VOLUME III

PERPETUAL

TROUBLESHOOTER'S MANUAL

JOHN F. RIDER
ALL-AMERICAN MOHAWK CORP.

MODEL Navajo
VA
Battery Operated

COLOR CODE AND BATTERY HOOKUP
GREEN - A-
WHITE CONNECTED TO RED - B - BROWN - C - BLACK - D - 6V
SLATE - 0.260 OR 45V.
BLUE - 0.247 OR 30V.

SCHEMATIC CIRCUIT OF MOHAWK RECEIVER.
BATTERY NAVAO 1926

5 TUBE VA CIRCUIT -1925-26.-
MODEL Mohawk 226
12 Contact
Power Pack
A-10 Eliminator

ALL-AMERICAN MOHAWK CORP.

To 110-V. AC.

12 CONTACT POWER PACK for Mohawk 226
WITH NEW TYPE CONDENSER

A-10 MOHAWK ELIMINATOR
ALL-AMERICAN MOHAWK CORP.

MODEL
All-Amax Junior
All-Amax Senior

ALL-AMAX SENIOR

ALL-AMAX JUNIOR
MODEL A-1, A-3, A-4, A-8
"B" Eliminators

ALL-AMERICAN MOHAWK CORP.

CHOOSE

BLUE

YELLOW

GREEN

RED

BROWN

E = 5

E = 10

110-V AC

BUFFER CON.

"B" CONDENSER

SWITCH

"CONSTANT B" ELIMINATOR type A1, A3, A4

BLUE

YELLOW

RED

BROWN

E = 5

E = 10

135 AMP.

45 DET.

90 INT.

B - NEG.

ORANGE

BLACK

333-5 COND.

"B" ELIMINATOR TYPE A8 -1926-
MODEL R
6 Tube Battery
Sextette
Duet

ALL-AMERICAN MOHAWK CORP.

Model R (1925)

Switch

10 OHMS

1 OHM

Model R (1925)

FRONT

ALL-AMERICAN - Model R. 1925

Tubes 5 Ux 201-A
1 Ux 112 (Power)

Model Sextette (1926)

1. 500,000 ohms
2. 2 meg. ohms
3. .002 mfd.
4. .00025 mfd.
5. .0005 mfd.
6. .001 mfd.
7. .002 mfd.
8. 1 mfd by-pass.
9. 1 mfd by-pass.
10. 1st. Audio transformer
11. 2nd. Audio (Impedance)(R-300)
12. 3rd. Audio (Impedance)(R-310)
13. 8/5 ohm.
14. 1 Meg. ohm.
15. 40,000 ohms.

1926 CIRCUIT DIAGRAM OF 6 TUBE BATTERY OPERATED RECEIVER... 1927
(Sextette & Duet models)
ALL-AMERICAN MODEL Sextette 6-Tube 1926 All-Electric Receiver Chassis

ALL AMERICAN MOHAWK CORP.

To SPEAKER

6 TUBE ALL ELECTRIC +1926
SEXTETTE MODEL
MODEL 115 -1926  ALL-AMERICAN MOHAWK CORP.
5 Tube All-Electric
MODEL 115- 1926
5 Tube All-Battery

5 TUBE ALL ELECTRIC - 1926.
MODEL - 115

5 TUBE ALL AMERICAN BATTERY SET.
MODEL 115 - 1926-27.
ALL-AMERICAN MOHAWK CORP.

MODEL S-40
S-50

SCHEMATIC DIAGRAM

MODEL S-40

SCHEMATIC DIAGRAM OF LYRIC MODEL S-50

IF PEAK 175 KC
NOTE: All voltage readings listed are taken with all controls turned on full and no signal. Use 1000 ohms per volt-voltmeter.

Tube operating voltages are shown at the respective tube elements.

SERVICE SCHEMATIC LYRIC Model S-63
Tube operating voltages are shown at the respective tube elements.

NOTE: All voltage readings listed are taken with all controls turned on full and no signal. Use 1000 ohm per volt voltmeter.
MODEL DC-65
110 Volts

ALL-AMERICAN MOHAWK CORP.

SERVICEMATIC LYRIC MODEL
DC-65 - 110 VOLTS

Tube operating voltages are shown at the respective tube elements.
NOTE: All voltages before tubes are taken with all controls turned on full and no signal. Use 1000 P.D. VOM for voltmeter.

Tube operating voltages are shown at the respective tube elements.

MODEL B-60

ALL-AMERICAN MOHAWK CORP.

SERVICE SCHEMATIC LYRIC MODEL B-60

IF PEAK 175 KC
NOTE: All voltage readings listed are taken with all controls turned on full and no signal. Use 1000Ω per volt-voltmeter.

Tube operating voltages are shown at the respective tube elements.
SERVICE NOTES

LYRIC MODEL SA 91 RECEIVER.

The Lyric type SA 91 Receiver is a 9 tube superheterodyne, embodying the following circuits:

1. 1 stage RF amplification
2. First detector
3. Oscillator
4. 1 stage IF amplification
5. Second detector, AVC and NOISE Suppressor
6. First audio stage
7. Second audio stage
8. High voltage rectifier
9. 1 Type 56 Tube
10. 1 Type 57 Tube
11. 1 Type 56 Tube
12. 1 Type 56 Tube
13. 2 Type 47 Tube
14. 1 Type 2CO Tube
15. 1 Type 560 Tube

Inasmuch as the operation of the set up to the second detector follows conventional principles, no detailed discussion will be given here. The action of the automatic volume control and noise suppressor, however, will be described in detail. To make the operation of these circuits more evident, they are shown isolated from the rest of the set in diagram 90 A.

The type 56 tube used in the second detector position consists of a standard three element tube, similar to the type 56 with the addition of two small diode plate elements placed at the lower end of the cathode.

AUTOMATIC VOLUME CONTROL.

The detector and automatic gain control functions are performed by the diode section of the type 56 tube which rectifies the energy sent to it by the intermediate frequency amplifier. The DC component of this energy passes through a set of high resistance and by-pass condensers to the control grid of the RF and IF tubes to control the amount of amplification in these stages.

An increase in signal strength results in an opposite action increasing the amount of IF and IF amplification. The audio component of the signal rectified by the diode is passed through the manual volume control which also serves as a part of the diode resistance set work. The adjustment of this control sets the amount of energy passed on to the audio amplifier for further amplification.

NOISE SUPPRESSOR

The noise suppression system operates by blocking the first audio amplifier tube and is controlled by the AVC system. Reference to figure 59A will show that the control grid of the 56 tube divides its bias from the AVC circuit being connected to the same point as the IF grid circuit. The plate circuit of this tube includes a resistance in the grid circuit of the 1st AF stage and the "noise" suppressor control which is one section of the voltage divider.

When no signal is being received, no voltage is developed in the AVC system and consequently the bias is no bias on the control grid of the 56 tube. This permits current to flow in its plate circuit which builds up a bias across resistor "R" overbiasing the 567 first audio tube and preventing it from amplifying static or noise which is being picked up.

When a signal is picked up the condenser is reversed as the voltage developed in the AVC biases the suppressor tube grid and stops the flow of plate current. This removes the blocking bias from the first AF tube and permits the amplification of the signal.

The function of the noise suppressor control is to limit the minimum signal level, which the set will receive. This control varies the plate voltage on the control tube. As the voltage is increased (control turned to left) the amount of signal necessary to unlock the control system is increased and the voltage is decreased (control turned to right) the signal required to unlock the noise suppressor is decreased until at the extreme clockwise position the noise control is inoperative.

To set the control the receiver should be tuned to a point where no stations are heard with the noise control turned to the extreme clockwise position. The noise control should then be turned to the left just far enough to silence static and other noise.

TECHNICAL DATA.

Drawing No. 59. Attached gives the complete circuit diagram of this receiver, electrical constants of parts and operating voltages on all tubes.

All voltage measurements should be made with a meter having a resistance of at least 1000 ohms per volt. The volume and noise controls should be turned to the extreme clockwise position and the set tuned between stations so that no signal is received while measurements are being made.

BALANCING.

Caution: When balancing radio frequency or IF circuits, be sure that the volume control is turned to the full "On" position and out of the test oscillator adjusted to give a very weak signal. This is necessary to minimize the automatic volume control action and to permit the most accurate adjustment.

Intermediate

INTERMEDIATE FREQUENCY CIRCUITS.

The intermediate frequency amplifier of this receiver operates at 175 kc. and an accurately calibrated test oscillator generating this frequency is necessary for tuning.

Current from the test oscillator should be fed into the set by removing the control grid cap on the type 57 detector modulator tube, and connecting the oscillator output terminals between the chassis pan and the control grid cap of this tube.

The IF transformers are tuned by adjusting the screws under the removable name plate on the rear of the chassis.

To align the IF circuits the test oscillator should first be set to some known frequency between 1400 and 1500 kc. and the set tuned so that the dial pointer indicates this frequency. The trimmer condenser of the oscillator section of the variable condenser (front section) should then be tuned until the test signal is received with greatest output.

There are two possible adjustments on the trimmer condensers at which this signal may be received; the proper adjustment is that at which the trimmer is set to minimum capacity; that is, the adjustment at which the trimmer plate is furthest out. This has been done the trimmer condensers of the second and third variable condensers are to be set to give maximum output.

The set should next be balanced at approximately 1250, 950, 700 and 550 kc. in the order mentioned as follows:
 servicio notes

model sa-130 service notes

lyric model sa 130 receiver.
The lyric model sa 130 receiver is a thirteen tube superheterodyne, embodying the "channel control" noise suppression system - an exclusive lyric development.

Tune equipment consists of:

3 RCA 56 or equivalent
4 RCA 5V or equivalent
3 RCA 50 or equivalent
1 RCA 247 or equivalent
1 RCA 82 or equivalent

The outstanding feature of the "channel control" system of noise suppression is the fact that in addition to eliminating all static and other noise while the set is being tuned from one station to another, it makes it impossible to tune the set to anything but exact resonance with the desired signal. A variable control for the noise suppression system is placed toward the rear on the left side of the cabinet. This permits compensation for all conditions of static and other interfering noises. With the set tuned between stations so that no signal is received this knob should be rotated counter clockwise to the point where the static and other noises are just alleviated. The set may then be tuned in the ordinary manner without further attention to the channel control. On channels where no station is operated or where the station is weaker than the static or interfering noise level nothing will be heard; however, on all channels where the received signal is above the noise level, the signal will be received when the set is tuned to exact resonance. Thus it is impossible for the operator to mistune the set and receive the accompanying distorted signal.

The requirements of circuit alignment in this receiver make necessary extreme care when adjusting either the RF or IF systems. For this reason detailed instructions are given. Unless these are followed, precisely, it will be impossible to obtain proper "channel control" operation.

Information regarding constants of the various parts, operating voltages and speaker connections are shown on the accompanying circuit diagram, drawing #56.

CIRCUIT ALIGNMENT.
Warning: Do not disturb alignment of this set unless you are sure it is in need of adjustment.

When aligning the tuned circuits of the Model Sa 130 Lyric Channel Control receiver, it is necessary to follow the exact sequence of operations given in order to maintain accurate dial calibration and proper operation of the channel control system.

EQUIPMENT.

Equipment necessary for aligning the tuned circuits is as follows:

1. Calibrated RF oscillator with frequency range 550 - 1500 Kc.
2. Accurately calibrated 175 Kc. oscillator.
3. Output meter.
4. Insulated screw driver.

5. 3 Metalized 20,000 ohm, 1/2 watt resistors
   May be obtained from: International Resistance Corporation
   2006 Chestnut Street
   Philadelphia, Pa., or
   Rudolph Marlitzer Mfg. Company Service Dept.

G is:

During all ganging operations the "channel control" knob must be in full "on" (extreme clockwise) position and the channel control tube, (indicated on diagram) removed from socket.

INTERMEDIATE FREQUENCY SYSTEM.
The intermediate frequency system of this receiver consists of two stages of 175 Kc. amplification. Three IF transformers are used.
The attached diagram #56 A shows a bottom view of the rear edge of the chassis pan and indicates the points at which the 20,000 ohm resistors are connected and the adjusting screws of the IF transformers.

Energy from the 175 Kc. oscillator is fed into the set by removing the grid cap from the first detector tube and connecting the oscillator between the grid cap of the tube and the chassis pan. As weak a signal as possible should be used in order to eliminate the apparent broadband of tuning caused by the automatic volume control.

1. Attach 20,000 ohm resistor across points 1 and 2 (This is done by bending ends of resistor leads to form plugs and inserting one lead into one of the small eyelets #1 and the other into the large eyelet #2).
3. Remove resistor from 1 and 2 and connect across points 3 and 4.
4. Adjust screw "P" for maximum output.

Note: Resistor must be left connected across points 3 and 4 while adjusting 2nd and 3rd stages and RF circuits.

5. Adjust second IF transformer as described above placing a second resistor across points 5 and 6 when adjusting C and transferring it to points 7 and 8 when adjusting D.
   Note: Second resistor must be left connected across 7 and 8 while adjusting 3rd stage and RF circuits.
6. Adjust third IF transformer as described above placing a third resistor across points 9 and 10 when adjusting E and transferring it to points 11 and 12 when adjusting F.
   Note: Third resistor must be left across 11 and 12 while adjusting RF circuits.

Important: Be sure to leave the three 20,000 ohm resistors connected across the IF transformers at points 5 and 4, 7 and 6, 11 and 12 while gaging them. In place also while gaging the RF circuits. It is impossible to align these circuits if this is not done.
7. Tune channel control circuit (adjusting screw 0) for dip in output reading.

Note: The circuits of the three IF transformers are tuned for maximum output. The channel control circuit must be tuned for a dip or decrease in the output meter reading either side of which output increases.

It is important that the input from the 175 Kc. oscillator be kept as low as possible all during the aligning operations so this permits the most accurate adjustment.

and volume control turned all the way "On"

RF SYSTEM

Viewing the variable condenser from the front of the chassis the four sections tune various circuits in the following order:

1st Section) Antenna pre-selector system.
2nd Section) Oscillator.
3rd Section) RF interstage transformer.

In this receiver an adjustable padding condenser is used to obtain the difference of 175 Kc. between the tuning of the oscillator and remaining RF circuits. The adjusting screw for this condenser is accessible through a hole in the chassis pan between the partitions of the oscillator section of the variable condenser.

Before attempting to gang the RF circuits the service man should be sure that the IF and channel control circuits are accurately tuned to 175 Kc. as described in the preceding section.

1. Adjust dial mechanism so that when condenser is turned to maximum capacity with pointer against stop dial reads 562 Kc.

2. Set test oscillator to some known frequency between 550 and 600 Kc. Tune variable condenser so that pointer indicates this frequency on dial. Adjust trimmer condenser of oscillator section, third trimmer from front of chassis until signal is heard with maximum output.

3. Test set oscillator to some known frequency between 1400 and 1500 Kc. and tune variable condenser until pointer indicates this frequency on dial. Adjust trimmer condenser of oscillator section, third trimmer from front of chassis until signal is heard with maximum output. Note: There are two possible settings of the oscillator trimmer condenser at which the signal can be heard. The proper setting is that at which the trimmer is not to minimum capacity (plate of trimmer condenser turned out). The trimmer condensers of 1st, 2nd and 4th variable condenser sections should then be adjusted to give maximum output.

4. Align circuits at known frequencies approximately 1200 Kc., 900 Kc., 700 Kc. and 550 Kc. as follows: Set test oscillator to some known frequency. Approximately 1200 Kc., tune set so that dial indicates this frequency, bend adjustable sections of rotor end plates of oscillator condenser for maximum output, then bend adjustable sections of 1st, 2nd and 4th variable condenser sections for maximum output. Repeat process at some known frequency, approx. 900 Kc., 700 Kc. and 550 Kc. in order given.

With IF transformers set to exactly 175 Kc. and RF circuits aligned according to these instructions, the dial calibration should be accurate at all points of the dial to within one or two kilocycles.
ALIGNMENT OF RECEIVERS:

Because of the construction and thorough impregnation of the intermediate coils, the intermediate stages should rarely need retacking. Only when an intermediate coil has become defective due to an open or burned out winding, should it be necessary to readjust the intermediate trimmers. Should this occur, it is necessary that an oscillator be used and the intermediate trimmers be adjusted at 175 kilocycles. To align the intermediate stages, connect the high side of the oscillator output to the grid circuit of the first detector, which is done by disconnecting the grid cap of the 224 first detector and connecting the high side of the test oscillator to the control grid of this tube. The ground side of the test oscillator should be connected to the ground post on the chassis, set the oscillator at 175 kilocycles and adjust the output of the oscillator so that a convenient reading is obtained on the output meter. Be sure that the output from the oscillator is not so large that it will overload the second detector. If during the alignment the meter goes off scale, reduce the output of the test oscillator or adjust the receiver volume control.

The trimmers of the intermediate coils are accessible through the small holes in the bottom of the chassis. There are two trimmers to each intermediate coil. Align the grid trimmer of the first intermediate coil after a maximum reading is obtained by adjusting the grid trimmer of the first intermediate, adjust the primary for maximum reading and then redial the grid side to make certain the alignment of the secondary has not been changed by the adjustment of the primary. The same procedure is followed in aligning the second intermediate coils. After both intermediate coils are properly aligned the adjustment of the intermediate stage is complete and they should not be further disturbed.

Replace the grid cap on the first detector and connect the oscillator output leads to the antenna and ground posts of the receiver and set the oscillator at 1455 kilocycles. Then tune the receiver to 1455 kilocycles on the dial. It is important that the receiver be tuned to this point. If the receiver is out of the cabinet it will be necessary to use some temporary indicator so that the position 1455 kilocycles on the the dial may be accurately located. (This indicator should be set so that when the variable condensers are at the maximum capacity stop the indicator points to the last line on the dial at the low frequency end.) Then track the variable condensers by adjusting the trimmer condensers in the following order: Oscillator, antenna and radio frequency - (reading from the front of the receiver toward the back, the variable condenser sections are: Oscillator, antenna and radio frequency). After the variable condensers have been properly tracked at 1455 kilocycles, adjust the oscillator to 1295 kilocycles. Tune the receiver to this frequency. Check alignment of the condensers at this point by bending the end plate of the rotors in and out, noting the change in reading on the output meter. If when the plates are bent in the reading is increased, it is an indication that that particular section requires more capacity and the end plate should be permanently bent in at this point; or, if when the end plate is bent away the reading is increased, the end plate should be bent away permanently, as it is an indication that that particular section requires less capacity at that particular point. The variable condensers should be checked in this manner at 1850, 880, 650 and 550 kilocycles. These points have been chosen so as to take advantage of the slots in the end plates of the variable condensers. This procedure of bending plates should rarely be necessary on the oscillator section, as the plates of the oscillator section are especially designed to properly track over the broadcast spectrum, providing the antenna and radio frequency stages are correctly aligned.

**Tube Voltages**

<table>
<thead>
<tr>
<th>Type of tube</th>
<th>Position of Tube</th>
<th>Filament Volts</th>
<th>A Volts</th>
<th>C Volts</th>
<th>Normal Plate M.A.</th>
<th>Screen Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>224</td>
<td>Oscillator</td>
<td>2.4</td>
<td>82.5</td>
<td>2.15</td>
<td>2.75</td>
<td>47.5</td>
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<tr>
<td>225</td>
<td>Radio Frequency</td>
<td>2.4</td>
<td>224</td>
<td>2.19</td>
<td>2.75</td>
<td>27</td>
</tr>
<tr>
<td>224</td>
<td>1st Detector</td>
<td>2.4</td>
<td>230</td>
<td>4.35</td>
<td>.4</td>
<td>65</td>
</tr>
<tr>
<td>225</td>
<td>Intermediate</td>
<td>2.4</td>
<td>237</td>
<td>2.15</td>
<td>2.75</td>
<td>72</td>
</tr>
<tr>
<td>227</td>
<td>End Detector</td>
<td>2.4</td>
<td>237</td>
<td>2.15</td>
<td>2.75</td>
<td>72</td>
</tr>
<tr>
<td>247</td>
<td>Pentode</td>
<td>2.4</td>
<td>220</td>
<td>8.4*</td>
<td>32.5</td>
<td>250</td>
</tr>
<tr>
<td>247</td>
<td>Pentode</td>
<td>2.4</td>
<td>220</td>
<td>8.4*</td>
<td>32.5</td>
<td>250</td>
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<tr>
<td>250</td>
<td>Rectifier</td>
<td>4.0</td>
<td>100</td>
<td>2.1*</td>
<td>47.5 ca.plate</td>
<td>.5</td>
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<tr>
<td>224</td>
<td>1st Audio</td>
<td>2.4</td>
<td>100</td>
<td>2.1*</td>
<td>47.5 ca.plate</td>
<td>.5</td>
</tr>
</tbody>
</table>

**115 V. Line Voltage Control Full On**

"To read the 247 bias, read between 247 grid and ground.
These readings are only comparative and are not true voltages applied. The volt meter, when the readings are taken at these points, is in series with a very high resistance."
ALLIED RADIO CORP.  MODEL KNIGHT 6 Tube Dual Wave

<table>
<thead>
<tr>
<th>Tube</th>
<th>Position of tube</th>
<th>Filament volts</th>
<th>Plate volts</th>
<th>C volts</th>
<th>Normal plate M.A.</th>
<th>Screen Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>255</td>
<td>Composite Det. &amp; Osc. &amp; I.F.</td>
<td>2.3</td>
<td>225</td>
<td>2.5*</td>
<td>8</td>
<td>92</td>
</tr>
<tr>
<td>258</td>
<td>Elect. Cond. I.F. Transf.</td>
<td>2.3</td>
<td>225</td>
<td>5.</td>
<td>3.5</td>
<td>92</td>
</tr>
<tr>
<td>257</td>
<td>258 R.F. Tube</td>
<td>2.3</td>
<td>225</td>
<td>2.5*</td>
<td>8</td>
<td>92</td>
</tr>
<tr>
<td>255</td>
<td>257 Det. &amp; Osc. Tube</td>
<td>2.3</td>
<td>215</td>
<td>5</td>
<td>32.5</td>
<td>225</td>
</tr>
<tr>
<td>280</td>
<td>R. F. Coil #9077</td>
<td>4.9</td>
<td>271</td>
<td>5.85</td>
<td>32.5</td>
<td>225</td>
</tr>
<tr>
<td>247</td>
<td>R. P. Coil #9077</td>
<td>4.9</td>
<td>271</td>
<td>5.85</td>
<td>32.5</td>
<td>225</td>
</tr>
</tbody>
</table>

VOLTAGE TABLE:
Never check voltages until all tubes are fully warmed up to proper operating condition. The voltage table given below is taken at 115 volts line. It must be remembered that the voltage readings vary directly as the line voltage and also with the accuracy of the meters used. A variation of 10% plus or minus is permissible.

**The ground side of the test oscillator should be connected to either the ground lead of the set or to the chassis. Set oscillator at 175 kilocycles (this must be accurate) and adjust the output of the oscillator so that a convenient reading is obtained on the output meter. If during the alignment, the meter goes off scale reduce the output of the oscillator or adjust the receiver volume control.

Align the first intermediate transformer by turning the I.F. trimmer screw up and down until maximum reading is obtained on the output meter. The first intermediate transformer has two screws which are accessible through the top of the transformer shield can. The second I.F. trimmer should also be aligned in this manner. This trimmer is also mounted on top of the shield can. It is always best to re-check the adjustment after the first alignment to be sure that the alignment of the secondary has not been changed by the adjustment of the primary trimmer.
**INTERMEDIATE TRANSFORMERS:**
The intermediate transformers are of the band pass type and of exceptionally high uniform gain. They are tuned to 175 kilocycles. The intermediate frequency trimmers are mounted on an isolating base, preventing the transformer from becoming detuned due to the trimmer condensers absorbing moisture or warping. For this reason it should rarely, if ever, be necessary to re-track the intermediate frequency trimmers. In the event that an oscillator has become defective due to re-align the intermediate frequency coils, it is absolutely essential that a 175 kilocycle oscillator and an output measuring device be used.

**ALIGNMENT OF RECEIVER:**
Because of the construction and thorough impregnation of the intermediate coils, the intermediate stages stage rarely need re-tracking. Only when an intermediate stage has become defective due either to that should be necessary to re-adjust the intermediate trimmers. Should this occur, it is necessary that an oscillator be used and the intermediate trimmers be adjusted at 175 kilocycles. To align the intermediate stages, connect the high side of the oscillator output to the grid circuit of the first detector, which is done by disconnecting the grid cap of the 224 first detector and connecting the high side of the test oscillator to the control grid of this tube. The ground side of the test oscillator should be connected to the ground post on the chassis. Set the oscillator at 175 kilocycles and adjust the output of the oscillator so that a convenient reading is obtained on the output meter. Be sure that the output from the oscillator is not so large that it will overload the second detector. If, during the alignment the meter goes off scale, reduce the output of the test oscillator or adjust the receiver volume control.

The trimmers of the intermediate coils are accessible through the small holes in the top of the intermediate shield can. There are two trimmers to each intermediate coil. Align the grid trimmer of the first intermediate coil. After a maximum reading is obtained by adjusting the grid trimmer, trim the primary for maximum reading and then re-check the grid side to make certain that the alignment of the secondaries has not been changed by this adjustment of the primary. The same procedure is followed in aligning the second intermediate coils. After both intermediate coils are properly aligned the adjustment of the intermediate stage is complete and they should not be further disturbed.

Replace the grid cap on the first detector and connect the oscillator output leads to the antenna and ground posts of the receiver and set the oscillator at 1435 kilocycles. Then tune the receiver to 1435 kilocycles on the dial. It is important that the receiver be tuned to this point. If the receiver is out of the cabinet it will be necessary to use some temporary indicator so that the receiver is 1435 kilocycles on the dial may be accurately located. (This indicator should be set so that when the variable condensers are at the maximum capacity stop the indicator points to the last line on the dial at the low frequency end.) Then track the variable condensers by adjusting the trim condensers in the following order: Oscillator, antenna and radio frequency - (reading from the front of the receiver toward the back, the variable condenser sections are: Oscillator, antenna and radio frequency). After the variable condensers have been properly tracked at 1435 kilocycles, adjust the oscillator to 1295 kilocycles. Tune the receiver to this frequency. Check alignment of the condensers at this point by bending the end plate of the rotors in and out, noting the change in reading on the output meter. If when the plates are bent in the reading is increased, it is an indication that that particular section requires more capacity and the end plate should be permanently bent in at this point; or, if when the end plate is bent away, the reading is increased, the end plate should be bent away permanently, as it is an indication that that particular section requires less capacity at that particular point. The variable condensers should be checked in this manner at 1295, 890, 420 and 350 kilocycles. These points have been chosen so as to take advantage of the slots in the end plates of the variable condensers. This procedure of bending plates should rarely be necessary on the oscillator section, as the plates of the oscillator section are especially designed to properly track over the broadcast spectrum, providing the antenna and radio frequency stages are correctly aligned.

