

# How to Build A HOME TELEVISOR

## A BRAND NEW THRILL

*Especially prepared for  
TELEVISION NEWS*

By H. G. CISIN, M.E.



*Radiovision—pictures via radio—is simple with a properly engineered radiovisor and associated receiver and amplifier.*

SEVERAL months ago, the editor of TELEVISION NEWS sent for me and requested an article on "How to Build a Television Receiver". Since my previous experience had been largely confined primarily to ordinary radio work, it required some persuasion before I finally

agreed to investigate the present possibilities of television from the standpoint of the home experimenter and set builder.

### Television Now Practical

My preliminary researches revealed some extremely interesting facts. I

found that television, in its present state of development, is indeed practical and very much worth while. Furthermore, I ascertained that there is really nothing complicated about it; since even a novice can construct a television outfit, which will be a source of immense pride, instruction and entertainment to him.

This does not mean that television has reached its final stage of perfection. We have been hearing about television for a number of years and, during all this time, tireless research workers have been devising cumulative improvements. While these developments have advanced the art rapidly, it is my personal opinion that the home experimenters are destined to play a most important part in bringing this fascinating form of entertainment to its ultimate perfection.

When I built my first cigar-box radio receiver in 1921 and tuned in music from station WJZ, I received a thrill which I shall never forget. This experience, however, was duplicated recently, when I finished the construction of my first television outfit and

### EDITOR'S NOTE

The Editors of TELEVISION NEWS have frequently been urged to supply practical constructional articles on television apparatus. In order to meet this unprecedented demand, the editor commissioned Mr. Cisin to investigate the possibilities of home television and to prepare a series of articles containing complete working data on the construction of television equipment. Mr. Cisin, who is known to radio enthusiasts throughout the country, is the designer of over fifty different radio circuits. His interesting articles on home set-building have appeared in nearly every radio magazine and also in newspapers from coast to coast. The article presented here is the result of careful research. It contains just the information needed to assemble an excellent television receiver at a surprisingly low cost.

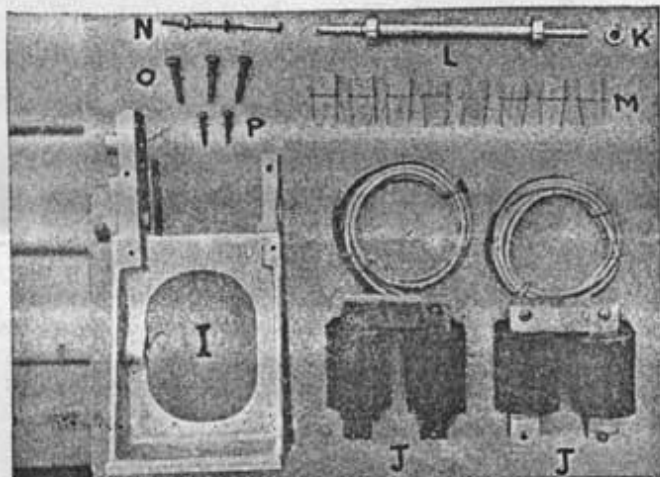
tuned in an interesting radio movie which was being transmitted over station W2XCR.

There are two essential elements for television reception, or radio-vision, as it is sometimes called. These are a suitable short-wave receiver (used because television radio impulses are transmitted, in the United States, on certain allotted short wavebands) and a properly designed scanning mechanism or "radiovisor", capable of translating the amplified audio signals into pictorial form.

As regards the short-wave receiver, there is nothing startling in its design or construction. This is apparent to anyone who cares to study the diagram of a typical television short-wave receiver, as here presented. Most readers of this journal will experience no difficulty whatsoever in constructing such a receiver. For those who like to work from detailed instructions, I will present complete assembly and wiring data on an efficient television short-wave (tuner) receiver, in an early issue.

Of course, it is possible to purchase

Front bracket components, including ball-bearing shaft for scanning disc.



### Constructing the Scanning System

We now come to the construction of the all-important scanning system. Through the progressiveness and initiative of the Jenkins Television Corporation of Passaic, N. J., a complete home radio-

visor kit is now available, which removes the last vestige of uncertainty, as far as the home constructor is concerned.

