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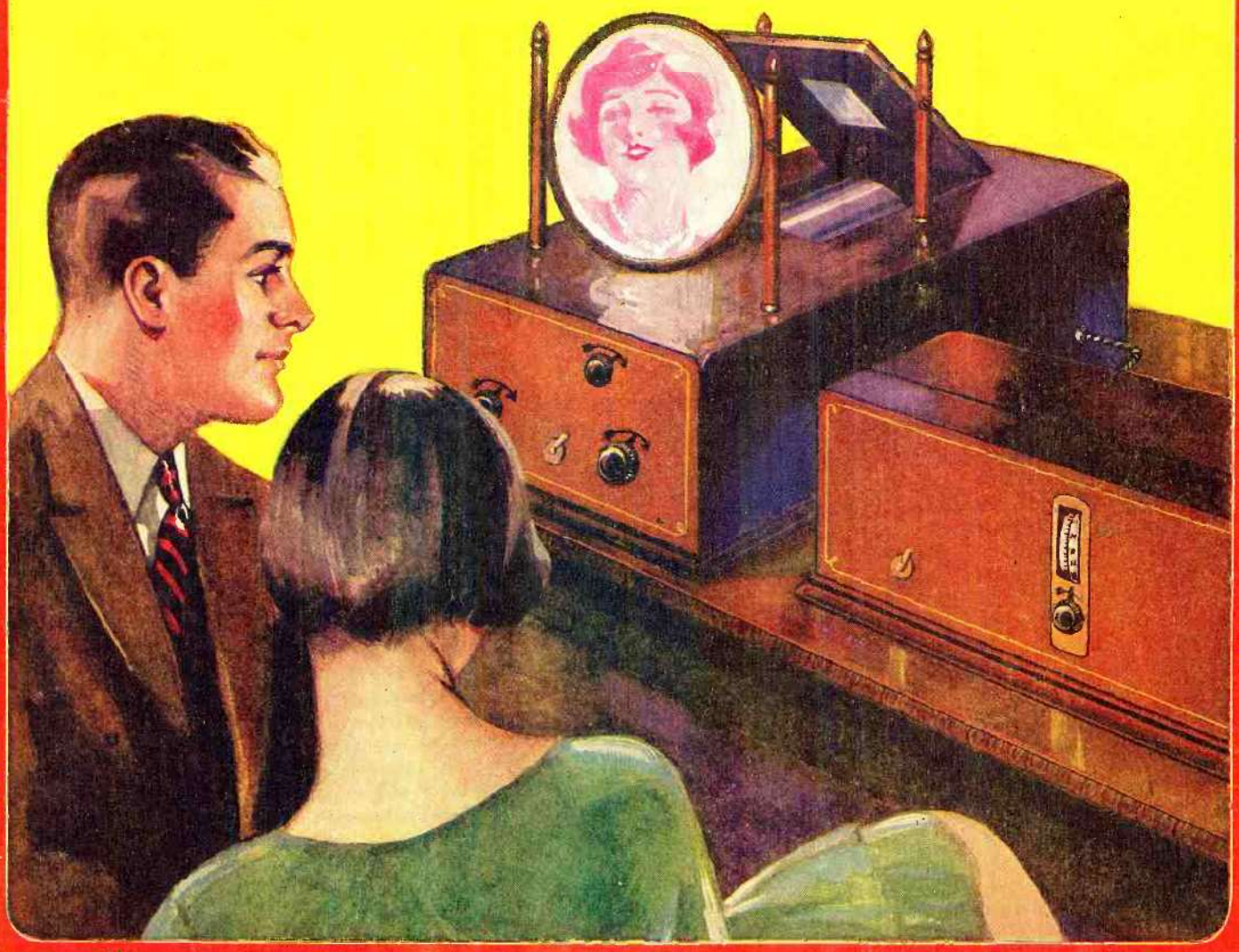
RADIO MOVIES and TELEVISION FOR THE HOME

(See Page 116)



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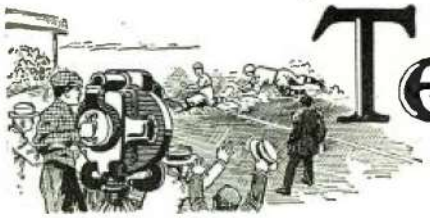


Television

Under this heading, RADIO NEWS publishes each month descriptions of the latest developments in the extremely interesting field of television.