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**ELECTRO DYNAMIC SPEAKER:**
The electro dynamic speaker has a tapped field winding - one section of which is 1320 ohms and is utilized as the second choke in the filter circuit. The other section, which is 300 ohms, is used to obtain the proper bias for the 247 tube, as well as acting as an additional filter choke.
SIX TUBE AUTOMOBILE RADIO

List of Parts

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 R.F. Coils</td>
<td>R3, 50,000 ohms</td>
</tr>
<tr>
<td>1 3Gang Condenser</td>
<td>R4, 50,000 ohms</td>
</tr>
<tr>
<td>1 Input Push-pull Triode</td>
<td>R5, 2 meg.</td>
</tr>
<tr>
<td>C1, C2, C3, C4, C5, 1/2 Mfd. Cond.</td>
<td></td>
</tr>
<tr>
<td>C6, 01 Cond.</td>
<td>R8, 250,000</td>
</tr>
<tr>
<td>C7, 001 Cond.</td>
<td>R7, 250,000</td>
</tr>
<tr>
<td>R1, 200 ohms</td>
<td>R8, 2,000 ohms</td>
</tr>
<tr>
<td>R2, 10,000 ohms</td>
<td>R9, 500 ohms</td>
</tr>
</tbody>
</table>

The 5 Tube Model identical to above print except less 1 - 41 tube.
AMRAD—Model 81
Line Voltage 120—Set on 120 Volt Tap—Volume Control Position Full On
Note: To get the 10.5 V. reading (4-8) the hum control potentiometer must be turned to ground side.

BEL - CANTO SERIES
RCA Speaker
0.8 Ohm
Secondary
410 Ohm Primary
Aria, Minuettes, Serenata, Duet, Symphony
4700 Ohm Field
Peerless Speaker
Single turn
Secondary
560 Ohm Primary
Condenser Data on next page.
MODEL Bel-Canto 81
Condenser Data

AMRAD CORPORATION

BY-PASS BLOCK CONDENSER, NO. 8113

"Lug Terminal" Style. This block contains Fixed Condensers, C3, C4, C6, C7, C9. The different units are indicated, with their connections to their respective circuits.

BY-PASS BLOCK CONDENSER, NO. 8113

"Wire Terminal" Style. This block contains the same units as does the No. 8113 "Lug Terminal" Style. To test for capacity, opens or shorts, it is necessary to disconnect at least one terminal of the unit from the circuit.
ATWATER KENT MFG. CO.

Model 20 # 7570

Data

CONDENSERS

Detector phone 0.002 mfd # 8241 500 volts
Detector grid .000250 mfd # 4465 500 volts
Plate bypass .3 mfd # 14902 450 volts

RESISTORS

Grid suppressors 600 ohms # 4949 wire wound
Detector grid leak 2 megs # 15892 1 watt Green
R-f rheostat 10 ohms # 4690
Detector rheostat 10 ohms # 4690

TRANSFORMERS

1st a-f primary 1700 ohms # 4779
1st a-f secondary 3250 ohms
2nd a-f primary 1700 ohms # 4779
2nd a-f secondary 3250 ohms

Model 20 # 4640

The parts used in # 4640 are substantially the same as used in # 7570 shown above, with the following exceptions.

1st and 2nd a-f transformers have different part numbers. In # 4640 they are # 7661. The d-c resistance of the respective primary and secondary windings is the same as designated for Model 20 # 7570. In other words a-f transformers # 4779 and # 7661 have like d-c resistance specifications for the primary and secondary windings. In receiver # 4640, transformer # 7661 is used in both the 1st and 2nd stages.

The detector grid condenser in receiver Model 20 # 4640 has the same capacity and voltage rating as used in # 7570, but has a different part number. The part number of this unit in receiver # 4640 is # 8112.

In both receivers, the plate circuit bypass condenser is adjacent to the 2nd r-f stage socket. The grid and phone condensers are adjacent to the detector and a-f assembly.

The wiring diagram in the manual shows a .2 mfd condenser as the plate circuit bypass unit. The Atwater-Kent specifications in their diagram manual shows such a condenser. On the other hand the parts specifications show a .3 mfd condenser in this position. If a .2 mfd unit is being used and the receiver performs well, there is no occasion for a change.
## Model 20 #7960

### DATA

**CONDENSERS**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Part Number</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector phone</td>
<td>0.002 mfd</td>
<td>#8241</td>
<td>500 volts</td>
</tr>
<tr>
<td>Detector grid</td>
<td>0.0025 mfd</td>
<td>#8112</td>
<td>500 volts</td>
</tr>
<tr>
<td>Plate bypass</td>
<td>0.3 mfd</td>
<td>#14902</td>
<td>450 volts</td>
</tr>
</tbody>
</table>

**RESISTORS**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Part Number</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid suppressors</td>
<td>600 ohms</td>
<td>#4949</td>
<td>wire wound</td>
</tr>
<tr>
<td>Detector grid leak</td>
<td>2.0 megs</td>
<td>#15892</td>
<td>1 watt Green</td>
</tr>
<tr>
<td>Detector bias</td>
<td>450 ohms</td>
<td>#8190</td>
<td>tapped 180-270 ohms</td>
</tr>
<tr>
<td>A-f filament</td>
<td>1.0 ohm</td>
<td>#8303</td>
<td>brown covered</td>
</tr>
<tr>
<td>Detector rheostat</td>
<td>20. ohms</td>
<td>#8310</td>
<td></td>
</tr>
<tr>
<td>R-f rheostat</td>
<td>10. ohms</td>
<td>#4690</td>
<td></td>
</tr>
</tbody>
</table>

**TRANSFORMERS**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Part Number</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st a-f primary</td>
<td>1000 ohms</td>
<td>#8060</td>
<td></td>
</tr>
<tr>
<td>1st a-f secondary</td>
<td>8000 ohms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd a-f primary</td>
<td>1700 ohms</td>
<td>#7661</td>
<td></td>
</tr>
<tr>
<td>2nd a-f secondary</td>
<td>3250 ohms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The detector grid bias resistor is adjacent to the detector socket. It is a flat resistor. The plate bypass condenser is adjacent to the 2nd r-f socket. The phone condenser is located between the detector and 1st a-f sockets.
Model 30 Early

**CONDENSERS**

- Detector phone: 0.002 mfd # 8241, 500 volts
- Detector grid: 0.0025 mfd # 8112, 500 volts
- Plate bypass: 0.3 mfd # 14902, 450 volts

**RESISTORS**

- Grid suppressors: 500 ohms # 8092, flat wire wound
- Detector grid leak: 2.0 mgs # 15892
- Detector bias: 450 ohms # 8190
- A-f filament: 1.5 ohm # 8256, tapped 180-270 ohms
- Detector rheostat: 20 ohms # 8310
- R-f rheostat: 10 ohms # 4690

**TRANSFORMERS**

- 1st a-f primary: 1000 ohms # 8060
- 1st a-f secondary: 7000 ohms
- 2nd a-f primary: 1700 ohms # 7661
- 2nd a-f secondary: 3250 ohms
- Antenna Choke: 35 ohms # 8232

**Note.** The early production of Model 30 can be recognized by the moulded end plate tuning condensers. The later production employed metal end plate or frame condensers. Furthermore, the early production has three separate sockets for the r-f tubes. The later production employs a single moulded base for the three r-f sockets. The same wiring diagram is used for the early and late productions of this receiver.

Model 30 Late

The parts employed in Model 30 Late, are substantially the same as used in Model 30 Early, with the exceptions as noted and also, the use of grid suppressors of 350 ohms each and part # 8439. These resistors are small flat, wire wound units.

Model 48

Model 48 is the identical of Model 30 Late, but has a gold finished panel and a few minor refinements.

Model 35 Early

Model 35 is like Model 30 except that the detector and a-f filaments are controlled by a single fixed resistor of 1.0 ohm, part # 8126 (brown covered). Also that grid suppressors are part # 8225. Same value as in Model 30 Early.
MODEL 32

ATWATER KENT MFG. CO.

Data

Model 32

CONDENSERS

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Part No.</th>
<th>Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector phone</td>
<td>.002 mfd</td>
<td>8241</td>
<td>500</td>
</tr>
<tr>
<td>Detector grid</td>
<td>.00025 mfd</td>
<td>8112</td>
<td>500</td>
</tr>
<tr>
<td>Plate bypass</td>
<td>.3 mfd</td>
<td>14902</td>
<td>450</td>
</tr>
</tbody>
</table>

RESISTORS

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Part No.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid suppressors</td>
<td>865 ohms</td>
<td>8284</td>
<td>flat wire wound</td>
</tr>
<tr>
<td>Detector grid leak</td>
<td>2.0 mgs</td>
<td>15892</td>
<td>1 watt green</td>
</tr>
<tr>
<td>Detector bias</td>
<td>450 ohms</td>
<td>8190</td>
<td>tapped 180-270 ohms</td>
</tr>
<tr>
<td>A-f filament</td>
<td>1.5 ohm</td>
<td>8265</td>
<td>green covered</td>
</tr>
<tr>
<td>Detector rheostat</td>
<td>20 ohms</td>
<td>8310</td>
<td></td>
</tr>
<tr>
<td>R-f rheostat</td>
<td>5 ohms</td>
<td>8308</td>
<td></td>
</tr>
</tbody>
</table>

TRANSFORMERS

<table>
<thead>
<tr>
<th>Transformer Type</th>
<th>Value</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st a-f primary</td>
<td>1000 ohms</td>
<td>8060</td>
</tr>
<tr>
<td>1st a-f secondary</td>
<td>7000 ohms</td>
<td></td>
</tr>
<tr>
<td>2nd a-f primary</td>
<td>1700 ohms</td>
<td>7661</td>
</tr>
<tr>
<td>2nd a-f secondary</td>
<td>3250 ohms</td>
<td></td>
</tr>
</tbody>
</table>

CHOKES

<table>
<thead>
<tr>
<th>Choke Type</th>
<th>Value</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna choke</td>
<td>35 ohms</td>
<td>8232</td>
</tr>
</tbody>
</table>

Phone condenser and grid bias resistor are mounted upon detector and a-f tube shelf. The plate bypass condenser is located adjacent to the 4th r-f socket. The antenna choke listed above is designated as the "choke coil" in the wiring diagram. The antenna choke is located near the 1st r-f tube socket. The plate bypass condenser referred to in the above parts specification is listed as "fixed condenser" in the wiring diagram. While it is true that the wiring diagram illustrates a 3. meg detector grid leak, the Atwater-Kent parts list calls for the 2. meg unit mentioned above.

Model 35 Late

The parts used in the Model 35 Late, are the same as in Model 35 Early, except that the grid suppressors are 350 ohms each and are part # 8349 and are flat wire wound units.
MODEL 36 Receiver Chassis Data

ATWATER KENT MFG. CO.

MODEL 36

SPECIAL NOTE. The parts listed on this page are those used in the receiver chassis. The power supply chassis was available in two productions. The diagrams of the two power supply units are shown on page 98 of Rider's Manual, Volume 1. See Special page 98 for data concerning these two power packs.

These parts in receiver chassis

CONDENSERS

Detector phone .002 mfd # 9598 500 volts
Detector grid .00025 mfd # 8112 500 volts
Speaker filter .3 mfd # 14902 450 volts
R-f filament and plate bypass .3 mfd 200 volts

RESISTORS

Volume control two sections 425 ohms # 9781-9782 Each section 425 ohms
Filament shunt 50 ohms # 9597 tapped 25-25 ohms
Detector grid leak 2. mega # 15892 1 watt green
Grid suppressors 800 ohms # 8996 flat wire wound

TRANSFORMERS

1st a-f primary 1000 ohms # 8060
1st a-f secondary 700 ohms
2nd a-f primary 1700 ohms # 7661
2nd a-f secondary 3250 ohms

Note... In late "Y" units shown on page 139 the following resistors are used but not shown in the schematic. The "Y" unit is the power pack for the Model 36 receiver. These parts in power unit chassis.

RESISTORS

Detector plate 0.1 meg # 8919 green paint
1st a-f plate 12500 ohms # 15941 1 watt purple and yellow
R-f and 1st a-f bias 1100 ohms # 9691 wire wound elliptical
2nd a-f bias 1750 ohms # 9692 wire wound elliptical

These units and three center tapped filament shunt resistances are contained upon the panel assembly, which is located within the metal unit. The filament shunt resistors are of 20 ohms each, part # 9434.

Special attention is called to the fact that the r-f and 1st a-f filament circuit contains resistance wire in place of fixed resistors. The same is true of the detector circuit. See schematic of the early "Y" unit on page 139 Resistor 15941 (12,500 ohms) may be marked 9424, when found in the chassis. It is to be replaced by unit # 15941.
ATWATER KENT MFG. CO.

MODEL 33 and 49

Data

Model 33

CONDENSERS

Detector phone  .002 mfd  # 8241  500 volts
Detector grid  .00025 mfd  # 8112  500 volts
Plate bypass  .3 mfd  # 14902  450 volts

RESISTORS

Grid suppressors  800 ohms  # 8996  flat wire wound
Detector grid leak  2. megs  # 15892  1 watt green
detector bias  450 ohms  # 8190  tapped 180 - 270 ohms
da-f filament  1.5 ohms  # 8256  green covered
detector rheostat  20 ohms  # 8310
r-f rheostat  10 ohms  # 4690

TRANSFORMERS

1st a-f primary  1000 ohms  # 8060
1st a-f secondary  7000 ohms
2nd a-f primary  1700 ohms  # 7661
2nd a-f secondary  3250 ohms

The wiring diagram illustrates a .5 mfd fixed condenser. This should be the value quoted in the table above in connection with the plate bypass condenser. In other words, the .5 mfd specification in the wiring diagram should be .3 mfd. The r-f control rheostat shown in the wiring diagram is rated at 20 ohms. The correct figure is 10 ohms, as stated in the table above.

The difference between the Model 33 and the Model 49 is that the latter has a gold finished panel. The antenna adjustment specification in the wiring diagram is a separately variable plate which is a part of the first tuning condenser. This plate is controlled by a small knob.

The wiring diagram on page 137 of Rider's Manual, Volume 1 shows a .006 mfd phone condenser. The correct value is as stated in the table above. At the time the diagrams were first published, the values designated were assumed to be correct as secured from supposedly reliable sources. The diagram further shows a 3. meg grid leak. This data was a part of the original diagram as furnished by the A-K organization. Subsequent to the publication of the original diagram, the parts list for that receiver showed a 2. meg grid leak as advised in the table.

Model 49

The Model 49 receiver is the same as the Model 33 and the parts list supplied above is applicable in its entirety.
MODEL 38
Early and Late
Data
SPECIAL NOTE.
Wiring diagram of power unit for Model 38 receiver is shown on page 144

These parts are in the receiver chassis.

CONDENSERS

R-f filament bypass .3 mfd # 16158
R-f plate bypass .05 mfd # 16155
Speaker filter .3 mfd # 14902
Detector phone .002 mfd # 9598
Detector grid .00025 mfd # 8112

* In one can.

RESISTORS

Volume control 400 ohms # 13604
Grid suppressors 800 ohms # 8996
Detector grid leak 2.0 mgs # 15892
Filament shunt ** 50 ohms # 9597
R-f plate (late 38 only) 1500 ohms # 16253

** In early 38 only.

TRANSFORMERS

1st a-f primary 1000 ohms # 8060
1st a-f secondary 7000 ohms
2nd a-f primary 1700 ohms # 7661
2nd a-f secondary 3250 ohms

NOTE.
Other parts used in this receiver and to be found in the power pack are listed in connection with the power pack shown on special page 144

POWER PACK for Model 38.

The power pack for the Model 38 receivers is the same as for the Model 37 (early) and (late) except that the r-f and 1st a-f bias resistor is 550 ohms, # 13138 in the (early) pack and is of the same ohmic value but part # 13303 in the (late) pack. Both are elliptical resistors, wire wound.

CONDENSER NOTE.

The r-f filament and r-f plate bypass condenser listed in the Atwater-Kent parts lists as # 16158 contains four individual condensers, although the receiver circuit employs only three of these units. It is possible that the fourth condenser which is of .2 mfd may be tied in with the .05 mfd unit via external connections. Bear in mind that this form of connection is not stated as being standard practice. This .2 mfd condenser is also rated at 400 volts.
A 2nd A.F. filament shunt resistor is used before Serial No. 1,752,000 and the green-yellow tracer cable lead is not used. Connections for this resistor are shown in dotted lines in the diagram on page 61. A schematic diagram of the volume control is shown in Fig. 78.

A 2nd A.F. filament shunt resistor is used before Serial No. 1,385,000, in which case speaker post No. 2 connects to the centre-tap of this resistor, and the green-yellow tracer lead is not used. The R.F. plate circuit resistor is used after Serial No. 1,385,000.

In Model 37-C the on-off switch is connected to the two terminals on either side of the ground cybert. A 2nd A.F. filament shunt resistor is used in the chassis of all Model 37-C receivers.

**ATWATER-KENT—Models 37-38**

Line Voltage 115—On Early Models "B" and "C" Voltages Are Lower Than Shown

<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>POSITION OF THIS RESISTOR</th>
<th>Time Out</th>
<th>D.V.</th>
<th>Time in Seconds</th>
<th>D.V.</th>
<th>Time in Seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>225</td>
<td>R-2</td>
<td>3.4</td>
<td>192</td>
<td>12</td>
<td>2.0</td>
<td>260</td>
<td>2.0</td>
</tr>
<tr>
<td>226</td>
<td>R-2</td>
<td>3.4</td>
<td>192</td>
<td>12</td>
<td>2.0</td>
<td>260</td>
<td>2.0</td>
</tr>
<tr>
<td>227</td>
<td>R-2</td>
<td>3.4</td>
<td>192</td>
<td>12</td>
<td>2.0</td>
<td>260</td>
<td>2.0</td>
</tr>
<tr>
<td>228</td>
<td>R-2</td>
<td>3.4</td>
<td>192</td>
<td>12</td>
<td>2.0</td>
<td>260</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**SKETCH SHOWING CONNECTIONS FROM R.F. TRANSFORMER**

**WIRING DIAGRAM OF MODEL 37, 37-F, 37-C.**

**WIRING DIAGRAM OF MODEL 38.**

**POWER PACK ON PAGE 144**

**POWER PACK ON PAGE 144**
MODEL 37
Power Pack
Early and Late
Data

Schematic

RESISTORS

Detector plate
100000 ohms
#6919 Green paint
1st a-f plate
12500 ohms
#15941 red
R-f and 1st a-f bias
1100 ohms
#9691 elliptical
2nd a-f bias
1750 ohms
#9692 elliptical
Filament shunt
20 ohms #9434
Speaker choke
500 ohms
Filter chokes
1600 ohms total

CONDENSERS

Early
See schematic
Late
See Schematic. Condenser unit is # 13315. Also houses transformer.

Special Note.
A 1. mfd condenser is also contained in the transformer-condenser housing but this condenser is not connected in the model 37 power pack.

Diagram of Power Unit in Models 37 and 33

ATWATER KENT MFG. CO.
ATWATER KENT MFG. CO.  MODEL 40, 42 and 52

Data

Model 40, 42 and 52

These parts are to be found in receiver chassis.

CONDENSERS

R-f filament bypass  .3 mfd # 15158  200 volts *
R-f plate bypass     .05 mfd # 15158  400 volts *
Speaker filter       .5 mfd # 14902  450 volts
Detector filter      .002 mfd # 9598  500 volts
Detector grid        .00025 mfd # 8112  500 volts

* In one can.

RESISTORS

Volume control       400 ohms # 13604  wire wound
Grid suppressors     350 ohms # 8439   flat wire wound
R-f plate            3000 ohms # 13369  flat wire wound
Detector grid leak   2.0 megs # 15892 1 watt green

TRANSFORMERS

1st a-f primary      1000 ohms # 8069
1st a-f secondary    7000 ohms
2nd a-f primary      1700 ohms # 7661
2nd a-f secondary    3250 ohms

These parts are to be found in the power pack chassis.

See page 145

RESISTORS

Detector plate       65000 ohms # 15592 1 watt black or black and green
1st a-f plate        12500 ohms # 15941 1 watt red or purple and red or purple and yellow flat wire wound *
R-f and 1st a-f bias 625 ohms # 13538 flat wire wound *
2nd a-f bias         2200 ohms # 13538 flat wire wound *
Line voltage **      28 ohms # 13645 flat wire wound
Filament shunt       20 ohms # 9434 flat wire wound

* # 13538 is a single unit tapped 625 and 2200 ohms
** This line voltage control used only in Models 42 and 52

CHOICES

Speaker               500 ohms
Filter                1320 ohms total

SPECIAL NOTES ON FILTER CONDENSERS

It is necessary to refer to the power pack schematic on page 145 for the first model 40 power pack.

Also to the same page for the regular run of Models 42 and 52 power packs. In these units, the three filter condensers have capacity values of 1.5 mfd each. This assembly can be recognized by the fact that the speaker choke

Page reference is 100 in Vol. 1.
as a part of the assembly. The detector bypass condenser is rated at .5 mfd and the 1st a-f bypass condenser also is of .5 mfd. This type of assembly is also used in the 40-F, 42-F and 52-F.

The second type Model 40 power pack differs from the first. Refer to page 148 lower half of the page. You will find a circular illustration towards the right hand end of the layout, designated as condenser assembly. In this case, the condenser assembly is separate from the choke assembly. Only two filter condensers are used. The condenser shown on page 100 as connected between (F-1) of the rectifier filament system and ground, has been omitted. The first filter condenser in the revised power pack circuit is of 2.0 mfd and is connected to condenser terminal (1). The respective terminals upon this condenser represent the actual numerical designations upon the condenser unit in the power pack. In the majority of instances the condenser units are connected between the main can and the respective terminals. There are however some cases where the condenser unit is connected between two terminals.

The output filter condenser is of .5 mfd and joins terminal (5), being connected between terminal (5) and the main housing can. The detector bypass condenser is of .5 mfd and is connected to terminal (2), between terminal (2) and the condenser can. The 1st a-f bypass condenser is also of .5 mfd, but in this case is connected between the terminals (3) and (4).
SPECIAL NOTE.

Wiring diagrams of the three types of power packs employed in conjunction with this receiver are shown upon page 160.

These parts are in the receiver chassis.

CONDENSERS

R-f filament bypass  0.1 mfd  # 15157  450 volts *
R-f plate bypass  0.1 mfd  # 15157  450 volts *
Detector phone  0.002 mfd  # 14072  500 volts
Detector grid  0.00025 mfd  # 8112  500 volts
Volume control bypass  0.03 mfd  # 13956  200 volts **
Detector filament bypass  0.2 mfd  # 13956  200 volts **
* All condensers in one can. Three used for r-f filament and one for r-f plate circuit.
** Both condensers in same can.

RESISTORS

Volume control  400 ohms  # 13604  wire wound
Grid suppressors  350 ohms  # 8439  flat wire wound
Detector grid leak  2.0 mgs  # 15892  1 watt green tapped for 235, 125 and 175 ohms. Yellow lead to contact 1. Between contact 1 and 2, 235 ohms; between contact 2 and 3, 125 ohms. Between contact 3 and 4, 175 ohms. Flat wire wound.
Filament shunt  535 ohms  # 14039  thin tubular thin green covered, flex.

TRANSFORMERS

1st r-f plate  5000 ohms  # 13901
1st r-f bias  4 ohms  # 13961

1st a-f primary  1000 ohms  # 8060
1st a-f secondary  7000 ohms
2nd a-f primary  900 ohms  # 14015
2nd a-f secondary  7000 ohms

These parts are in the power pack chassis.

Voltage regulator  242 ohms  # 14041  flat wire wound
Detector plate resistor  12500 ohms  # 15941  Originally # 9424. Tubular
Filter chokes  90 ohms Total
Output choke  550 ohms
ATWATER KENT MFG. CO. MODEL 43 Receiver

Schematic

Wiring Diagram of Model 43 Set.
The +B, 1st A.F. cable lead is black with a red tracer.

Wiring diagram of Model 43 power pack is shown on 152

Test Chart for Model 43.
Model 43
Power Pack
Schematic

ATWATER KENT MFG. CO.

Wiring Diagram of Power Unit in Model 43.

Showing Connections and Approximate Position of Leads from Sealed Container in Model 43 Power Unit.

Early type of power unit for Model 43, two brown leads from the primary-shunt condenser connect to the +B, 2A terminal and to the brown P2Aa lead respectively. In later models these connections are made internally.
SPECIAL NOTE. For wiring diagram see Model 43

CONDENSERS

<table>
<thead>
<tr>
<th>Part</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-f filament bypass</td>
<td>.3 mfd # 15158</td>
</tr>
<tr>
<td>R-f plate bypass</td>
<td>.05 mfd # 15158</td>
</tr>
<tr>
<td>Detector phone</td>
<td>.002 mfd # 9598</td>
</tr>
<tr>
<td>Detector grid</td>
<td>.00025 mfd # 14861</td>
</tr>
</tbody>
</table>

200 volts) in one can

400 volts)

500 volts

RESISTORS

<table>
<thead>
<tr>
<th>Part</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume control</td>
<td>400 ohms # 13604</td>
</tr>
<tr>
<td>Grid suppressors</td>
<td>350 ohms # 8439</td>
</tr>
<tr>
<td>R-f plate</td>
<td>3000 ohms # 13369</td>
</tr>
<tr>
<td>Detector cathode</td>
<td>3000 ohms # 13369</td>
</tr>
<tr>
<td>Detector grid leak</td>
<td>2.0 megs # 15892</td>
</tr>
</tbody>
</table>

flat wire wound

flat wire wound

flat wire wound

green 1 watt

These parts in power pack chassis

CONDENSERS

It is necessary to quote the color code connections of the condensers as they emanate from the condenser can.

Black= ground...White= 2. mfd...Green yellow= 1.5 mfd...Blue= 1.5 mfd...

Yellow= 1. mfd... Black and red and black and red= .5 mfd...

RESISTORS

<table>
<thead>
<tr>
<th>Part</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector plate</td>
<td>65,000 ohms # 15592</td>
</tr>
<tr>
<td>1st a-f plate</td>
<td>12,500 ohms # 15941</td>
</tr>
<tr>
<td>R-f, 1st a-f bias</td>
<td>625 ohms # 14427</td>
</tr>
<tr>
<td>2nd a-f bias</td>
<td>1,000 ohms # 14427</td>
</tr>
<tr>
<td>Filament shunt</td>
<td>20 ohms # 9434</td>
</tr>
</tbody>
</table>

1 watt

1 watt

single unit. flat wire wound and tapped.

flat tapped 10-10 ohms

CHASES

<table>
<thead>
<tr>
<th>Part</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter #1 and #2</td>
<td>300 ohms</td>
</tr>
<tr>
<td>Speaker field (46)</td>
<td>1700 ohms # 15629</td>
</tr>
<tr>
<td>Speaker field (53)*</td>
<td>2500 ohms # 14361</td>
</tr>
<tr>
<td>Speaker field (53)**</td>
<td>1700 ohms # 15631</td>
</tr>
</tbody>
</table>

This value in early (53) only.

This value in late (53) only.
MODEL 47

ATWATER KENT MFG. CO.

Model 47

SPECIAL NOTE.