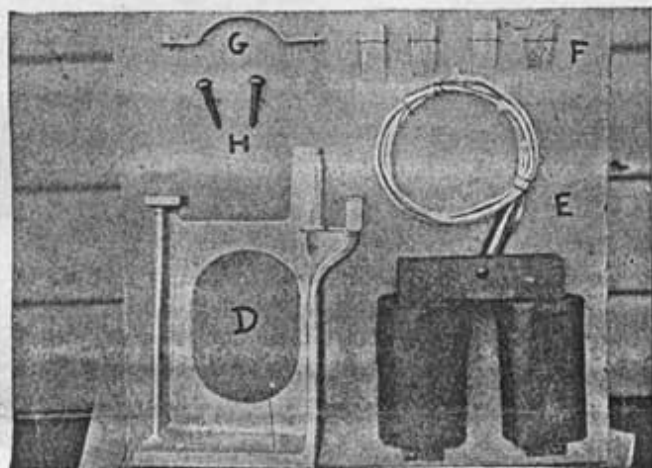
This kit can be assembled and wired by the average beginner in a few hours time. The kit contains all necessary parts, with the exception of the wood and bakelite for the platform or base. All parts are drilled and tapped, so that the work is merely a matter

of work from written instructions, complete directions are given.

The first step is to cut two pieces of white pine measuring  $\frac{3}{4} \times 5 \times 9$  inches, as shown at "A", in the base drawing. The pieces should be carefully planed and perfectly square. Two additional pieces, measuring  $\frac{3}{4} \times 1\frac{1}{4} \times 11\frac{1}{2}$  inches, should also be cut, as shown at "B". Next, cut a bakelite strip measuring  $2\frac{1}{2} \times 9 \times \frac{3}{8}$  inches, and drill the necessary holes in the strip, as indicated in the layout drawing; thus obtaining the part shown at "C".

Assemble the platform by placing strips "B" on edge, parallel to each other; and laying across them the "A" pieces, allowing  $1\frac{1}{2}$ -inch spaces between the latter. The pieces should be neatly and accurately fitted, followed by nailing in place. The bakelite piece is then placed across one end and screwed to the ends of the "B" strip; forming the control panel, as shown in the completed assembly view of the radiovisor.

The template, shown in another drawing, is placed on top of the platform, face-side up, making sure that the edge marked "front" faces the control-panel end of the platform. The edges of the platform should match the edges of the template, for accurate location of the holes. Next, prick-punch the points indicated on the template, remove the template, and



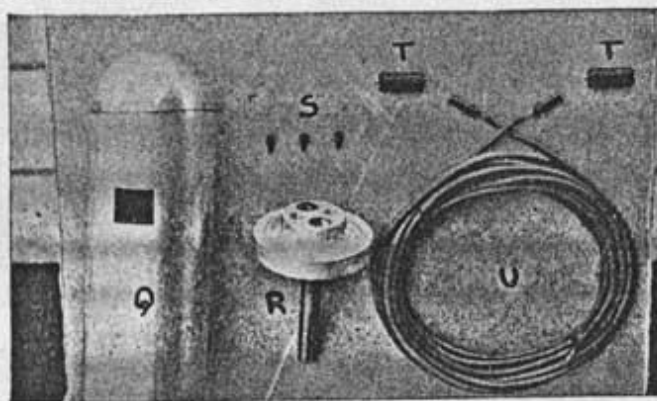
Rear bracket component, including rotor guard and bracket mounting screws.

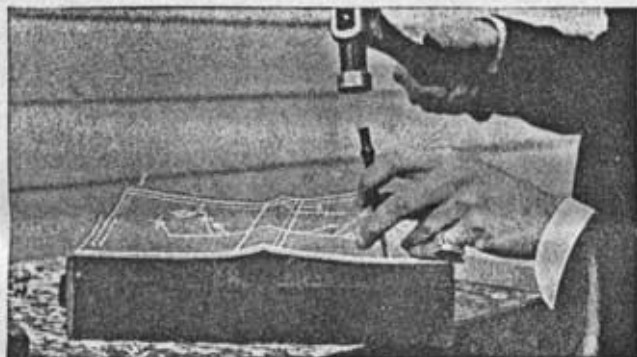
such a set completely assembled, if desired. The standard television short-wave receiver differs from the ordinary short-wave job in several important particulars. For one thing, the television receiver does not employ regeneration; as this would tend to produce excessive selectivity. Instead, it uses an extra stage of radio frequency to provide the additional sensitivity required. The television short-wave receiver must tune to 100 kc., instead of to the conventional 10 kc. waveband; a special band-pass filter is therefore necessary. It is obvious that shielding must be adequate and complete.

