Popular Radio

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# *Experimenting With*
# TELEVISION

Here is POPULAR RADIO'S first direct contribution to the advancing art of "seeing by radio." The following article outlines the Technical Staff's experiments with the use of the fundamental components of modern television systems—scanning disc, photo-electric cell, and neon lamp. These experiments have been purposely made with apparatus that is within the reach of the fan of modest means, so that all those interested in the advance of television may follow the course of our investigation, from month to month, with apparatus similar to that used in the Laboratory.

By ROBERT W. TAIT

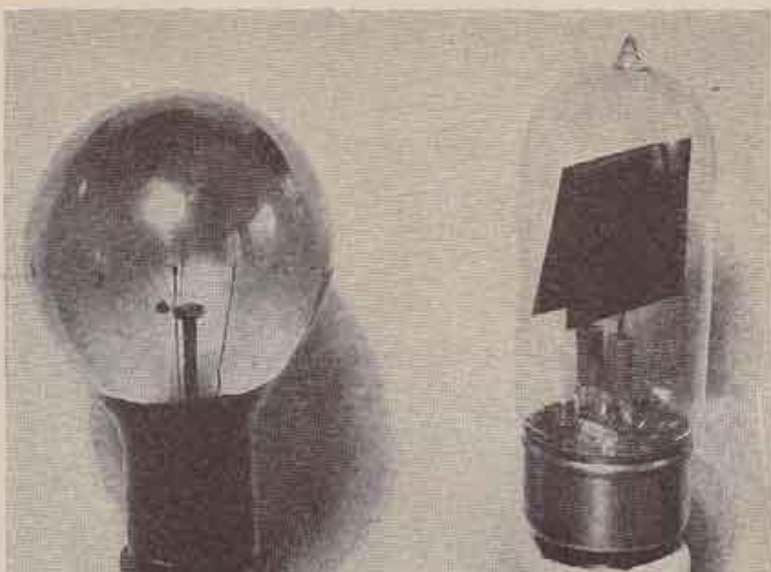
TELEVISION reception and even television transmission has at last been reduced to the stage of simplicity and practicability, where it becomes available for home experimentation. The apparatus involved in these experiments is not expensive, nor does its manipulation require anything more than an empirical knowledge of radio. Any alert experimenter and radio fan who has had the experience of assembling radio receivers and who understands, even superficially, the principal laws of radio and electricity, may plunge into the construction of television apparatus with every assurance of some measure of success.

The equipment about to be described was recently assembled in the POPULAR RADIO Laboratory and, while this article is more in the nature of a report on the results, an article which will appear in a subsequent number which will give full details and constructional data.

The experimental equipment involved comprises not only a television receiver but a simple transmitter as well, the television transmitter being connected to the receiver by wire.

The equipment about to be described is, in a sense, not really a television transmitter. For actual television an extremely powerful source of light is necessary and large and expensive photo-electric cells must be used to intercept the scanning beams. Naturally, this large and expensive equipment is quite beyond the pocketbook of the average experimenter. Consequently, the POPULAR RADIO Laboratory decided to confine its efforts to modest equipment that could easily be purchased and that would be inexpensive. This plan made it necessary to be satisfied with the transmission of ordinary photographic negatives and little black and white cartoons, drawn on celluloid or glass in simple outlines.

A television transmitter of the type about to be described involves three principal components: the source of light, the scanning disc, and the photo-electric cell. The source of light, in the case of the experiments under discussion, was simply a 500-watt lamp mounted in an aluminum shield or can and provided with proper ventilation. In the front of the can an aperture was cut which was the size of the picture to be projected over the apparatus. This arrangement will be clear by referring to Figure 3, which shows the laboratory set-up. If the experimenter has a small motion picture arc lamp available, it would be advisable to use this source of light; for it must be remembered that the more powerful the source of light the more pronounced the fluctuations at the receiving end will be. Consequently the picture will be clearer. During normal operation this source of light is moved as close to



THE TWO EYES OF TELEVISION

FIGURE 1: *The photo-electric cell at the left and the neon lamp at the right were used in the Laboratory experiments in television. The photo-electric cell was painted dull black, except on the clear glass window, to eliminate the danger of distortion due to reflected light.*

the scanning disc as possible so that there will be no waste of light energy. Naturally, the position of the light source and the aperture must coincide with the holes in the scanning disc, so that successive holes will move across the light source in the proper sequence.

