Here is Your

By Frank L. Brittin

ALTHOUGH far from perfect, television signals and apparatus are in a sufficiently advanced state to provide an interesting field for the experimenter. Anyone having a radio receiver can easily add the necessary equipment for the new purpose. Experimental broadcasts are increasing in number and, by the time this article appears, they will probably be available in most parts of the country. DX-reception has not been very satisfactory up to the present time, although visual programs broadcast from Washington, D. C., have been received fairly well in Chicago. It is quite likely that most of these programs will be broadcast on short waves. Any radio receiver may be adapted for short-wave reception by means of a simple tuning unit to be plugged into the detector, or sometimes the first r.f., socket of the set. A suitable adapter unit was described in the March, 1928, issue and may be used in combination with your present set or directly connected to the amplifier shown in the diagram on page 1006.

The receiver must be selective enough to receive a clear audible signal with little distortion and good volume. Pictures of a sort may be received with transformer-coupled a.f. amplification, but the wide band of frequencies necessary for good picture definition make resistance-coupled amplifiers especially suitable for this work.

Before attempting to build a television receiver, the elementary principles involved should be understood. Seeing by radio is only slightly more complicated than sound reception. When broadcasting voice, as the reader knows, the person stands before a sensitive microphone, similar to a telephone transmitter, in which the sound waves are converted into varying electrical impulses; these are then amplified and broadcast through the ether and received in the home. For television transmission, the person stands before four or more photo-electric or light-sensitive cells capable of responding to varying intensities of light or shadow and faithfully converting them into electrical impulses of corresponding strength. A rapidly revolving metal disk, perforated with a series of holes arranged in spiral form and known as the "scanner," is located behind the light-sensitive cells. A powerful arc light is employed behind the disk, and light is focused on the subject through the revolving disk, with very little discomfort to

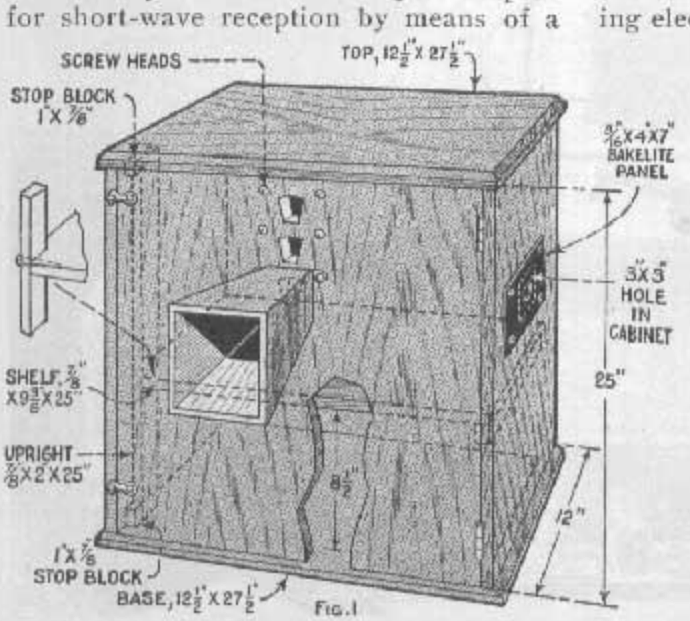


FIG. 1

Television Receiver!

him. The pencils of light through the holes, play across the face of the subject, thus, in effect, dividing it into horizontal lines the number of which depends on the quality of the picture desired. The variation of light and shadow along these lines is received and converted by the light-sensitive cells, and the resulting electrical impulses are amplified and transmitted through the ether in exactly the same manner as for voice waves. The television signal has a very distinctive sound which may be tuned in at the receiving set and heard on the loud speaker or through the headphones.

