

# NATIONAL RADIO INSTITUTE

 *Washington D. C.* 

# Radio-Trician Service Manual

(TRADE MARK REGISTERED U. S. PATENT OFFICE)

Compiled solely for  Students & Graduates

ON

EVEREADY RECEIVERS, MODELS 1, 2, 3, SERIES 30, 40 AND 50

The circuit used in Models 1, 2 and 3 consists of three stages of neutralized tuned Radio frequency amplification, detector and two transformer coupled audio stages ending in a push-pull power stage. The receiver uses four type —26 tubes, one —27 and two —71-A type tubes.

Instead of coupling the antenna to the input of the first tube through the usual stationary coupler, this receiver employs a small adjustable variometer, tuned by one of the condensers in the main tuning gang. This antenna trimmer acts as an auxiliary tuning control and can be used to bring the antenna circuit into resonance when desired. Adjustment of the antenna trimmer is not necessary when tuning the set to local signals, but when it is desired to bring in the occasionally weak signal from a distant station, a slight adjustment of the antenna trimmer brings the input circuit into resonance, with a marked gain in volume.

In the Eveready A.C. set, volume control is accomplished by a high resistance potentiometer located in the 1st RF circuit. The volume control is driven by means of a simple fabric belt from the volume control shaft. The volume control is electrically connected between the stator of the 1st RF condenser and ground. The movable arm connects to the grid contact of the RF socket.

Two stages of transformer coupled audio-frequency amplification are used with a stage of push-pull amplification using two power tubes. In an A.C. set, much better tone quality can be obtained from two tubes in push-pull than from

one larger tube having equivalent power output, for two reasons: First, the demand for plate current of the two tubes is constant, because as the current increases in one tube, it is decreasing to the same extent in the other. This places a steady drain on the "B" supply unit, and avoids the fluctuating voltage on its terminals which results when only one tube is used, while in turn, affects all the other tubes in the set and produces a tendency to over-emphasize notes of certain frequencies. Second, the second harmonic which causes distortion and which is always present when an output tube is producing loud volume, is absent in the push-pull arrangement, because the two tubes, working in opposite phase, cancel out the second harmonic, leaving the output uninfluenced by this disturbing factor. The output of the last audio stage is coupled to the loud-speaker terminals through an output transformer which is an important part of the set. The output transformer prevents the heavy plate current of the power tubes from flowing through the loud-speaker windings, thus protecting the loud-speaker against danger of burn-out, and aiding materially in improving tone quality. It also confines the high voltage of the power tubes to the interior of a power plant, the only voltage emerging from the set being the safe, low voltage of the secondary of the output transformer, in addition to the generous filter within the "B" power supply unit.

The set is liberally by-passed at every

point in the circuit where troublesome potentials might develop. There are a total of 8 by-pass condensers in the receiver. These condensers insure continued stability of the receiver and contribute largely to the tone quality of the set.

### Power Plant

The power unit is complete within itself, and in addition to the "A," "B" and "C" supply, it also contains the last audio stage and output transformer.

The power transformer has 3 taps in the primary to compensate for variations in the line voltage encountered in different localities. These 3 taps correspond to normal line voltage of 105, 115 and 125 volts. This compensator takes the form of three holes on a terminal board. A plug which comes with the set is inserted in the hole corresponding to the average line voltage prevailing at the point where the set is installed. If the correct hole is used, and if the line voltage does not swing through abnormally wide limits, long and satisfactory A.C. tube life will result. The connection between the power plant and receiver proper is made by a multiple plug and socket, requiring no tools to connect or disconnect. The rectifier is the UX-280 or CX-380 full-wave rectifying tube. The filter is a new and improved type having a very small unfiltered ripple in its output. "C" biasing resistors are incorporated in the power plant, and automatically supply the correct "C" voltage under a wide variety of line voltage conditions. The entire power plant is filled with a special sealing compound which absolutely excludes all moisture.

In the schematic diagram, Fig. 1, the numbers shown in the circles refer to the different parts used. Table No. 1 lists these numbers and apparatus which they indicate.

### Testing and Servicing

No hard and fast rule can be given concerning the best method to use in locating trouble in this receiver. However, the procedure given will be found satisfactory in the majority of cases.