With respect to the audio amplifier, resistance coupling is essential; since it is necessary to pass a band of frequencies of from 15 to 30,000 cycles. A schematic diagram of such an amplifier is shown here.

of simple assembly and wiring. The various components are shown in the accompanying illustrations; the details of assembly are also clearly illustrated but, for those who prefer to

Lamp house components, including shield, socket, prong clips and conductors.





Using the template to indicate screw mounting holes and wiring holes to be drilled in platform.

drill the various holes as indicated. The platform is now ready for the subsequent mounting of parts and for wiring. A coat of shellac or varnish, at this time, provides an attractive finish and also serves as a protection against moisture.

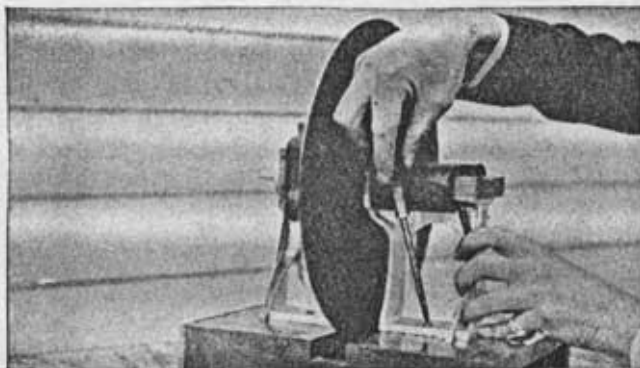
The rear bracket assembly is started next. The first step is to place the bracket upright on a table. The rear electromagnet is placed on top of the bracket, as shown in one of the illustrations, with the open end of magnet straddling center post of bracket. Next, place the rotor guard "G" on top and across the open end of the electromagnet core and align its holes with those in the pole pieces and bracket; slip through and tighten the screws. Secure the remaining magnet screw in place. Ascertain which two of the four wires of both coils lead out from the outside of each coil, and mark them "Outside"; while the wires leading from the inside of the coils are marked "Inside". This is to simplify subsequent wiring. Each coil should be pushed as far back as possible, snugly against the back or crosspiece of the core. Insert one wooden wedge between the inside of each coil, to hold the coils firmly in place. If necessary, drive the wedges home with a piece of metal and a hammer, taking care not to damage the coils, which must be wedged firm-

ly to prevent noise when set is operating. This completes the rear-bracket assembly.

#### Front-Bracket Assembly

The parts for the front bracket assembly are shown in one of the illustrations. To begin the assembly, place the front bracket on its base, upright on the table as illustrated, and place

Mounting brackets on wooden platform, after scanning disc has been set in place.



one electromagnet against one side; noting that the open end straddles the rounded bearing-holder of the bracket. Keep wires or leads outside. Drive home three screws to hold the magnet in position, and do the same with the other magnet. It will be noted that the fourth hole in each electromagnet

is without a magnet screw and, subsequently, takes the bearing clamping screw "N". The coils should be pushed as far back as possible, with wedges driven in to hold them, as explained for the rear-bracket assembly.