When the signal has been tuned in to the loudest volume, a tube filled with neon gas is substituted for the phones or speaker. This tube has the property of responding instantly to the varying signal intensities and glows with a pinkish light, the brilliance of which depends on the strength of the signal. Immediately in front of this neon tube another scanning disk, identical with the one used at the broadcasting station and revolving at the same speed, permits the light from the tube to pass through the holes in the disk, where it reaches the eye of the observer. The revolving disk recreates the image, serving the eye, in a way, as the loud speaker serves the ear.

At present practically the same system is used at all stations broadcasting television, the only difference being in the number of holes in the revolving disk.

The aim of this article is to give the experimenter simple directions for assembling his own television receiver so that he may tune in on test programs. The cost for parts is about that for building a standard radio receiver and may be reduced by building up the amplifier stages instead of using the wired unit.

The metal disk used in the model is a manufactured type employing three perforated spirals, a combination of 24, 36 and 48 holes. This permits the operator to tune in on any one of the three popular transmitting methods now in use. As the art develops, disks employing a larger number of perforations may come into use, and disks will be available to meet such

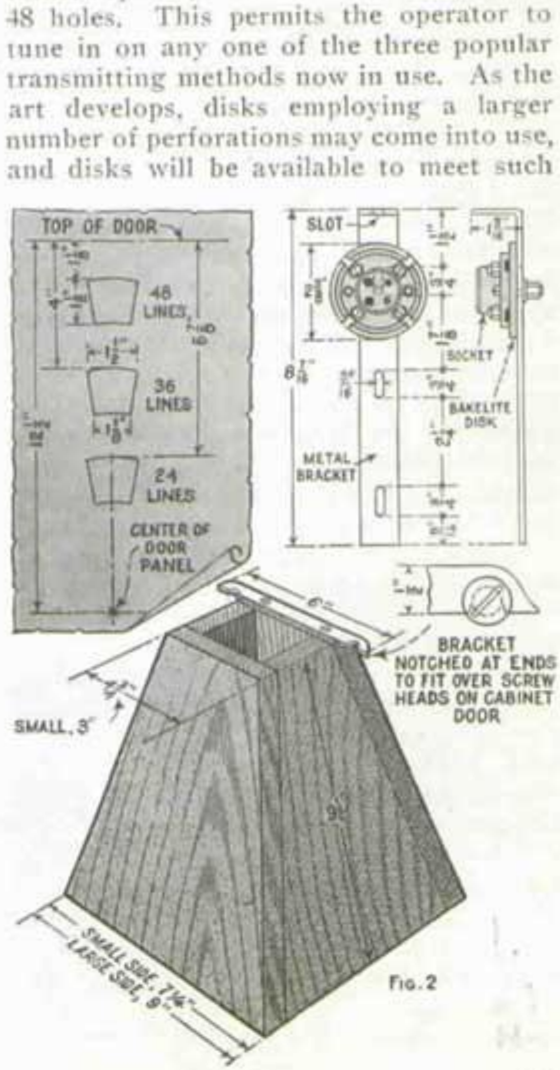


Fig. 2

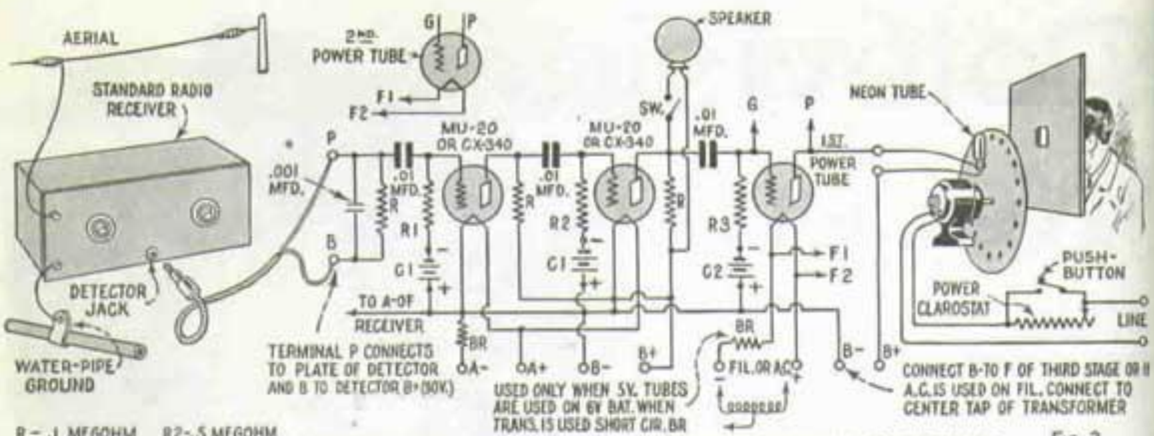
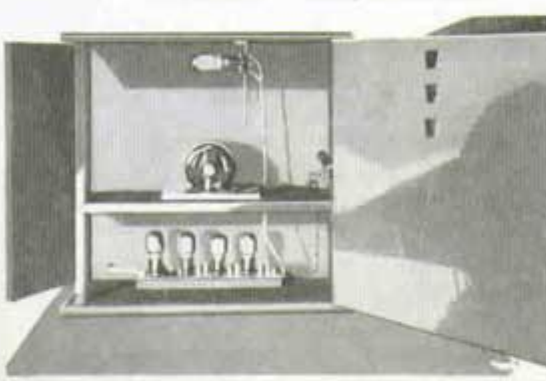


Fig. 3

changes, the other parts remaining practically the same, at least for some time to come, except for simple refinements such as will be covered in later articles.