On the opposite side of the disc a small frame, with an aperture measuring 1½ inches by 1½ inches, was placed. In this frame the picture was mounted. Back of the picture there was placed a photo-electric cell of the vacuum type. The cell was in a small metal or cardboard box, painted a dull black inside to eliminate the danger of reflection. An aperture was cut in the box so as to accommodate the frame holding the picture.

The photo-electric cell was connected to a four-stage, resistance-coupled amplifier, properly biased. To the output of this resistance-coupled amplifier a neon lamp was attached. Modulation of the cell was brought about in the manner shown in Figure 4. The voltage of the "B" eliminator was adjusted to a point somewhere near the critical voltage of the neon lamp, and the biasing of the resistance-coupled amplifier was adjusted so that when the light fell upon the photo-electric cell the neon lamp would function.

To facilitate research and to avoid the necessity, for the time being, of using two independent motors, only one scanning disc was employed and transmission was made on one side of the disc and reception on the opposite side. This entirely solved the problem of synchronization, for it is obvious that the apparatus was perfectly synchronized. Subsequent experiments, however, proved that the transmitter and receiver could be widely separated by employing two scanning discs and two ordinary ¼-horse-power synchronous motors. A subsequent article in the June issue will outline the details of this arrangement. With the present apparatus it was possible to see, at the receiving side of the disc, a crude outline of the picture in the frame at the transmitting side. The neon lamp, which takes the place of a loudspeaker, and which might be called a "light loudspeaker," was placed back of the scanning disc so that it could be viewed through the holes that were arranged in the spiral. A small cardboard frame was cut to dimensions corresponding to the aperture in the transmitting frame. This cardboard frame was then mounted before the scanning disc in exact line with the neon lamp so that it too could be scanned with holes in the spiral.

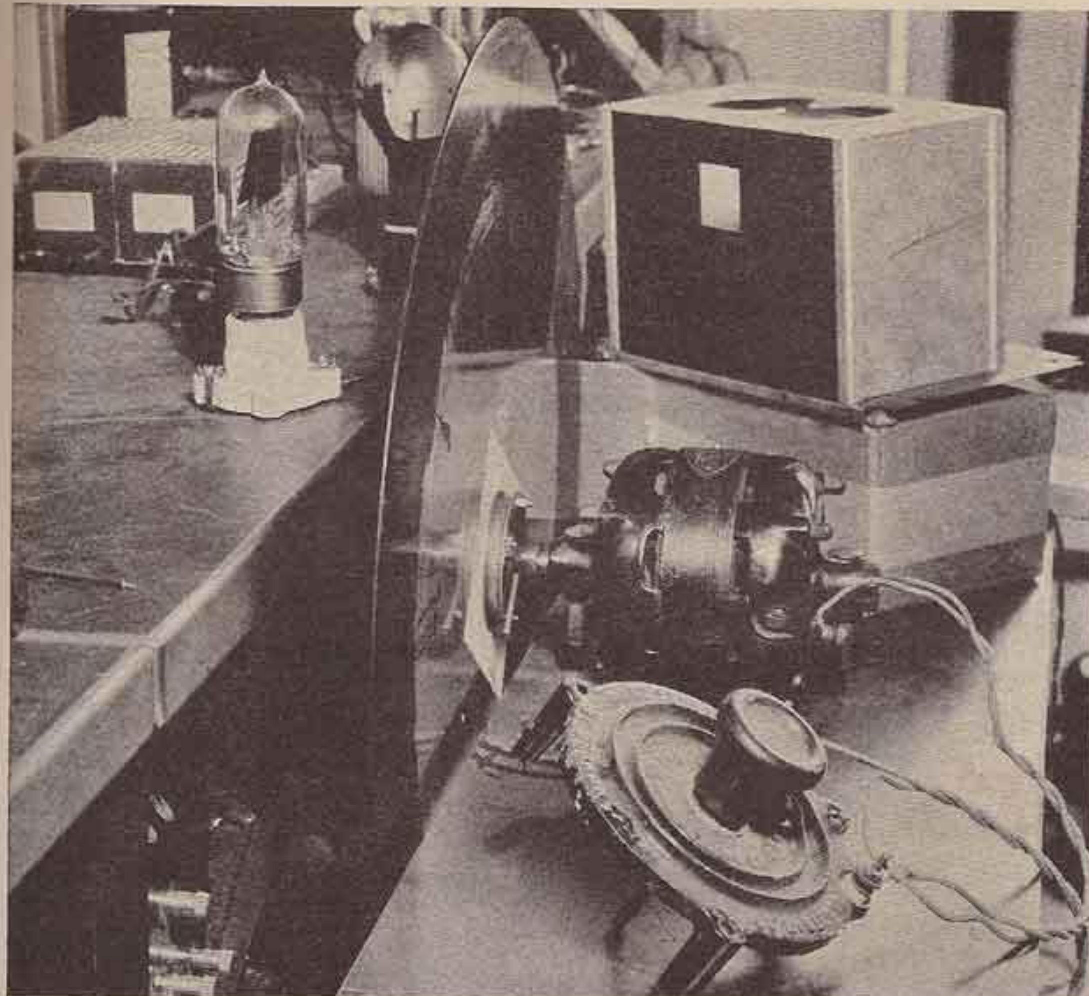
The scanning disc used was made of aluminum, 23 inches in diameter and provided with 48 holes .033 inches in diameter. This corresponds to a No. 61 drill. The spiral was off-set 1½ inches and the holes were placed 1½ inches apart, corresponding to a picture sized 1½ by 1½ inches.