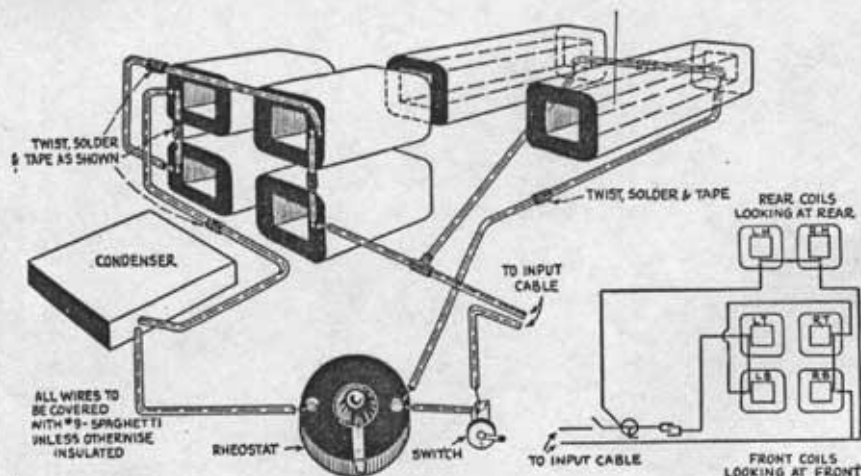
Now take the shaft assembly "L" in your right hand, holding it horizontal, with the rounded end of shaft to your left. Insert the rounded end of shaft and bearing through that end of front bracket which is slotted through to the bearing hole. Push the shaft assembly as far back as it will go; so that the ball bearing nearest rounded end fits snugly into the boss at the far side of the bracket. The boss is so formed that the bearing cannot be pushed clear through, except by sheer force, which must be avoided. Be careful not to hit against the coils while inserting the shaft assembly. If preferred, the shaft assembly may be inserted in place before inserting the coils on the front bracket.

The ball bearing should now be flush

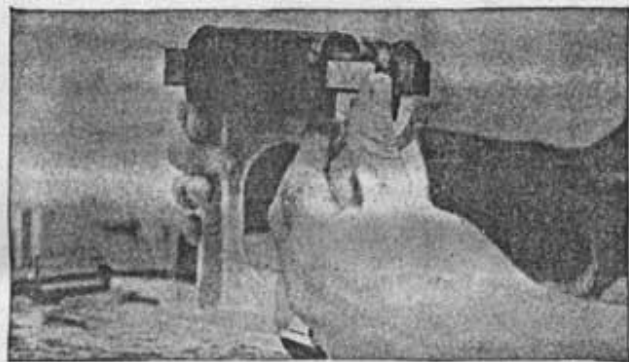
at both ends of the bracket. If the ball bearings fail to clear the first or slotted hole, insert a screw driver in slot and open it slightly to allow enough space in the hole. Now insert the bearing, tightening the screw "N" through the empty holes in the cores which are aligned with holes in slotted bracket arm. Apply the lock washer and nut on the screw, and draw them up tightly to hold the bearing in place. However, be sure to twirl the shaft while tightening up on the bearing, to avoid binding the bearing. It is very important that the shaft be free enough so that it can be spun with the thumb and the first finger. The front-bracket assembly is now complete.

#### The Neon Lamp-House

The lamp-house is assembled next. The components are: "Q", the lamp-shield; "R", the base for the lamp-shield; "S", the tube-shield screws; "T", the prong jack sleeves, for establishing contact with the television lamp's prongs; and "U", the rubber-covered leads. The prong-jack sleeves come already assembled in the tube socket, thus simplifying the assembly. The three felt cushions supplied



This shows wiring diagram for Jenkins Television scanning disc motor.



After pushing magnet windings as far back as possible, the wooden wedges are driven in between core and winding.

should be cemented to the inside of the lamp-house at three points equally spaced, just above the rectangular opening; DuPont's household cement is recommended for this purpose. To assemble the lamp-house, simply place the television or neon lamp in the socket, with the smooth surface of the tube's plate facing the constructor. Place the tube shield over the lamp, with its window or opening aligned with plate of lamp. Align the screw holes in shield with those of the tube-socket member, insert screws and tighten. The lamp-house is then complete.

#### The Scanning Disc

One of the pictures shows the components of the scanning disc. To assemble, take the black disc "V" and hold it in your left hand, while the side that shows the spiral of tiny holes running clockwise towards the center is facing you. Place the copper hub-flange "Y" at the back of the disc, aligning its holes with those in the scanning disc. Drive home the screws from the front face to engage with threaded holes in rear copper disc.

Now place the rotor in center on side facing you, align the holes with those about center of disc, and insert flat-head screws in the rotor, through the disc, and the copper hub-flange; slipping nuts on rear side and drawing up tightly. The disc assembly is now complete.