Model 47 is similar to Model 46, bearing in mind the notes stated on page 154 and the information specified below. All parts not mentioned in the following list are as stated in connection with Model 46.

1st and 3rd grid suppressors 350 ohms # 8439
2nd grid suppressors 500 ohms # 8225
R-f plate resistor 1500 ohms # 16253
R-f and 1st a-f bias 550 ohms # 15063)
2nd a-f bias 1000 ohms # 15063)
Speaker field 1700 ohms # 16629

The above mentioned units are used in the Model 47, in place of whatever equivalent units are stated as being used in Models 46 and 53 and the balance of the units listed in connection with Models 46 and 53 may be interpreted as being used in Model 47.
MODEL 44 and 45

ATWATER KENT MFG. CO.

SPECIAL NOTE.

1st type power unit for Model 44 is shown on page 145. Second type power unit for Model 45 is shown on page 148.

TRANSFORMERS IN MODELS 44 and 45

1st a-f primary 1000 ohms  2nd a-f primary 1700 ohms
1st a-f secondary 7000 ohms  2nd a-f secondary 3250 ohms

Pages referred to are 3-11 and 3-12.
MODEL 50

ATWATER KENT MFG. CO.

Model 50

CONDENSERS

- Detector grid 0.0025 mfd # 8593 500 volts
- Detector phone 0.002 mfd # 8590 500 volts
- Plate bypass .3 mfd # 14902 450 volts

RESISTORS

- Detector grid leak 2.0 mgs # 15892 (8195) 1 watt
- 1st r-f plate 12500 ohms # 8796 yellow glass
- A-f filament 1.5 ohms # 8627 black covered, flexible
- Detector rheostat 20 ohms # 8310
- R-f rheostat 5 ohms # 8599
- R-f grid leak 2.0 mgs # 15892 (8195) 1 watt

CHOKES

- A-f plate 35 ohms # 8232

TRANSFORMERS

- 1st a-f primary 1000 ohms # 8650
- 1st a-f secondary 7000 ohms
- 2nd a-f primary 1400 ohms # 8940
- 2nd a-f secondary 7000 ohms

Note—Black lead (-F) is grounded—not shown in diagram
Most of Model 50 Sets also have an R.F. choke
between plate of second audio tube and speaker post No. 1.

WIRING DIAGRAM OF MODEL 50.
## ATWATER KENT MFG. CO.

### VOLTAGE TABLE

<table>
<thead>
<tr>
<th>Tube</th>
<th>Filament</th>
<th>Plate Early</th>
<th>Plate Late</th>
<th>Grid Early</th>
<th>Grid Late</th>
<th>Screen Early</th>
<th>Screen Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-F</td>
<td>2.2</td>
<td>160</td>
<td>160</td>
<td>2.8</td>
<td>3.7</td>
<td>78</td>
<td>96</td>
</tr>
<tr>
<td>Det</td>
<td>2.2</td>
<td>101</td>
<td>101</td>
<td>11.0</td>
<td>11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st A-F</td>
<td>2.2</td>
<td>64</td>
<td>69</td>
<td>1.8</td>
<td>2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd A-F</td>
<td>2.2</td>
<td>213</td>
<td>230</td>
<td>39</td>
<td>46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rec</td>
<td>4.5</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Measured voltage, not operating voltage. Line voltage 110 V.

### FILTER CONDENSER CONNECTIONS

- First a-f Filter: 5 mfd, connected between centre terminal (3) and can.
- Detector Filter: 1.5 mfd, connected between centre terminal (4) and can.
- First a-f Bias: 2.0 mfd, connected between terminals (2) and (4).
- Filter #2: 2.3 mfd
- Filter #3: 10 mfd
- Filter #4: 5 mfd

The numbers refer to the figures shown within the circle representing the filter condenser data.
MODEL 55, 55-C
Early

ATWATER KENT MFG. CO.

Diagram of Model 55, 55-C, showing the internal wiring and component placements.

This drawing shows the new style R.F. bias resistor. In some early sets a separate double-type phone condenser is used.
MODEL 55-F and 55-FC
ATWATER KENT MFG. CO.

Early

VOLTAGE TABLE

<table>
<thead>
<tr>
<th>Tube</th>
<th>Filament</th>
<th>Plate</th>
<th>Grid</th>
<th>Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-F</td>
<td>2.2</td>
<td>160</td>
<td>3.7</td>
<td>96</td>
</tr>
<tr>
<td>Det</td>
<td>2.2</td>
<td>101</td>
<td>11.</td>
<td></td>
</tr>
<tr>
<td>1st A-F</td>
<td>2.2</td>
<td>69</td>
<td>2.8*</td>
<td></td>
</tr>
<tr>
<td>2nd A-F</td>
<td>4.5</td>
<td>174</td>
<td>41.</td>
<td></td>
</tr>
<tr>
<td>Rect.</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Measured voltage, not operating voltage. Line voltage 110 V.

Diagram of Early-Type Model 55-F and 55-FC
ATWATER KENT MFG. CO. MODEL 55-F and 55-FC Chassis Early

Bottom Wiring of Early-Type Model 55-F and 55-F-C.

Some of these sets had a combination resistor, No. 10374, which is superceded by two separate resistors, No. 10388 being used as R. F. bias resistor, and No. 10077 as filament shunt resistor.
FILTER CONDENSER CONNECTIONS. See data pertaining thereto on page 162. Bypass condenser specifications are shown below.
## Comparison of the Three Types of Model 60-C

<table>
<thead>
<tr>
<th></th>
<th>IN THE FIRST TYPE</th>
<th>IN THE SECOND TYPE</th>
<th>IN THE THIRD TYPE</th>
</tr>
</thead>
</table>
| **VOLUME CONTROL**  | A **single** volume control regulates the screen-voltage| A **dual-type** volume control—  
|                     | 1. Regulates the amount of R.F. energy transferred from the 1st- to the 2nd-R.F. tube. | 1. Regulates the amount of R.F. energy transferred from the antenna circuit to the 1st-R.F. tube. | 1. Regulates the **R.F. control** grid voltage. |
|                     | 2. Regulates the screen-voltage.                        | 2. Regulates the R.F. control grid voltage.             |                                                        |
| **LOCAL-DISTANCE SWITCH** | The local-distance switch is connected to the primary of No. 2 R.F.T. (between the 1st and 2nd R.F. tubes). | The local-distance switch is connected to the 2nd stoppong condenser (between the 2nd- and 3rd-R.F. tubes). | The local-distance switch is connected to the secondary of No. 1 R.F.T. (ahead of the 1st-R.F. tube). |
|                     | In the distance position, the switch cuts in the entire primary of No. 2 R.F.T., thus giving three straight stages of R.F. amplification. | In the distance position, the switch connects the 2nd stoppong condenser to the plate of the 2nd-R.F. tube, thus giving three straight stages of R.F. amplification. | In the distance position, the switch connects the grid-return lead of the 1st-R.F. tube to the chassis, thus giving three straight stages of R.F. amplification. |
|                     | In the local position, the switch cuts out a part of the primary of No. 2 R.F.T., thus reducing the total R.F. amplification. | In the local position, the switch connects the 2nd stoppong condenser to the +B side of the plate-circuit of the 2nd-R.F. tube, thus reducing the total R.F. amplification. | In the local position, the switch connects the grid-return lead of the 1st-R.F. tube to a coupling coil (on the 2nd-R.F. transformer) and then to the bias circuit of the 2nd-A.F. tubes. |
| **R.F. TRANSFORMERS** | The R.F. transformers are inductively coupled.          | The R.F. transformers are **auto-transformer coupled**.  | The R.F. transformers are **auto-transformer coupled**.  |
| **VARIABLE CONDENSERS** | Both the 1st and 2nd types have four separate variable condensers controlled by pulleys and belts. |                                                        | The variable condensers are of the "multiple" type, with the four rotors mounted on a common shaft. |

---

### Output Measuring Circuit for Electro-Dynamic Receivers

A—Plug-and-cord No. 14537. This is to be inserted in the speaker-plug socket of set that is being tested.

B—Speaker-plug socket No. 17512. Insert plug of correct type of electro-dynamic speaker in this socket.

C—Thermo-coupled galvanometer (115 milliamperes). This meter gives an indication of the amount of A. F. current that is flowing through the voice-coil circuit.

D—Single-pole—double-throw toggle switch No. 13678. With this switch, either the voice coil or the galvanometer may be shorted out of the circuit.
FILTER CONDENSER CONNECTIONS. See chassis layout Data
The numbers listed as connections are marked upon the filter condenser unit and shown within the circle designating the condenser unit on the chassis layout.

1st a-f filter .5 mfd connected between center stud and terminal (3)
Detector filter 1. mfd connected between terminal (4) and can
1st a-f bias .5 mfd connected between center stud and can
Filter #1 2.0 mfd connected between terminals (1) and (4)
Filter #2 2.3 mfd connected between terminals (2) and (4)
Filter #3 2.3 mfd connected between terminals (6) and can

Voltage data on page 173

Chassis reference is page 3-30. Voltage reference is page 3-35.
ATWATER KENT MFG. CO.  MODEL 60 and 60-C
Late
Schematic

Circuit of Later Model 60 and 60-C.

Voltage data on page 173.

Filter Condenser data on page 3-29. Voltage data reference to page 3-35.

www.americanradiohistory.com
Page 166 reference is to page 3-28.
MODEL 60 and 60-C  
ATWATER KENT MFG. CO.

3rd Type

SPECIAL NOTE.

The Model 60-C, 3rd type was made in two productions. In the first production of this model, the r-f bias resistor, the 1st r-f bias resistor and the 1st a-f bias resistor were of the flat type; that is, wire wound upon a flat bakelite strip about 3 inches long by \( \frac{3}{8} \) inch wide. In the second production of this model, these "flat" resistors were replaced by "flexible" resistors which resemble ordinary insulated leads, except that each resistor has a die cast or molded metal lug at each end. The identification of these resistors is as follows:

- R-f bias resistor #15830 Brown with white diagonal tracer
- 1st r-f bias #15810 Brown with white straight stripe and no chassis lug
- 1st a-f bias #15820 Brown with white straight stripe and one chassis lug.

When examining the chassis diagram you will find that these flexible resistors are indicated and bear descriptive designations, relative to their function and not color code.

FILTER CONDENSERS

Detector filter .05 mfd connected between terminal (1) and can
Filter #1 .01 mfd connected between terminal (3) and center stud
Filter #2 2.0 mfd connected between terminal (2) and center stud
Filter #3 1.0 mfd connected between terminal (4) and can

BYPASS CONDENSERS

RF Bypass #1 L .01 mfd 400 volts L .01 mfd 400 volts
C .01 mfd 400 volts E .01 mfd 400 volts
RF Bypass #2 A .01 mfd 150 volts U .012 mfd 400 volts
B .01 mfd 150 volts
RF Bypass #3 D .01 mfd 150 volts H .02 mfd 400 volts
T .04 mfd 400 volts

*Detector Bypass F .01 mfd 400 volts M .0075 mfd 400 volts
P .00025 mfd 400 volts P .0012 mfd 400 volts

The function of the various individual units is designated upon the schematic wiring diagram.

MODEL 60-C 3rd type bears serial numbers from 5,670,001 to 5,684,000. It can further be recognized by the fact that the "local-distance" switch is connected to the secondary of the input transformer, "ahead" of the 1st r-f tube. This type connection is used only in the 3rd type of this model and in both productions of this model.

MODEL 60-C 2nd type has the "local-distance" switch between the 2nd and 3rd r-f tubes.
MODEL 60-C 1st type, has this switch between the 1st and 2nd r-f tubes.

Special page references are to pages 3-32 and 3-33.
ATWATER KENT MFG. CO.

VOLTAGE DATA FOR MODELS 60 and 60-C (1st and 2nd Types)

<table>
<thead>
<tr>
<th>Line Voltage 110</th>
<th>Tube</th>
<th>Filament</th>
<th>120 volt line is 10 percent higher,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tube</td>
<td>Plate</td>
<td>Grid</td>
</tr>
<tr>
<td>R-F (1st)</td>
<td>2.2</td>
<td>160</td>
<td>7.3</td>
</tr>
<tr>
<td>R-F (2nd-3rd)</td>
<td>2.2</td>
<td>160</td>
<td>3.7</td>
</tr>
<tr>
<td>Det.</td>
<td>2.2</td>
<td>101</td>
<td>1.0</td>
</tr>
<tr>
<td>A-F (1st)</td>
<td>2.2</td>
<td>69</td>
<td>1.8*</td>
</tr>
<tr>
<td>A-F (2nd)</td>
<td>2.2</td>
<td>230</td>
<td>4.4*</td>
</tr>
<tr>
<td>Rect.</td>
<td>4.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Measured, not actual operating voltage.

VOLTAGE DATA FOR MODEL 60 and 60-C (3rd Type)

<table>
<thead>
<tr>
<th>Line voltage 110</th>
<th>Tube</th>
<th>Filament</th>
<th>Plate</th>
<th>Grid</th>
<th>Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tube</td>
<td>Plate</td>
<td></td>
<td>Grid</td>
<td>Screen</td>
</tr>
<tr>
<td>R-F</td>
<td>2.3</td>
<td>170</td>
<td>16.5*</td>
<td>142</td>
<td></td>
</tr>
<tr>
<td>Det.</td>
<td>2.3</td>
<td>119</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-F (1st)</td>
<td>2.3</td>
<td>73</td>
<td>1.9**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-F (2nd)</td>
<td>2.3</td>
<td>224</td>
<td>36.***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Local distance switch at distance
** Measured, not actual operating voltage.
*** If 2nd A-F bias resistor #1 is open, bias will be about 85 v.

Checking Sensitivity of Set

When checking the sensitivity of the set, it is necessary to use an oscillator, and a meter to indicate maximum output volume.

A local oscillator is necessary to ensure constancy of signal strength; signals from broadcast stations are not sufficiently constant for this work.

An output meter is necessary to ensure a reliable indication of output volume; the ear is not reliable enough for this purpose.

The oscillator feeds a weak signal into the receiver. The signal is amplified in the receiver and produces a reading on a meter which is connected to the output of the set. This meter indicates the strength of output volume. The reading on the output meter is greatest when all the tuned circuits in the set are adjusted to the same frequency as the oscillator signal.

1. Oscillator.

   The oscillator must provide modulated R. F. signals at four different frequencies in the broadcast range. These four frequencies should correspond to dial settings of 5, 45, 65 and 95 on the dial of a 3rd type Model 60-C which has the original factory synchronism.

   Each of the four R. F. oscillators should have an adjustable pick-up so that the strength of each oscillator may be controlled independently of the other three.

2. Output Measuring Circuit.

   The output measuring circuit is shown and described

Adjusting Trimmer Condensers

1. Connect the common pick-up lead from the four R. F. oscillators to one end of a No. 8112 condenser. Connect the other end of this condenser to the Long Antenna post. Connect the oscillator container to the Ground 5 post.

2. Put plug "A" of the output measuring circuit in the speaker-plug socket on the set. Plug an F-4 type speaker in socket "B." Throw switch "D" to the right.

3. Put all tubes in the set; power switch on; volume control at maximum; local-distance switch at distance. Break away the sealing wax on the trimmer-condenser screws

4. Tune set exactly to 5 on dial. Reduce or increase the amount of pick-up from the 1st oscillator to secure a reading of about 20 on the output meter.

   With a screw-driver, turn the pressure screw of the 4th trimmer condenser one way or the other, as necessary, to the point where the reading on the output meter is greatest. Repeat this process on the 3rd trimmer, then on the 2nd, and finally on the 1st. Reduce the pick-up from the 1st oscillator if necessary in order to keep the needle of the galvanometer near the centre of its scale.

   This adjustment of the trimmer-condenser screws is termed the CORRECT POSITION.
FILTER CONDENSER DATA. The filter condenser unit in the Model 61 and 61-C, (Direct Current) Early, contains two of the filter condensers and two other bypass condensers. The numbers to be quoted in connection with the connections are marked upon the condenser can and are shown upon the chassis layout.

1st a-f filter 0.5 mfd connected between terminals (1) and (5)
Detector filter 1.0 mfd connected between terminals (2) and (6)
Filter #2 4.0 mfd connected between terminal (4) and center stud
Filter #3 2.0 mfd connected between terminal (5) and center stud

Filter #1 is a part of one of the bypass units as stated elsewhere on this page.
MODEL 61-61-C
Late Schematic
ATWATER KENT MFG. CO

Schematic Diagram of Later Model 61 and 61-C (Direct Current).

FILTER CONDENSER SPECIFICATIONS are shown on page 174. BYPASS CONDENSER designations shown upon wiring diagram also appear upon chassis layout on page 177. For BYPASS CONDENSER data refer only to page 177 and not to page 174.

R-F Det. 1st A-F 2nd A-F
Fill. 2.9 4.6 4.6 4.6
Plate 78 32 50 80
Grid 4.6* 1.4 9
Screen 60**

* This voltage applies only to the 1st R-F stage. The 2nd R-F bias voltage is 1.4 volts and the 3rd R-F bias voltage is 0.9 volts.

** The screen voltage quoted applies only to the third R-F tube. He other K-F tubes secure different values of screen voltage. K-F tube number 1 or rather the first K-F stage has 46 volts applied to its screen. Likewise, the 2nd K-F stage has 46 volts applied to its screen.

The forementioned voltage measurements are made with the volume control adjusted to minimum.

FILTER CONDENSER CONNECTIONS. The following specifications should be used in conjunction with the schematic shown below and the chassis layout shown on the next page.

The numerals refer to the numbers marked upon the condenser can:

- **Filter #1**: 2.1 mfd connected between terminals (1) and (4).
- **Filter #2**: 2.3 mfd connected between terminals (2) and (4).
- **Filter #3**: 2.3 mfd connected between terminals (6) and (4).
- **Detector filter**: 1.0 mfd connected between terminals (5) and (4).
- **1st a-f filter**: 0.5 mfd connected between center stud and (3).
- **1st a-f bias**: 0.1 mfd connected between center stud and (3).

In some early Model 66's, volume control resistor No. 1 is connected across the K.F. choke coil in the plate circuit of the 1st R.F. tube. The slider of this resistor is connected to a tap on No. 2 R.F. through a coupling condenser.

**BYPASS CONDENSER VALUES.** The letter designations given should be used in conjunction with the schematic wiring diagram above and the chassis layout.

<table>
<thead>
<tr>
<th>RP Bypass #1</th>
<th>F</th>
<th>1 mfd 400 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP Bypass #2</td>
<td>E</td>
<td>1 mfd 400 volts</td>
</tr>
<tr>
<td>Detector Bypass</td>
<td>D</td>
<td>3 mfd 400 volts</td>
</tr>
</tbody>
</table>
Bottom Wiring of Later-Type Model 60.

The resistor shown in dotted lines is the old-style R.F. bias resistor. This is shown merely to indicate how the old-style R.F. bias resistor was connected. The 1st-R.F. bias resistor is mounted on top of the new-style R.F. bias resistor. The 1st-A.F. bias resistor is mounted under the 2nd-A.F. grid-filter resistor.
MODEL 66 Voltage

ATWATER KENT MFG. CO.

VOLTAGE DATA FOR MODEL 66

Line voltage 110, line voltage of 120 volts increases voltage 10%.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Filament</th>
<th>Plate</th>
<th>Grid</th>
<th>Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-F (1st)</td>
<td>2.2</td>
<td>158</td>
<td>5.5</td>
<td>110</td>
</tr>
<tr>
<td>R-F (2nd-3rd)</td>
<td>2.2</td>
<td>160</td>
<td>2.8</td>
<td>78</td>
</tr>
<tr>
<td>Detector</td>
<td>2.2</td>
<td>206</td>
<td>23.</td>
<td></td>
</tr>
<tr>
<td>A-F (1st)</td>
<td>2.2</td>
<td>137</td>
<td>2.8*</td>
<td></td>
</tr>
<tr>
<td>A-F (2nd)</td>
<td>6.9</td>
<td>412</td>
<td>78.</td>
<td></td>
</tr>
</tbody>
</table>

*This is the measured voltage, not the actual operating voltage.

VOLTAGE DATA FOR MODELS 67 and 67-C

These values apply when the total "B" voltage is 150 volts.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Filament</th>
<th>Plate</th>
<th>Grid</th>
<th>Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF (1st-2nd)</td>
<td>3.3</td>
<td>110</td>
<td>1.5</td>
<td>30</td>
</tr>
<tr>
<td>R-F (3rd)</td>
<td>3.3</td>
<td>110</td>
<td>2.5</td>
<td>25</td>
</tr>
<tr>
<td>Det.</td>
<td>5.6*</td>
<td>50</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>A-F (1st)</td>
<td>5.0</td>
<td>55</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>A-F (2nd)</td>
<td>5.0</td>
<td>150</td>
<td>45.</td>
<td></td>
</tr>
</tbody>
</table>

These values apply when the total "B" voltage is 180 volts.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Filament</th>
<th>Plate</th>
<th>Grid</th>
<th>Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-F (1st-2nd)</td>
<td>3.3</td>
<td>135</td>
<td>1.5</td>
<td>45</td>
</tr>
<tr>
<td>R-F (3rd)</td>
<td>3.3</td>
<td>135</td>
<td>2.5</td>
<td>40</td>
</tr>
<tr>
<td>Det.</td>
<td>5.0</td>
<td>60</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>A-F (1st)</td>
<td>5.0</td>
<td>65</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>A-F (2nd)</td>
<td>5.0</td>
<td>180</td>
<td>45.</td>
<td></td>
</tr>
</tbody>
</table>
ATWATER KENT MFG. CO.  
MODEL 67, 67-C  
Early and Late  
Schematic

Diagram of Early Model 67 and 67-C (Battery Operated).

Voltage data on page 180

Diagram of Later Model 67 and 67-C (Battery Operated).

Voltage reference page 3-42.
MODEL 70, 74, 76
Chassis F

BYPASS CONDENSERS. The letters within the circles correspond with the designations within the bypass units shown in the chassis layout.

RF Bypass #1  C .1 mfd 400 volts  E .1 mfd 400 volts  # 15790
            F .01 mfd 400 volts (In very early F "F" is .1 mfd.)
RF Bypass #2  A .1 mfd 150 volts  U .12 mfd 400 volts  # 15770
            B .1 mfd 150 volts
RF Bypass #3  D .1 mfd 400 volts  H .2 mfd 400 volts  # 15780
            T .04 mfd 400 volts
Detector Bypass E .1 mfd 400 volts  M .075 mfd 400 volts  # 15640
            P .0012 mfd 400 volts  P .00025 mfd 400 volts
Tone Control  All condensers are rated at 100 volts

Voltage reference page 3-38.
BYPASS CONDENSERS. The letters within the circles adjacent to the various bypass condensers correspond with the letters shown within the respective bypass units on chassis layout. Note exception stated beneath the following tabulation.

| RF Bypass #1 | L  1 mfd 400 volts | L  1 mfd 400 volts | #14710 |
| RF Bypass #2 | E  1 mfd 400 volts | F  1 mfd 400 volts | #15262 |
| RF Bypass #3 | H  1 mfd 400 volts | S  1 mfd 400 volts | #16880 |
| RF Bypass #4 | D  1 mfd 400 volts | V  1 mfd 400 volts | #15262 |

* Used only in D-2 chassis as shown in wiring diagram of D-2 receiver. These two condensers are not used in D-1 chassis, but are shown in their proper position in the chassis layout.

Tone control All condensers are rated at 100 volts

SPECIAL NOTE.

Chassis D-1 and D-2 are identical except for the minor changes noted above in connection with bypass condensers W1 and V1 and also as noted on the D-2 schematic.
**MODEL 70, 74, 76**

**ATWATER KENT MFG. CO.**

**VOLTAGE TABLE FOR TYPE F CHASSIS**

Set in operation. Volume control at maximum L-D switch at distance

Use High Resistance D C Voltmeter (about 0-50-250) to Measure Plate and Grid Voltages
Use A. C Voltmeter to Measure Filament Voltages

**APPROX. VOLTAGES, USING 120 V. LINE**

<table>
<thead>
<tr>
<th>TUBE</th>
<th>FILAMENT VOLTAGE</th>
<th>PLATE VOLTAGE</th>
<th>CONTROL-GRID VOLTAGE</th>
<th>SCREEN VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st-R.F.</td>
<td>2.5</td>
<td>118</td>
<td>6</td>
<td>93</td>
</tr>
<tr>
<td>2nd-R.F.</td>
<td>2.5</td>
<td>118</td>
<td>4</td>
<td>93</td>
</tr>
<tr>
<td>3rd-R.F.</td>
<td>2.5</td>
<td>118</td>
<td>4</td>
<td>93</td>
</tr>
<tr>
<td>Detector</td>
<td>2.5</td>
<td>117</td>
<td>30**</td>
<td>—</td>
</tr>
<tr>
<td>1st-A.F.</td>
<td>2.4</td>
<td>70</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>2A</td>
<td>2.7</td>
<td>250</td>
<td>55*</td>
<td>—</td>
</tr>
<tr>
<td>2Aa</td>
<td>2.7</td>
<td>250</td>
<td>55*</td>
<td>—</td>
</tr>
</tbody>
</table>

All readings made from cathode in heater-type tubes, and from —F in plain-filament-type tubes.

**This condenser is used in late production.**

* Use 250-volt scale.

**This is the voltage across the detector bias resistor; when measuring from grid to cathode, the voltage reading is only 2.*

---

**Condensers in R.F. By-Pass No. 1**

C—2nd-A.F. bias by-pass.

**Condensers in Detector By-Pass**

M—Detector 1st A.F coupling condenser
P—“Phone” condenser.
F—“Phone” condenser.
R—Filament by-pass.

**Condensers in R.F. By-Pass No. 2**

A—1st-R.F. bias by-pass
B—R.F. bias by-pass.
U—1st-A.F filter condenser

**Condensers in R.F. By-Pass No. 3**

D—Detector bias by-pass
H—R.F. plate-circuit by-pass
T—Detector grid-circuit by-pass

---

**Diagram**

[Diagram showing schematic of the circuit and various components labeled with their functions.]

---

**Note:**

- All readings made from cathode in heater-type tubes, and from —F in plain-filament-type tubes.
- Use 250-volt scale.
- This is the voltage across the detector bias resistor; when measuring from grid to cathode, the voltage reading is only 2.*
Schematic Diagram of Type D-2 Chassis.

Note the addition of by-pass condensers V-1 and W-1 and the reversal of screen-grid resistors No. 1 and No. 2.

Voltage Table for Type D Chassis

Set in operation. Volume control at maximum.

I-D switch at distance.

Use High Resistance D.C. Voltmeter (about 0-50-250) to measure plate and grid voltages. Use A.C. Voltmeter to measure filament voltages.

Approx. Voltages, Using 120 V. Line

<table>
<thead>
<tr>
<th>Tube</th>
<th>Filament Voltage</th>
<th>Plate Voltage</th>
<th>Control-Grid Voltage</th>
<th>Screen Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st-R.F.</td>
<td>3.3</td>
<td>75</td>
<td>4.2</td>
<td>50</td>
</tr>
<tr>
<td>2nd-R.F.</td>
<td>3.3</td>
<td>75</td>
<td>1.3</td>
<td>50</td>
</tr>
<tr>
<td>3rd-R.F.</td>
<td>3.3</td>
<td>75</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Detector</td>
<td>5</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st-A.F.</td>
<td>5</td>
<td>45</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>5</td>
<td>75</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2Aa</td>
<td>5</td>
<td>80</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

All readings made from cathode in heater-type tubes, and from -F in plain-filament-type tubes.