Radio Movies and Television for the Home

EARLY in May of this year, C. Francis Jenkins, the noted radio inventor, demonstrated in Washington, D. C., his latest system of radio photography, or rather "radio movies," as he prefers to describe it. Using a wavelength of 300 meters, in the regular broadcast band, he transmitted a number of reels of specially-prepared standard-size motion-picture film, while members of the Federal Radio Commission and a number of other nationally prominent individuals looked on. The signals were picked up in the homes of Commissioner Sam Pickard, W. P. MacCracken, Jr., of the Department of Commerce, Captain S. C. Hooper, U. S. N., and William Gibbs McAdoo, where they were converted into light impulses and viewed by the onlookers through a large magnifying glass.

A private demonstration was arranged later for a member of the staff of RADIO NEWS, who was very favorably impressed by what he saw. The original film showed, in black and white silhouette, a little girl bouncing a ball, dancing and kicking into the air. It was reeled off in front of the radio-movie transmitter at the rate of 15 pictures per second, the pictures at the receiving end being reproduced at the same rate. The images seen through the observing lens at the receiver were, apparently, about six inches square, and remarkably clean cut. In most of the systems of television and picture-transmission shown up to this time, it has been usually difficult for the observer to determine whether he is seeing the image of a rolled newspaper or that of a man scratching his nose; but with the Jenkins apparatus the definition is so good that the images are instantly recognizable.

The illusion of motion is excellent; almost as good, in fact, as that produced by a regular motion picture thrown on a screen. The received radio images appear with a frequency of 15 a second; whereas regular motion pictures are projected at a rate only one per second faster.

It is the present plan of the inventor to produce the complete radio-movies instrument on a commercial basis and to sell it as an accessory to the regular broadcast receiver, as a device for home amusement. Whether or not a suitable broadcast service will be available is another question, which cannot be answered at this early date because of the unsettled state of broadcast affairs. However, the apparatus does work well, and its possibilities are numerous. There is no reason why it cannot be extended eventually to operate as a true television machine; that is, to transmit (and receive) the images of people as the latter stand in front of the televisor in the studio.

THE JENKINS TRANSMITTER

The Jenkins system is quite different from others which have been described in RADIO NEWS. The general layouts of the transmitter and receiver are shown in Figs. 1 and 2, respectively. Unfortunately, no photographs of the transmitting equipment are available, but a number of views of the actual receiver are shown here.

In Fig. 1, the essential parts of the transmitting apparatus are shown in approximately the positions they occupy in relation to each other. The film reels are arranged on a simple framework, one above the other, in such a manner that the film is pulled vertically downward by a set of sprockets which are, in turn, driven by an electric motor. One end of the shaft which drives the sprockets is fitted with a gear meshing with another of only half its size. The small gear is attached directly to the shaft of the motor, which is a synchronous alternating-current machine developing 1,800 revolutions per minute. Because of the reducing action of the gears, the pictures are pulled past the sprockets, or past any fixed point next to the film, at the rate of 900 per minute, or 15 per second.