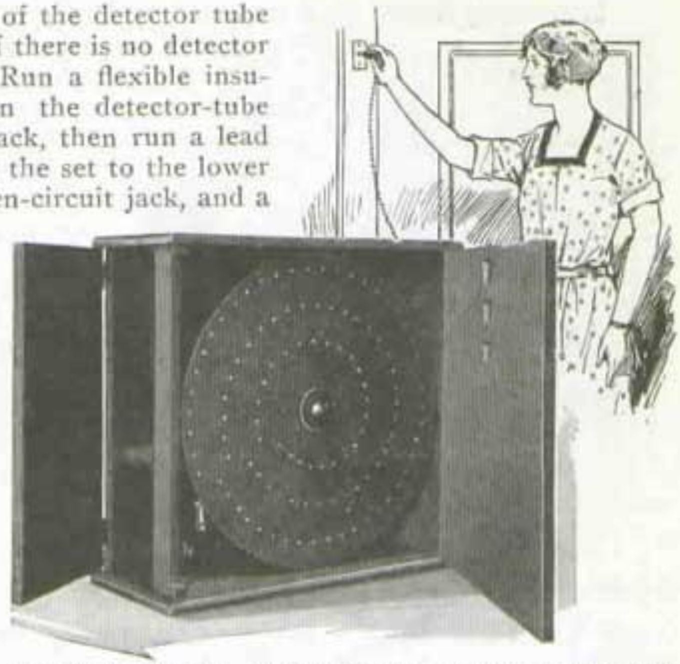
To begin with, it is well to entertain no false hopes regarding the results from present-day television transmission and reception. The pictures are small, generally 1½ by 1½ in., and lacking in detail. It is possible to recognize the person televised, see him turn his head, roll his eyes and open his mouth. Smoke from a cigaret is also clearly seen.

The cabinet housing the television receiver is shown in Fig. 1, ⅜-in. poplar, basswood or five-ply panel stock being used throughout and finished in dull black. Color ground in japan and thinned with turpentine is the simplest medium to use in finishing, as it dries dead flat. One side panel and the front panel are hinged to provide easy access to the instruments within. The height of the shelf will depend on the type of motor used. It is well to have it slightly lower than necessary and then build it up to the required height to center the disk in the cabinet by means of cardboard shims under the motor, which is then screwed to the shelf. The neon tube above the motor and directly behind the disk is mounted on an adjustable bracket-and-socket arrangement screwed to the top of the cabinet. The details are given in Fig. 2. The socket is mounted on a bakelite disk from the center of which a machine screw protrudes through the slots in the bracket, where it is held with a knurled nut. This assembly permits the operator to slide the neon lamp up or down until it is directly behind either of the three holes cut in the front panel. The tube socket can be turned so as to place the plate of the tube squarely behind the observation hole. The slot shown at the top of the bracket permits slight adjustment when centering the tube.