The parts required to start and regulate the motor driving the scanning disc are the rheostat, the fixed condensers and the holding screws for the condenser; these components are mounted on the underside of the platform. A toggle switch may be used for starting and stopping the motor. The condenser should be mounted under the board adjacent to the bakelite panel, being screwed to the left-hand upright board. The rheostat is mounted on the panel in the right-hand hole, facing the panel front. The switch, if used, is mounted in the panel's center hole.

The brackets are now ready to be mounted on the platform. First, the front bracket is mounted with the rounded end of the scanning-disc shaft facing the front or panel end of the platform. Next, the scanning

disc is mounted on the shaft protruding from the rear of the front bracket. The rotor spacer "K" is first slipped over the square end of the shaft, and then pushed back until it is up against the ball bearing. Then the scanning disc is slipped over the shaft and pushed back against the spacer, with the rotor facing rear of platform; after which the set-screw in the rotor is tightened.



Direction of rotation of disc necessary to receive the images broadcasted by the Jenkins Television transmitting station.

The rear bracket is now placed on the wooden platform, and so adjusted that its holes align with the small holes already drilled in the platform. The pole-pieces and the rotor guard should now surround the rotor. The

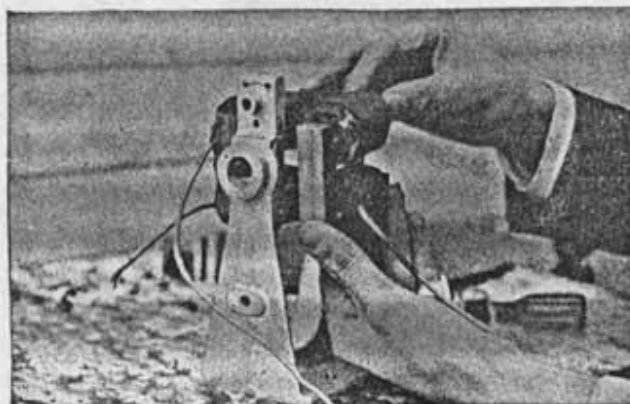
screws are driven home through the bracket base and into the wooden platform as shown. The scanning disc should be twirled, to make certain that it turns freely and that the rotor does not rub against the coils or core of rear magnet. It is best to tighten the rear bracket's wood-screws only lightly; so that, after the set is wired and the power turned on, the rotor can be made to rotate under its own power. The proper setting between the rotor and the rear magnet's core may then be found by tapping lightly on the rear bracket at the bottom until the set runs quietly. The proper distance between the front of the scanning-disc assembly and the ends of front magnet core is  $\frac{3}{16}$ -inch. The rear magnet's core and the back of the scanning disc should also be  $\frac{3}{16}$ -inch apart.

#### Wiring Diagram Instructions

A pictured wiring diagram, furnished with the radiovisor kit, makes this part of the job exceedingly easy. All leads coming from the outside of the coils, as shown on the diagram, are lacquered red. The splices should be taped with adhesive tape. From this diagram it can be seen that the motive power is furnished by an "eddy current" motor, made up of six electromagnets. These operate in conjunction with the toothed rotor and the copper disc. The "eddy current" motor functions as a synchronous motor for automatic synchronization, when used on the same A.C. power system as the transmitter. The speed-control rheostat allows for manual synchronization; although the automatic synchronizer described below makes this use of the rheostat unnecessary.

The lamp-house is mounted on the rear bracket, by inserting the long pin of the lamp socket in the hole in the center post. The pin permits raising or lowering the lamp, or turning it from side to side, to "frame" the pictures properly. There is a special type of radiovision lamp, known as "Model 601-B", which has been found best adapted for use with this kit. A magnifying lens and holder may be obtained, separately, for the purpose

Mounting the electromagnet assembly on the front bracket, with wires outside.