At the other end of the sprocket-driving

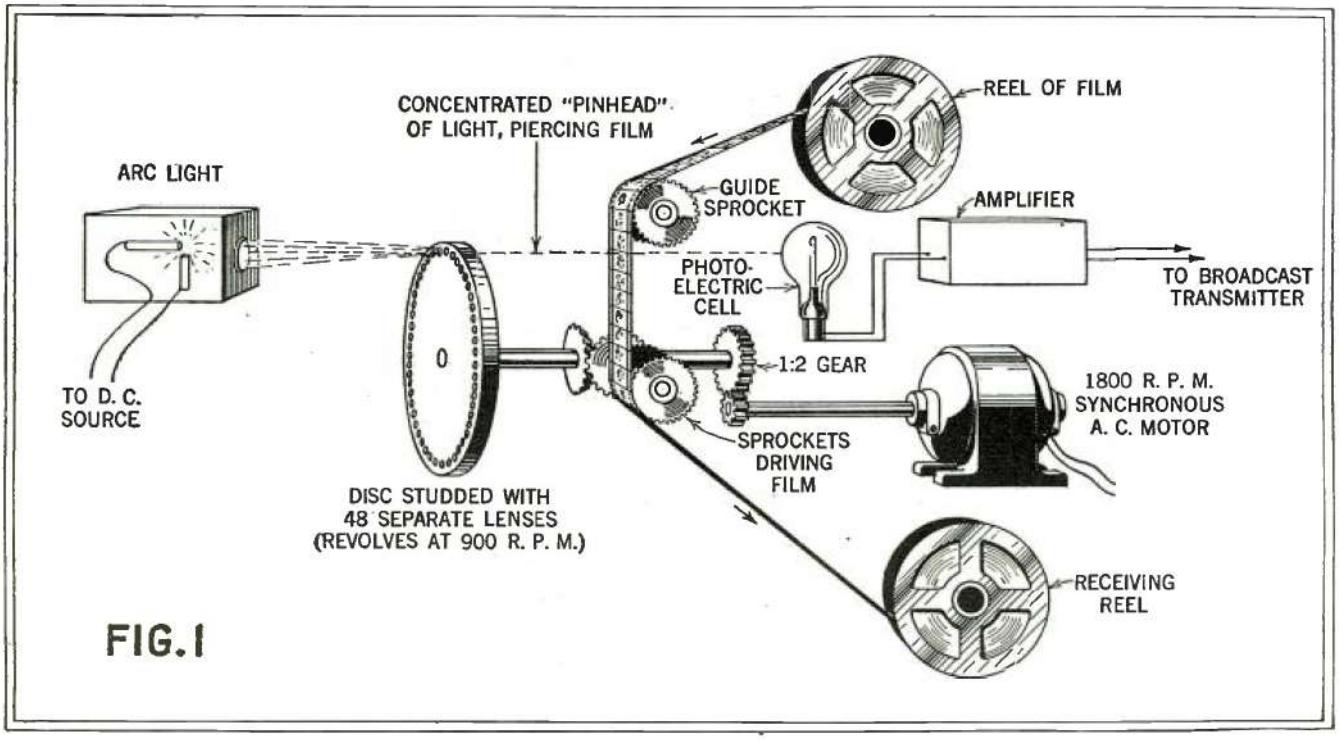
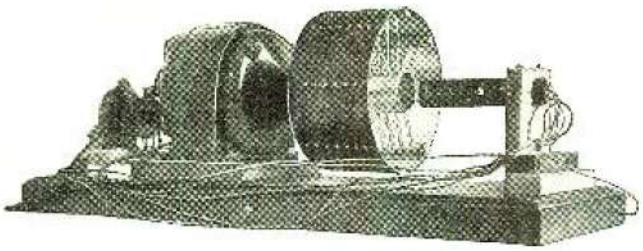
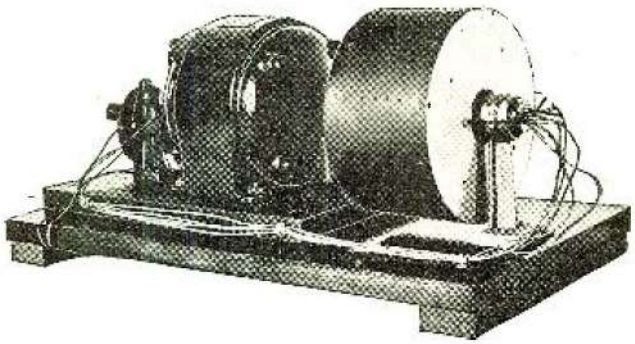


FIG. 1

General layout of the radio-movie transmitter, showing the essential parts without the supporting frameworks, etc. The leads marked "to broadcast transmitter" run to the regular input amplifier of the broadcast station through which the pictures are being sent out.