### Procedure for Trouble Shooting

First see if all tubes are in their proper sockets and that the multi-stage plug is connected to the power plant. NEVER TURN ON THE OPERATING SWITCH OF TIME WITH THE CONNECTOR PLUG OR TUBES OUT OF THEIR SOCKET AS DAMAGE TO THE POWER PLANT WILL RESULT.

No. 1. Turn on the set switch and notice if all the tubes light in both the chassis assembly and power plant. Tube filaments should show dull red.

If all tubes fail to light look for: (A) loose A. C. connecting plug (b) house current turned off (c) fuse blown out in house lighting circuit (d) defective set switch (e) loose key or prongs in transformer tap switch.

If this does not locate the trouble apply a continuity test to the power plant.

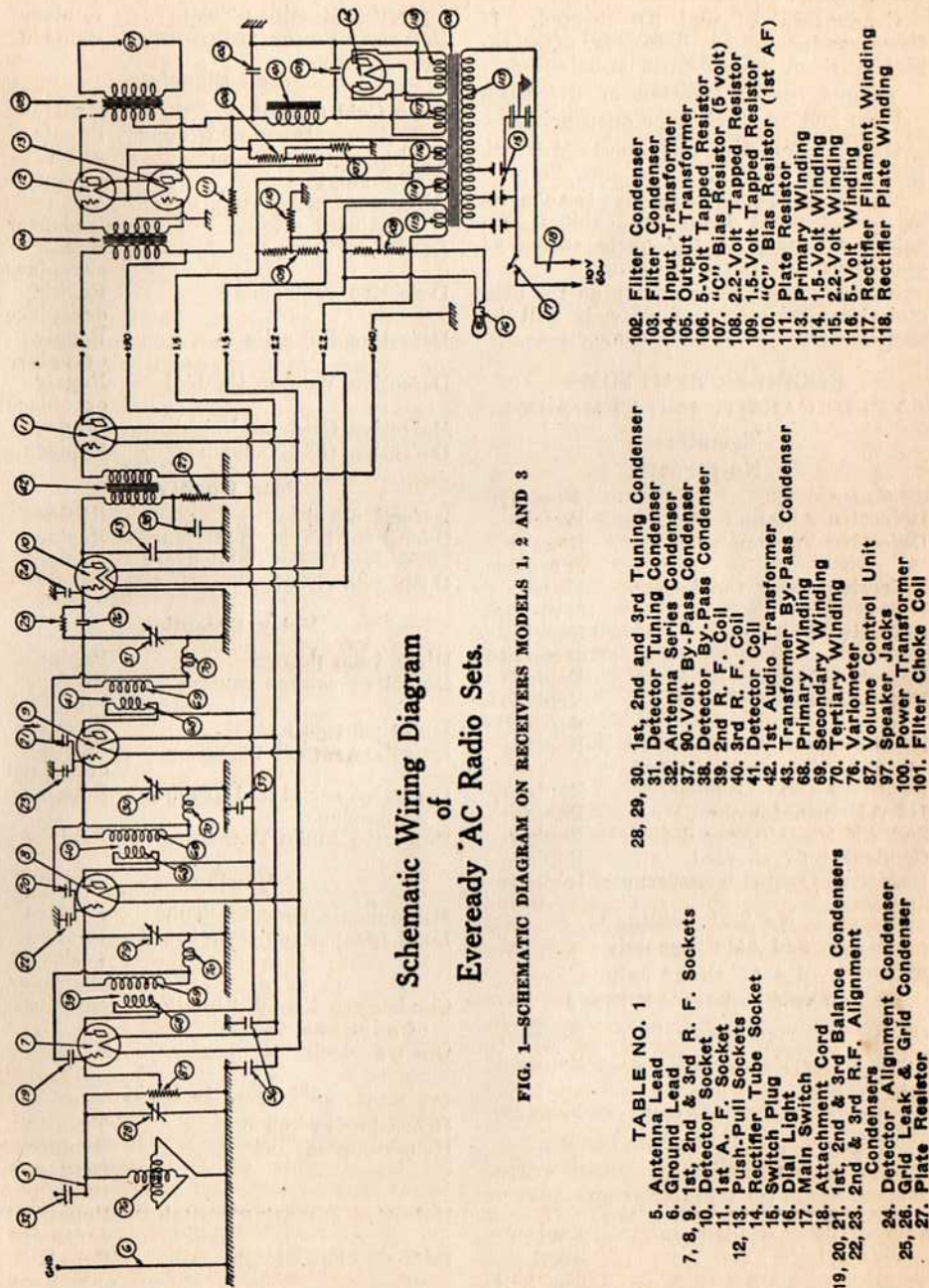
No. 2. If some tubes light and some do not, turn set off and examine tube sockets for bent or defective prongs, and check to see whether the tube prongs are clean.