Use 250-volt scale to measure 2nd-A.F. grid voltage.

*This is 50 volts in D-2 chassis.
MODEL 76
Chassis P

ATWATER KENT MFG. CO.

BYPASS CONDENSERS. The letters within circles designate the condensers within the multiple units shown on the chassis layout:

| RF Bypass #1 | L   | .01 mfd | 400 volts | L   | .01 mfd | 400 volts # 15790 |
|             | C   | .1 mfd  | 400 volts | E   | .1 mfd  | 400 volts          |
| RF Bypass #2 | A   | .1 mfd  | 150 volts | U   | .12 mfd | 400 volts # 15770  |
|             | B   | .1 mfd  | 150 volts |     |          |                    |
| RF Bypass #3 | D   | .1 mfd  | 400 volts | H   | .2 mfd  | 400 volts # 15780  |
|             | T   | .04 mfd | 400 volts |     |          |                    |
| Detector Bypass | F  | .1 mfd  | 400 volts | M   | .075 mfd | 400 volts # 15640 |
|             | P   | .0012 mfd | 400 volts | P   | .00025 mfd | 400 volts |

Tone Control: All condensers are rated at 100 volts.

Voltage data on page 194.

Voltage reference page 3-54.
ATWATER KENT MFG. CO.

ADJUSTING TRIMMER CONDENSERS

When adjusting the trimmer condensers, it is necessary to have a four-wave oscillator, providing modulated signals at 1500, 1800, 800 and 600 kilocycles. The oscillator signals should come in at exactly these settings on two or more Type L sets THAT HAVE THE ORIGINAL FACTORY SYNCHRONISM.

1. Connect the common pick-up lead from the four R. F. oscillators to one end of a No. 8112 condenser. Connect the other end of this condenser to the Long-Antenna post. Connect the oscillator container to the Ground post.

2. Connect the output measuring circuit shown in Figure 259 to the speaker plug socket on the set. Close S2 and S3. Throw S1 to the left.

3. Put all tubes in the set; power switch on; volume control at maximum; local-distance switch at distance.

4. Break away the sealing wax on the trimmer-condenser screws.

5. Turn pointer exactly to the 1500 K. C. mark. Reduce or increase the amount of pick-up from the 1500 K. C. oscillator to secure a reading of about 20 on the output meter.

6. With a screw-driver, turn the pressure screw of the 4th trimmer condenser (on front variable condenser) one way or the other, as necessary, to the point where the reading on the output meter is greatest. Repeat this process on the 3rd trimmer, then on the 2nd, and finally on the 1st. Reduce the pick-up from the 1st oscillator if necessary in order to keep the needle of the galvanometer near the centre of its scale.

This adjustment of the trimmer-condenser screws is termed the CORRECT POSITION.

IMPORTANT SERVICE NOTES

1. In the Types L, F, P, D and Q chassis receivers, it is very important to arrange the three control-grid leads to the screen-grid tubes exactly parallel to each other. If these leads are not parallel, and two of them come close together, the dial readings will not be accurate, especially at the high-frequency end of the scale.

2. When replacing a flexible resistor, care must be taken to use a resistor having the same value. In the event of any uncertainty, make a continuity meter reading of a good resistor of the same type in a stock set, and then use a replacement resistor that gives the same reading on the continuity meter.

3. A number of different code markings may be used to identify by-pass condensers that have the same part number. If the part number is the same, the condensers are interchangeable, even though the code markings are different.

VOLTAGE TABLE FOR TYPE L-1 CHASSIS

Set in operation. Volume control at maximum.
L-D Switch at distance.
Use High Resistance D. C. Voltmeter (about 0-50-250) to Measure Plate and Grid Voltages.
Use A. C. Voltmeter to Measure Filament Voltages.

APPROX. VOLTAGES, USING 120 V LINE

<table>
<thead>
<tr>
<th>TUBE</th>
<th>FILAMENT VOLTAGE</th>
<th>PLATE VOLTAGE</th>
<th>CONTROL-GRID VOLTAGE</th>
<th>SCREEN VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st-R.F.</td>
<td>2.4</td>
<td>185</td>
<td>6</td>
<td>85</td>
</tr>
<tr>
<td>2nd-R.F.</td>
<td>3.35</td>
<td>185</td>
<td>4.5</td>
<td>85</td>
</tr>
<tr>
<td>3rd-R.F.</td>
<td>3.35</td>
<td>185</td>
<td>4.5</td>
<td>85</td>
</tr>
<tr>
<td>Detector</td>
<td>2.35</td>
<td>120</td>
<td>12**</td>
<td></td>
</tr>
<tr>
<td>1st-A.F.</td>
<td>2.35</td>
<td>75</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>2.45</td>
<td>265</td>
<td>55*</td>
<td></td>
</tr>
<tr>
<td>2Aa</td>
<td>2.45</td>
<td>265</td>
<td>55*</td>
<td></td>
</tr>
<tr>
<td>Rectifier</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In order to identify modifications of each chassis, where such modifications require new part numbers, a numeral is used after the type letter. Thus the 1st style of Type L chassis (below No. 6,234,881) is termed Type L-1, and the 2nd style (above No. 6,234,881) is termed Type L-2. This marking is for use only in Service literature and will not appear on the serial-number plates.
MODEL 70, 74, 76
Chassis L-1

ATWATER KENT MFG. CO.

BYPASS CONDENSERS. The letters within the circles designate the condensers within the multiple units shown on the chassis layout:

RF Bypass #1
- L .01 mfd 400 volts
- C .1 mfd 400 volts
- E .1 mfd 400 volts

RF Bypass #2
- A .1 mfd 150 volts
- B .1 mfd 150 volts

RF Bypass #3
- D .1 mfd 400 volts
- H .02 mfd 400 volts
- T .04 mfd 400 volts

Detector Bypass
- F .1 mfd 400 volts
- M .075 mfd 400 volts
- P .0012 mfd 400 volts

Tone Control
- All condensers rated at 100 volts

FILTER CONDENSORS
- Numbers within circles designate condensers connected upon chassis block. These numbers are also shown upon the chassis layout:
  - RF 1 mfd connected between terminal (1) and center stud
  - RF 2 mfd connected between terminal (2) and center stud
  - RF 1.0 mfd connected between terminal (3) and center stud

Diagram of L-1 Chassis.
BYPASS CONDENSERS. The letters within circles designate the condensers within the multiple units shown on the chassis layout.

| RF Bypass #1 | L  | .01 mfd 400 volts | L  | .01 mfd 400 volts | #15790 |
| RF Bypass #2 | A  | .1 mfd 400 volts  | E  | .1 mfd 400 volts  |
| RF Bypass #3 | B  | .1 mfd 150 volts  | U  | .12 mfd 400 volts | #15770 |
| Detector Bypass | F  | .1 mfd 400 volts  | M  | .075 mfd 400 volts | #15640 |
| Tone Control | All | condensers are rated at 100 volts |

Voltage reference page 3-54.
MODEL 70, 74, 76
Chassis "L-2" - "P"
Voltage Data

Notes

VOLTAGE TABLE FOR TYPE L-2 AND P CHASSIS

Set in operation. Volume control at maximum.
L-D (or 'phonograph') switch up.
Use High Resistance D.C. Voltmeter (about 0-30-200) to measure Plate and Grid Voltages.
Use A.C. Voltmeter to measure filament Voltages.

APPROX. VOLTAGES, USING 120 V. LINE

<table>
<thead>
<tr>
<th>TUBE</th>
<th>FILAMENT VOLTAGE</th>
<th>PLATE VOLTAGE</th>
<th>CONTROL-GRID VOLTAGE</th>
<th>SCREEN VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st-R.F.</td>
<td>2.4</td>
<td>180</td>
<td>5</td>
<td>8f</td>
</tr>
<tr>
<td>2nd-R.F.</td>
<td>2.35</td>
<td>180</td>
<td>4.5</td>
<td>8f</td>
</tr>
<tr>
<td>3rd-R.F.</td>
<td>2.35</td>
<td>180</td>
<td>4.5</td>
<td>8f</td>
</tr>
<tr>
<td>Detector</td>
<td>2.35</td>
<td>110</td>
<td>14*</td>
<td></td>
</tr>
<tr>
<td>1st-A.F.</td>
<td>2.35</td>
<td>70</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>2.45</td>
<td>250</td>
<td>55*</td>
<td></td>
</tr>
<tr>
<td>2Aa</td>
<td>2.45</td>
<td>250</td>
<td>55*</td>
<td></td>
</tr>
<tr>
<td>Rectifier</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Use 250-volt scale.
** This is the voltage across the diode bias resistor; when measuring from grid to cathode, the voltage reading is only 2.35 volts.

All readings made from cathode in heater-type tubes, and from "P" in plain-filament-type tubes.

Condensers in R.F. By-Pass No. 1
L-Line by-pass.
L-Line by-pass.
C-2nd-A.F. bias by-pass.

Condensers in Detector By-Pass
F-2nd-3rd R.F. screen by-pass.
M-Detector-1st A.F. coupling condenser.
P-Phone condenser.
P-Phone condenser.

Condensers in R.F. By-Pass No. 2
B-R.F. bias by-pass.
U-1st-A.F. filter condenser.

Condensers in R.F. By-Pass No. 3
D-Detector bias by-pass.
T-Detector grid-circuit by-pass.

Connection of Units in Type L-2 Chassis, and, at Right, Connections to Terminal Panel of Type N Speaker.
Type Q Chassis (battery operated) has three stages of screen-grid R.F. amplification, grid detection, one stage of transformer-coupled audio, and a double audio output stage.

An output filter choke and condenser are used in the Q-2 (above Serial No. 5704025), as shown in the diagram below. The Q-1 Chassis does not have these two parts.

VOLTAGE TABLE FOR TYPE Q CHASSIS

Set in operation. Volume control at maximum.
L-D switch at distance.

Use High Resistance D.C. Voltmeter (about 0-50-250) to Measure Plate and Grid Voltages.
Use A.C. Voltmeter to Measure Filament Voltages.

<table>
<thead>
<tr>
<th>TUBE</th>
<th>FILAMENT VOLTAGE</th>
<th>PLATE VOLTAGE</th>
<th>CONTROL-GRID VOLTAGE</th>
<th>SCREEN VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st-R.F.</td>
<td>3.3</td>
<td>135</td>
<td>1.5</td>
<td>45</td>
</tr>
<tr>
<td>2nd-R.F.</td>
<td>3.3</td>
<td>135</td>
<td>1.5</td>
<td>45</td>
</tr>
<tr>
<td>3rd-R.F.</td>
<td>3.3</td>
<td>135</td>
<td>2.5</td>
<td>45</td>
</tr>
<tr>
<td>Detector</td>
<td>5.0</td>
<td>70</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1st-A.F.</td>
<td>5.0</td>
<td>67</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>5.0</td>
<td>180</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>2Aa</td>
<td>5.0</td>
<td>180</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

R.F. By-Pass No. 1
G—R.F. screen by-pass.
Y—Output filter condenser.
N—1st-R.F. filament by-pass.

R.F. By-Pass No. 2 *
H—R.F. plate-circuit by-pass.
T—Detector filter condenser.
P—"Phone" condenser.
P—"Phone" condenser.

R.F. By-Pass No. 3
S—Detector filament by-pass.
O—2nd-R.F. filament by-pass.

The output filter choke is not used in the Q-1 chassis.

*The connections shown for R.F. by-pass No. 2 are correct when this part is No. 16060.
However, if a No. 18250 (K-28) is used, "F" and "R" are at top and "H" and "T" are at bottom; therefore, the connections to this condenser are reversed (lineoleu wire changed).
The output filter choke and filter condenser are used only in Type Q-2 Chassis. The choke is mounted in the 2nd A. F. input transformer container. Type Q-1 Chassis may be converted to Q-2 by installing this unit (No. 18020) and connecting it as shown above.

Voltage data on page 201

Diagram of Q-2 Chassis.

Voltage reference page 3-55.
FILTER CONDENSERS. Numerals in circles indicate connections upon filter condenser terminal block. These numbers are shown upon the parts layout below and also upon the chassis layout.

Detector filter  0.1 mfd connected between terminal (1) and can
Filter #1  2.0 mfd connected between terminal (2) and center stud
Filter #2  1.0 mfd connected between terminal (3) and center stud
Filter #3  1.0 mfd connected between terminal (4) and can
Resonant condenser  0.225 mfd connected between terminal (5) and center stud

BYPASS CONDENSERS. The small numerals adjacent to the bypass condensers correspond with the designating numerals upon the chassis layout.

| RF Bypass #1 | 1 | 0.01 mfd | 400 volts |
| RF Bypass #2 | 2 | 0.01 mfd | 400 volts |
| RF Bypass #3 | 3 | 0.01 mfd | 400 volts |
| RF Bypass #4 | 4 | 0.01 mfd | 400 volts |
| RF Bypass #5 | 5 | 0.01 mfd | 400 volts |
| RF Bypass #6 | 6 | 0.01 mfd | 400 volts |
| RF Bypass #7 | 7 | 0.01 mfd | 400 volts |
| RF Bypass #8 | 8 | 0.01 mfd | 400 volts |
| RF Bypass #9 | 9 | 0.01 mfd | 400 volts |
| RF Bypass #10 | 10 | 0.01 mfd | 400 volts |
| RF Bypass #11 | 11 | 0.01 mfd | 400 volts |
| RF Bypass #12 | 12 | 0.01 mfd | 400 volts |
| RF Bypass #13 | 13 | 0.01 mfd | 400 volts |
| RF Bypass #14 | 14 | 0.01 mfd | 400 volts |
| RF Bypass #15 | 15 | 0.01 mfd | 400 volts |
| RF Bypass #16 | 16 | 0.01 mfd | 400 volts |
| RF Bypass #17 | 17 | 0.01 mfd | 400 volts |
EQUIPMENT REQUIRED FOR SERVICING TYPE H CHASSIS

In order to make the correct adjustments of trimmer condensers in Type H chassis, it is necessary to have the following equipment:

1. A four-wave oscillator providing modulated signals at 1,500, 1,000, 800 and 600 kilocycles. The oscillator signals must come in at exactly these settings on a Type H chassis that has been checked on "standard-frequency" broadcast stations to make certain that the dial calibration is accurate. In other words, the set is used as a wavemeter to check the frequency of the oscillator. In turn, the set must be checked frequently against "standard-frequency" broadcast stations.

The oscillator frequencies should be checked at least once a day, and more often if necessary.

Each oscillator in the four-wave oscillator must have an adjustable pick-up. Adjustment of any one pick-up must not affect the frequency of its oscillator, nor should it affect the volume of the other oscillators.

The 1500 K. C. oscillator must have an extra pick-up that may be cut in to provide an extra-strong 1500 K. C. signal, or cut out to provide a normal-strength 1500 K. C. signal. The extra-strong 1500 K. C. signal is used in adjusting the double-spot trimmer.

2. A 130-kilocycle oscillator. This should be tuned to 130 K. C. by adjusting its trimmers to give maximum output when this oscillator is coupled to the I. F. amplifier in a Type H chassis that has the original factory synchronism. The frequency of the 130-K. C. oscillator should be checked frequently.

The 130-K. C. oscillator may be coupled to the Type H chassis in either one of two different methods, as follows: (a) The oscillator may be completely shielded, with a shielded lead connecting an adjustable pick-up in the oscillator to the control-grid cap of the 1st-detector. (b) The oscillator may be mounted under the test bench in such a position that it will be close to the 1st-detector plate-circuit choke. A 2-inch hole should be drilled at this point in the metal plate that covers the test bench. In this case, of course, the bottom plate of the set should be removed.

3. An output measuring circuit such as that shown on page 166.

4. Two No. 18261 coil shields with the tops cut off. These are used in place of the regular No. 18261 shields to cover the I. F. transformers in Type H-2 Chassis, in order to make the I. F. trimmer condensers accessible.

5. One No. 17295 coil shield with a half-inch hole cut in the top. This is used in place of the regular No. 17295 shield to cover No. 4 R. F. T., in order to make the double-spot trimmer accessible. These specially cut shields are NOT supplied from the factory.

6. One No. 15592 (black) tubular resistor with a half-inch length of solid wire soldered to each end. This is used as described on Page 275.

7. A trimmer-condenser screw-driver. This should be made from a fibre rod about 10" long and 1/4" in diameter.

INITIAL ADJUSTMENT OF ROTORS AND POINTER TO 1500 KILOCYCLES

When the variable-condenser unit has been replaced or adjusted in any way, it is necessary to check the alignment as follows:

Center the pointer on the control arm and tighten the pointer screws.

(1) Loosen the gear set-screws.
(2) Move the rotor plates to the position shown
(3) With the rotor in this position, adjust the control arm to the 1500 K. C. position and tighten the gear set-screws.
(4) Note how far down on the 1500 K. C. mark the pointer comes, then turn the condenser knob to the 550 K. C. mark. The pointer should come down on this mark approximately the same as on the 1500 K. C. mark. If it does not, it is an indication that the front panel is not centered.

(5) If the front panel is not centered, loosen the screw at each end of the bottom of the front panel and shift the panel as necessary. Tighten the panel screws and then reset the control arm.

ADJUSTING TRIMMERS ON TYPE H-1 CHASSIS

Preliminary
(a) Couple the 130 K.C. oscillator to the set.

(b) Connect the common pick-up lead from the four-wave oscillator to one end of a No. 8112 condenser. Connect the other end of this condenser to the Long-Antenna post. Connect the oscillator container to the Ground post.

(c) Connect the output measuring circuit shown on Page 256 to the speaker-socket on the set. Close S2 and S3. Throw S1 to the left. Put S4 on the second tap.

(d) Put all tubes in the set. Break away the sealing wax on the trimmer-condenser screws.

(e) Put special coil shield on No. 4 R.F.T. so the double-spot trimmer is accessible.

(f) Make initial adjustment of rotors and dial pointer to 1500 K.C.

I. F. Trimmers
(g) Switch on the set and the 130 K.C. oscillator. Adjust the 2nd-I. F. trimmer for maximum output. Keep meter reading about 50 by regulating volume control on set.

(h) Adjust the 2nd-detector trimmer for maximum output. Do not touch the 1st-I. F. trimmer unless the I. F. amplifier is unstable. In this case, turn the adjusting screw of this trimmer anti-clockwise until the amplifier becomes stable. Turn off the 130 K.C. oscillator.

Oscillator Trimmers
(i) Tune in the 1500 K.C. signal and adjust the oscillator trimmer to bring in this signal at exactly 150 on the dial.

(j) Adjust the pre-selector trimmers Nos. 1, 2 and 3 for maximum output.

(k) Turn dial pointer exactly to 80. Screw the oscillator-transformer adjusting disc in or out as necessary to the point that gives maximum output from the 800 K.C. signal.

(l) Turn dial pointer to 150. Re-set the oscillator trimmer to give maximum output from the 1500 K.C. signal.

(m) Turn dial pointer to 80. Re-set the disc for maximum output.

(n) Turn dial pointer exactly to 150. Adjust the oscillator trimmer for maximum reading.

(o) Repeat operations (m) and (n) if necessary. The object of this procedure is to bring in both the 1500 K.C. and the 800 K.C. signals at exactly the correct points on the dial; 150 and 80 respectively.

Double-Spot Trimmers
(p) Switch on the extra-strong 1500 K.C. signal and tune in its double-spot at 1240 K.C. Adjust the double-spot trimmer to give minimum output.

(q) Switch on the normal-strength 1500 K.C. signal and tune it in at 150. Adjust trimmer No. 3 to give maximum output.

(r) Repeat the instructions given in paragraphs (p) and (q) until further adjustment gives no change in output.

1st-I. F. Trimmer
(s) Tune in the 1000 K.C. signal and adjust the 1st-I. F. trimmer for maximum audible output with the volume control full on. If the I. F. amplifier is unstable, screw the 1st-I. F. trimmer anti-clockwise to a stable position.

Re-seal the trimmer screws.
MODEL 72  
Chassis H-2  
Above serial  
5,855,201  

ATWATER KENT MFG. CO.

FILTER CONDENSERS. Numerals in circles shown on wiring diagram indicate connections upon filter condenser terminal block. These numbers are also shown upon the parts layout below. Also upon the chassis wiring diagram.

Detector filter \(0.1 \text{ mfd}\) connected between terminal (1) and can  
Filter #1 \(2.0 \text{ mfd}\) connected between terminal (2) and center stud  
Filter #2 \(1.0 \text{ mfd}\) connected between terminal (3) and center stud  
Filter #3 \(1.0 \text{ mfd}\) connected between terminal (4) and can  
Resonant condenser \(0.225 \text{ mfd}\) connected between terminal (5) and center stud.

BYPASS CONDENSERS. The small numerals adjacent to the various bypass condensers shown on the wiring diagram correspond with the designating numerals upon the parts layout below and the chassis.

RF Bypass #1  
1 \(0.01 \text{ mfd}\) 400 volts  
2 \(0.1 \text{ mfd}\) 400 volts  
3 \(0.3 \text{ mfd}\) 400 volts  
4 \(0.1 \text{ mfd}\) 400 volts  
5 \(0.1 \text{ mfd}\) 400 volts  
6 \(0.1 \text{ mfd}\) 400 volts  
7 \(0.1 \text{ mfd}\) 400 volts.

RF Bypass #2  
8 \(0.075 \text{ mfd}\) 400 volts  
9 \(0.0012 \text{ mfd}\) 400 volts.

RF Bypass #3  
10 \(0.3 \text{ mfd}\) 150 volts  
11 \(0.1 \text{ mfd}\) 400 volts  
12 \(0.00123 \text{ mfd}\) 400 volts  
13 \(0.1 \text{ mfd}\) 400 volts.

RF Bypass #4  
14 \(0.04 \text{ mfd}\) 400 volts.

RF Bypass #5  
15 \(0.1 \text{ mfd}\) 400 volts  
16 \(0.1 \text{ mfd}\) 400 volts  
17 \(0.1 \text{ mfd}\) 400 volts.

In this chart, the 2nd-I. F. screen resistor should be maroon instead of purple.
ADJUSTING TRIMMERS ON TYPE H-2 CHASSIS

Preliminary
(a) Couple the 130 K.C. oscillator to the set.
(b) Connect the common pick-up lead from the four-wave oscillator to one end of a No. 8112 condenser. Connect the other end of this condenser to the Antenna post. Connect the oscillator container to the Ground post.
(c) Connect the output measuring circuit shown to the speaker-plug socket on the set. Close S2 and S3. Throw S1 to the left. Put S4 on the second tap.
(d) Put all tubes in the set. Break away the sealing wax on the trimmer-condenser screws.
(e) Put special coil shield on No. 4 R.F.T. so the double-spot trimmer is accessible. Also put special shields on the I.F. transformers.
(f) Make initial adjustment of rotors and dial pointer to 1500 K.C.

I.F. Trimmers
(g) Switch on the set and the 130 K.C. oscillator. Connect the black resistor across the 2nd-detector grid trimmer (see small illustration at left) and adjust the 2nd-I.F. plate trimmer for maximum output.
(h) Connect the resistor across the 2nd-I.F. plate trimmer and adjust the 2nd-detector grid trimmer for maximum output.
(i) Connect the resistor across the 2nd-I.F. grid trimmer and adjust the 1st-I.F. plate trimmer for maximum output.
(j) Connect the resistor across the 1st-I.F. plate trimmer and adjust the 2nd-I.F. grid trimmer for maximum output.
(k) Adjust the volume control to keep the output meter reading about 50 during these operations. Turn off the 130 K.C. oscillator.

Oscillator Trimmers
Connect the black resistor across the 2nd-detector grid trimmer while adjusting the oscillator trimmers.
(l) Tune in the 1500 K.C. signal and adjust the oscillator trimmer to bring in this signal at exactly 150 on the dial.
(m) Adjust the antenna trimmer and trimmers Nos. 2 and 3 for maximum output from the 1500 K.C. signal.
(n) Turn dial pointer exactly to 80. Screw the oscillator-transformer adjusting disc in or out as necessary to the point that gives maximum output from the 800 K.C. signal.
(o) Turn dial pointer to 150. Re-set the oscillator trimmer to give maximum output from the 1500 K.C. signal.
(p) Turn dial pointer to 80. Re-set the disc for maximum output.
(q) Turn dial pointer exactly to 150. Adjust the oscillator trimmer for maximum output reading.
(r) Repeat operations (p) and (q) until further adjustment gives no change in dial reading. The object of this procedure is to bring in, without further adjustment, both the 1500 K.C. and the 800 K.C. signals at exactly the correct points on the dial: 150 and 80 respectively.

Double-Spot Trimmers
Remove the black resistor for this adjustment.
(s) Switch on the extra-strong 1500 K.C. signal and tune in its double-spot at 1240 K.C. Adjust the double-spot trimmer to give minimum output.
(t) Switch on the normal-strength 1500 K.C. signal and tune it in at 150. Adjust trimmer No. 3 to give maximum output.
(u) Repeat the instructions given in paragraphs (s) and (t) until further adjustment gives no change in output.

1st-I.F. Trimmer
Connect the black resistor across the 2nd-detector grid trimmer for this adjustment.
(v) With volume control full on, tune in the 1000 K.C. signal and adjust the 1st-I.F. trimmer for maximum audible output. Re-seal the trimmer screws.
VOLTAGE TABLE
FOR MODEL 80, 81, 82, 82-D, 82-Q, 83, 84, 84-D, 84-Q, 85, 85-Q, 86, 87 and 89

The voltages listed in this table are only approximate, and are measured values, not actual operating values. Turn volume control to maximum.

Use 250-volt scale of a 1000-ohm-per-volt D.C. voltmeter.

All plate, screen and grid measurements are made from cathode in heater-type tube, and from — F in plain-filament-type tube.

### VOLTAGE TABLE

<table>
<thead>
<tr>
<th>MODEL</th>
<th>FOR MODEL 80, 81, 82, 82-D, 82-Q, 83, 84, 84-D, 84-Q, 85, 85-Q, 86, 87 and 89</th>
<th>80</th>
<th>81</th>
<th>82</th>
<th>82-D</th>
<th>82-Q</th>
<th>83</th>
<th>84</th>
<th>84-D</th>
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<td>FILAMENT PLATE</td>
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<tr>
<td>CONTROL TUBE</td>
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</tbody>
</table>

*The measured oscillator grid voltages will vary depending on the capacity of the voltmeter units. In some cases, the presence of the tubes will stop oscillation.**This includes the 8T2 and 8T3 tubes in Model 81.

When replacing a tubular resistor, use a resistor of the same color as the defective unit. However, if a resistor having the color specified in the diagram does not agree with the color specified in the diagram, replace it with a resistor having the color that is specified in the diagram for that set.
In Model 83 and 83-F, a filter-condenser unit is used and it is connected as shown in dotted lines. This unit is NOT used in Model 80 and 80-F.