Above: A six-target neon tube and drum, used in experimental work. Right: This illustration shows the neon tube inside the drum, ready for operation. This drum is a four-hole model.

shaft is a heavy metal disc, about 15 inches in diameter and about one inch thick; its edge is studded with 48 separate little lenses, each having an "optical speed" of *f.* 3.5. Each lens is designed to concentrate the light from a powerful arc lamp into an intensely-brilliant "pinhead" beam, which is caused to pierce the film as the latter travels down past the back of the disc. This disc is a very carefully-constructed unit; according to a member of Mr. Jenkins' laboratory staff, it cost about $9,000. The principal part of this expense is represented by the lenses, which are all matched to each other.

Directly behind the film is fixed a sensitive photoelectric cell, so placed that it receives the "pinhead" beam of light projected through the film by each lens. The cell is connected to a three-stage resistance-coupled amplifier, and that in turn to an eight-stage amplifier of similar design. To prevent the amplifiers from picking up external disturbances of various kinds, which would be registered as part of the pictures, Mr. Jenkins has buried them under double copper shields. The photoelectric cell itself is also completely sheathed in copper, except, of course, for a small aperture which is left to admit the light beams. The eight-stage-amplifier shield is fully the size of an ordinary business desk.

SCANNING THE PICTURE

A close study of the apparatus will make its operation clear. The disc is revolving at the rate of 900 revolutions per minute, or 15 per second. The separation between the centers of the lenses is just equal to the width of the film. The film moves steadily down at the rate of 15 pictures per second (its action is not jerky, as in a moving-picture projector). Now let us start with a pinhead of light from one lens piercing through the lower right-hand corner of the first picture on the film. As the disc revolves, the pinhead of light travels horizontally across the film; the instant it runs off the left edge, the beam of the next lens starts at the right again, but at a point a trifle above where the first one started. *The starting point is higher on the picture because the film is moving down at the same time while the disk is turning.* Just as the second beam runs off the left edge of the film a third one starts on the right at a still higher point on the picture. This movement is continuous during the operation of the device.

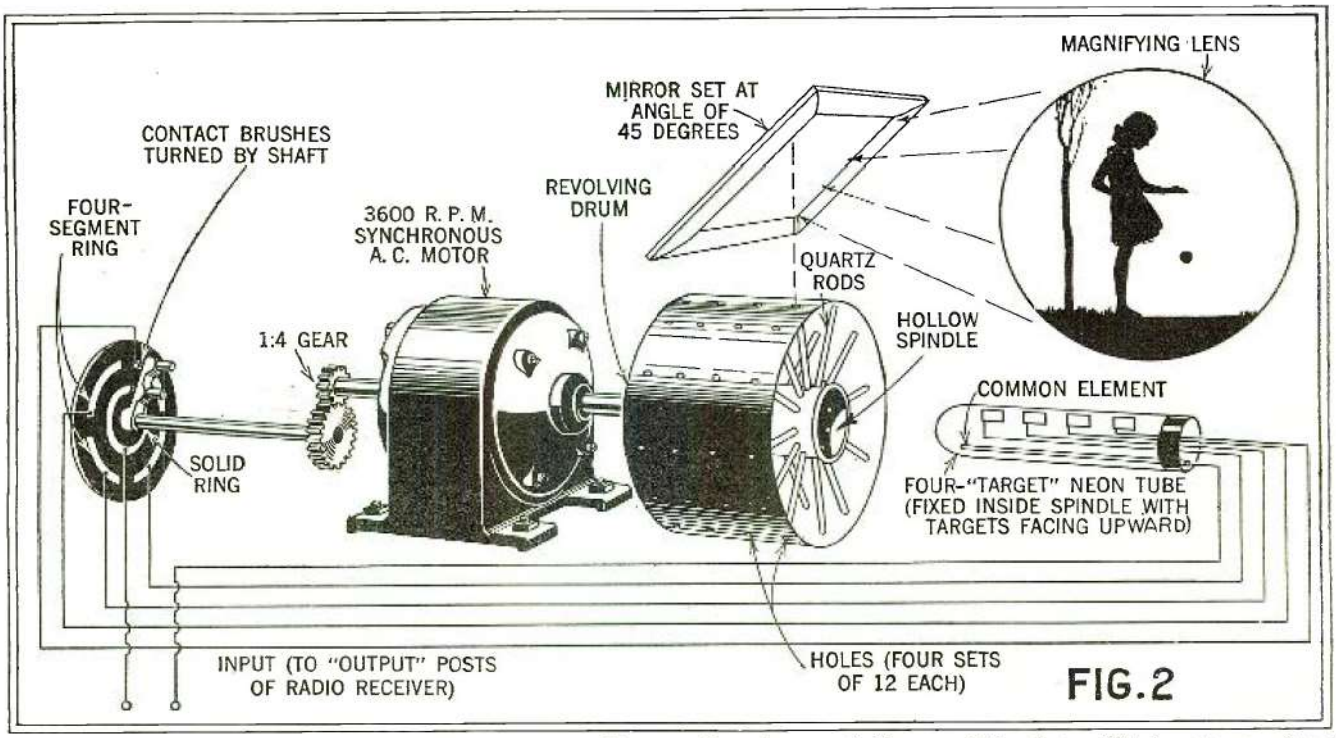
Forty-eight separate beams of light travel across each individual picture on the film, this operation consuming one fifteenth of a second. At the start of the second fifteenth of the second, a new picture slides into position and another series of 48 light beams starts to pierce it. All this is obvious, as both disc and film are moving at the same rate; one complete revolution of the disc consumes one fifteenth of a second, and the downward movement of one complete picture through the light beams consumes the same amount of time.