If this does not locate the trouble leave tubes in their sockets and measure the voltage obtained across the filament prongs of the lighted tubes. Sockets 7, 8, 9 and 11 should show 1.5 volts across the filament prongs. Sockets 12, 13 and 14 should show 5.0 volts. Socket 10 should show 2.2 volts.

Tube No. 14 will have to be removed from its socket to allow access to the filament prongs with a meter. If the voltage readings obtained are more than 10% higher than those specified above, turn the set off and change the tap switch key to a higher socket. If the voltage readings obtained are not more than 10% higher than the values specified turn the set off and replace the unlighted tubes with new ones, or, check tube filament for burn outs. If this does not locate the trouble, apply continuity test to the power plant and chassis respectively.

No. 3. If all tubes light properly but reception is unsatisfactory, examine aerial, ground and loud-speaker. If this does not locate the trouble measure the plate, grid and filament voltages on all tubes with tubes in their respective sockets. If no grid and plate voltages are obtained, apply the continuity test to the power pack. If all tubes light and no signal is obtained examine the plate of tube 14. If the plate becomes red hot, the filter condensers in the power plant are probably shorted. Check by applying continuity test to the power plant. If plate or grid voltages are either high or low, turn set off and substitute new tubes one at a time. If this does not locate the trouble, remove the shield from the set and examine the gang condensers for shorts, dirt in plates, etc., and then apply continuity tests.

No. 4. No Trouble Indicated by Con-



Schematic Wiring Diagram of Eveready AC Radio Sets.

FIG. 1—SCHEMATIC DIAGRAM ON RECEIVERS MODELS 1, 2 AND 3

### TABLE NO. 1

- 5. Antenna Lead
- 6. Ground Lead
- 7, 8, 9. 1st, 2nd & 3rd R. F. Sockets
- 10. Detector Socket
- 11. 1st A. F. Socket
- 12, 13. Push-Pull Sockets
- 14. Rectifier Tube Socket
- 15. Switch Plug
- 16. Dial Light
- 17. Main Switch
- 18. Attachment Cord
- 19, 20, 21. 1st, 2nd & 3rd Balance Condensers
- 22, 23, 24. 2nd & 3rd R.F. Alignment Condensers
- 25. Detector Alignment Condenser
- 26. Grid Leak & Grid Condenser
- 27. Plate Resistor

- 28, 29, 30. 1st, 2nd and 3rd Tuning Condenser
- 31. Detector Tuning Condenser
- 32. Antenna Series Condenser
- 37, 38. 90-Volt By-Pass Condenser
- 39. Detector By-Pass Condenser
- 40. 2nd R. F. Coil
- 41. 3rd R. F. Coil
- 42. 1st Audio Transformer
- 43. Transformer By-Pass Condenser
- 68. Primary Winding
- 69. Secondary Winding
- 70. Tertiary Winding
- 76. Variometer
- 87. Volume Control Unit
- 97. Speaker Jacks
- 100. Power Transformer
- 101. Filter Choke Coil

- 102. Filter Condenser
- 103. Filter Condenser
- 104. Input Transformer
- 105. Output Transformer
- 106. 5-Volt Tapped Resistor
- 107. "C" Bias Resistor (5 volt)
- 108. 2.2-Volt Tapped Resistor
- 109. 1.5-Volt Tapped Resistor
- 110. "C" Bias Resistor (1st A.F.)
- 111. Plate Resistor
- 113. Primary Winding
- 114. 1.5-Volt Winding
- 115. 2.2-Volt Winding
- 116. 5-Volt Winding
- 117. Rectifier Filament Winding
- 118. Rectifier Plate Winding

**tinuity Tests.** There are several causes of receiver trouble which will not be shown by the continuity test. These are listed below:

Condensers 36 and 37 shorted. If these condensers are defective, after replacing them the set must be balanced.

