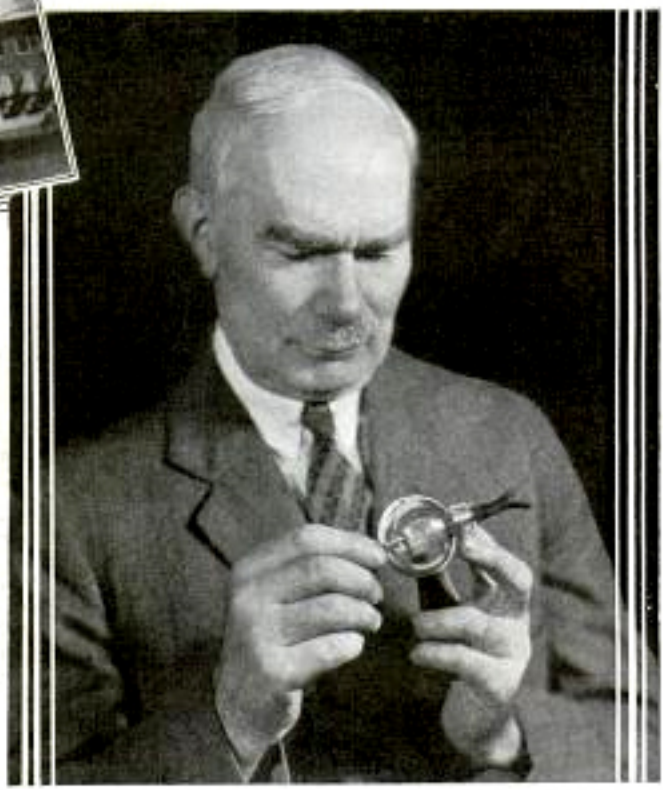
MIRACLES



Left, Television Image Reproduced on Cathode Ray Tube from Outdoor Pickup; Right, Author Holding 1908 Tube Used in Radiophone

By DR. LEE DE FOREST

TELEVISION programs are being broadcast today, many of them on regular schedules, from nineteen different stations from New York to Los Angeles.

A television motion picture has been successfully reproduced in an airplane cruising among the clouds.

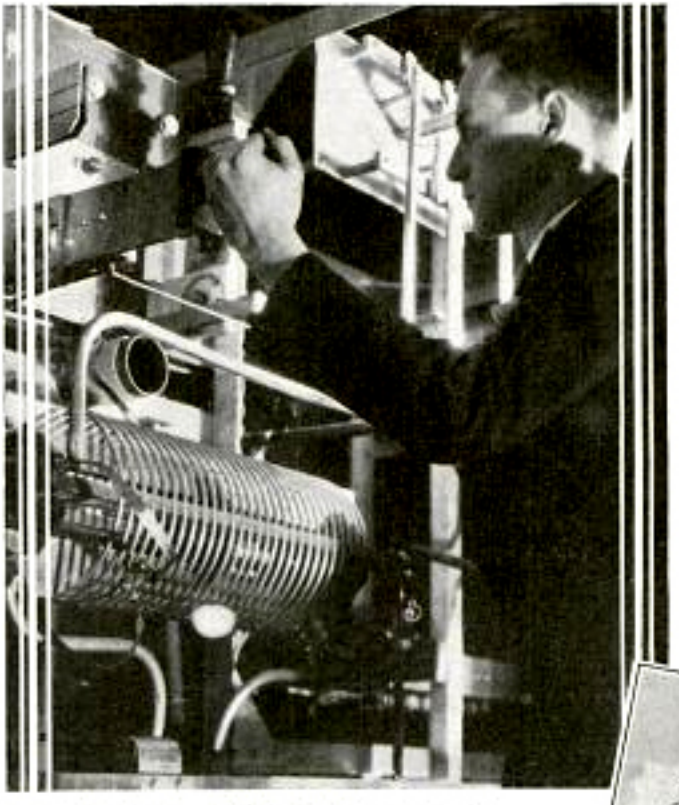
Long-wave television pictures put "on the air" in Los Angeles have been received at Oakland, 350 miles distant and at Houlton, Maine, 2,500 miles distant. Regularly programs of feature film plays and short subjects go out by short wave from scattered stations. How many thousands are receiving these programs, largely with home-made receivers, no one can say. Yet we stand today at the threshold of radio's next great advance—the wedding of television broadcasting to audio broadcasting. In several laboratories scientists are perfecting methods which soon will permit "pictures" in their various forms to be broadcast to the accompaniment of sound.