While this movement is taking place, the light beams fall with varying intensity into the photoelectric cell, which produces an electric current that varies with the transparency of the film. This varying current modulates the output of a broadcast transmitter in the same manner that voice and music impulses do in ordinary broadcast. Forty-eight lines of alternate black-and-white areas per picture are "written" into the cell, and by it sent out to the receivers.

THE RECEIVING END

The Jenkins receiver is altogether different from any of the other television and picture machines now in existence. It consists of six essential parts, arranged as shown in Fig. 2. The heaviest unit is a 3,600-r.p.m. synchronous A.C. motor, to the shaft of which is attached a hollow metal drum about seven inches in diameter and about five inches wide. The center of this drum is a hollow spindle with a thin wall.

In corresponding places on the drum and



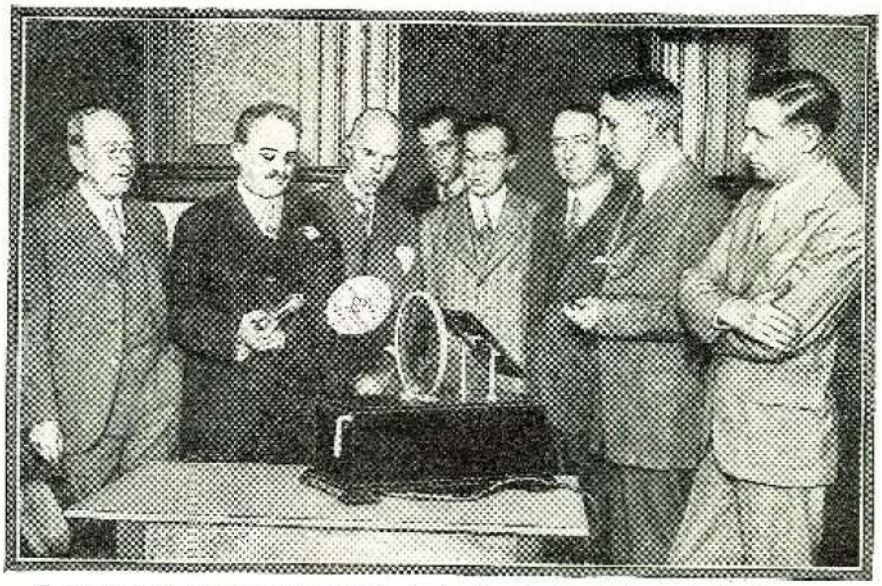
General layout of the picture receiver. The whole lower assembly-line is enclosed in a wooden box, on the top of which are mounted the mirror and the magnifying lens. The images are viewed through the latter, as illustrated on the cover of this magazine.

the spindle (both outer and inner surfaces) are four spiral rows of tiny holes, twelve holes to a row. A short piece of quartz rod between the outside and inside connects each pair of corresponding holes. The purpose of the 48 little rods is to conduct light from the inner spindle to the holes in the outer drum with as little loss as possible.

