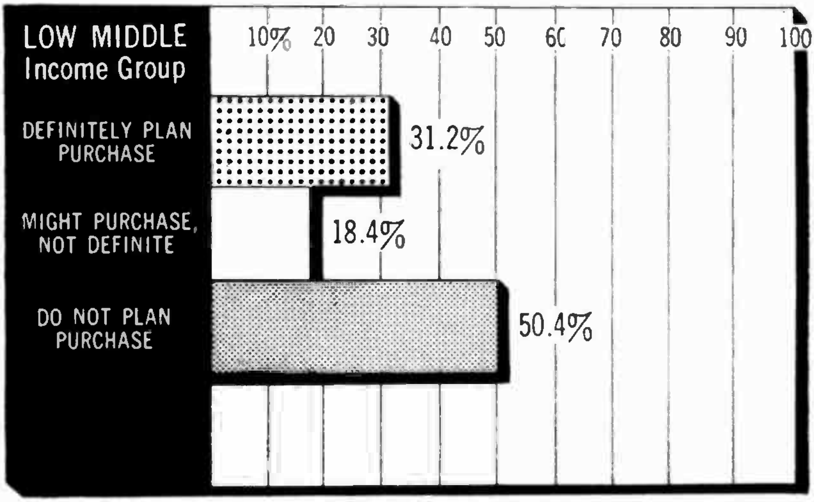
The Urban Market for Television*

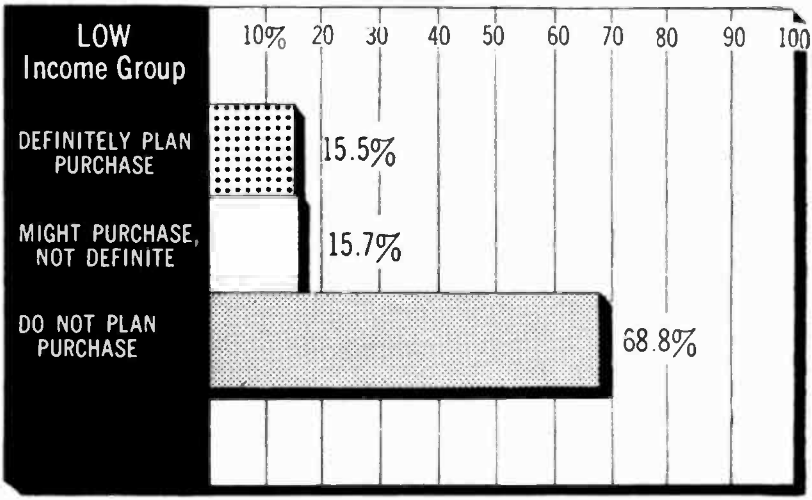


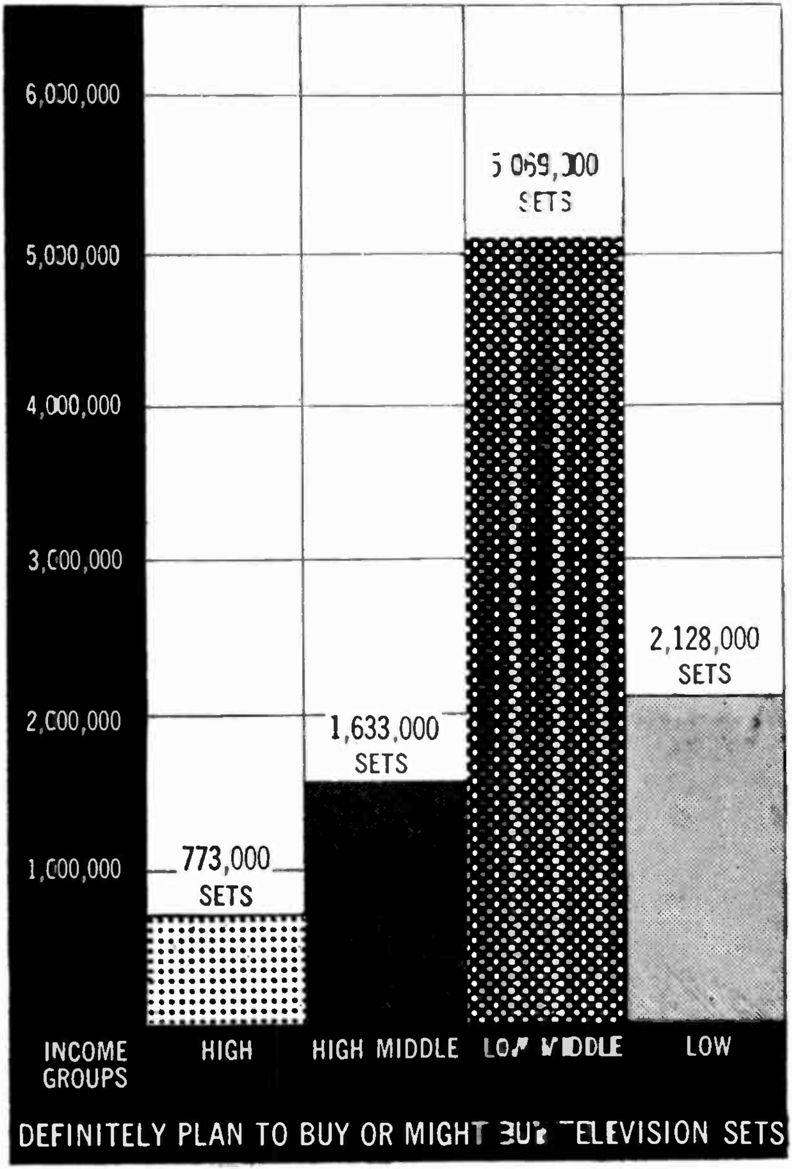


* Based upon reports of the Sales Research Department of Sylvania Electric Products, Inc., New York, N. Y., made on June 18, 1946 and October 10, 1946.

It was shown in the surveys that *personal knowledge of television is greater among those in the higher income groups, but the lower income groups have a more enthusiastic attitude toward television's possibilities.*



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INCOME GROUPS
HIGH
HIGH MIDDLE
LOW MIDDLE
LOW
DEFINITELY PLAN TO BUY OR MIGHT BUY TELEVISION SETS

It is the higher income groups which have high proportions of potential customers for television sets; interest in buying a television set slackens as income decreases, but it is only in the lowest economic class that we find a significant drop.

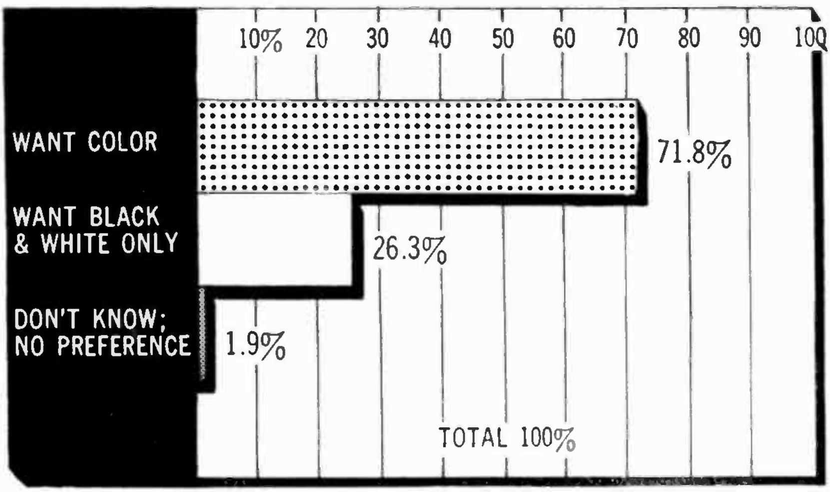
Despite the smaller proportion of prospects in the lower income groups, they make up the major share of the market numerically.

Prospective customers expected to pay between $200 and $250 per set, on the average.