Volume control shorted or defective.

First audio transformer open primary.

Open or defective resistances 109, 108, 106.

To check these units remove the chassis or power plant from the cabinet, unsolder all leads to the parts suspected and check for shorts or opens.

Note: To test the primary on the first audio-frequency transformer it will be unnecessary to unsolder connections.

### RECEIVER SYMPTOMS THEIR CAUSES AND REMEDIES

| Symptom                            | Cause  | Remedy                  |
|------------------------------------|--|-------------------------|
| No Signal                          | Defective Antenna                                  | Repair                  |
|                                    | Defective Variometer                               | Repair                  |
| Defective Gang Condenser           | Defective RF Coils                                 | Repair or replace       |
|                                    | Defective tubes                                    | Replace                 |
| Defective Power Plant              | Resistances 109, 108, 106 and condenser 24 shorted | Replace                 |
|                                    | Defective Grid Condenser                           | Replace                 |
| 1st AF transformer def.            | 2nd AF transformer def.                            | Replace                 |
|                                    | Condenser 37 shorted                               | Replace                 |
| Defective Output transformer       | Defective Output transformer                       | Replace                 |
| No "B" Voltage                     | 2nd AF Stage only                                  | Repair                  |
|                                    | 1st AF Stage only                                  | Replace                 |
| 90 volt and 1st AF Stage           | Open or shorted connections                        | Repair                  |
|                                    | Open primary output transformer                    | Replace                 |
| Open primary 2nd AF transformer    | Resistance 111 open                                | Replace                 |
|                                    | No "B" Voltage at all                              | Replace                 |
| Shorted filter condensers 102, 103 | Open filter choke                                  | Replace                 |
|                                    |  | Replace filter assembly |

| Cause  | Remedy               |
|--|----------------------|
| High voltage winding of Power transformer open | Replace power trans. |
| Defective Rectifier Tube                       | Replace              |
| Defective Power Transformer                    | Replace              |

| Weak Signals                           |                   |
|--|-------------------|
| Open Grid Circuit                      | Repair            |
| Defective antenna or ground            | Repair            |
| Tuning condensers out of alignment     | Align condenser   |
| Alignment condensers out of adjustment | Align condenser   |
| Defective tubes                        | Repair or replace |
| Defective variometer                   | Repair or replace |
| Defective RF coils                     | Repair or replace |
| Defective Volume Control               | Repair or replace |
| Defective Grid Leak                    | Replace           |
| Defective Grid Condenser               | Replace           |

| Poor Quality                  |         |
|-------------------------------|---------|
| Defective Tubes               | Replace |
| Open grid biasing resistances | Replace |
| Defective Filter Condensers   | Replace |
| Open grid circuits            | Repair  |

| Noisy Reception                         |                   |
|---|-------------------|
| Dirty tube prongs                       | Replace           |
| Defective volume control                | Repair or replace |
| Loose connections                       | Repair            |
| Defective socket prongs                 | Repair or replace |
| Defective aerial and ground connections | Repair            |
| Defective Audio Transformers            | Replace           |

| Howling                                 |                            |
|---|----------------------------|
| Microphonic Detector Tube               | Replace                    |
| Loud-speaker too close to set           | Change position of speaker |
| Condensers 19, 20, 21 out of adjustment | Readjust                   |
| Open grid circuit                       | Repair                     |

| Tubes Fail to Light         |                         |
|-----------------------------|-------------------------|
| Operating switch off        | Turn on                 |
| House current off           | Replace fuse or turn on |
| Defective operating switch  | Repair or replace       |
| Defective key switch        | Repair or replace       |
| Defective power transformer | Replace                 |
| Defective connector plug    | Repair or replace       |

### Series 30

This receiver uses five —27 type tubes and two —71-A type tubes in push-pull. The volume control is a 600-ohm potentiometer, connected in the voltage dividing resistance network, the movable arm of which connects to the cathode of the three R. F. tubes. By varying the position of the movable arm the bias voltage on the cathode may be varied which has the effect of varying the grid voltage of these tubes.