By the word "pictures," I mean groups assembled in broadcasting studios as well as nearly every kind of scene viewed by theater audiences today—staged events, such as boxing, wrestling, ice hockey, operas, motion pictures, the President in his fireside chat—anything, in brief, which can be illuminated adequately and brought within range of the television camera.

Television will hook in with the present machinery of broadcasting. It can start probably before the close of 1935, in two important cities, with 1,000 receivers reproducing pictures broadcast from each station. From such a beginning, it will roll like a snowball across the continent, with transmitters in all cities now supporting radio broadcast stations.

Unlike present radio broadcasting, tele-

in TELEVISION



Left, Operator at Switch of WLW's 500,000-Watt Amplifier; Right, Television Image from Movie

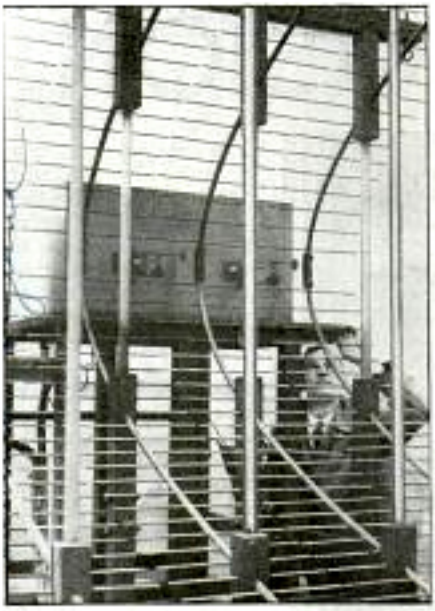
vision will have a comparatively short range. To create the illusion of motion successfully, each image must consist of no fewer than 180 parallel, shaded lines, twenty-four pictures appearing each second. This necessitates a wide band of frequencies, ranging from fifty to 1,000,000 a second, which represents such a broad range of the radio spectrum that we cannot transmit them except at high frequencies, or below ten meters.

These are known as "quasi optical" waves, which travel only about as far as the eye can see, or in the neighborhood of fifty miles. These ultra-short waves, unlike long waves, are not reflected downward by the heaviside layers, those mysterious strata about fifty miles above the earth from which certain types of electrical impulses are turned back toward this planet. Also it will be impracticable for wires to carry these short-wave programs from coast to coast. Thus we must depend upon numerous local programs, sound and picture being broadcast simultaneously on long and short waves, respectively.

First television programs will adapt the present experimental method of motion pictures. In the homes, the television receivers will be located near present

radio receivers, thus preserving the illusion of sound and picture emerging from a common source.

Eventually, television cameras will be pointed toward scenes in and out of doors. I have picked up outdoor scenes, including games of quoits and baseball. Wires



Marconi Micro-Wave Aerial System with Parabolic Reflectors; It Is Used in Experimental Work

carried the impulses from the camera to an indoor receiver. Reproduction of great spectacles, such as parades and naval reviews, are not yet possible, as our picture of the amateur ball game proved. I planted the camera near the home plate and found we could catch the pitcher winding up and throwing the ball, the batter hitting out a two-bagger and running to first base. But the camera could see clearly no further than 100 feet, for the distance between lines forming the picture increased as it encompassed a broader scene, resulting in a blur.