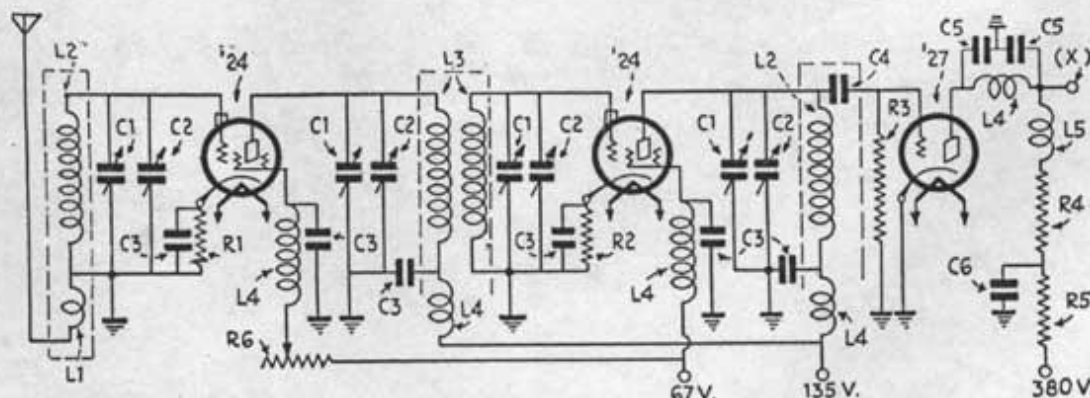


Diagram here with shows the connections of the Jenkins Television receiver or "tuner", utilizing screen grid tubes in two radio frequency stages, and a '27 tube in the detector stage. The output terminal "X" joins with the input terminal "X" of the amplifier shown below.

of magnifying the radiovision images, instead of viewing them in their original small dimensions. To assemble the lens, place the lens in frame, with its rounded side facing the front. Then slip in the screws (with the large or lower washers next to the glass, and the small or upper washers next to the screw heads), into the holes at rear of the lens frame. Drive home the screws, completing the assembly. It will be noted that the lens frame fits on the front of the front bracket,

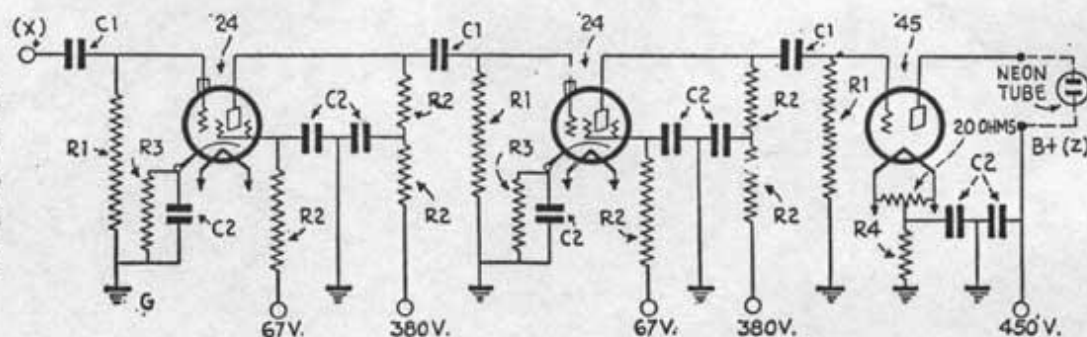
The radiovision lamp should glow when connected with the amplifier output. If the plate does not appear to glow, as seen through the aperture, and yet there is a faint sign of light, the rubber-covered leads from the amplifier or set output should be reversed.

The voltage impressed on the television lamp should be not less than 230 volts for proper operation; the usual '71-type power tube has insufficient power to operate the television lamp

nals, these running lines blend into lights and shadows forming pictures.

The figures as viewed may float towards the right or left, depending on the scanning disc's gaining on the transmitted images, or falling behind. To get the disc in synchronism, or perfect step, with the transmitted images, the speed-control or rheostat knob on the front panel should be turned, left and right, as necessary until the desired effect is obtained. It is possible to hasten synchronism

Jenkins Television amplifier for boosting the television image signal before it is passed into the neon tube. The input terminal "X" joins to the similarly marked terminal of the output receiving circuit shown above.



fastening in place with three flat-head machine-screws.