In Model 83, 83-F, the electrolytic filter condenser No. 1 is not used, and the filament circuit is slightly different.

Voltage reference page 3-66.
MODEL 80, 80-F
83, 83-F

ATWATER KENT MFG. CO.

Condensers in Multiple By-pass Model 80, 80-F, 83, 83-F

1—Tone-control condenser.
2—Tone-control condenser.
3—1st-detector—I. F. screen by-pass.
4—I. F. bias by-pass.
5—2nd-detector bias by-pass.
6—Phone condenser.
7—2nd-detector—A. F. coupling condenser.
8—2nd-detector screen by-pass.
9—Quality condenser.
10—1st-detector plate filter condenser.
11—A. F. bias by-pass.
12—1st-detector bias by-pass.

The numbers given above correspond with the numbers marked upon the multiple condenser unit.

The parts on Model 83, 83-F are similar except that Model 83, 83-F has a filter condenser unit and only one electrolytic condenser.
Voltage reference page 3-66.
MODEL 81
81-B
81-C

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Wiring diagram is shown on reverse side of this page.
MODEL 82-D

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MODEL 82-D TOP VIEW AND CHART

Top View of Model 82-D.

CHART OF MODEL 82-D.

All bypass condensers 400 volts except tone control which is 100 volts.

By-pass Condensers in Model 82-D

R. F. By-pass No. 1
1—Ground coupling condenser.
2—1st-detector screen by-pass.
3—110-volt line condenser.
4—1st-detector grid by-pass.

R. F. By-pass No. 2
5—2nd-detector—1st-A.F. coupling condenser
6—Filter condenser No. 2.
7—Not used.

R. F. By-pass No. 3
8—Quality condenser.
9—2nd-detector filter condenser.
10—110-volt line by-pass.

Tone-control Condenser
11—Not used.
12—Tone condenser.
13—Tone condenser.
14—Tone condenser.
Voltage reference page 3-83.
**MODEL 82-D**  
2nd Type  
Above serial  
5,760,301

---

**ATWATER KENT MFG. CO.**

Circuit of Speaker Used in Model 82-D.

The protective lamp (75 watts) is connected in series with the electrolytic filter condenser in the chassis. If the 110-volt D.C. supply plug is reversed, the lamp will light. When the 110-volt plug is properly inserted, the lamp does not light. This action is due to the fact that the electrolytic condenser passes current if the polarity of the applied D.C. voltage is not correct.

---

### By-pass Condensers

**By-pass No. 1**

1. Ground coupling condenser.  
2. Negative 110-volt line by-pass.  
3. Not used.  
4. 1st-detector grid filter condenser.

**By-pass No. 2**

5. 1st-detector screen by-pass.  
6. 1st-detector plate filter condenser.  
7. Filter condenser No. 2.  
8. F. F. screen by-pass.

**By-pass No. 3**

10. 2nd-detector plate filter condenser.  
11. Negative 110-volt line by-pass.

### Tone-Control Condenser

12. Tone-control condenser.  
13. Tone-control condenser.  
14. Tone-control condenser.  
15. Not used.

*All bypass condensers rated at 400 volts. Tone control condensers rated at 100 volts.*

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**Bottom Chart.**
Numerals adjacent to bypass condensers designate units shown upon parts layout on next page within multiple condensers. Condenser voltage ratings are shown upon next page.

Voltage reference page 3-66.
The top view of Model 80, 80-F is similar except that it has no control tube and the position of No.1 and No. 2 R.F.T. is interchanged.
ATWATER KENT MFG. CO.

MODEL 82-Q
1st Type
Below serial
2,550,940

In some early 82-Q volume control is shunted by 100,000 ohm resistor.

All bypass condensers are rated at 400 volts except tone control which is 120 volts.

Voltage data on page 212.

Voltage reference page 3-66.
MODEL 82-Q
1st Type
Below serial
2,550,940

ATWATER KENT MFG. CO.

By-pass Condensers in Model 82-Q

R. F. By-pass No. 1
1—Not used.
2—Quality condenser.
3—2nd-detector grid-circuit by-pass.

R. F. By-pass No. 2
4—+B filter condenser.
7—1st-detector grid-circuit by-pass.

R. F. By-pass No. 3
8—2nd-detector filter condenser.
10—Tracking condenser.

R. F. By-pass No. 4
11—2nd-detector screen by-pass.
12—1st-A. F. filter condenser.
13—1st-detector screen by-pass.
14—I. F. plate filter condenser.

Tone-control Condenser
15—Tone condenser.
16—Tone condenser.
17—Tone condenser.
18—Not used.

Chart of Model 82-Q.
ATWATER KENT MFG. CO

MODEL 82-Q
2nd Type
Above serial
2,550,940

Voltage reference page 3-83.

Voltage data on page 229.

Numbers adjacent to bypass condensers correspond with numbers shown upon multi-section bypass units in parts layout on next page.
MODEL 82-Q
2nd Type
Above serial
2,550,940

ATWATER KENT MFG. CO.

MODEL 82-Q (2nd Type) Above Serial No. 2550940

By-pass Condensers

By-pass No. 1
1—2nd detector screen by-pass.  
2—R. F. grid filter condenser.  
3—1st detector screen by-pass.  
4—1st detector plate filter condenser.

By-pass No. 2
5—B by-pass.  
6—1st detector—R. F. grid filter condenser.  
7—2nd detector grid-circuit by-pass.  

By-pass No. 3
9—2nd detector plate filter condenser.  
10—Not used.  
11—1st A. F. plate filter condenser.  
12—Quality condenser.

Tone-control Condenser
13—Not used.  
14—Tone control condenser.  
15—Tone control condenser.  
16—Tone control condenser.
Originaly tapped 60-160. Now tapped 50-60 ohms

All bypass units are 400 volts
Tone control 100 volts

Voltage data on page 212

Antenna choke 130 w 2nd A-F grid condenser #10 is .0025 mf

Early Model 84-D does not have tone control; it has a condenser, instead of a resistor, across the secondary of the audio input transformer; it has a small phone condenser .01 mf connected to the plate of the 2nd-detector, and it has an antenna choke connected between the antenna and ground posts.
OUTPUT TRANSFORMER

Primary 500 ohms
Secondary 0.25 ohm
Field coil 1200 ohms

By-pass Condensers in Model 84-D

Condensers in R. F. By-pass No. 1
1—Ground coupling condenser.
2—1st-detector screen by-pass.
3—110-volt line condenser.
4—1st-detector grid by-pass.

R. F. By-pass No. 2
6—Filter condenser No. 2.
7—Tracking condenser.

R. F. By-pass No. 3
8—Quality condenser.
9—2nd-detector filter condenser.
10—2nd-A. F. grid condenser in early-type sets, 2nd-detector phone condenser in later-type sets.

Tone-control Condenser (Late-type sets only)
11—Not used.
12—Tone condenser.
13—Tone condenser.
14—Tone condenser.
**VOLTAGE TABLE FOR MODELS**

81, 81-B, 81-C, 82-D, 82-Q, 85-Q, 86, 87, 89, 90, 92, 92-F, 93, 94, 96, 96-F, 99, 99-F, 99-P

The voltages listed in this table are only approximate, and are measured values, not actual operating values.

Use 250-volt scale of a 1,000-ohm-per-volt D. C. voltmeter.

Turn volume control to maximum.

In all sets equipped with sensitivity switch, voltage switch, or neon tuning light potentiometer: Before making measurements, place sensitivity switch in NORMAL position, voltage switch in REDUCED VOLTAGE position, or neon tuning light potentiometer in full counter-clockwise position.

All plate, screen and grid measurements are made from cathode in heater-type tubes, and from --F in plain-filament-type tubes.

**Line voltage=110 volts.**

<table>
<thead>
<tr>
<th></th>
<th>81</th>
<th>82-D</th>
<th>82-Q</th>
<th>85-Q</th>
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</table>

* The measured oscillator grid voltage will vary dependent on several factors. In some cases, no reading will be secured for grid bias. In other cases the reading will be only slight, or it may be as high as 10 volts.

* In Model 93, make measurements with frequency range switch turned to low frequency scale.
MODEL 84, 84-F
Early
ATWATER KENT MFG. CO.

Diagram of Early-Type Model 84 and 84-F (A. C.-Operated).
In Model 84-F, the filter resistor (connected in series with the center-tap of the high-voltage winding) is NOT used.

Voltage reference page 3-66.
SPECIAL NOTE. Numerals within circles and adjacent to bypass condensers correspond with numbers marked within multi-section bypass condensers shown on parts layout. See next page.

Voltage reference page 3-66.
**MODEL 84, 84-F CHARTS**

**CHART OF EARLY-TYPE MODEL 84, 84-F.**

In some early-type Model 84, 84-F, the 1st-detector bias resistor is a flexible type, and the quality resistor is wire-wound. These are both superseded by the tubular resistors indicated above. The filter-resistor at top-right is NOT used in any Model 84-F.

**By-pass Condensers in Model 84, 84-F.**

- **400 Volts**
  - R. F. By-pass No. 1
    - 1—2nd-detector filter condenser.
    - 2—Quality condenser.
    - 3—I.F. bias by-pass.
    - 4—A. F. bias by-pass.
  - R. F. By-pass No. 2
    - 5—2nd-detector—A. F. coupling condenser.
    - 6—Tracking condenser.
    - 7—2nd-detector bias by-pass.
  - R. F. By-pass No. 3
    - 8—1st-detector filter condenser.
    - 9—1st-detector bias by-pass.
    - 10—1st-detector—1. F. screen by-pass.
    - 11—2nd-detector screen by-pass.

- **100 Volts**
  - Tone-control Condenser
    - (used only in late type)
    - 12—Not used.
    - 13—Tone-control condenser.
    - 14—Not used.
    - 15—Tone-control condenser.

**CHART OF LATE-TYPE MODEL 84, 84-F.**

Some late-type Model 84, 84-F receivers have slightly different oscillator transformers and connections than indicated in the diagram. When servicing such sets, carefully note and adhere to the original method of wiring. A flexible type 1st-detector bias resistor (not shown above) is connected from condenser 9 to condenser 3.
Antenna choke of 130 ohms is connected across antenna trimmer in early 84-Q.

OUTPUT TRANSFORMER
Primary 500 ohms
Secondary 0.25 ohm

Numbers in circles adjacent to bypass condensers correspond with numbers within multi-section bypass condensers in parts layout.

INTERMEDIATE FREQUENCY 130 KC

Voltage data on page 212

A diagram of the speaker used with this set is shown in the diagram of Model 82-Q. Early-type 84-Q does not have tone control; it has a phone condenser in the 2nd-detector plate circuit, and it has an antenna choke connected across the antenna trimmer. The oscillator transformer in early-type Model 84-Q is different in this way: it has only one pick-up coil, which is connected in series with the screen of the 1st-detector. (The two filament-circuit pick-up coils are not used in the early model.)
In a few early-model 84-Q receivers, the position of the R.F. and the 1st-A.F. socket is interchanged.
A few early-type Model 85 do not have automatic volume control; they have three electrolytic filter condensers; the circuit of these early Model 85 sets is similar to Model 80. The tracking condenser is mounted on the oscillator transformer in Model 82 and some 85 sets. The filament circuit of Model 82 is somewhat different from that shown above.

Voltage reference page 3-66.
MODEL 85, 85-F

ATWATER KENT MFG. CO.

CONDENSERS

RF Bypass # 1
# 19160 Early
# 19980 Late
All 400 volts

RF Bypass # 2
# 19150 Early
# 19990 Late
All 400 volts

RF Bypass # 3
# 16262
All 400 volts

Tone Control
# 16490 Early
# 20010 Late
All 100 volts

The circle in the top right corner represents the shield for the coupling unit between the 1st-detector and I.F. tubes.

See schematic

The filter resistor is not used in Model 85-F.

BY-PASS CONDENSERS IN MODEL 85, 85-F

R. F. By-pass No. 1

1—Quality condenser.
2—2nd-detector—A. F. coupling condenser.
3—Phone condenser.
4—2nd-detector bias by-pass.

R. F. By-pass No. 2

5—A. F. bias by-pass.
6—I. F. bias by-pass.
7—Tracking condenser.
8—Control-plate by-pass.

R. F. By-pass No. 3

9—1st-detector—I. F. screen by-pass.
10—2nd-detector filter condenser.
11—1st-detector filter condenser.
12—1st-detector bias by-pass.

Tone-control Condenser
(on front panel)

Two top contacts—2nd-detector screen by-pass and oscillator plate-circuit by-pass.

Two bottom contacts—tone-control condensers.
Voltage reference page 3-66.
MODEL 85-Q
1st Type
Below serial
163767

TOP VIEW OF MODEL 85-Q.
The circle in the top right corner indicates the shield for the coupling unit between the 1st-detector and the 1st-I. F. tubes. The circle in the bottom center is the shield covering the coupling unit between the 2nd-I. F. and the 2nd-detector tubes.

Tone Control condenser #16490 100 volts

By-pass Condensers in Model 85-Q.

RF By-pass No. 1
1—1st-detector grid-circuit by-pass.
2—Quality condenser.
3—Not used.

RF By-pass No. 2
5—1st-A. F. grid filter condenser.
6—Tracking condenser.

RF By-pass No. 3
7—2nd-detector grid filter condenser.
8—2nd-detector screen by-pass.
9—2nd-detector filter condenser.
10—1st-A. F. plate filter condenser.

RF By-pass No. 4
11—1st-I. F. plate filter condenser.
12—1st-I. F. screen by-pass.

RF By-pass No. 5
15—1st-detector screen by-pass.

CONDENSERS
RF Bypass #1
#19990
400 volts
RF Bypass #2
#19150
400 volts
RF Bypass #3
#15262
400 volts
RF Bypass #4
#15262
400 volts
RF Bypass #5
#15262
400 volts

www.americanradiohistory.com
MODEL 85-Q
2nd Type
Above serial
163,767

ATWATER KENT MFG. CO.

The 1st type of Model 85-Q has two stages of I.F. and no R.F. stage.

Numbers adjacent to bypass condensers correspond with numbers shown upon multi-section bypass units on parts layout on next page.

Voltage data on page 229.

Voltage reference page 3-83.
MODEL 85-Q
2nd Type
Above serial
163,767

A.T.WATER KENT MFG. CO.

TUBES
R. F. = '32
1st Det. = '32
I. F. = '32
2nd Det. = '32
1st A. F. = '30
2nd A. F. = '33
Osc. = '30

TONE CONTROL
STATION SELECTOR
ON-OFF SWITCH
LOCAL-DISTANCE SWITCH
VOLUME CONTROL
DOUBLE-SPOT TRIMMER B. NO. 1 R. F. T.

Top View.
The coil shield in the upper-right corner encloses the coupling unit between the 1st-detector and the I. F. tubes.
The coil shield at bottom center encloses No. 2 R. F. T.

By-pass Condensers

<table>
<thead>
<tr>
<th>By-pass No. 1</th>
<th>By-pass No. 2</th>
<th>By-pass No. 3</th>
<th>By-pass No. 4</th>
<th>Tone-control Condenser</th>
</tr>
</thead>
<tbody>
<tr>
<td>1—2nd-detector plate filter condenser.</td>
<td>4—2nd detector—1st-A. F. coupling condenser.</td>
<td>7—1st-detector grid filter condenser.</td>
<td>11—1st A. F. plate filter condenser.</td>
<td>15—Tone-control condenser.</td>
</tr>
<tr>
<td>3—Not used.</td>
<td>6—Tracking condenser.</td>
<td>9—I. F. plate filter condenser.</td>
<td>13—2nd-detector screen by-pass.</td>
<td>17—Tone-control condenser.</td>
</tr>
</tbody>
</table>

ALL BYPASS CONDENSERS RATED AT 400 VOLTS. TONE CONTROL RATED AT 100 VOLTS.

www.americanradiohistory.com
Voltage reference page 3-66.
FILTER CONDENSER. The two small numbers adjacent to the filter condenser representation correspond with the numbers upon the condenser. The capacity between terminal (1) and the center stud is 3. mfd and between terminal (4) and the center stud it is 4. mfd.

BYPASS CONDENSER. The numbers in circles adjacent to the bypass condensers correspond with the designations within the multi-section units shown on the parts layout.

**RF Bypass # 1**
- 1. .01 mfd 400 volts
- 2. .03 mfd 400 volts
- 3. .04 mfd 200 volts
- 4. .0006 mfd 400 volts

**RF Bypass # 2**
- 5. .03 mfd 200 volts
- 6. .02 mfd 200 volts
- 7. .04 mfd 200 volts
- 8. .05 mfd 200 volts

**RF Bypass # 3**
- 9. .1 mfd 400 volts
- 10. .1 mfd 400 volts
- 11. .1 mfd 400 volts
- 12. .1 mfd 400 volts

**Tone Control**
- 13. .001 mfd 100 volts
- 14. .005 mfd 100 volts
- 15. .1 mfd 100 volts
- 16. .1 mfd 100 volts

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**Chart of Model 86, 86-F.**
The filter resistor is not used in Model 86-F.

**By-pass Condensers in Model 86, 86-F**
- R. F. By-pass No. 1
  1—2nd-detector—A. F. coupling condenser.
  2—Quality condenser.
  3—2nd-detector bias by-pass.
  4—Phone condenser.

- R. F. By-pass No. 2
  5—A. F. bias by-pass.
  6—R. F. grid filter condenser.
  7—Control plate by-pass.
  8—R. F. I. F. bias by-pass.

- R. F. By-pass No. 3
  9—1st-detector plate filter condenser.
  11—1st-detector bias by-pass.
  12—2nd-detector filter condenser.
ATWATER KENT MFG. CO.

MODEL 86-F
2nd Type

MODEL 86 (2nd Type) Above Serial No. 5876861
MODEL 86-F (2nd Type) Above Serial No. 7168925

Voltage data on page 229

Voltage reference page 3-83.
MODEL 86, 86-F
2nd Type

ATWATER KENT MFG. CO.

MODEL 86 (2nd Type) Above Serial No. 5876861
MODEL 86-F (2nd Type) Above Serial No. 7168925

TUBES
R. F. = '35
1st Det. = '35
I. F. = '35
2nd Det. = '24
A. F. = '47
Osc. = '27
Control = '24
Rectifier = '80

SENSITIVITY SWITCH
2ND DET.
CTRL. TUBE
SPEAKER PLUG

ON-OFF SWITCH
AND VOLUME CONTROL
STATION SELECTOR
TONE CONTROL

ALL BYPASS CONDENSERS RATED AT 400 VOLTS

BOTTOM CHART.
The filter resistor is not used in 86-F.

By-pass Condensers

By-pass No. 1
1—2nd-detector—A. F. coupling condenser.
2—Quality condenser.
3—2nd-detector bias by-pass.
4—Phone condenser.

By-pass No. 2
5—A. F. bias by-pass.
6—R. F. grid filter condenser.
7—Control plate by-pass.
8—R. F. I. F. bias by-pass.

By-pass No. 3
9—1st-detector plate filter condenser.
10—Screen by-pass.
11—1st-detector bias by-pass.
12—2nd-detector plate filter condenser.

100 Volts

Tone-control Condenser
13—Tone-control condenser.
14—Tone-control condenser.
15—2nd-detector screen by-pass.
16—2nd detector screen by-pass.
In a few early-type Model 87 receivers, No. 2 and No. 3 R. F. transformers are connected between the R. F. tube and the 1st-detector, similar to the arrangement used in early Model 89.

Voltage reference page 3-66.
BYPASS CONDENSERS: All bypass condensers located within the multiple unit are rated at 200 volts. The numbers shown within circles adjacent to the bypass condensers correspond with the numbers shown within the multiple bypass unit shown in connection with the schematic diagram. The multiple condenser unit is not marked with numbers. The condensers and numbers closest to the mounting holes represent the side of the condenser nearest the mounting holes.

FILTER CONDENSERS. The numbers in circles correspond with the numbers marked upon the filter unit. The following are the connections.

Filter #1 2.0 mfd connected between terminals (1) and (4)
Filter #2 2.3 mfd connected between terminals (2) and (4)
Filter #3 2.3 mfd connected between terminal (6) and can
1st A-F Bias .6 mfd connected between terminal (3) and center stud
Hum .25 mfd connected between terminals (4) and (5)
.1 mfd connected between center stud and can
.1 mfd connected between terminal (2) and can
Voltage data on page 229

MODEL 87
3rd Type
Above serial
2,525,871

Voltage reference page 3-83.
MODEL 87
3rd Type
Above serial)
2,525,871

ATWATER KENT MFG. CO.

By-pass Condensers
1—1st detector plate filter condenser.
2—1st-detector bias by-pass.
4—2nd detector grid-circuit by-pass.
5—2nd detector—1st A. F. coupling condenser.
6—Phone condenser.
7—R. F. grid filter condenser.
8—Quality condenser.
9—2nd detector bias by-pass.
10—2nd detector plate filter condenser.
11—Screen by-pass.

FILTER CONDENSERS. The numbers in circles adjacent to the filter condensers correspond with the numbers marked upon the filter condenser terminal block. The following are the connections within the unit.

Filter #1 2.0 mfd connected between terminals (1) and (4)
Filter #2 2.3 mfd connected between terminals (2) and (4)
Filter #3 2.3 mfd connected between terminal (6) and can
Hum .25 mfd connected between terminals (4) and (5)
A-F Filter .6 mfd connected between terminal (3) and center stud
.1 mfd connected between terminal (2) and can (not used)
.1 mfd connected between center stud and can (not used)
The readings given in the table below were obtained with the 250-volt scale of a 1000-ohm-per-volt D.C. voltmeter. The values given are only approximate and are the measured values, not the actual operating voltages. All measurements are made from cathode in heater tubes and from —F in plain-filament-type tubes.

### Voltage Table for Model 87-D

<table>
<thead>
<tr>
<th></th>
<th>Filament</th>
<th>Plate</th>
<th>Screen</th>
<th>Grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F.</td>
<td>6</td>
<td>100</td>
<td>65</td>
<td>4</td>
</tr>
<tr>
<td>1ST-Det.</td>
<td>6</td>
<td>100</td>
<td>60</td>
<td>3</td>
</tr>
<tr>
<td>I. F.</td>
<td>6</td>
<td>100</td>
<td>60</td>
<td>3</td>
</tr>
<tr>
<td>2ND-Det.</td>
<td>6</td>
<td>65</td>
<td>40</td>
<td>SMALL</td>
</tr>
<tr>
<td>1ST-A. F.</td>
<td>6</td>
<td>93</td>
<td>98</td>
<td>4</td>
</tr>
<tr>
<td>2ND-A. F.</td>
<td>2</td>
<td>95</td>
<td>98</td>
<td>5</td>
</tr>
<tr>
<td>Oscillator</td>
<td>6</td>
<td>100</td>
<td>—</td>
<td>5</td>
</tr>
</tbody>
</table>

The readings were obtained with the 250-volt scale of a 1000-ohm-per-volt D.C. voltmeter. The values given are only approximate and are the measured values, not the actual operating voltages. All measurements are made from cathode in heater tubes and from —F in plain-filament-type tubes.

### Connection of Panel Units and I. F. Transformers, Model 87-D

The 2nd-A. F. Grid resistors are colored gray and green.

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www.americanradiohistory.com
The 2nd-detector grid resistor and the 2nd-detector grid-circuit by-pass are NOT used in this set, and the grid-return of the 2nd-detector connects directly to the chassis.

Later types of this Model have No. 1 and No. 2 R. F. transformers connected ahead of the R. F. tube, as shown in the diagram of Model 87.

The phonograph-switching circuit in 89-P is shown above in dotted lines.

Voltage reference page 3-66.
FILTER CONDENSERS. The numerals adjacent to the filter condensers shown up the wiring diagram correspond with the numbers stamped upon the condenser terminal block. The following are the connections:

Filter #1 2.0 mfd connected between terminals (1) and (4)
Filter #2 2.3 mfd connected between terminals (2) and (4)
Filter #3 2.5 mfd connected between terminal (6) and can
Hum .25 mfd connected between terminals (5) and (4)
A-F Filter .5 mfd connected between terminal (6) and center stud

BYPASS CONDENSERS. The numerals within circles adjacent to the bypass condensers shown upon the schematic wiring diagram correspond with the numbers shown upon the multi-section bypass units below.

Quality Condenser 1. .03 mfd 450 volts 2. .03 mfd 450 volts # 21450
RF Bypass #1 6. .06 mfd 400 volts 7. .06 mfd 400 volts # 21440
1. .3 mfd 400 volts * See Note.
RF Bypass #2 3. .1 mfd 400 volts 4. .1 mfd 400 volts # 22050
5. .3 mfd 400 volts
RF Bypass #3 9. .1 mfd 400 volts 10. .02 mfd 400 volts # 21430
11. .06 mfd 400 volts 12. .1 mfd 400 volts

CHART OF MODEL 89, 89-F.
The 2nd-detector grid resistor is not used in late-type Model 89 89-F, 89-P.

Quality Condenser
1—Quality condenser.
2—Quality condenser.
R. F. By-pass No. 1
7—2nd-detector grid-circuit by-pass.
8—2nd-detector bias by-pass.
(A small "phone" condenser, not shown, is connected internally to the lower-left terminal of by-pass No. 1.)
R. F. By-pass No. 2
3—R. F. bias by-pass.
4—2nd-detector filter condenser.
5—l. F. screen by-pass.
R. F. By-pass No. 3
9—l. F. plate by-pass.
10—1st-detector grid-circuit by-pass.
11—1st-detector bias by-pass.
12—Control-plate condenser.
ATWATER KENT MFG. CO.

MODEL 89 (3rd Type) Above Serial No. 6755181
MODEL 89-F (3rd Type) Above Serial No. 1585395
MODEL 89-P (3rd Type) Above Serial No. 1935904

Voltage data on page 229

The photographs switching circuit in 89-P is shown above in dotted lines corresponding to bypass units in parts layout on next page.

Voltage reference page 3-83.
MODEL 89 (3rd Type) Above Serial No. 6755181
MODEL 89-F (3rd Type) Above Serial No. 1585395
MODEL 89-P (3rd Type) Above Serial No. 1935904

MODEL 89, 89-F, 89-P
3rd Type

ATWATER KENT MFG. CO.

TUBES
- R.F. = '35
- 1st Det. = '35
- I.F. = '35
- 2nd Det. = '27
- 1st A.F. = '27
- 2nd A.F. = '47(2)
- Osc. = '27
- Control = '34
- Rectifier = '80

Top View.
Model 89-P has two binding posts for pick-up connection at the rear of the chassis, and a radio-phonograph toggle switch is mounted on the front panel.

- RF Bypass #1 rated at 400 volts
- Quality condenser rated 450 volts
- RF Bypass #2 rated at 200 volts
- Tone control rated 200 volts
- RF Bypass #3 rated at 400 volts

Bottom Chart.

By-pass No. 1
6—2nd detector—1st A.F. coupling condenser.
7—Not used.
8—2nd detector bias by-pass.
8A—Phone condenser.

By-pass No. 2
4—2nd-detector plate filter condenser.
5—Screen by-pass.