The antenna trimmer condenser serves to bring the antenna stage more closely in resonance with the three tuned stages by slightly varying the tuned circuit, in which it is connected in parallel with the variometer.

### Balancing and Aligning Condensers

In order to allow for stray capacity in

through a small hole in the rear of the chassis. To adjust for hum, simply turn with a screw-driver to the setting that gives least hum, while the volume control is set for maximum volume.

Try several different tubes for detectors, readjusting the hum control each time until one is found which gives the least hum.

The Radio-Trician can test the continuity of the various circuits by using the voltmeter and "C" battery method, referring to the wiring diagram which is shown in Figure 2.

### Series 40 Receivers

Eveready Series 40 Receivers are console type A. C. receivers employing the new 245 power tubes in push-pull. They are identical with Series 30 Receivers in all respects except in the circuits asso-

TABLE NO. 2  
TYPICAL VOLTAGE READINGS ON SERIES 30 RECEIVERS

| Type of Tube | Position of Tube 1st R. F. Det., etc. | Readings, Plug in Socket of Set |         |                |         |         |               |                    |
|--------------|---------------------------------------|---------------------------------|---------|----------------|---------|---------|---------------|--------------------|
|              |                                       | Tube Out                        |         | Tube in Tester |         |         |               |                    |
|              |                                       | A Volts                         | B Volts | A Volts        | B Volts | C Volts | Cathode Volts | Normal Plate M. A. |
| 227          | 1st RF                                | 2.5                             | 109     | 2.45           | 100     | 6       | 6             | 2.6                |
| 227          | 2nd RF                                | 2.5                             | 109     | 2.45           | 100     | 6       | 6             | 2.5                |
| 227          | 3rd RF                                | 2.5                             | 109     | 2.45           | 100     | 6       | 6             | 2.5                |
| 227          | Detector                              | 2.5                             | 109     | 2.45           | 50      | 0       | 0             | 3                  |
| 227          | 1st AF                                | 2.5                             | 109     | 2.46           | 100     | 4.5     | 4.5           | 3                  |
| 171A         | 2nd AF ( Push                         | 5.2                             | 192     | 5.1            | 175     | 37.5    | ..            | 20                 |
| 171A         | 2nd AF ( Pull                         | 5.2                             | 192     | 5.1            | 175     | 38      | ..            | 20                 |
| 280          | Rectifier                             | ..                              | ..      | 5.1            | ..      | ..      | ..            | 44                 |

Line Voltage—119. Set on 115 Volt Tap. Volume Control Position—On Full.

the tuned circuits, small adjustable condensers are connected in shunt with the units of the main gang. These aligning condensers are mounted on the hard rubber plates that also serve to support the stator groups of the gang condenser. They are reached through three holes in the front of the condenser shield.

The balancing condensers, which are mounted on a hard rubber strip in the R. F. sub-panel, are reached through three holes in the rear of the R. F. chassis.

The setting of both these condensers is a delicate operation, as their adjustments are interdependent. For this reason, no adjustment should be attempted without the proper tools.

In order to balance this receiver a modulated oscillator should be used following the same procedure as in balancing any other receiving set of this type.

**HUM CONTROL.** The hum control is a 10-ohm potentiometer. It is accessible

ciated with the power tubes and in the type of dynamic speaker used. No special remarks are necessary concerning the R. F. chassis, as this is unchanged from that used in Series 30 Receivers.

In the Audio Chassis, several changes have been made. The power transformer has been replaced by a larger type, which supplies 2.5 volts to the filaments of the 245 power tubes and approximately 250 volts to their plates. This increased plate voltage necessitates the use of a filter condenser of larger working voltage, and also the use of a dynamic speaker field of greater resistance to drop the high voltage to the proper value for the remaining tubes of the receivers. A smaller value of bias resistor is also required.

The schematic diagram is essentially the same as that for the type 30 Series, although the values of some of the resistances are slightly different.