The public expected to pay a total of $2,416,446,000 for television sets. This figure is unreasonably large, but does show a favorable public attitude toward television.

What sort of a set does the public want? How large a screen would people like to have? *A set designed for four people will fill the average need of about 80% of the families.* Screen size relates directly to the size of the family. *The smaller the family the smaller the screen size* mentioned.

The question was asked: "Do you wish to have color or black and white television programs?" This was the response:



The desire for color increases as income increases; this was shown also in other surveys. The indication is that *the 26.3% who are con-*

tent with black and white only are so because of the cost differential.

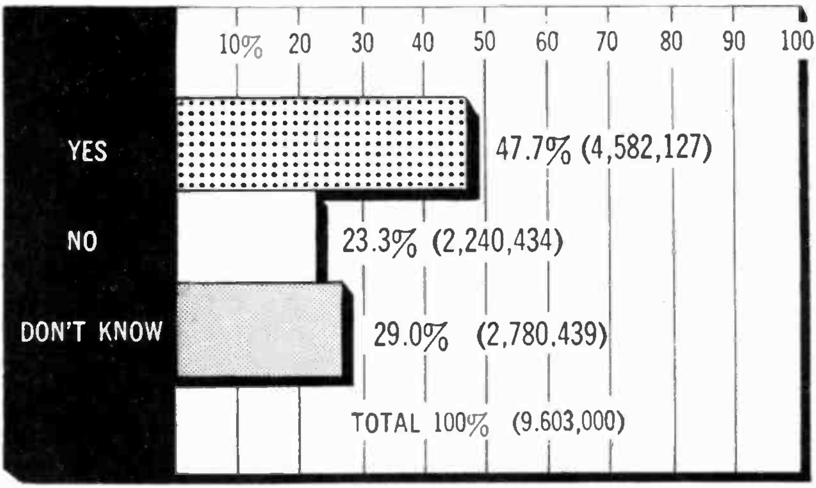
How much extra is color worth to those wanting it? *About half say that they will pay $100 or more for color, over the cost of black and white.* Opinion on color in television might change rapidly, however, and it is assumed that, *when more definite information is available on color, the public might show a greater inclination toward color and a greater willingness to pay for the differential between it and black and white.*