By-pass No. 3
9—I. F. plate filter condenser.
10—R. F. grid filter condenser.
11—1st-detector bias by-pass.
12—Control plate by-pass.

Tone-control Condenser
13—Tone-control condenser.
14—Tone-control condenser.
15—Tone-control condenser.
16—Tone-control condenser.
All condensers within multiple unit rated at 200 volts

Voltage reference page 3-83.
In late type Model 90, the grid returns of the R.F., I.F., and 2nd-detector tubes are connected to ground through a red-and-yellow resistor as shown above.

All Bypass condensers are rated at 200 volts

By-pass Condensers
1—2nd-detector—A.F. coupling condenser.
2—2nd-detector screen by-pass.
3—1st-detector plate filter condenser.
4—Quality condenser.
5—A.F. bias by-pass.
7—Phone condenser.
8—2nd-detector bias by-pass.
9—R.F. bias by-pass.
10—1st-detector bias by-pass.
11—Tone condenser.
12—Tone condenser.
Numbered bypass condensers are rated at 200 volts.

Voltage data on page 229

The changes from early to late type consist of the addition of a choke in the R.F. cathode, the use of a separate control-plate by-pass, and a slight re-arrangement of leads to the multiple by-pass.
By-pass Condensers in Early-Type Model 92

1—2nd detector—A. F. coupling condenser
2—A. F. bias by-pass.
3—1st detector grid filter condenser
4—2nd detector bias by-pass.
5—R. F. grid filter condenser.
6—1st detector bias by-pass.
7—2nd detector—A. F. coupling condenser
9—1st detector plate filter condenser.
10—Control plate by-pass.
11—Quality condenser.

Numbers adjacent to bypass condensers correspond with numbers shown upon multi-section bypass units in schematic diagram on preceding page.
Voltage data on page 229

Model 92-F

Numbered bypass condensers are rated at 200 volts.
By-pass Condensers in Late-Type 92 and 92-F

1. 2nd-detector—A. F. coupling condenser.
2. 2nd-detector bias by-pass.
3. 1st-detector grid filter condenser.
4. 2nd-detector bias by-pass.
5. R. F. grid filter condenser.
6. 1st-detector bias by-pass.
7. 2nd-detector—A. F. coupling condenser.
10. I. F. bias by-pass.
11. 1st-detector plate filter condenser.
12. Quality condenser.

Tone-control Condenser
13. 2nd-detector plate filter condenser.
14. 2nd-detector screen by-pass.
15. Tone condenser.
16. Tone condenser.
MODEL 93
Short Wave Converter

The intermediate Frequency is 1,000 kilocycles.

The two fixed condensers across contacts C and H of the antenna transformers are listed as "compensating condensers" in the parts list.

In a few early-type sets, a paper and foil condenser is used instead of electrolytic filter condenser No. 1. Non-alkaline is connected across the two fixed condensers across contacts C and H of the antenna transformers. This may be necessary if the effect of coupling or adjusting the detector is felt to be unsatisfactory.

Voltage data on page 229

Voltage reference page 3-83.
In servicing this converter, do not change the original position of the wiring as it will disturb the dial calibration. An antenna choke, No. 26516, not shown above, is connected across the antenna condenser in some Model 93 converters.
Small numerals adjacent to bypass condensers correspond with numbers shown upon multiple bypass units. All such marked condensers are rated at 200 volt units.

The filter resistor (on the high-voltage center tap lead) is not used in Model 94-F.

Voltage reference page 3-83.
In late type Model 94, the grid returns of the R. F., I. F., and 2nd-detector tubes are connected to ground through a red-and-yellow resistor as shown above.

**Bottom Chart.**

The filter resistor is not used in Model 94-F.

- **Tone-control Condenser (on panel)**
  - 13—Tone condenser.
  - 14—2nd-detector plate filter condenser.
  - 16—Tone condenser.

**Condensers in Multiple, By-pass**
- 1—Phone condenser.
- 2—2nd-detector bias by-pass.
- 3—Not used.
- 4—A. F. bias by-pass.
- 5—R. F. bias by-pass.
- 6—1st-detector bias by-pass.

**Electrical values of other units are the same as shown on preceding page.**
Voltage data on page 229.

Voltage reference page 3-83.
MODEL 96
1st Type
Below serial
7289385

MODEL 96, 96-F TOP VIEW

FILTER CONDENSERS. The small numbers adjacent to the filter condensers correspond with the numbers marked upon the filter condenser terminal block. The following are the internal connections.

Filter #1  1. mfd connected between terminal (3) and center stud
Filter #2  2. mfd connected between terminal (2) and center stud
Filter #3  1. mfd connected between terminal (4) and can
Hum      .225 mfd connected between terminal (5) and center stud
Divider  .5 mfd connected between terminal (1) and can

CHART OF MODEL 96 (1st Type) Below Serial No. 7289385
Voltage data on page 229

MODEL 96
2nd Type
Serial 7283385
to 7291674

BYPASS CAPACITORS
See data on model 96, 1st type.

FILTER CAPACITORS
See data on model 96, 1st type.

Voltage reference page 3-83.

The neon light voltmeter in 2nd type Model 96 does not have any identifying color.
In some late type Model 96 receivers, a flexible type 1st-detector bias resistor (No. 16320) is connected between condenser 3 (in by-pass No. 1) and the lower contact of the potentiometer. In this case, bleeder No. 2 is connected from the lower contact of the potentiometer to the R.F. cathode. Also in some of these sets, a flexible bleeder No. 8 (No. 24450) is connected in series with the lead to the center contact of the potentiometer.
Voltage reference page 3-83.
### VOLTAGE TABLE

91, 91-B, 91-C, 188, 188-F, 260, 260-F, 469, 469-F

The voltages listed in this table are only approximate and are measured values, not actual operating values.

Use 250-volt scale of a 1000-ohm-per-volt voltmeter.

TONEBEAM ADJUSTMENT FULL COUNTER CLOCKWISE; RANGE SWITCH AT LOCAL.

** All plates, screen and grid measurements are made from cathode in hextaplate type tubes, and from cathode in plain filament type tube.

** LINE VOLTAGE 110 VOLS.

### VOLTAGES ACROSS BLEEDER AND BIAS RESISTORS

<table>
<thead>
<tr>
<th>RESISTOR</th>
<th>FILAMENT</th>
<th>PLATE</th>
<th>SCREEN</th>
<th>GRID</th>
<th>TUBE</th>
<th>CIRCUIT</th>
<th>91-B</th>
<th>91-C</th>
<th>188</th>
<th>188-F</th>
<th>260</th>
<th>260-F</th>
<th>469-F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeder No. 1</td>
<td>FILAMENT</td>
<td>6</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
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<tr>
<td>Bleeder No. 2</td>
<td>TUBE</td>
<td>130</td>
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<td></td>
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<tr>
<td>Bleeder No. 3</td>
<td>SCREEN</td>
<td>65</td>
<td>75</td>
<td>90</td>
<td>70</td>
<td>70</td>
<td>110</td>
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<tr>
<td>Bleeder No. 4</td>
<td>Grid</td>
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<td>2</td>
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<td>2</td>
<td>2</td>
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<td></td>
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<td></td>
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<tr>
<td>Bleeder No. 5</td>
<td>1ST-DETECTOR</td>
<td>FILAMENT</td>
<td>6</td>
<td>2.4</td>
<td>2.4</td>
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<tr>
<td>Bleeder No. 6</td>
<td>PLATE</td>
<td>130</td>
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<td>200</td>
<td>250</td>
<td>250</td>
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<td>Bleeder No. 7</td>
<td>SCREEN</td>
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<td>1</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Bleeder No. 8</td>
<td>Grid</td>
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<td>2</td>
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<tr>
<td>Bleeder No. 9</td>
<td>1ST-A. F.</td>
<td>FILAMENT</td>
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<td>2.4</td>
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<tr>
<td>Bleeder No. 10</td>
<td>PLATE</td>
<td>130</td>
<td>130</td>
<td>200</td>
<td>250</td>
<td>250</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bleeder No. 11</td>
<td>SCREEN</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Bleeder No. 12</td>
<td>Grid</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<td></td>
<td></td>
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<tr>
<td>Bleeder No. 13</td>
<td>OSC</td>
<td>FILAMENT</td>
<td>6</td>
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<td>2.4</td>
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<td>2.4</td>
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<td>Bleeder No. 14</td>
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<td>100</td>
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<td>75</td>
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<td>Control Bleeder</td>
<td>GRID</td>
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<td>10</td>
<td>10</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The measured oscillator grid voltage will vary dependent on several factors. In some cases, no reading will be secured for grid bias. In other cases, the reading will be only slight, or it may be as high as 10 volts.

** In Model 260 and 260-F, the 2nd-detector also functions as automatic-volume-control tube. The voltages that can be read at this socket are as follows: 1st type, cathode to ground 20 volts, grid to ground 7 volts; 2nd type, cathode to ground 15 volts, grid to ground 2 volts.
FILTER CONDENSERS. The filter condenser block employed in the 96-F is not the same as that used in the 96 (1st type). The small numerals adjacent to the filter condensers correspond with the numerals marked upon the filter condenser terminal block. The following are the internal connections.

Filter #1 2.0 mfd connected between terminal 5 and center stud
Filter #2 2.0 mfd connected between terminal (2) and center stud
Filter #3 1.0 mfd connected between terminal (4) and can
Hum 1.0 mfd connected between terminal (3) and center stud
Bypass .5 mfd connected between terminal (1) and can

MODEL 96-F BOTTOM CHART
1st Type Below Serial No. 4882380
2nd Type from 4882380 to 4884901

Voltage data on page 229.
FILTER CONDENSERS. See next page.

NOTE—In 1st type sets, the neon light potentiometer is not used, and the circuit is connected as shown in dotted lines. In early sets using the voltage switch, blander No. 11 is yellow.
In sets using the potentiometer, blander No. 11 is yellow and gray. In few sets using the potentiometer, blander No. 11 consists of two gray resistors in parallel.
The main-light potentiometer in both Type 99's does not have any identifying color.

Voltage reference page 3-88.
MODEL 99
1st Type
Below serial 4,882,380
The small numerals adjacent to the filter condensers upon the schematic wiring diagram correspond with the numbers marked upon the filter condenser terminal block. Also with the numbers shown upon the parts layout. The following are the internal connections. All of the units within the can are NOT used.

Filter # 1 2.0 mfd connected between terminals (1) and (4)
Filter # 2 2.3 mfd connected between terminals (2) and (4)
Filter # 3 2.3 mfd connected between terminal (6) and can
Hum .25 mfd connected between terminals (5) and (4)
A-F filter .5 mfd connected between terminal (3) and center stud
.1 mfd connected between terminal (2) and can (not used)
.1 mfd connected between center stud and can (not used)

CHART OF MODEL 99 (1st Type) Below Serial No. 4882380

MODEL 99, 99-F, 99-P TOP VIEW

Bleeder Resistor No. 11 is Yellow.

400 volts #21440
By-pass No. 2
1—2nd detector — A F coupling condenser
2—Phone condenser
3—2nd detector bias by-pass
4—R. F. bias by-pass
200 volts #22060
By-pass No. 3
7—R. F. plate filter condenser.
8—Control plate filter condenser
9—1st detector screen by-pass
10—Control cathode by-pass
400 volts #15262
200 volts #21630

400 volts #21450
Quality Condenser
11—R. F. grid filter condenser
12—1st-detector bias by-pass
13—Control plate by-pass
14—I. F. plate filter condenser
450 volts #21450
Tone-control Condenser
15—Quality condenser
16—Quality condenser
400 volts #21450

Quality Condenser
17—Tone condenser
18—Tone condenser
19—Tone condenser
20—Tone condenser

Parts layout for Model 99 (2nd type) next page.
Additional data on 99 (3rd type), 99-F and 99-P will be found on the next page. Also filter condenser data for 99-F will be found on the same page.
MODEL 99 (3rd Type)
Above Serial No. 4884901

ATWATER KENT MFG. CO.

BYPASS CONDENSERS for 99 (3rd type) on next page

The same type filter condenser is used in 3rd type Model 99A and is marked with green color as identification.

FILTER CONDENSERS for 99-F are the same as in 1st and 2nd types.
SPECIAL NOTE.

The model 99-F receiver is the same as the model 99 (3rd type) except for the use of a different filter condenser and for the use of a speaker field coil of 1100 ohms. The internal connections of this filter condenser # 26180 are shown below. Also data pertaining to the model 99-P. In all other respects, the receivers are like the model 99-(3rd type).

FILTER CIRCUIT OF MODEL 99-F

The rest of the circuit is the same as the 3rd type Model 99.

FILTER CONDENSER CONNECTIONS. The small numerals in circles adjacent to the filter condensers shown above correspond with the numerals marked upon the filter condenser terminal block and also with the numbers shown upon the parts layout. The following are the internal connections.

Filter #1 2.0 mfd connected between terminal (1) and can
Filter #2 2.5 mfd connected between terminal (2) and can
Filter #3 2.5 mfd connected between terminal (6) and can
Hum 2.0 mfd connected between terminal (4) and can
1.0 mfd connected between terminal (5) and can
.5 mfd connected between terminal (3) and center stud

BYPASS CONDENSERS for models 99 (3rd type), 99-F and 99-P.

The numbers shown adjacent to the bypass condensers in the schematic wiring diagram correspond with the numerals designated in the parts layout within the bypass condenser cans. The following are the specifications.

RF Bypass #1 #21440 400 volts Condensers 1,2,3 and 3A. (3A is not used)
RF Bypass #2 #22050 200 volts Condensers 4,5 and 6
RF Bypass #3 #15262 400 volts Condensers 7,8,9 and 10
RF Bypass #4 #16262 400 volts Condensers 11,12,13 and 14
Quality #21450 450 volts Condensers 15 and 16
Tone control #21530 200 volts Condensers 17,18,19 and 20
### Voltage Table for Models 188, 260, 469, 469-D, 469-Q, 480, 558, 558-D, 558-Q, 612, 627, 812.

**Turn Silencing Adjustment Full Clockwise, Tonebeam Adjustment Full Counter-Clockwise, Range Switch at Local.**

All plate, screen and grid measurements are made from cathode in heater-type tubes, and from -- P in plain-filament-type tubes.

*Line voltage = 110 volts. Total "B" voltage on "Q" sets at time of test = 170 volts.*

<table>
<thead>
<tr>
<th>R.F. Tube</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
<th>7th</th>
<th>8th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate</td>
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### Voltages Across Resistors

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### Miscellaneous

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<td>2nd I.F. Screen Resistor</td>
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<td>Four-Prong Speaker Field</td>
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<td>Front Rectifier (B)</td>
<td>140 230</td>
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<tr>
<td>Back Rectifier (C)</td>
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*In Models 558-Q and 469-Q, the 2nd-detector and control are combined in one tube.

**In Models 558-D and 469-D, the 1st-detector and oscillator are combined in one tube.

It is advisable to repeat measurements of the R.F., 1st det., and I.F. tubes in Model 480 at each position of the frequency-control switch. The voltages on the short-wave range should correspond to those at the "divert broadcast" position.

In cases where bleeder No. 1 is gray, its voltage is 170, and the voltage across the silencing adjustment is 115. In early 612 and 617, the measured voltage on the driver grid is about 27.
In late-type sets, bleeder No. 2 is black. In late-type Models 188 and 188-F, the oscillator grid winding on No. 2 R. F. T. is split into two separate sections, thus making five coils instead of four on this transformer. Also, a small compensating condenser (No. 10300) is connected across contacts K and M of No. 2 R. F. T. and to the plate of this transformer.

The late-type No. 28926 R. F. transformer group, which incorporates these changes, superseded the early-type group. The early-type group is not supplied for service. When installing the late group in place of an early group, it is essential to remove the early-type 1st detector bias resistor No. 21600, and install in its place a late-type 1st detector bias resistor No. 16300.

A No. 16320 flexible resistor is provided for this purpose with each No. 28926 R. F. transformer group.

It is also necessary to connect the blue lead from the oscillator grid condenser (125 mmf.) to the extra terminal at the side of No. 2 R. F. T. instead of to terminal K. The extra terminal is the center tap of the oscillator grid coil.
MODEL 188, 188-F
1st Type

ATWATER KENT MFG. CO.

No. 2 R. F. T includes the oscillator transformer.

MODEL 188, 188-F
MODEL 228
Early and Late

ATWATER KENT MFG. CO.

PAGES LAYOUT

228 Early

Numbers adjacent to bypass condensers correspond with numbers shown upon multi-section units in schematic diagram on preceding page.

Bypass Condensers
1. 2nd detector—A, F, coupling condenser
2. R, F, I, F, bias by-pass
3. H, F, in detector condenser
4. E, detector plate by-pass
5. K, F, and after condenser
6. R, E, and after condenser
7. Collector condenser
8. 10th detector bias by-pass
9. 11th detector bias by-pass
10. Detector plate by-pass
11. Control plate by-pass

Bypass Condensers
1. 2nd detector—A, F, coupling condenser
2. R, F, I, F, bias by-pass
3. H, F, in detector condenser
4. E, detector plate by-pass
5. K, F, and after condenser
6. R, E, and after condenser
7. Collector condenser
8. 10th detector bias by-pass
9. 11th detector bias by-pass
10. Detector plate by-pass
11. Control plate by-pass
The difference between the 228 and 228-F is the omission of the filter resistor, also bleeder #5, addition of dry electrolytic condenser and position of sensitivity switch.
MODEL 228-F Chart
228-F Top View
228 Top View
ATWATER KENT MFG. CO.

By-pass Condensers in Late-Type
1—2nd detector—A. F. coupling condenser
2—A. F. bias by-pass.
3—1st detector grid filter condenser
4—2nd detector bias by-pass.
5—R. F. grid filter condenser.
6—1st detector bias by-pass.
7—2nd detector—A. F. coupling condenser
8—R. F. bias by-pass.
10—I. F. bias by-pass.
11—1st detector plate filter condenser.
12—Quality condenser.

Tone control Condenser
13—2nd detector plate filter condenser
14—2nd detector screen by-pass.
15—Tone condenser.
16—Tone condenser.

MODEL 228-F CHART
For voltage data
see model 82-D,
2nd type.

OUTPUT TRANSFORMER (Next page)
Primary 300 ohms
Secondary 0.25 ohm
Field coil 1200 ohms

CONDENSER DATA. See next page.
All bypass condensers are rated
at 400 volts. Tone control con-
densers are rated at 100 volts.
MODEL 228-D

ATWATER KENT MFG. CO.

CIRCUIT OF SPEAKER

The protective lamp (75 watts) is connected in series with the electrolytic filter condenser in the chassis. If the 110-volt D.C. supply plug is reversed, the lamp will light. When the 110-volt plug is properly inserted, the lamp does not light. This action is due to the fact that the electrolytic condenser passes current if the polarity of the applied D.C. voltage is not correct.

By-pass Condensers

By-pass No. 1
1—Ground coupling condenser.
2—Negative 110-volt line by-pass.
3—Not used.
4—1st-detector grid filter condenser.

By-pass No. 2
5—1st-detector screen by-pass.
6—1st-detector plate filter condenser.
7—Filter condenser No. 2.
8—I.F. screen by-pass.

By-pass No. 3
9—Quality condenser.
10—2nd-detector plate filter condenser.
11—Negative 110-volt line by-pass.

Tone-Control Condenser
12—Tone-control condenser.
13—Tone-control condenser.
14—Tone-control condenser.
15—Not used.

All bypass condensers rated at 400 volts. Tone control condensers rated at 100 volts.
MODEL 228-Q

ATWATER KENT MFG. CO.

By-pass Condensers

By-pass No. 1
1—2nd. detector screen by-pass. All 400 volts
2—R. F. grid filter condenser.
3—1st. detector by-pass.
6—1st. detector plate filter condenser.

By-pass No. 2
5—B by-pass.
6—1st. detector—I. F. grid filter condenser.
7—2nd. detector grid circuit by-pass.

By-pass No. 3
9—2nd. detector plate filter condenser.
10—Not used.
11—1st. A. F. plate filter condenser.
12—Quality condenser.

Tone-control Condenser
13—Not used.
14—Tone-control condenser.
15—Tone-control condenser.
16—Tone-control condenser.

All 400 volts
All 400 volts
All 100 volts
The plate screen and grid voltages, shown in the above diagram, are made from the cathode of the respective tubes. Use the 250-volt scale of a 1000-ohm-per-volt D.C. voltmeter. Line voltage = 110 volts.
ATWATER KENT MFG. CO.

MODEL 260, 260-F
1st Type
Below serial
8,422,101

Numbers adjacent to bypass condensers correspond with numbers shown within multi-section bypass units on parts layout. See next page.
ATWATER KENT MFG. CO.

MODEL 260, 260-F
1st Type
Below serial
8,422,101

MODEL 260, 260-F
(1st Type)
Below Serial No. 8422101
Numbers adjacent to bypass condensers correspond with numbers shown within multi-section bypass condensers on parts layout. See next page.
The flexible resistor connected to condensers 5 and 7 is the 2nd I. F. bias resistor.

### BYPASS/CONDENSERS

- **RF Bypass #1**: #23330 200 volts
- **RF Bypass #2**: #15262 400 volts
- **RF Bypass #3**: #22050 200 volts
- **RF Bypass #4**: #27120 200 volts
- **Tone control**: #21530 200 volts
- **Quality**: #21450 450 volts
- **2nd detector bias bypass**: .05 mfd 200 volts
- **2nd detector plate to grid**: .05 mfd 200 volts
- **2nd detector-1st A-f coupling**: .01 mfd 450 volts
- **Phone condenser**: .000125 mfd 500 volts
In late-type sets, the 2nd detector plate choke is replaced by a No. 29860 red-and-blue resistor, and the black-and-red bleeder No. 4 is replaced by a No. 29710 gray resistor, and in these sets, the voltage across bleeder No. 4 is about 160 volts, and the voltage across the silencing adjustment is about 107 volts.
Voltage reference page 3-134.
ATWATER KENT MFG. CO.

MODEL 480

(Intermediate Frequency, 472½ Kilocycles)

BYPASS CAPACITORS. See parts layout on next page.

In some early-type Model 480 receivers the circuit arrangements and connections of the frequency band switch are different from that shown above.

IMPORTANT: In late-type Model 480, the control-coupling condenser and the control grid link are omitted, and there is no blue lead from No. 31, F. T., to the yellow lead from No. 31, F. T.

Voltage reference page 3-134.
In late-type Model 480 receivers, the arrangement of the frequency-band switch is different from that shown above. The late arrangement is shown in the diagram on page 400.
MODEL 480 FREQUENCY-RANGE-SWITCH CIRCUIT (Early Type)

ATWATER KENT MFG. CO.

MODEL 480

OSCISSOR PLATE & GRID CIRCUITS
The frequency-range switch in Model 480 has five positions as follows:

1st. position — 8.3 to 21.2 megacycles.
2nd. position — 3.6 to 9.2 megacycles.
3rd. position — 1.5 to 4 megacycles.
4th. position — "Distance" broadcast.
5th. position — "Local" broadcast.
ATWATER KENT MFG. CO.

MODEL 489-D
MODEL 588-D

See special note about dry electrolytic capacitor on next page. Also about oscillator resistor.

Small numerals adjacent to bypass condensers correspond with numerals shown upon multiple section bypass condenser on this page and parts layout on next page.
All condensers within multiple section units are rated at 200 volts. Also a black resistor is connected across the maroon oscillator plate filter resistor. In some of these sets a tubular dry electrolytic is used as the 110 volt line condenser.
ATWATER KENT MFG. CO.

MODEL 558-Q
MODEL 469-Q

NUMBER
BYPASS CONDENSERS
400 VOLTS

QUALITY
450 VOLTS

TONE
200 VOLTS

200 VOLTS
All condensers within multiple unit rated at 200 volts.

Numbers adjacent to bypass condensers correspond with numbers shown upon multiple bypass unit on this and next page.

The colors of indicators No. 1 and No. 2 may be reversed in some sets. This does not affect the operation.

Voltage Reference page 3-134.
In late type the grid returns of the R. F., I. F., and 2nd-detector tubes are connected to ground through a red-and-yellow resistor as shown above.

**Bottom Chart.**

In some sets, the colors of bleeders No. 1 and No. 2 may be reversed. This does not affect the operation.

In late type sets, the connections to R. F. T. No. 2 are as follows:—Yellow to F. black to G. white to H. green to J.

**Top View.**

All numbered bypass condensers are rated at 200 volts.

**By-pass Condensers**

1—2nd-detector—A. F. coupling condenser.
2—2nd-detector screen by-pass.
3—1st-detector plate filter condenser.
4—Quality condenser.
5—A. F. bias by-pass.
7—Phone condenser.
8—2nd-detector bias by-pass.
9—R. F. bias by-pass.
10—1st-detector bias by-pass.
11—Tone-condenser.
12—Tone condenser.
Voltage Reference page 3-134.
MODEL 612
ATWATER KENT MFG. CO.

BYPASS CONDENSERS

Bypass # 1
400 volts
Bypass # 2
200 volts
Bypass # 3
200 volts
Bypass # 4
400 volts
Bypass # 5
400 volts

In early 612, bypass condensers 16, 17, 18 and 19 are .1 mfd each.
Voltage Reference page 3-134.
ATWATER KENT MFG. CO.

SERVICE NOTES

SYNCHRONIZING SPEAKERS IN MODELS 612 and 812

In order to get correct tone quality from the dual-speaker sets, Models 612 and 812, it is essential that the two speakers be so connected that the diaphragms of both work in unison or synchronism. If the terminals of one speaker are reversed, the tone of the set will be flat.

To test for proper connections, remove the speakers from the cabinet (leaving them plugged in) so the movement of the diaphragms can be observed. Turn on set, but turn volume down. Connect the terminals of a 1 1/2-volt dry cell across the voice coil terminals of either one of the speakers. If the diaphragms move in or out together at the instant of contact, the speaker connections are O.K. If one moves out and the other moves in, they are bucking, and the remedy is to reverse the red leads of the five-prong speaker at the voice-coil terminal strip.

TYPE '55 TUBE

The 55 tube (known as a duo-diode triode) as used by Atwater Kent in current models, serves three purposes, acting as 2nd-detector, automatic volume control, and 1st-A.F. amplifier.

The lower part of the tube has two small plates and the cathode, forming a duo-diode. One of these small plates (D-1) and the cathode function as a diode or half-wave 2nd-detector. The other small plate (D-1) and the cathode functions as a diode or two-element automatic volume control.

The upper part of the tube has a plate, grid, and cathode, forming a triode, with the grid brought out to a cap on the top of the tube.

The signal voltage developed across the manual volume control in the 2nd-detector plate circuit is impressed on the grid of the triode, which acts as 1st-A.F. amplifier.

The automatic volume control plate (D-1) is actuated by strong signals in such a way as to produce an increased negative bias on the control grids of the R.F. and I.F. tubes, thus reducing their amplification and tending to keep a uniform signal level. The voltage drop across control bias resistors No. 1 and 2 determines the signal level at which the automatic volume control begins to function.