The method of laying out the spiral will be made clear by reference to the article on this subject which appears in this number on page 390. The aluminum disc, owing to its highly polished surface, was painted with an egg shell black preparation, care being taken to see that the preparation did not fill up any of the holes in the disc.

In these experiments, the motor speed was by no means critical and, to avoid mechanical difficulties involved in high

THE AMPLIFIER FOR THE TELEVISION RECEIVER

FIGURE 2: *The above resistance-coupled low-frequency amplifier was constructed especially for the television experiments. It employs standard parts in an easily assembled layout. Its construction will be described in the June number of this magazine.*



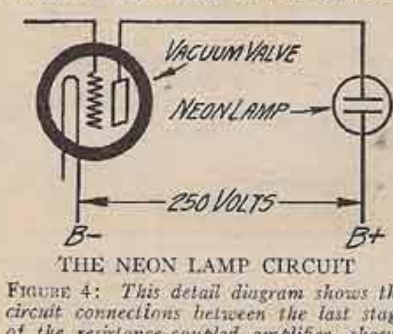
THE APPARATUS USED IN THE EXPERIMENTS

FIGURE 3: *At the left are the photo-electric cell and the neon lamp. The scanning disc, with its driving motor and resistor for controlling the motor speed, are in the center. At the right is the light source, in this case a 500-watt lamp mounted in a standard aluminum box shield with a small window in front and ventilating holes in the top. Egg shell black paint was applied to all the surfaces which might cause distortion from reflected light.*

speed, which would have made the mounting of the disc on the shaft somewhat of a problem, the resistance was placed in series with the motor to cut it down to low speed. To those who have gone into the subject of television, it is obvious that the picture, whether still or moving, must be transmitted at the rate of sixteen times per second; that is, the scanning disc must scan the picture sixteen times every second, which means a minimum R. P. M. of 960. Due to visual persistency, the eye insists on seeing an impression for at least 1/16th of a second, and any speed below this produces unsatisfactory results. However, in the experiments mentioned, it was found possible to cut down the speed as low as twelve per second and to still preserve the illusion.

When the outfit described above is used in the transmission of pictures, the room must be darkened. Otherwise the photo-electric cell will respond to extraneous light and the picture illusion which appears in front of the neon lamp will be considerably weakened.

A resistance-coupled amplifier was chosen for these experiments owing to its aperiodic reproducing qualities. When simple silhouettes are to be transmitted, it is perfectly feasible to use an ordinary transformer or impedance-coupled amplifier, for the frequencies involved are well below the critical point of this type of transformer-coupled amplification. The average low-frequency transformer will not respond to impulses over 10,000 cycles, and if a complicated picture is being transmitted (that is, a picture that breaks the light beam up a large number of times per second), the frequencies involved may well become high enough to go beyond that point where a low-frequency transformer will not pass them without distortion. In resistance-coupling this problem is entirely obviated, and if the experimenter plans to go into television, it will be wise for him provide himself with the proper kind of resistance-coupled amplification. The details of the particular amplifier used in these experiments will be described in the June issue of POPULAR RADIO.




THE NEON LAMP CIRCUIT

FIGURE 4: *This detail diagram shows the circuit connections between the last stage of the resistance-coupled amplifier, shown in Figure 2, and the neon lamp.*