Fixed inside the hollow spindle, with the flat little plates facing directly upward, is a special four-"target" neon tube. This tube is similar in general operation to the standard flat-plate neon tubes now sold generally for television purposes, but is in reality a quadruple tube. It is about four inches long and one inch in diameter, the little plates or "targets" being about ¼-inch square. A straight wire running near the edges of the plates acts as a common element. In Fig. 2 this lamp is shown out of the spindle; in actual use it fits inside the latter without touching it.

The other end of the motor shaft is fitted with a 1:4 reducing gear which drives a revolving switch. The revolving element is simply a pair of contact brushes connected together; one brush effects continuous electrical connection to a solid brass ring imbedded in an insulating disc, while the other makes a wiping contact over the four sections of a split ring. The four segments connect with the four targets of the neon tube, while the solid ring goes to one of the input posts of the machine. The common element of the neon tube goes to the other input post.

All the apparatus described so far is contained in a wooden box about two feet long and a foot square at the end. Directly above the top of the revolving drum is a square opening in the top of the cabinet; over this opening an ordinary mirror is mounted at an angle of 45 degrees to the top. About a foot in front of the mirror, standing upright, is a magnifying glass about ten inches in diameter.



C. Francis Jenkins (second from the left), showing his apparatus to Commander C. C. Hooper, extreme left; Brig. General George O. Squier; Carl H. Butman, Secretary Federal Radio Commission; Capt. C. H. Hill, U. S. Signal Corps; and Federal Radio Commissioners Harold La Fount, Ira E. Robinson and Sam Pickard.

The input posts of the picture receiver unit are connected to the last audio amplifier tube of a regular receiver. For his demonstrations Mr. Jenkins used a popular one-dial receiver with an additional power amplifier stage.

REPRODUCING THE PICTURE

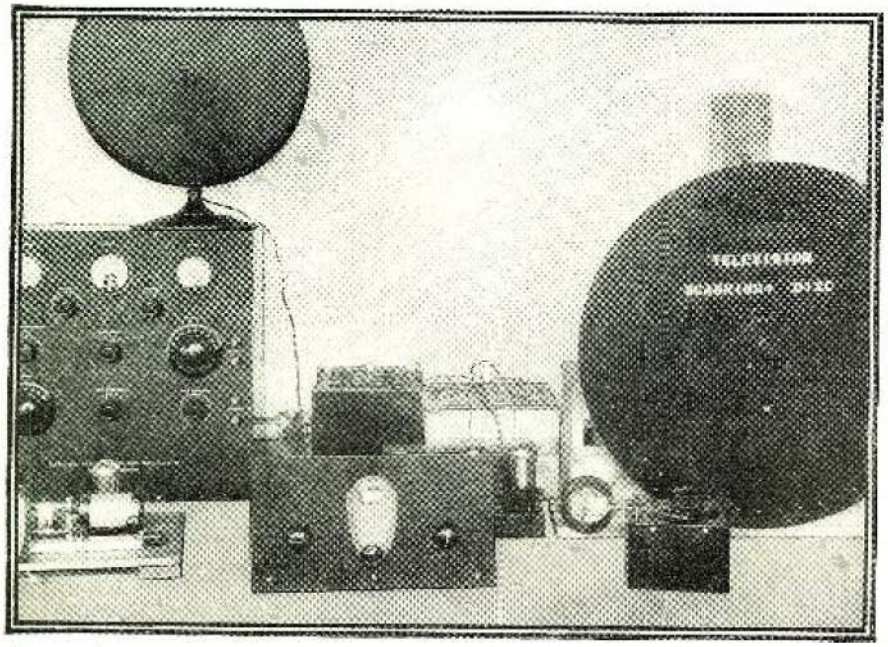
Now let us follow through the operation of the receiver: the modulated signal of the transmitter is picked up by the aerial, amplified, detected and again amplified by the receiver, and then led to the "radio-movie" projector. Let us assume that the contact brushes have just made contact with the upper right ring, as shown in Fig. 2, and that one of the quartz rods in the first (outermost circle) is pointing straight up. This condition corresponds with the start of a picture in the transmitter, just when the pinhead of light is starting to sweep across the film.