The drop across control bias resistor No. 1 is the bias voltage for the 1st-A.F. grid.

There is no bias on the 2nd-detector plate.

TYPE '85 TUBE

The 85 tube used in Models 469-D and 518-D corresponds to the 55 tube described above.

ACTION OF SILENCING TUBE

The silencing tube is so connected in the plate circuit of the 1st-A.F. tube that when no signal is being received (that is, when the set is tuned between stations), the plate voltage and consequently the amplification of the 1st-A.F. tube is decreased. Where the signal is tuned in, the silencing tube automatically restores the normal plate voltage and amplification of the 1st-A.F. tube.

The automatic action of the silencing tube is secured by having the grid of the silencing tube connected to the automatic volume control circuit.

An adjustment for selecting the desired amount of silencing between stations is provided by having the screen of the silencing tube connected to a potentiometer by means of which the screen voltage may be regulated.

PUSH-PUSH AMPLIFICATION

"Class B" or push-pull amplification is used in Atwater Kent Models 612, 812, 469-Q and 518-Q, to provide high power output with comparatively low power consumption.

Class B amplification differs from regular push-pull amplification in this way:

In push-pull amplification, the grids of the two tubes are biased to a point where there is comparatively high plate current in one tube. When an A.C. signal voltage is impressed on the grids, the plate current of one tube decreases, and the plate current of the other tube increases in like amounts. This action reverses as the impressed A.C. grid voltage reverses.

In push-pull amplification, the grids of the two tubes are biased to a point where there is practically no plate current in either tube. The 46 tube is designed to give low plate current with zero grid bias. When an A.C. signal voltage is impressed on the grids, one grid swings less negative, and the other grid swings positive. The plate current of the first tube cannot decrease as it is already practically zero, but the plate current of the other tube increases. This action reverses as the impressed A.C. signal voltage reverses. Note that no bias on the grids is provided for this action.

NECESSITY FOR DRIVER TUBE

In push-pull amplification, the grids do not swing positive, and very little power is required to feed the grid circuit.

However, in push-push amplification the grids swing positive, thus drawing grid current, and considerable power is required to feed the grids of these tubes. This power is furnished by a "driver" tube which provides sufficient power output to swing or "drive" the grids of the push-push-tubes.

NECESSITY FOR 83 TUBE

In push-push amplification, the average plate current of the two tubes is practically constant at all times, regardless of signal strength. The bias drain on the power unit is therefore practically constant, so there is no tendency for the output voltage of the power supply to vary. Under this condition the type 83 rectifier tube is satisfactory as it can supply the constant drain.

In push-pull tubes there is practically no plate current when the volume control is turned down. But when a signal is received and the volume control is turned up, the push-pull tubes alternately draw high plate current. This intermittent drain on the power supply necessitates use of a special rectifier and filter circuit to maintain constant voltage under the varying current drain. The 83 tube is designed to meet this condition as it has low internal resistance and good voltage regulation.

ACTION OF TONEBEAM

The Atwater Kent tonebeam is a neon light-column that indicates visually when the set is tuned correctly to resonance with the incoming signal.

A typical circuit arrangement for the tonebeam is shown below. This particular circuit is used in Model 812.

The tonebeam requires an initial bias to make the short center electrode (E-2) positive with respect to the long electrode (E-1). The bias is adjustable to take care of different tonebeam tubes, the adjustment being provided by a potentiometer in series with resistors R-1 and R-3 which limit the range of adjustment. In the circuit shown below, the bias voltage across E-1 and E-3 can be adjusted from 0.1 to 1.5 volts.

When a signal is tuned in, the automatic volume control increases the negative bias on the control grids of the R.F., 1st-detector, and I.F. tubes, thus decreasing their amplification. This decrease in plate current causes a decrease in voltage across E-1 and E-3 and a corresponding increase in the voltage difference between electrodes E-1 and E-3. The increase in voltage across E-1 and E-3 causes the neon glow to extend up the long electrode. When the initial bias voltage is adjusted to the correct operating point, an increase of about 20 volts across E-1 and E-3 will cause the neon glow to extend up to the top of the long electrode E-1.

The electrode E-3 and resistor R-3 are used to ensure stable operation of the tonebeam. Resistor R-4 is used to make the tonebeam action more uniform on weak and strong signals.
**ATWATER KENT MFG. CO.**

**RESISTOR DATA**

**TUBULAR RESISTORS**

(When replacing a tubular resistor, use a resistor of the same identifying color and size)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Color</th>
<th>Resistance</th>
<th>List Price</th>
<th>Part No.</th>
<th>Color</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>21040</td>
<td>Black</td>
<td>65,000 Ohms.</td>
<td>$ 25</td>
<td>21090</td>
<td>Blue-gray</td>
<td>1,000,000 Ohms.</td>
</tr>
<tr>
<td>21030</td>
<td>Black-purple</td>
<td>100,000 Ohms.</td>
<td>$ 25</td>
<td>21320</td>
<td>Red-black</td>
<td>20,000 Ohms.</td>
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<tr>
<td>21020</td>
<td>Green</td>
<td>2,000,000 Ohms.</td>
<td>$ 25</td>
<td>21330</td>
<td>Red-gray</td>
<td>800,000 Ohms.</td>
</tr>
<tr>
<td>21010</td>
<td>Maroon</td>
<td>10,000 Ohms.</td>
<td>$ 25</td>
<td>21370</td>
<td>Green-yellow</td>
<td>900,000 Ohms.</td>
</tr>
<tr>
<td>20960</td>
<td>Gray-yellow</td>
<td>15,000 Ohms.</td>
<td>$ 25</td>
<td>21600</td>
<td>White</td>
<td>40,000 Ohms.</td>
</tr>
<tr>
<td>20970</td>
<td>Gray</td>
<td>30,000 Ohms.</td>
<td>$ 25</td>
<td>21640</td>
<td>Green-red</td>
<td>3,000 Ohms.</td>
</tr>
<tr>
<td>20980</td>
<td>Red-blue</td>
<td>100,000 Ohms.</td>
<td>$ 25</td>
<td>21800</td>
<td>Blue-yellow</td>
<td>5,000 Ohms.</td>
</tr>
<tr>
<td>21050</td>
<td>Black-yellow</td>
<td>65,000 Ohms.</td>
<td>$ 25</td>
<td>23120</td>
<td>Blue</td>
<td>1,000,000 Ohms.</td>
</tr>
</tbody>
</table>

The resistors shown above are of the tubular type, that is designated and illustrated as such. The wattage rating are shown in the illustrations. In order to avoid confusion, by listing the wattage rating of the various tubular resistors upon each wiring diagram and parts layout, such information is omitted and this page furnished in its place.

The various tubular resistors, with the possible exception of those used in the very old receivers, are exactly as shown above and it is a simple matter to determine the wattage rating by comparing the resistor with the illustration shown above. As a matter of fact, there can be no confusion concerning the half watt resistor. As to the difference between the one watt and one and one-half watt unit, the increased diameter of the latter is easily seen. As a matter of fact the one watt unit has pointed caps, whereas the one and one-half watt unit has somewhat blunt cap ends.

The color designations stated upon the wiring diagrams correspond with the colors stated above. Likewise the values stated in the diagrams correspond with the values given above. The flexible and flat resistors are so indicated upon the wiring diagrams and parts layouts. Wattage rating for these units is not available at the time of this writing.
The type 75 tube is not used in any 1st-type Model 155. The 2nd-type 155, which uses the 75 tube, will be described in a later supplement.

The 1st-type of Model 155 was made with three different arrangements of parts under the chassis. The first and third arrangements are shown in the charts below. The second arrangement is similar to the third except that in the second arrangement, condensers C9, C10, C12, C13, C14 and C15 are separate units.

In early 1st-type Model 155, the 1st-detector and oscillator is a type '36 tube.

The voltages shown above are for a line supply of 110-volts A.C.

Resistor R1 in the above diagram should be 1 meg, blue and gray.
MODEL 155
Schematic
2nd Type Above
serial 7086900

ATWATER KENT MFG. CO.

Diagram of 2nd-type Model 155 above Serial No. 7086900. Voltages shown above are for a line supply of 110-volts A.C.
MODEL 23-T-5
MODEL 23-T-5-SW

AUDIOLA RADIO CO.

2375

2375SW
SERIES 50B

<table>
<thead>
<tr>
<th>MODEL</th>
<th>VOLTS</th>
<th>FREQ</th>
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<tbody>
<tr>
<td>51B</td>
<td>110</td>
<td>60 cyc.</td>
</tr>
<tr>
<td>52B</td>
<td>110</td>
<td>25</td>
</tr>
<tr>
<td>53B</td>
<td>220</td>
<td>60</td>
</tr>
<tr>
<td>54B</td>
<td>220</td>
<td>25</td>
</tr>
</tbody>
</table>

Decimals are microfarads
Whole numbers are ohms
BELMONT RADIO CORP.

MODEL Series 40 AC
MODEL Series 40-A AC

SERIES 40

<table>
<thead>
<tr>
<th>MODEL</th>
<th>VOLTS</th>
<th>FREQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>110</td>
<td>60</td>
</tr>
<tr>
<td>42</td>
<td>110</td>
<td>25</td>
</tr>
</tbody>
</table>

VOLTAGES
Chassis frame to
Red  240
Blue 230
Yellow 140
Green  10
24 PL. 105
35 SG. 110
35CA   2
Line 115

B.R.C.
CHICAGO

DEIMALS ARE MICROFARADS. WHOLE NUMBERS ARE OHMS.

SERIES 40A

<table>
<thead>
<tr>
<th>MODEL</th>
<th>VOLTS</th>
<th>FREQ</th>
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</thead>
<tbody>
<tr>
<td>41A</td>
<td>110</td>
<td>60</td>
</tr>
<tr>
<td>42A</td>
<td>110</td>
<td>25</td>
</tr>
</tbody>
</table>

VOLTAGES
Chassis frame to
Red  240
Blue 230
Yellow 140
Green  10
35 PL. 105
35 SG. 110
35CA   2
Line 115

B.R.C.
CHICAGO

DEIMALS ARE MICROFARADS. WHOLE NUMBERS ARE OHMS.
OPERATING INSTRUCTIONS

1. Carefully remove antenna wire from its compartment and stretch out full length. A properly erected well insulated outdoor antenna about 75 feet in length, including lead-in, is recommended for permanent installations. ANTENNA TIP REQUIRED.

2. After making certain that power supply is off, weld, short-plug in receptacle.

3. Rotating VOLUME control clockwise (right) from an unloaded position increases volume. IF SET DOES NOT OPERATE IN ONE MINUTE ON DIRECT CURRENT REVERSE PLUG IN RECEPTACLE.

4. Advance volume control three-quarter turn, then select the desired station. Tune this station to the loudest point on the scale, then raise or lower volume with VOLUME control. Never regulate volume by defluting station selector, always adjust VOLUME control.

FIVE TUBES: 55C, 55E, 510, 560, 525,

SERVICE SUGGESTIONS

NOTE—CONNECTING CORD OF SET GETS WARM IN NORMAL OPERATION. DO NOT BECOME ALARMED.

Make sure that all tubes are pushed firmly in their proper sockets and that the clips are securely fastened to the caps on the tops of the tubes.

That the aerial is stretched out and that the connections to an outdoor antenna (if used) are good.

If necessary to change tubes or repair chassis, UNDER NO CIRCUMSTANCES REMOVE BACK OR CHASSIS WITHOUT FIRST REMOVING PLUG FROM LIGHT SOCKET.

To remove chassis from cabinet, pull wiring leads from front, remove back (held with screws to case). Remove four mounting screws, then chassis can be slipped out of case.

Schematic circuit diagram Model 525 AC-DC Superheterodyne. with automatic volume control

Should it be necessary, at any time, to dismantle this set the procedure is as follows. Attach a 450 kilocycle oscillator to the grid of the 606 tube in back of the variable condenser and adjust the trimming condensers of the i. f. transformer to maximum deflection on an output meter connected across the primary of the speaker input transformer. While adjusting these trimmers, the variable condenser should be at the maximum capacity position—full the rearmost fret or its rotation.

Next disconnect the antenna wire and connect an oscillator in series with a 75 milliamp. condenser to the antenna coil. Rotate the condenser plates to the maximum capacity position—extreme left turn, and adjust the trimmer condenser of the rear section of the variable condenser to resonance with an oscillator set at 1725 kilocycles. Then adjust the condenser at the front section of the variable condenser to resonance. Align at 500-1200-1800-600-330 kilocycles.

Series 50C: C is connected to B

1. If necessary, at any time, to dismantle this set the procedure is as follows. Attach a 450 kilocycle oscillator to the grid of the 606 tube in back of the variable condenser and adjust the trimming condensers of the i. f. transformer to maximum deflection on an output meter connected across the primary of the speaker input transformer. While adjusting these trimmers, the variable condenser should be at the maximum capacity position—full the rearmost fret or its rotation.

2. Next disconnect the antenna wire and connect an oscillator in series with a 75 milliamp. condenser to the antenna coil. Rotate the condenser plates to the maximum capacity position—extreme left turn, and adjust the trimmer condenser of the rear section of the variable condenser to resonance with an oscillator set at 1725 kilocycles. Then adjust the condenser at the front section of the variable condenser to resonance. Align at 500-1200-1800-600-330 kilocycles.

3. BRC, CHICAGO
BREMER-TULLY MFG. CO

B-T 7-70

REPORT

VOLUME CONTROL CHANGED.
2-.0002S CONDENSERS ADDED IN AUDIO.

B-T 7-70 & 71

VOLUME CONTROL CHANGED.
2-.0002S CONDENSERS ADDED IN AUDIO.

www.americanradiohistory.com
BREMER-TULLY MFG. CO

MODEL 81, 82
Power Unit Chassis

81, 82 AF and Power Unit Chassis

*8SC = 8 STRAND COPPER WIRE
*8SS = 8 STRAND SILVER WIRE
*½SC = ½ STRAND COPPER WIRE
*½SS = ½ STRAND SILVER WIRE

TERMINALS FOR A.C. SWITCH

www.americanradiohistory.com
MODEL 81, 82 Data
MODEL "ABC" Power Pack
BREMER-TULLY MFG. CO

INTERNAL CONNECTIONS OF FILTER AND BY-PASS CONDENSERS

Model 81, 82 Data

INTERNAL CONNECTIONS OF POWER TRANSFORMER

ARRANGEMENT OF RESISTORS ON TERMINAL BOARD

Model ABC Power Pack for AC Receivers
ACTUAL WIRING DIAGRAM OF AUDIO AMPLIFIER POWER SUPPLY CHASSIS
MODEL S-81, S-82
25 Cy. Power pack and AF schematic

MODEL S-81, S-82 25 cycle AF and Power Supply schematic
Material needed: Non-metallic screw driver, special 180 kilocycle test oscillator; coupling lead and a UY-227 with one filament or heater prong sawed off close to base of tube. Do not under any circumstances attempt these adjustments without this equipment.

Proceed as follows:

(a) Remove radio chassis from cabinet and place on box, or table, located convenient to rear of cabinet. Leave all cables connected but if necessary remove tape that holds these cables together.

(b) Take tandem tuning condenser from chassis by removing the three retaining screws, nuts and lock washers. Unsolder the four leads by pulling the condensers as far forward as possible to make the rear connections accessible. The condensers may now be removed by tilting the rear end up and pulling clear.

(c) Replace the screw holding the ground connection on under side of chassis and be sure this lead makes good electrical contact with chassis. See Print CA-6039.

(d) Place oscillator near receiver chassis and connect resonance meter in series with plate lead of second detector as explained in paragraph (a) under "Adjustment of Trimming Condensers."

(e) Clip coupling lead from oscillator to grid lead of 1st detector (2nd lead from left of those removed from gang condenser) marked "B" in Print CA-6039, and turn operating switch on. Turn the oscillator on, adjusted for 180 kilocycles, and signal from oscillator should be heard in speaker.

(f) With non-metallic screw driver adjust the third, second and first I. F. tuning condenser adjustment screws in order mentioned (tuning condensers on those nearest front of chassis, see Print CA-6039), for maximum volume in speaker and maximum deflection of milliammeter.

If meter needle goes off scale, reduce volume with volume control. After setting adjustment screws once for maximum milliammeter reading, carefully go over them a second time to be sure they are all exactly tuned for maximum amplification at 180 kilocycles. No signal or a loud howl indicates that the neutralizing condensers are off and should be adjusted before the final tuning operation.

C. Part II—Neutralization of I. F. Transformer.

(a) With apparatus set up as before, substitute special UY-227 tube with amputated heater prong in first I. F. socket (fifth tube from left side). Adjust set screw toward the rear of the right hand transformer for minimum meter deflection and minimum sound in speaker.

(b) Inter-change special UY-227 tube in first I. F. stage with the regular tube in the second I. F. stage (fourth tube from left side) and adjust set screw toward rear of middle transformer for minimum meter reading and minimum sound in phones. The left transformer is not neutralized, the two condensers in this unit are in parallel and are both used for tuning.

After tuning and neutralizing the I. F. amplifier, it is best to check the adjustment of the oscillator trimming condensers as mentioned before in this Bulletin.
Adjustment for Low Line Voltages. The R-1 is normally adjusted for line voltages between 115 and 120 volts and should not be changed unless it has been definitely ascertained that the line voltage is less than 115 volts and then only when the volume is insufficient to satisfy the customer.

To change the taps used on the power transformer untape and unsolder the **black with red tracer** lead at its junction with the power cable about three inches from the SPU. Connect the **red and black** lead to the power cable lead, solder and tape. Tape up the unused **black with red tracer** lead.
MODEL 3 MW 8
Trimmers and Notes

THE BRUNSWICK-BALKE-COLLENDER CO.
CHICAGO, ILLINOIS.
TECHNICAL DIVISION

- VOLTAGE DIVIDER CIRCUIT
- LOCATION OF ADJUSTMENT CONDENSERS
- TUBE SEQUENCE AND FUNCTION

DESIGNED DRAWN CHECKED DATE

APPROVED

CA-6057

INTERNAL CONNECTIONS OF POWER TRANSFORMER
INTERNAL CONNECTIONS OF FILTER CONDENSERS
Voltage and Notes

-VOLTAGE AND CONTINUITY TESTS

Voltage Test on Chassis, X-1104—With set in normal operating condition, Volume Control on maximum, Radio-Record Switch on “Radio” and all tubes known to be good.

<table>
<thead>
<tr>
<th>Socket</th>
<th>Tube Type</th>
<th>Fil.</th>
<th>Grid</th>
<th>Cathode</th>
<th>Plate</th>
<th>Plate Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st R.F.</td>
<td>UY-227</td>
<td>2.25</td>
<td>6</td>
<td>17</td>
<td>135</td>
<td>4</td>
</tr>
<tr>
<td>2nd R.F.</td>
<td>UY-227</td>
<td>2.25</td>
<td>6</td>
<td>17</td>
<td>135</td>
<td>4</td>
</tr>
<tr>
<td>1st Det.</td>
<td>UY-227</td>
<td>2.25</td>
<td>11</td>
<td>16</td>
<td>80</td>
<td>1</td>
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<tr>
<td>1st I.F.</td>
<td>UY-227</td>
<td>2.25</td>
<td>6</td>
<td>17</td>
<td>135</td>
<td>5</td>
</tr>
<tr>
<td>2nd I.F.</td>
<td>UY-227</td>
<td>2.25</td>
<td>6</td>
<td>17</td>
<td>135</td>
<td>5</td>
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<tr>
<td>Osc.</td>
<td>UY-227</td>
<td>2.25</td>
<td>0</td>
<td>17</td>
<td>80</td>
<td>6</td>
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<tr>
<td>2nd Det.</td>
<td>UY-227</td>
<td>2.25</td>
<td>22</td>
<td>15</td>
<td>180</td>
<td>1</td>
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<tr>
<td>2nd Det.*</td>
<td>UY-227</td>
<td>2.25</td>
<td>22</td>
<td>5</td>
<td>140</td>
<td>5</td>
</tr>
<tr>
<td>Vol. Cont.</td>
<td>UY-227</td>
<td>2.25</td>
<td>5</td>
<td>0</td>
<td>90</td>
<td>None</td>
</tr>
<tr>
<td>Pilot</td>
<td>T-3, 6 V. @ O. 15A</td>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Power</td>
<td>UX-250</td>
<td>7.25</td>
<td>60</td>
<td>None</td>
<td>400</td>
<td>50</td>
</tr>
</tbody>
</table>

*Note: This reading applies when Radio-Record Switch is in “Record” position.

Voltage Test on SPU, X-902, Terminal Strip

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
<th>VOLTAGE</th>
<th>CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bias</td>
<td>Detector Cathode</td>
<td>10</td>
<td>Direct</td>
</tr>
<tr>
<td>Bias</td>
<td>Amplifier Plate</td>
<td>12</td>
<td>Direct</td>
</tr>
<tr>
<td>Bias</td>
<td>Amplifier Cathode</td>
<td>150</td>
<td>Direct</td>
</tr>
<tr>
<td>Pilot</td>
<td>Pilot</td>
<td>4</td>
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</tr>
<tr>
<td>Filament</td>
<td>Amplifier</td>
<td>2.5</td>
<td>Alternating</td>
</tr>
<tr>
<td>Filament</td>
<td>Detector</td>
<td>2.5</td>
<td>Alternating</td>
</tr>
<tr>
<td>Filament</td>
<td>Volume Control</td>
<td>2.5</td>
<td>Alternating</td>
</tr>
</tbody>
</table>

Note: The voltages given in the above tests are not necessarily the true voltages but are rather the readings obtained on a standard set checker.

The Tuning Meter is a necessity in securing the maximum in tone quality from this instrument. With the automatic volume control set for the pre-determined volume all signals are amplified to or cut down to the desired volume and it is difficult to tell the exact point of resonance on the tuning dial. For this reason the meter instead of the ear should be used as a guide for true resonance. The tuning meter is in reality a milliammeter inserted in the plate circuits of the radio frequency and intermediate frequency amplifier tubes. Until the current is turned on the tuning meter will register at its maximum position. This is because the meter has a reversed movement and will automatically assume a 0 position when the maximum plate current is flowing through it. The action of the incoming signal is to reduce the current and the needle will move towards 10. This meter is also of considerable advantage to the Technician in adjusting the 3NW8 intermediate tuning and neutralizing condensers.
-SERVICE ADJUSTMENTS

The Line Voltage Switch should be adjusted at the time of installation. This switch is normally placed in the 120 volt position and should be left there at all times unless the Technician has measured the line voltage and finds it to be constantly below 115 volts and that the volume on the 120 volt position is insufficient to satisfy the customer. If such is the case, this voltage switch located between the two UX-281 rectifier tubes on the SPU should be thrown over into the opposite position marked 110 volts.

The Hum Minimizing Potentiometer located on the SPU between the UX-250 power amplifier tubes and the field plug should be adjusted with a screw driver at the time of installation for minimum hum. If this adjustment makes a noise in the loud speaker due to corrosion on the potentiometer winding, the slotted shaft should be worked vigorously back and forth. Allow a period of two minutes before this adjustment is made to be sure that all tubes are operating at the correct temperature.

The Compensating Condenser located on the left hand side of the radio chassis facing the instrument from the rear should be adjusted if the set shows any tendency toward oscillation. This is adjusted at 1400 kilocycles with a non-metallic screw driver in the following manner:

Tune in the 1400 kilocycle signal to maximum intensity with the volume control in maximum position. Turn compensating screw to the right until instrument oscillates in a pronounced manner, then reverse the direction of rotation until this oscillation ceases. Tune in a 550 kilocycle signal and repeat adjustment as above.

The Trimming Condensers should not be adjusted unless the Technician is sure that all other portions of the circuit are correct, that all tubes are good and that the line voltage switch and compensating condenser are in the correct positions. If the instrument appears normal in every way but is insensitive on any or all portions of the tuning drum, it is fairly safe to assume that the trimming condensers are out of adjustment.

The adjustment of these condensers requires a modulated oscillator capable of oscillating from 550 to 1400 kilocycles. If such an oscillator is available, locate it two or three feet from the 3NW8 and adjust it to oscillate at 1400 kilocycles. Tune this radiated signal in on the 3NW8 to its point of maximum intensity, as registered on the tuning meter. Then with non-metallic screw driver adjust trimming condenser No. 1 as shown on Print CA-6057 for the maximum deflection of the tuning meter. The peak is fairly sharp at this frequency and care should be taken to get the condenser adjustment accurate. Now readjust the modulated oscillator to oscillate at 550 kilocycles and adjust trimmer condenser No. 2 for maximum meter reading. The adjustment will be found much broader and to get a definite peak indication it will be necessary to set the oscillator some distance from the set and retard the sensitivity control.

After these adjustments have been made once it will be necessary to go over them a second time at least, and if they are far out of adjustment a third re-adjustment is advisable.

The Intermediate Transformer Tuning Condenser Adjustment Screws are located beneath the tandem tuning condenser assembly. These adjustments are provided to peak the transformers of the intermediate amplifier, should the intermediate transformers lose their adjustment during shipment. An untuned intermediate transformer is characterized by low volume, distortion and the inability of the receiver to pick up distant signals. If adjustment
has been made of the oscillator trimming condenser and R. F. compensating condenser, and if the antenna, ground and tubes are known to be in good condition, insensitivity and distortion on the part of the receiver indicates that an adjustment of the transformer tuning condensers is necessary. They should be adjusted in the following manner:

1. Remove chassis from cabinet by taking out the four machine screws, removing volume control, sensitivity control and tuning control knobs and unscrewing the two wood screws that hold tuning meter to front panel of cabinet. The control knobs are of the “push-on” type and can be removed by pulling straight out. The chassis with power cable attached, but with radio-record switch cable detached, should be placed on a small table located conveniently at the rear of the cabinet so that the instrument may be operated connected to the socket power unit. As indicated in Print CA-6057, it will be necessary to connect small jumper wires between terminals 1, 2 and 4 on the radio-record switch terminal strip.

2. Remove the tandem tuning condenser assembly by unscrewing the three machine screws bolting it to the chassis, and unsoldering four connection made to the rear of the condensers. Place tuning condenser assembly in a convenient position for operation in front of the receiver chassis, as shown in Print CA-6057. It will facilitate the tuning of these condensers if they are set on a tube carton or similar sized box. The machine screw holding the grounded lug should be replaced in the chassis. This is indicated on Print CA-6057 by the screw head marked “ground.” Small jumper leads should be soldered between the condenser assembly and the former condenser connections. These should be approximately four inches long and are shown on Print CA-6057.

With all tubes in their proper sockets and known to be in good condition the set may now be operated in the usual manner and at the same time the tuning and neutralizing condensers are available for adjustment.

The oscillator referred to in the previous paragraph under the caption “Trimming Condensers” may be used to adjust the tuning and neutralizing condensers of the intermediate transformers. This oscillator should be modified in such a way that it will transmit an unmodulated wave. Assuming the oscillator described on Page 6 of Service Bulletin No. 63 is used, this may be changed from a modulated to an unmodulated oscillator by replacing the 3-8 megohm grid leak with a grid leak of about 40,000 ohms.