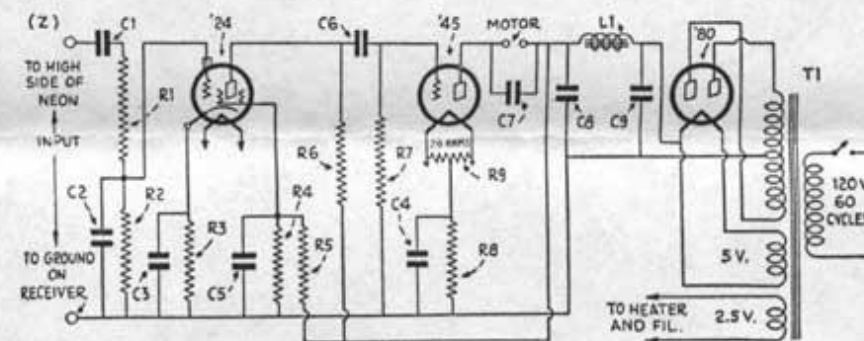
#### Operating Instructions

The first step, in using the completed radiovisor, is to provide the necessary input for the radiovision lamp. This input is supplied by a resistance-coupled amplifier, as outlined above, with a '45 or a '50 power tube; the amplifier in turn being supplied by the detector output of a short-wave (100-150 meter) receiver. As in sound-broadcast reception, it is necessary first to tune in the desired signal. Before doing this, it is best to ascertain the schedules of regular and experimental radiovision broadcasters. A complete list of these stations is given elsewhere. When radiovision signals are on the air, they may be found quite readily by tuning the receiver in the conventional manner until the characteristic "buzz-saw" note, of rising and falling pitch, is at maximum volume and clarity; at which time the radiovisor is substituted for the loud speaker by means of a double switching arrangement.

satisfactorily. When the motor is turned on, it may be necessary to give the scanning disc a slight twirl, clockwise (as seen from the front) for 48- and 60-line pictures, and counter-clockwise for 45-line pictures. When the scanning disc gets up to speed, a luminous pattern made up of the 48, 45 or 60 lines should appear. Under the influence of the radiovision sig-

by pressing lightly on the protruding scanning-disc shaft, at just the right time.

When the motor is synchronized with the current supply, a slight uniform purr is heard. With a little practice, one soon becomes an adept at synchronizing. If the radiovisor is employed on the same A.C. power system as the transmitter, the disc

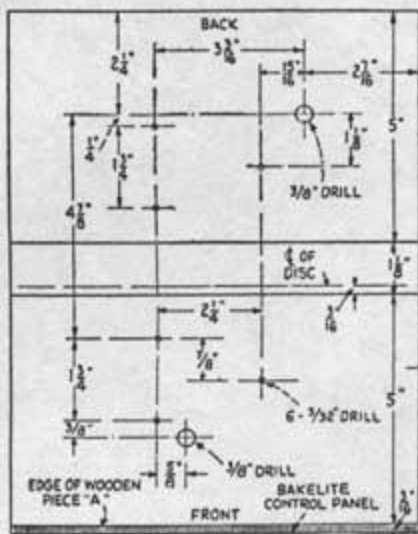
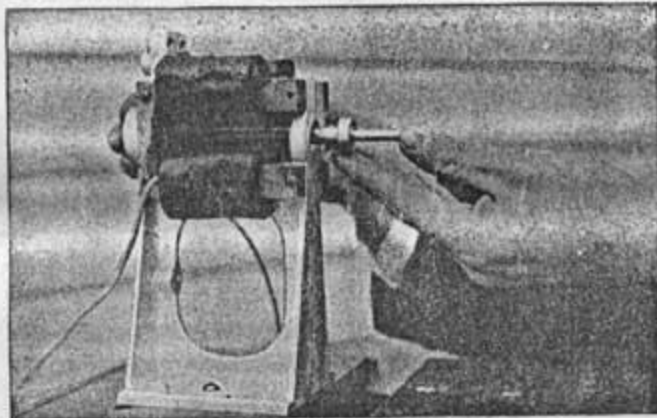


Amplifier for synchronizing motor, the input terminal "Z" connecting to the correspondingly marked terminal in the amplifier shown above.