In early broadcasts on a brightly illuminated stage, the actors suffered under the intense heat, but now we have improved photo-electric cells for the pick-up apparatus. The scanning disc pick-up with a single photo-electric cell has been superseded by a multiple-cell plate known as V. K. Zworykin's iconoscope, and the electron picture of Philo T. Farnsworth.

The iconoscope is a vacuum tube containing an electron gun and a photosensitive surface consisting of millions of microscopically tiny droplets of caesium-oxide-silver on a sheet of mica. Though thicker than frost crystals on a window pane, each droplet not only is separated, but is also insulated from its neighbors. A lens in the camera focuses the image on the droplets, which in turn free electrons

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Center, Dr. Zworykin with the Kinescope, "Heart" of Latest Television System; Bottom, Power Control Desk at NBC's Headquarters in Radio City

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in proportion to the intensity of light reaching them. As the electrons are freed, a cathode-ray beam scans the plate or droplets and reproduces the picture created by differences in light intensities.

Farnsworth transforms a picture appearing on a flat, metal photo-sensitive plate into a picture in electrons, which are focused from their diverging paths by magnetism into a picture at the other end of the tube. Then through an ingenious multiplier, the scientist increases the number of electrons a thousand times until the projected picture is many times brighter than is possible with the original beam.

Three years ago, William Priess, a veteran radio engineer of New York, began the development of a novel method of mechanical scanning which recently has been so simplified it offers the key to the solution of television. Priess employs a polished steel mirror one-fourth-inch square and plated with rhodium alloy, a metal having high reflecting value. He mounts the mirror midway on a six-inch length of piano steel wire and welds each end of the wire into an iron yoke supported by two small metal rods, the outer ends of which are welded to blocks of iron. Back of the mirror is a steel fin located in the air gap of an electro-magnet, through whose coil is passed alternating current of 5,000 cycles.

The current causes the mirror to swing right and left about the axis of the steel wire through a total angle of seven and one-half degrees, which throws the reflected beam of light through an angle of fifteen degrees. Meanwhile, the yoke supporting the wire and mirror is caused to oscillate at right angles to the swing of the mirror. The mirror as it vibrates reflects the beam right and left. In order to obtain a square, magnets move the mirror up and down twenty-four times a second. This square beam, then, scans an object 5,000 times a second right and left and twenty-four times up and down.

Fortunately, no fabulous sum is needed to give the world efficient television. From the hands and minds of these experimenters, television is almost ready. Miracle will pile upon miracle from a simple beginning until we have brought into our homes sight and sound of great educational and entertainment values.

What Other Leaders Say

"It should be appreciated that technical solutions are but one phase of a national television system, which, in order to exist, must provide lasting entertainment and not deteriorate into a novelty of passing interest," says W. R. G. Baker, vice president of the R. C. A.

Here are some of the problems which Mr. Baker has in mind:

First, there must be general agreement among manufacturers and broadcasters as to the system of television which should be employed, in order to make it possible for any home receiver to intercept the full broadcast range of signals.

Second, believing that television will ultimately finance itself, there is yet no visible means of making it pay during the early days.

Next, the industry is considering the supply of televizable material. If it falls back on movie films, it encounters a knotty copyright situation. Besides, the present movie production is inadequate for the needs of television since the whole movie industry produces only 300 feature films per year, an equivalent of 350 hours of entertainment.

John V. L. Hogan, who invented single dial tuning on broadcast receivers, holds the opinion that television is no longer around the corner—it's here.

"The reason no television broadcast programs are available is that the three essential elements of such a service are lacking. They are: first, an adequate television transmitter; second, a source of interesting program material, and third, a supply of television receivers that can be distributed at a reasonable price and which will give good reproduction. Another essential is that picture programs shall be accompanied by synchronized sound.

"It is quite probable that before very long some forward-looking broadcasters and manufacturers will combine their facilities in such a way as to provide a useful and interesting television service."

David Sarnoff, chief of the RCA-Victor forces, said:

"If we use our imagination, we also may dream of television in faithful colors. I believe that dream will come true one day, and when it does, every home equipped for reception can at certain times become an art gallery."