Television Receiver with Disk Removed, to Show the Instrument Arrangement

The adjustable hood is also detailed in Fig. 2. The metal bracket consists of a brass strip notched at each end and inset flush with the end of the hood. The builder can easily square off the front and back of the hood by placing it on a flat surface and drawing a line around each end for sawing.

The speed control for the motor consists of a push button and rheostat in one side of the power line. The variable unit is mounted on a bakelite panel through a hole cut in the side of the cabinet, as shown in the sketch. The resistance-coupled amplifier may be of the three or four-stage type, either a ready-built unit, as shown, or built up from single-stage units. These units contain the necessary blocking condensers and resistors. When this three-stage amplifier is employed, the audio amplifier of the set is not in use. The output of the detector tube is fed directly into the amplifier. If there is no detector jack in the receiver, install one. Run a flexible insulated wire from the plate post on the detector-tube socket to the upper blade of the jack, then run a lead from the detector B-supply post in the set to the lower blade of the jack. Use a single open-circuit jack, and a standard horn plug for the input leads to the amplifier unit, as shown in Fig. 3.



Completed Television Receiver Showing the Combination Disk in Position

In order to obtain greater illumination from the neon tube, two power tubes may be used in multiple as shown in the diagram. The power tubes may be MU-6 or any type desired. Battery-operated tubes of the MU-20, or similar, type are used for the first and second amplifier stages. Raw a.c. may be used on the filaments of the power tubes if desired, and this is advised for best results, but a.c. must not be employed for the first two stages.

When a resistance-coupled amplifier is employed, as in this case, it will be necessary to raise the detector B-voltage in the receiving set to an approximate value of 45 to 67½ volts.

In operation, as the disk approaches critical speed, flashes will be thrown across the window and finally strange figures will appear until the speed of the receiving disk matches or is synchronized with that of the disk at the transmitter. When synchronous speed is reached by adjusting the rheostat, the picture will make its appearance, and will remain as long as the disks are in step.

The push-button switch shunted across the rheostat is used only for the purpose of short-circuiting the resistance, thereby speeding up the motor momentarily in order to make it run at the same rate as the transmitter motor and keep in step with it, that is, to synchronize the two.

For testing purposes, the operator may employ a phonograph and magnetic pickup connected directly to the amplifier unit. The regular musical record will then throw a geometrical design on the revolving disk.

When receiving actual pictures, the operator may be puzzled to find his received picture upside down, but this may be easily corrected. It is only necessary to remove the disk from the shaft of the motor and turn it around.

A large blueprint showing the cabinet construction and detailed wiring diagram for building up the amplifier unit, may be obtained from Popular Mechanics radio department for 15 cents to cover cost and packing. Specify blueprint No. 139. No charge is made for a list of the materials used in the model, and it will be mailed to any address upon request. Copies of the March, 1928, issue, in which the Short-Wave Adapter article appeared, are available for those who wish to adapt their present sets for short-wave reception.

Improving the Tone of Old Sets

Although there is nothing new about shunting the secondary of the a.f. transformer with a variable resistance to improve tone quality, very few take advantage of the idea. The best method is to place a proper resistance across the secondary of the second a.f. transformer and possibly across the secondary of the first as well, although it may cause a slight loss of volume. Just what value of resistance to use is difficult to state, as it depends on conditions in the circuit. The range may be anywhere from 50,000 to 200,000 ohms, and in some cases even higher.