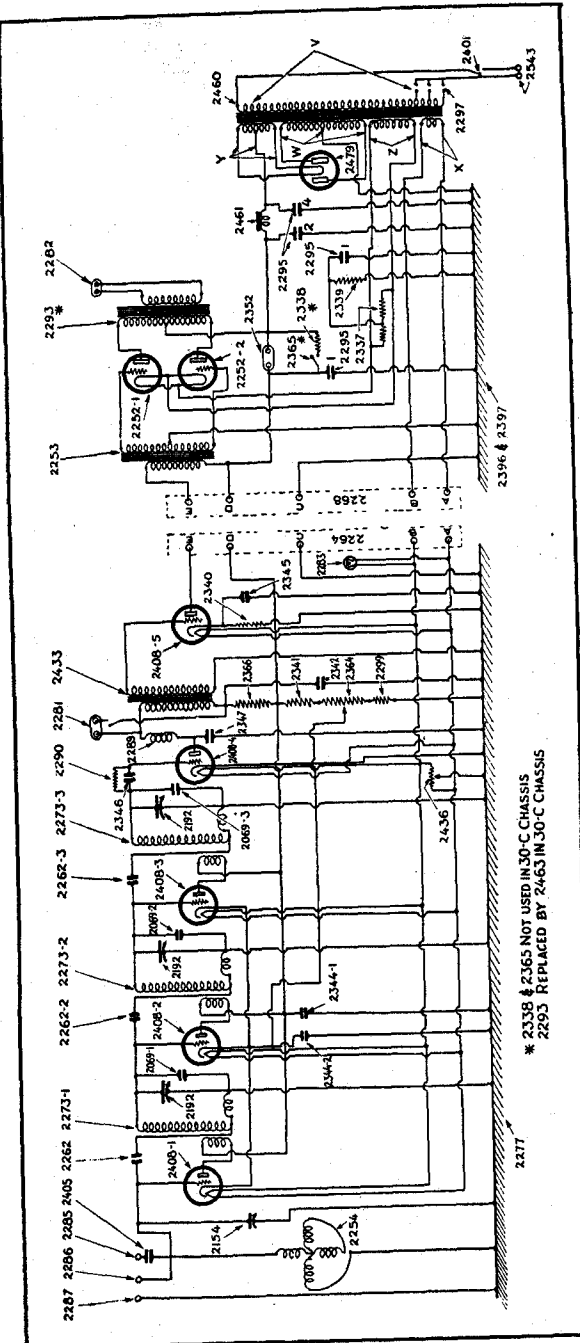


FIG. 2—SCHEMATIC DIAGRAM OF SERIES 50 RECEIVERS

\* 2339 & 2365 NOT USED IN 30-C CHASSIS  
2295 REPLACED BY 2465 IN 30-C CHASSIS

TABLE NO. 3  
SHOWING VALUES OF FIXED CONDENSERS AND RESISTORS

|                                       |          |  |
|---------------------------------------|----------|--|
| RF Plate by-pass condenser.....       | (2344-1) | 0.5 mfd.   |
| RF Cathode by-pass condenser.....     | (2344-2) | 0.5 mfd.   |
| Antenna series condenser.....         | 2405     | .0002 mfd.                                       |
| Grid condenser.....                   | 2346     | .0001 mfd.                                       |
| Detector plate by-pass condenser..... | 2347     | .00025 mfd.                                      |
| Resistor by-pass condenser.....       | 2343     | 2 mfd.   |
| Resistor by-pass condenser.....       | 2345     | 1 mfd.   |
| 2-megohm grid leak.....               | 2290     | Has red stripe.                                  |
| 17500-ohm resistor.....               | 2366     | Has green stripe.                                |
| 1750-ohm resistor.....                | 2299     | In voltage divider network.                      |
| 1750-ohm resistor.....                | 2340     | In voltage divider network.                      |
| 3500-ohm resistor.....                | 2341     | Grid bias for 1st A.F. tube.                     |
| 10-ohm center tap resistor.....       | 2436     | In voltage divider network.                      |
| 600-ohm volume control.....           | (2364)   | Used to adjust the hum.<br>On main R.F. chassis. |

**Series 50**  
The series 50 receivers use 3-24, 2-27 and 2-45 type tubes. The circuit diagram is shown in figure 3. The receivers are constructed in two major units known as the R. F. chassis and audio chassis respectively. The former uses the three R. F. stages, detector and first audio, and the latter contains the power supply and output tubes. The two are connected by a connector strip on the R. F. chassis to which cables from the audio chassis are fastened. The cover protects the connections.