As the contact brushes have just closed the circuit to the neon-tube plate at the extreme right, this "target" lights up immediately and fluctuates in accordance with the modulation of the signal. The fluctuations of light are carried up the quartz rods and projected through the holes in the

(*Continued on page* 173)

Television Experiments in Boston Create Great Interest

GREAT interest among radio fans in and around the city of Boston has been created by a series of experimental television broadcasts sponsored by the *Boston Post*, and carried on through the short-wave transmitter of Station WLEX, located at Lexington, Mass., a suburb of Boston. The broadcasts were first attempted during the late part of April, and were continued during May. A number of New England radio manufacturers built the transmitting apparatus and offered for sale the essential receiving components, such as neon tubes and scanning discs.



An experimental television receiver set up in the laboratory of James Millen, Malden, Mass.

It is reported that over 2,000 neon tubes were sold within two weeks of the initial experiment. Great quantities of sheet aluminum, for the scanning discs, were also purchased by local radio fans. However, the general results so far are said to have been negligible, practically no individual experimenters having reported successful reception of the broadcast images. The "televised" objects were rolled newspapers and the hand of a man.

RADIO NEWS has been informed by D. E. Replogle, of the Raytheon Mfg. Co., makers of the neon tubes, that toward the end of May the results had been greatly improved, the image of a man's face being plainly discernible. At the time this issue of RADIO NEWS went to press, no further information was available. More detailed reports of the experiments will be published in forthcoming numbers.

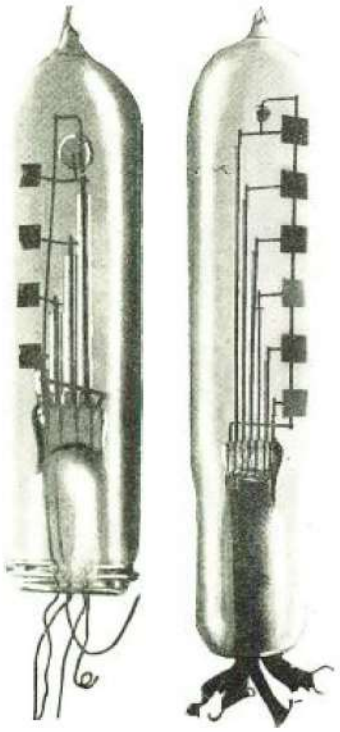
Radio Movies

(*Continued from page* 118)

outer drum upon the mirror. The light thus produced on the mirror follows the shading of the images on the original film, so that a picture is built up in the mirror. This may be observed through the magnifying mirror.

A complete picture of 48 lines (corresponding to the rate of transmission) is built up on the mirror with every four revolutions of the drum. At the beginning of the second revolution, the contact brushes turn to the next segment of the switching ring (because of the gearing) and the second target of the neon tube is illuminated. The third and fourth quarters of the picture are similarly built up from targets 3 and 4, and the cycle then begins again with No. 1 and the first spiral of holes. During one second the drum turns 60 times; since four revolutions create one picture, 60 revolutions create 15 pictures. This gives us the speed of 15 pictures per second mentioned in the early part of this article.

Of course, it is necessary to maintain perfect synchronism between the transmitting and receiving motors, as in all systems of



Left: A four-target neon tube, used in the radio-movies receiver. Right: an experimental six-plate lamp.

television and radio photography. In the Washington demonstrations the transmitter and the receivers were on the same power line, so little difficulty was experienced in keeping the pictures steady.

The pictures, as they appear through the magnifying lens at a distance of about ten feet, are clean-cut black silhouettes against the characteristic reddish glow of the neon tube. They possess no fine shading; as such refinement is not possible without the use of a very wide band of frequencies at the transmitting end.