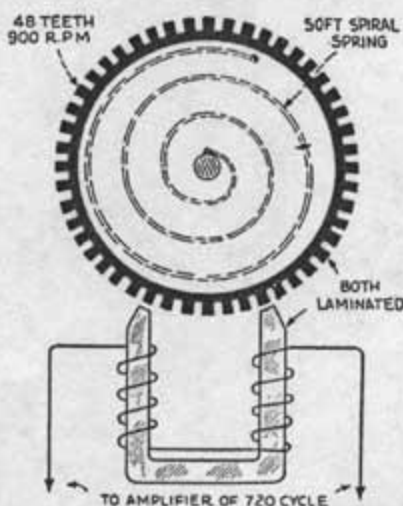
will remain in perfect step with the transmitted images, once it is in synchronism; if the radiovisor is used on a different power system from that supplying the transmitter, it is desirable to add one of the new self-synchronizing devices, recently developed by the research laboratories of the Jenkins Television Corporation.

This new device is a "phonic motor," consisting of a toothed rotor on the drive shaft of the radiovisor, together with a 2-pole electromagnet or field coil furnished with a 720-cycle energy component inherent in the 48-line, 15-frame television signals. This signal component is filtered out by a special circuit, and amplified sufficiently to definitely "lock" the radio-

Checking the end-play in the motor shaft.



Drawing above shows layout of holes on motor base at left, while diagram at right shows arrangement of synchronizing motor of Jenkins Radiovisor.



picture is improperly framed. To frame, or center, the picture horizontally, the lamp shield should be turned slightly to the right or left, as the case may be. To frame vertically, the lamp shield should be slightly raised or lowered. The pictures will then remain framed for considerable periods.

If the radiovisor is to be employed for reproducing 60-line pictures, a 60-line scanning disc with the necessary rotor for the proper operating speed is available. Changing disc with attachments is accomplished readily in a few minutes.

An ever-increasing variety of television programs are being broadcast; and, during the present season, these will include, not only moving pictures via radio but also synchronized sight and sound broadcasting.

For those whose interest is centered more in the actual reception of television, rather than in experimenting and construction, a completely-assembled radiovisor is obtainable; this is so designed that changes and additional equipment may be added, as advances are made in the art. It is known as "Model 100."

A completely-assembled and wired radiovision receiver, developed by the Jenkins research engineers, is also available for use in connection with the radiovisor; this is of the non-regenerative type, completely A.C. operated, and includes the necessary power amplifier.

visor disc in synchronism. The motor is attached to the front bracket; but first it is necessary to remove the slotted rotor from the scanning disc and replace this with a blank rotor. With the new motor attached, the radiovisor is ready to pick up any television signal; since in this case the signal itself synchronizes the picture. It should be understood that the motive power of the radiovisor is furnished by the eddy current motor; whereas the phonic-motor attachment

merely serves to keep the motor in synchronism with the incoming signals.

The self-synchronizing device, although it constitutes a decisive advance in television reception, is exceedingly simple in construction and is readily attached, either to an outfit already constructed, or to a radiovisor in the process of assembly.

If portions of two pictures show simultaneously, this indicates that the

## IN OUR NEXT ISSUE

**LATEST TELEVISION RECEPTION RESULTS WITH THE BRAUN TUBE**, by Baron Manfred Von Ardenne—Illustrated With Photos by the Author

**FULL SIZE TEMPLATE FOR LAYING OUT TELEVISION SCANNING DISC**

**LATEST GLOW-DISCHARGE LAMPS FOR TELEVISION SYSTEMS**

**PRACTICAL CONSTRUCTION AND OPERATION HINTS FOR TELEVISION SET BUILDERS**, by H. Winfield Secor

**A SHORT COURSE IN TELEVISION**—Part Two—by C. H. W. Nason, Television and Short Wave Specialist

**A NEW MULTI-CHANNEL TELEVISION SCANNING SYSTEM**

**TELEVISION PROJECTED IN THREE DIMENSIONS**

**HOW SHALL WE AMPLIFY TELEVISION SIGNALS?**

**HOW THE GERMANS TELEVISION**, by Dr. Fritz Noack

**SOME OF THE PROBLEMS OF TELEVISION**, by D. E. Replogle