Will people want a wall screen? *More than 77% answered in the negative.*

Is outright purchase preferable to rental? *More than 80% prefer outright purchase.*

Will the customer insist upon home demonstrations? *Only one in six will do so,* according to the survey; *47% find a demonstration in the store sufficient.*

After citing numerous specific difficulties and objections to televisions, the survey personnel asked the individuals who were definitely planning or considering the purchase of television sets



whether they still thought they wanted television. This was the reply:

The results showed that a *very large percentage of the prospective customers for television were still interested.* When these people were questioned further about the screen size they wanted and the price they were willing to pay, it appeared *the prospects expect a larger screen, but will settle for a smaller one at their price level they can best afford.*

In arriving at the summary tentative estimate of the market for television sets, certain basic assumptions were made, based upon the data at hand. It was assumed that:

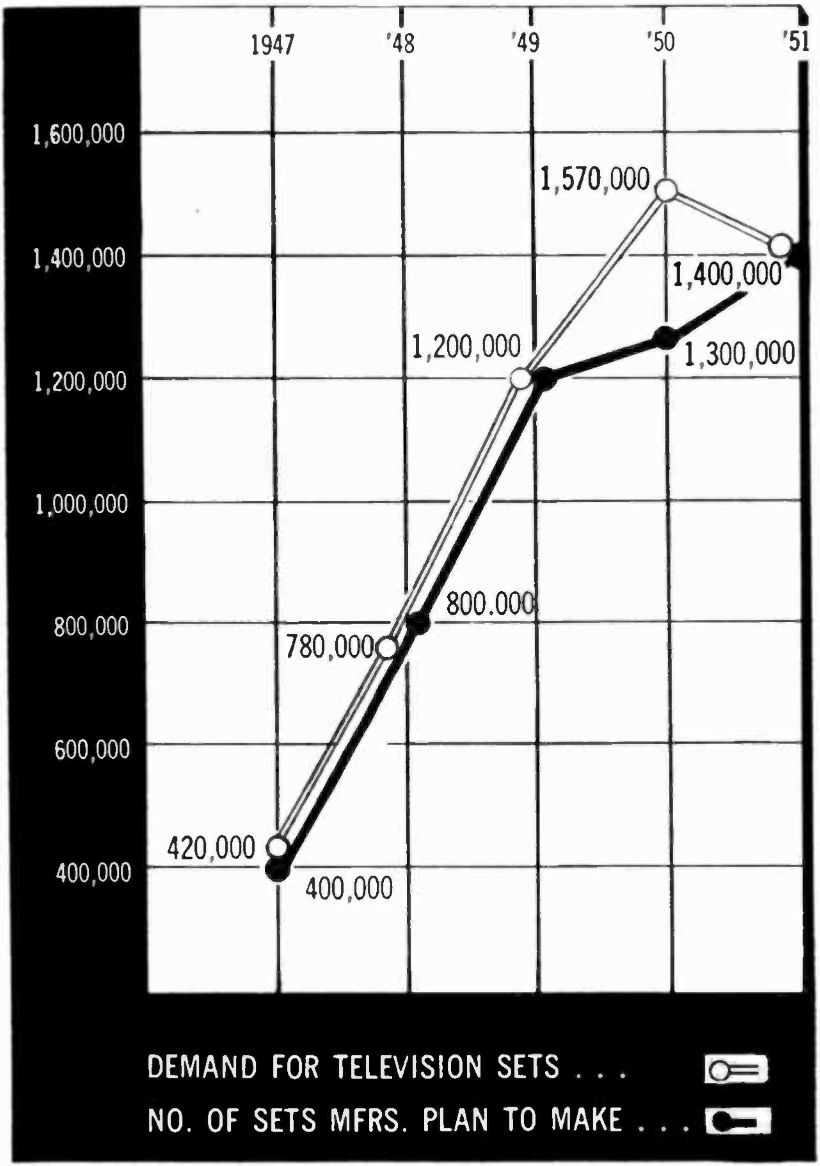
(1) All the people who expressed a desire to buy television receivers will do so;

(2) They will do so within four years of the date when television reception is available in their locality;

(3) There *is* a replacement market for sets, which will have a life-expectancy of twelve years.

Based on these assumptions, *the demand for television sets was determined and it should be noted in reading the graph that – these figures correlate very well with the best available estimates of the number of sets which manufacturers plan to make during* these years.

Nevertheless, the surveys concluded that *prices will have to be reasonable and in step with the national income.* To make television more attractive to the best prospective customers – those in the upper income groups – *it will be necessary to improve programs greatly,* it was also shown. Although television doesn't supplant movies in the public's mind, people will demand programs for which video is particularly adapted: sports, drama by real people, news events.



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420,000
400,000
DEMAND FOR TELEVISION SETS . . .
NO. OF SETS MFRS. PLAN TO MAKE . . .

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