Viewing the chassis from the rear the sequence from left to right is as follows: First R. F., second R. F., third R. F., detector and first A. F.

The antenna feeds directly into the grid of the first R. F. tube, which is shunted to the ground by the variometer and volume control. The antenna trim-

ground, the center tap of which connects to the grid of the first R. F. tube. The other is a 10,000-ohm resistor in the common cathode return of the three R. F. tubes. The hum control is the same as used with former models.

**ALIGNING.** Each stator group of the main gang condenser carries a small adjustable condenser, connected electrically in parallel with it. Since, in a single-dial receiver, the tuning condensers must be alike over the entire frequency range, the adjustment of these condensers is quite a delicate operation, and the performance of the receiver depends upon their proper adjustment. The procedure ordinarily used for aligning the variable condensers by the use of a modulated oscillator may be used. In adjusting the aligning condensers, an important point to observe is that after the receiver has been tuned to the signal from the oscil-

TYPICAL VOLTAGE READINGS ON SERIES 50 RECEIVERS

| Type of Tube | Position of Tube<br>1st R.F. Det., etc. | Readings, Plug in Socket of Set |         |                |         |                        |                      |                    |                   |
|--------------|---|---------------------------------|---------|----------------|---------|------------------------|----------------------|--------------------|-------------------|
|              |   | Tube Out                        |         | Tube in Tester |         |                        |                      |                    |                   |
|              |   | A Volts                         | B Volts | A Volts        | B Volts | C Volts (Control Grid) | Cathode Heater Volts | Normal Plate M. A. | Screen Grid Volts |
| 224          | 1st RF                                  | 2.4                             | 180     | 2.3            | 160     | - 2.2                  | + 3                  | 2.5                | 70                |
| 224          | 2nd RF                                  | 2.4                             | 180     | 2.3            | 160     | - 2.2                  | + 3                  | 2.5                | 70                |
| 224          | 3rd RF                                  | 2.4                             | 180     | 2.3            | 160     | - 2.2                  | + 3                  | 2.5                | 70                |
| 227          | Detector                                | 2.45                            | 100     | 2.3            | 65      | - 5.8                  | + 3½                 | .7                 | ..                |
| 227          | 1st AF                                  | 2.45                            | 180     | 2.3            | 150     | -11.7                  | +12½                 | 4.2                | ..                |
| 245          | 2nd AF                                  | 2.5                             | 300     | 2.4            | 240     | -46                    | .....                | 25                 | ..                |
| 245          | 2nd AF                                  | 2.5                             | 300     | 2.4            | 240     | -46                    | .....                | 25                 | ..                |
| 280          | Rectifier                               | 5.0                             | ...     | 4.8            | ...     | .....                  | .....                | 53                 | ..                |

Line Voltage 117. Set on 115 Volt Tap. Volume Control Position—On Full.

mer condenser is connected in parallel with the variometer. The successive R. F. stages and detector are coupled by the R. F. transformers which are tuned by the sections of the gang condenser.

Detection is accomplished by the grid bias method. The use of a so called linear or power detector insures adequate handling of large signals without overloading. The first A. F. tube is resistance coupled to the detector tube.

The variometer and antenna trimmer condenser are identical with those used in the Series 40 Receivers. The gang condenser is essentially the same as that used with previous models, with the exception of the tube shield partitions which have been added.

**VOLUME CONTROL.** The volume control consists of two variable resistors operating on the same common shaft. One of them is a 500,000-ohm potentiometer connected across antenna and

lator, none of the controls should be varied. Volume must be controlled by varying the distance of the oscillator from the set.

**IDENTIFICATION OF AUDIO UNITS AND LOUD SPEAKERS SERIES 50 RECEIVERS.** In the manufacture of the Series 50 Receiver, two different types of loud speakers were employed which in turn required the use of output transformers in the audio units of different ratios; namely, 25:1 and 80:1.

A designation in the form of a small aluminum disc, carrying the letter "D" denoting 25:1 transformer and the letter "E" 80:1 transformer, is fastened to the base of the particular audio unit.

Whenever it is necessary to replace an audio unit for a Series 50 Receiver, it will be necessary that the code letter be given with the request so that the proper unit may be furnished. Speaker No. 2794 requires an "E" audio unit. Speaker