The oscillator should be placed in operation at 750 kilocycles several feet from the receiver to be adjusted; and the receiver should be tuned accurately to the oscillator frequency. The volume and sensitivity controls should be so adjusted that the tuning meter will register three quarters of full scale deflection. With a non-metallic screw driver the tuning condensers may now be adjusted for maximum deflection on the tuning meter. A very sharp and well defined peak will be found by this method and the tuning meter may be kept on scale by reducing the volume control. The transformers should be adjusted, starting with No. 3, then No. 2 and No. 1 last.

After these transformers have been properly peaked once, using the above method, they should be neutralized and then repeaked a second time.

The Intermediate Transformer Neutralizing Adjustments are made with the apparatus set up in the same manner as described above.
Adjustment of Neutralizing Condensers

To neutralize the R.F. amplifier proceed as follows:

1. Adjust a modulated oscillator for operation at 1,400 kilocycles and couple it to the long antenna post of the receiver with a five-foot wire, one end of which should be wrapped two or three times about the oscillator coil.

2. Tune the oscillator signal in on the radio to maximum volume using both the tandem condenser control and the antenna condenser control.

3. Allow the receiver and oscillator to operate for about one minute in order that the tubes may become thoroughly warmed up and stable. Then replace the first R.F. tube with one having characteristics which are desired to use in the new R.F. amplifier—do not neutralize with one make of tube and then use a different make for an amplifier. To do so may cause the receiver to oscillate stronger than it did in the beginning.

4. Adjust the first R.F. neutralizing condenser for minimum signal. The neutralizing condensers will be found located between the coil and tube sockets of the stage they neutralize. Because of the great amplification secured, a node or dead spot will not be found.

5. Remove the dummy tube and insert in its place a good tube. Place the dummy tube in the second R.F. socket and after allowing one minute for the first R.F. tube to become thoroughly heated, neutralize the second stage as explained in the event any trouble is experienced in neutralizing this receiver, a thorough check should be made of the receiver voltages and the bypass condensers. An open bypass condenser may allow sufficient radio frequency energy to feed back from one stage to another to make neutralizing impossible. If voltages are tested and found O.K. and the bypass condensers are all good a different dummy tube should be used.
Adjustment for Minimizing Hum—In order that the receiver may be adjusted for quiet operation on any A.C. line, two hum minimizing potentiometers have been placed on the SPU chassis connected across the UY-227 filament winding and the UX-245 filament winding respectively. The UY-227 hum minimizing potentiometer is located between the UY-227 socket and the first UX-245 socket. The adjustment of this control should be made after the UX-245 hum minimizing potentiometer has been adjusted. If the UY-227 hum minimizing potentiometer appears irresponsive, a new tube should be inserted in the first audio and detector sockets.

An excessive hum which usually appears on a strong local or nearby station and which can not be balanced out with the hum minimizing potentiometers may be due to one or more of the R.F. stages oscillating, in which case the receiver should be neutralized before the hum minimizing potentiometers are adjusted.

MODELS 14, 21 and COMBINATION MODEL 31 with PANATROPE
The Panatrope Combination Model S-31

The Input Transformer, between the pickup and amplifier, has a very high turn ratio (75 to 1) and is mounted at an angle found to give the least amount of hum.

Adjusting Trimmers on Condenser Gang

To make this adjustment tune in a weak station as near the 1500 kilocycle end of dial as possible, and with lock nuts loose, adjust the four screws to give the loudest signal. With this adjustment completed, the lock nuts should be tightened. One factor to observe when making this operation is not to continually increase the capacity of the trimming condensers, as the high frequency tuning limit of the set will be lowered.

External Pickup Operation

In the event it is desired to use the Models S-14 and S-21 to amplify and reproduce phonographic music, any good pickup may be connected to an ordinary telephone plug and inserted in the radio jack located in the rear of the socket power unit. Phonograph volume may be controlled by the volume control usually furnished with such equipment. It is important to remember, if this magnetic pickup is used, that the radio cannot be operated until the plug is removed.

The Voltage Regulator Tube

While ballast D-110 is normally intended for use in these models, there are special conditions encountered where the line voltage is extremely high. When this is the case, it is advisable to use a D-105 tube, which will effect a reduction in the voltages applied to the different tubes, preventing short life due to over-voltage.

In the 25 Cycle Model an additional filter condenser is used; also the power transformer and filter choke deviate from the 60-cycle standard.

There are two hum minimizing potentiometers: on the socket power unit chassis.

Hum will result in the Model S-31 if the grounding wires on the induction disc motor and suspension arm are removed. Examine these to see that they are in place. It is possible in some cases where hum is experienced in the record side to make a slight reduction by unclamping the pickup input transformer and re-clamping it in the angle found to give less hum. This angle is determined with the set turned on and the switch turned toward the record position by noting the amount of hum when the transformer is held at various positions.

If the hum is heard only when the station is tuned in, it is probably caused by some peculiar condition existing in the lighting lines, and can usually be eliminated by grounding the ballast tube side of line through a .25 mfd. condenser.

THE POWER PACK.
The filter in the plate supply system is of the type wherein a certain percentage of the a-c component in the rectified voltage is applied across a choke section, inducing a corresponding current in an adjacent section. This latter section is connected in series with the filter output in such a manner as to buck out, or cancel, any alternating current induced across the filter input system.

Power Consumption

(60 cycle model) 110 Watt
(25 cycle model) 130 Watt

Speaker Field - 4750 Ohm, 160 Volt, 54 Ma.

PANATROPE - Type of motor - Induction disc
- Power consumption of motor - 35 Watt
- Type of magnetic pickup - Low imped.

The following Ballast units are specified by

BRUNSWICK - For 60 cyc. - DURESITE BALLAST D-110
- 25 Watt - D-125
VOLTAGE AT SOCKETS

<table>
<thead>
<tr>
<th>Position of Tube</th>
<th>Heater to Cathode Volts</th>
<th>Control Grid to Cathode Volts</th>
<th>Screen-Grid to Cathode Volts</th>
<th>Plate to Cathode Volts</th>
<th>Plate Current Milamps</th>
<th>Filament or Heater Volts</th>
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</thead>
<tbody>
<tr>
<td>1st, 2nd, 3rd R. F</td>
<td>-2.5</td>
<td>-5</td>
<td>-2.5</td>
<td>60</td>
<td>135</td>
<td>1.7</td>
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<td>Detector</td>
<td>*-5</td>
<td>*-5</td>
<td>*-13</td>
<td>*84</td>
<td>*4.5</td>
<td>*0.2</td>
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<td>1st A. F.</td>
<td>-8</td>
<td>*-.27</td>
<td>-45</td>
<td>245</td>
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<td>45 per</td>
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<td>Rectifier</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Readings may vary considerably depending on resistance of voltmeter used.
MODEL 15, 22, 32, 42 AC
AC Speaker
and Voltage

BRUNSWICK RADIO CORPORATION

TONE CONTROL RESISTOR

OUTSIDE WIRE FROM BUCKING COIL

BLACK

BRUNSWICK—Models 15-22-32-42
Line Voltage 110—Voltage Tap 120
Volume Control Full On

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Transformer Type</th>
<th>Operating Voltage</th>
<th>Plate</th>
<th>Control</th>
<th>Rectifier</th>
<th>Socket Pin</th>
<th>Plate Voltage</th>
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<tr>
<td>524</td>
<td>2A</td>
<td>2.5 192 5 480</td>
<td>60 8.5 2 180</td>
<td>10</td>
<td>-</td>
<td>3.2</td>
<td>1</td>
<td>50</td>
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<tr>
<td>524</td>
<td>2A</td>
<td>2.5 192 5 480</td>
<td>60 8.5 2 180</td>
<td>10</td>
<td>-</td>
<td>3.2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>524</td>
<td>2A</td>
<td>2.5 192 5 480</td>
<td>60 8.5 2 180</td>
<td>10</td>
<td>-</td>
<td>3.2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>524</td>
<td>2A</td>
<td>2.5 192 5 480</td>
<td>60 8.5 2 180</td>
<td>10</td>
<td>-</td>
<td>3.2</td>
<td>1</td>
<td>50</td>
</tr>
</tbody>
</table>

BRUNSWICK—Models 15-22-32-42
Line Voltage 110—Voltage Tap 120
Volume Control Full On

TONE CONTROL RESISTOR

OUTSIDE WIRE FROM BUCKING COIL

BLACK

BRUNSWICK—Models 15-22-32-42
Line Voltage 110—Voltage Tap 120
Volume Control Full On

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Transformer Type</th>
<th>Operating Voltage</th>
<th>Plate</th>
<th>Control</th>
<th>Rectifier</th>
<th>Socket Pin</th>
<th>Plate Voltage</th>
</tr>
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<tbody>
<tr>
<td>524</td>
<td>2A</td>
<td>2.5 192 5 480</td>
<td>60 8.5 2 180</td>
<td>10</td>
<td>-</td>
<td>3.2</td>
<td>1</td>
<td>50</td>
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<tr>
<td>524</td>
<td>2A</td>
<td>2.5 192 5 480</td>
<td>60 8.5 2 180</td>
<td>10</td>
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<td>60 8.5 2 180</td>
<td>10</td>
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<td>3.2</td>
<td>1</td>
<td>50</td>
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<tr>
<td>524</td>
<td>2A</td>
<td>2.5 192 5 480</td>
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<td>10</td>
<td>-</td>
<td>3.2</td>
<td>1</td>
<td>50</td>
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</tbody>
</table>

Models Brunswicks 15, 22, 32, 42 (1930)

DET 24A 15 45 45
3 RF 24A 10 10
2 RF 24A 10 10
1 RF 24A 10 10
24A FRONT

120 volt or normal position

110 volt position
MODEL 17, 24, 25 AC
Schematic

BRUNSWICK RADIO CORPORATION

Models 17, 24, 25 (1931)

<table>
<thead>
<tr>
<th>AF</th>
<th>AF</th>
<th>O/C</th>
<th>DET</th>
<th>A/V/C</th>
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<tbody>
<tr>
<td>'20</td>
<td>'24</td>
<td>'21A</td>
<td>'24A</td>
<td>'22</td>
</tr>
</tbody>
</table>

RECT 3R 3R 3R 3R 3R

IF PEAK 175 KC
NEUTRALIZING and RESONANCE TESTS

Neutralizing the Bush & Lane Chassis No. 10 De Luxe is an extremely simple and rapid operation. A near-by powerful station may be used for this purpose, but a much more desirable and accurate means is by use of a modulated oscillator, that is, a vacuum tube oscillator generating an audible note. Buzzer modulated, or other types of oscillators, are entirely satisfactory. The circuit of a very simple oscillator is given in Fig. 5, which is of the grid leak and condenser modulated type. It will be apparent, to a person unfamiliar with such apparatus, that is it nothing more than a regenerative detector circuit. For neutralizing purposes the switch across the grid leak and condenser is left open and no deflection will be had on the O-2 milliamperc DC meter.

Tune receiver to approximately 1200 kilocycles, and the oscillator to the receiver, which should result in a strong audible signal in the speaker. If the receiver was previously oscillating at 1200 kilocycles, first neutralize at a lower frequency, about 800 or 900 kilocycles, and repeat at 1200 kilocycles.

Replace the third R. F. tube (third from rear) with a "dead" tube, whose filament has been opened by drilling into the tube base near a filament prong and breaking that filament wire. Adjust neutralizer NC3 (third from rear) until a minimum of the oscillator signal is heard. If oscillator signal is weak, move oscillator closer to antenna, or even connect one of the resonance testing clips onto antenna. Change tube and allow to heat to normal operating condition.

Next replace the second R. F. tube with the "dead" or neutralizing tube, and adjust NC2 (second neutralizer from rear) for a minimum of signal. Replace good tube, allowing it to heat. Finally, replace the first R. F. tube with the "dead" tube and adjust NC1, (neutralizer nearest rear) for a minimum of signal. Replace good tube and allow to heat to normal operating temperature.

It is advisable to place shield over "dead" tube, each time, while neutralizing.

After neutralizing, the receiver should be stable over the entire frequency range, and if not, the trouble is due to tubes, ungrounded shielding of four-gang condenser, coil shields, tube shields, or altered wiring under the base.

Accurate resonance tests may be made with an oscillator indicating resonance by the "dip" of a meter in either the plate or the grid circuit of the oscillator tube. The simple oscillator shown in Fig. 5 may be used for this purpose by closing the switch across the grid leak and condenser, shorting them, when a deflection of the O-2 milliamperes meter will be noted, showing the circuit to be oscillating. One wire from the 8-turn pickup coil is connected directly to the "ground" or chassis. The other wire from this coil terminates at two .00025 Mfd. grid condensers in series which in turn are attached to a clip. These condensers must be as near the clip as possible. A single .0001 Mfd. condenser is sufficient.

Attaching the clip and condensers to the stator of the first condenser (this may be done below the base, 120VAC terminal of first coil) rotate dial of oscillator tuning condenser until a "dip" or "wiggle" of the milliammeter is found, indicating that the oscillator is in resonance with the circuit under test. Note oscillator dial reading. It should be repeated when moving clip and fixed condensers to each of the other coils, with receiver tuning condenser left in the same position.

A check for resonance with receiver tuning condenser plates nearly full "in" and nearly full "out" is sufficient.

If the oscillator dial is calibrated from 0 to 100, a difference in reading of one degree on the dial is considered fairly good resonance, though limits are held much more closely at the factory. Unless compensated for, while making resonance tests, the oscillator will usually show a variation in detector coil and antenna coil from the second and third coils. This is caused by the antenna coupling and detector coupling systems, and need not be considered alarming.

Service laboratories desiring any further testing information than given in this instruction manual may obtain same by writing the factory testing department.
CAPEHART CORPORATION

MODEL 110
Amperion
Wiring

WIRING DIAGRAM "110 CAPEHART AMPERION"
CAPEHART CORPORATION

MODEL 170
Amperion Wiring

WIRING DIAGRAM - VA AMPERION IMPERION
CENTURY RADIO PRODUCTS CO.

MODEL 4-47
Schematic

Century Radio Products Inc.

1003

www.americanradiohistory.com
| MODEL 51 |  -  | 60 CYCLE |
| Trans. Osc. | IF | RF | 247 | AVC | 280 | Det |
| 235 | 227 | 235 | 235 | Output | 227 | DC | 224 |

**PLATE VOLTAGE**
- 160
- 55
- 160
- 160
- 242
- 48
- 370
- 80

**AVERAGE PLATE CURRENT MA**
- 1
- -
- 5
- 5
- .2

**SCREEN VOLTAGE**
- 58
- -
- 58
- 58
- 250
- -
- 40

**AVERAGE SCREEN CURRENT MA**
- .2
- -
- 1
- 1
- 1.5
- 7
- -
- .15

**GRID VOLTAGE**
- 10
- -
- 1.5
- 1.5
- 18
- -
- 6

**FILAMENT VOLTAGE**
- 2.4
- 2.4
- 2.4
- 2.4
- 2.6
- 2.5
- 5
- 2.5

**SPEAKER FIELD VOLTAGE**
- 83 volts

**TOTAL PLATE CURRENT**
- 60 ma

**MODEL 52 |  60 CYCLE |**

| Trans. Osc. | IF | RF | 247 | Det | Pentode | 280 |
| 235 | 227 | 235 | 235 | 224 | 247 |

**PLATE VOLTAGE**
- 230
- 55
- 230
- 230
- 75
- 220
- 360

**AVERAGE PLATE CURRENT MA**
- 1
- -
- 3
- 5
- 5
- .2
- 26

**SCREEN VOLTAGE**
- 55
- -
- 55
- 55
- 38
- 230

**AVERAGE SCREEN CURRENT MA**
- .2
- -
- 1
- 1
- 1.15
- 7
- -

**GRID VOLTAGE**
- 10
- -
- 1.5
- 1.5
- 17

**FILAMENT VOLTAGE**
- 2.47
- 2.52
- 2.54
- 2.56
- 2.5
- 2.49
- 5

**SPEAKER FIELD VOLTAGE**
- 115 volts

**TOTAL PLATE CURRENT**
- 40 ma.
Note: All voltages measured with 1000 ohm per volt voltmeter. 280 output measured on 750 volt scale, DC voltages under 10 volts measured on 10 volt scale, and all others measured on 250 volt scale. Control grid bias measured from cathode to ground. 247 bias measured across 400 ohm bias resistor.
COLONIAL RADIO CORP.

MODEL 55
Schematic
Voltage

VOLTAGE TABLE
Line 115 volts Watts 18

<table>
<thead>
<tr>
<th>Plate Volts</th>
<th>RF</th>
<th>IF</th>
<th>Osc</th>
<th>Rect.</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>230</td>
<td>50</td>
<td>415</td>
<td>AC</td>
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<tr>
<td>Screen Volts</td>
<td>75</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Grid Volts</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fil. Volts</td>
<td>2.34</td>
<td>2.34</td>
<td>2.34</td>
<td>4.8</td>
</tr>
<tr>
<td>Plate Crnt.</td>
<td>4.8ma</td>
<td>4.8</td>
<td>2.8</td>
<td></td>
</tr>
</tbody>
</table>

IF PEAK 1000 KC

---

www.americanradiohistory.com
POWER TRANSFORMER COLOR CODE

25-60 cy.

MODEL 62
Schematic

COLONIAL RADIO CORP.
### Table: Voltage and Current

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Plate Voltage</th>
<th>Screen Voltage</th>
<th>Control Grid Voltage</th>
<th>Plate Current</th>
<th>Screen Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>224 - Translator</td>
<td>2.5, 215, 75</td>
<td>-6, -10</td>
<td>.5, .2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57 - Translator</td>
<td>2.5, 215, 75</td>
<td>-5, -7.5</td>
<td>.5, .25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58 - First I.F.</td>
<td>2.5, 175, 75</td>
<td>-4, -45</td>
<td>3.5, 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58 - Second I.F.</td>
<td>2.5, 220, 80</td>
<td>-4, -45</td>
<td>4.5, 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57 - Second Detector</td>
<td>2.5, 75, 40</td>
<td>-3, -5</td>
<td>.1, .06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>224 - Second Detector</td>
<td>2.5, 64, 40</td>
<td>-4.5, -25</td>
<td>.25, .06</td>
<td>.06, .06</td>
<td></td>
</tr>
<tr>
<td>247 - Output</td>
<td>2.5, 215, 250</td>
<td>**, **</td>
<td>26.5, 32</td>
<td>5.5, 6.75</td>
<td></td>
</tr>
<tr>
<td>56 - Oscillator</td>
<td>2.5, 40 - 60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>280 - Rectifier</td>
<td>4.8, Max DC Volts - 350</td>
<td></td>
<td>25 MA.</td>
<td>Each Plate</td>
<td></td>
</tr>
</tbody>
</table>

* 40 Volts when not oscillating; 60 Volts when oscillating. Stop from oscillating by touching finger to grid. Line - 117 Volts; Watts - 65.

### Diagrams

**A** and **B**

- **A** shows the layout with a 57 Translator and a 58 1st I.F.
- **B** shows the layout with a 57 Translator and a 224 1st I.F.

Some sets of this model have the layout shown at 'A'; others as shown at 'B'.

---

**Note:**

- Some 530,000 ohm in series.
- Others have a 57 Translator and a 224 detector.
Should the contacts of the wave changing switch become noisy in time, they can be cleaned with a piece of absorbent cotton twisted around a toothpick and dipped in alcohol, Carbona, carbon tetrachloride or similar substance.

The positions of the wave changing switch are:

#1 (Farthest left or counter-clockwise) 5000 to 16000 kc
#2 1600 to 5100 kc
#3 550 to 1600 kc

**Coil A**
- Lug #1 - To switch plate "D", lug 2
- Lug #2 - To coil "C", lug 1, and ground

**Coil B**
- Lug #1 - To switch plate "B", lug 2
- Lug #2 - To switch plate "A", lug 2
- Lug #3 - To coil "D", lug 3, and ground

**Coil C**
- Lug #1 - To ground and to coil "A", lug 2
- Lug #2 - To switch plate "D", lug 1

**Coil D**
- Lug #1 - To switch plate "B", lug 1
- Lug #2 - To switch plate "A", lug 1
- Lug #3 - To ground and coil "B", lug 3

**Coil E**
- Lug #1 - To switch plate "C", lug 2
- Lug #2 - To switch plate "F", lug 2
- Lug #3 - To coil "F", lug 1 and to + side of 4 MFD condenser mounted on rear chassis.
- Lug #4 - To .005 condenser
- Lug #5 - To ground

**Coil F**
- Lug #1 - To coil "E", lug 3 and to 75M ohms resistor
- Lug #2 - Blank
- Lug #3 - To switch plate "E", lug 1
- Lug #4 - To switch plate "F", lug 1

**Coil G**
- Lug #1 - To switch plate "F", lug 3
- Lug #2 - To + side of 4 MFD condenser mounted on rear chassis
- Lug #3 - To "High" side of padding condenser mounted on rear of variable tuning condensers.
- Lug #4 - To switch plate "E", lug 3
- Lug #5 - To ground
- Lug #6 - To switch plate "C", lug 3
SWITCH CONNECTIONS *

Two types of switches are used in these receivers. Some have three plates and others six. In the illustrations the switches are so numbered and lettered that the coil and switch connections tabulated below are correct for either type switch.

**Plate A**

<table>
<thead>
<tr>
<th>Lug #1</th>
<th>To coil &quot;P&quot;, lug 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lug #2</td>
<td>To coil &quot;B&quot;, lug 2</td>
</tr>
<tr>
<td>Lug #3</td>
<td>To coil &quot;H&quot;, lug 4</td>
</tr>
<tr>
<td>Lug S</td>
<td>To stator of #1(shaft-end unit) variable tuning condenser unit</td>
</tr>
</tbody>
</table>

**Plate B**

<table>
<thead>
<tr>
<th>Lug #1</th>
<th>To coil &quot;P&quot;, lug 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lug #2</td>
<td>To coil &quot;B&quot;, lug 1</td>
</tr>
<tr>
<td>Lug #3</td>
<td>To volume control and coil &quot;H&quot;, lug 1</td>
</tr>
<tr>
<td>Lug S</td>
<td>To antenna lead</td>
</tr>
</tbody>
</table>

**Plate C**

<table>
<thead>
<tr>
<th>Lug #1</th>
<th>To ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lug #2</td>
<td>To coil &quot;B&quot;,lug 1</td>
</tr>
<tr>
<td>Lug #3</td>
<td>To coil &quot;G&quot;, lug 6</td>
</tr>
<tr>
<td>Lug S</td>
<td>To .1 and .001 condensers mounted on rear of chassis</td>
</tr>
</tbody>
</table>

**Plate D**

<table>
<thead>
<tr>
<th>Lug #1</th>
<th>To coil &quot;G&quot;, lug 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lug #2</td>
<td>To coil &quot;A&quot;, lug 1</td>
</tr>
<tr>
<td>Lug #3</td>
<td>To coil &quot;I&quot;, lug 5</td>
</tr>
<tr>
<td>Lug S</td>
<td>To stator, second variable tuning condenser unit</td>
</tr>
</tbody>
</table>

**Plate E**

<table>
<thead>
<tr>
<th>Lug #1</th>
<th>To coil &quot;P&quot;, lug 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lug #2</td>
<td>To .005 condenser other side of which goes to coil &quot;E&quot;, lug 4.</td>
</tr>
<tr>
<td>Lug #3</td>
<td>To coil &quot;G&quot;, lug 4</td>
</tr>
<tr>
<td>Lug S</td>
<td>To .00025 oscillator grid condenser and stator of number three variable tuning condenser unit.</td>
</tr>
</tbody>
</table>

**Plate F**

<table>
<thead>
<tr>
<th>Lug #1</th>
<th>To coil &quot;F&quot;, lug 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lug #2</td>
<td>To coil &quot;P&quot;, lug 2</td>
</tr>
<tr>
<td>Lug #3</td>
<td>To coil &quot;G&quot;, lug 1</td>
</tr>
<tr>
<td>Lug S</td>
<td>To plate, 56 Oscillator</td>
</tr>
</tbody>
</table>
COLONIAL RADIO CORP.

MODEL 65
Schematic

Color code of R697A output transformer:
Primary - Red to B+; Green to 235 plate.
Secondary - Yellow and white to speaker.

STATOR No.1 (SHAFT END) VAR. TUNING COND.
R6687 2ND R.F. COIL

STATOR No.2 VAR. TUNING COND.
R6687 1ST R.F. COIL

STATOR No.3 VAR. TUNING COND.
R7300 ANT. COIL

COIL CONNECTIONS
VIEWED FROM BOTTOM OF CHASSIS
**Model 65**

Voltage Socket

---

**Colonial Radio Corp.**

**Tube Positions**

<table>
<thead>
<tr>
<th>Tube</th>
<th>Filament Voltage</th>
<th>Plate Voltage</th>
<th>Screen Voltage</th>
<th>Control Grid V.</th>
<th>Plate Current</th>
<th>Screen Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>232 - First R.F.</td>
<td>2.1</td>
<td>155</td>
<td>67</td>
<td>-3</td>
<td>1.7</td>
<td>.125</td>
</tr>
<tr>
<td>232 - Second R.F.</td>
<td>2.1</td>
<td>155</td>
<td>67</td>
<td>-3</td>
<td>1.7</td>
<td>.125</td>
</tr>
<tr>
<td>232 - Detector</td>
<td>2.05</td>
<td>27</td>
<td>13.5</td>
<td>*</td>
<td>.05</td>
<td>Too low to read</td>
</tr>
<tr>
<td>233 - Output</td>
<td>2.05</td>
<td>155</td>
<td>135</td>
<td>*</td>
<td>14</td>
<td>4</td>
</tr>
</tbody>
</table>

Total "B" current drain = 22.4 m.A.
Total "A" current drain = 440 m.A.

* 1 Meg. resistor in series.

Grid, plate and screen voltages taken between negative side of filament and respective element. Volume control at maximum.

Control grid readings taken on 7.5 volt scale of 1000 ohms per volt meter; others on 250 volt scale. These are average values. Usually, deviations up to 20% are permissible and do not necessarily indicate a fault. Where series grid resistors prevent grid voltage readings, proper plate current at rated plate voltage will serve as an indication of proper grid bias and normal functioning of the tube. Care must be used when readings are taken with an analyzer since the capacity of the cable may cause the circuit to oscillate and give erratic readings. Usually touching a finger to the grid will stop oscillation.
The color code of the R-6790A output transformer is:

Primary - Green to 233 plate; Red to B4
Secondary - White and Yellow to speaker jacks.
COLONIAL MODEL 69

Voltage Socket Parts Coding

<table>
<thead>
<tr>
<th>Part</th>
<th>Plate</th>
<th>Screen</th>
<th>Grid</th>
<th>Plate Current</th>
<th>Screen Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>232 Translator</td>
<td>2.</td>
<td>118</td>
<td>50</td>
<td>1.</td>
<td>.6 mA</td>
</tr>
<tr>
<td>232 1st IF</td>
<td>2.</td>
<td>78</td>
<td>60</td>
<td>2.</td>
<td>.4</td>
</tr>
<tr>
<td>232 2nd IF</td>
<td>2.</td>
<td>118</td>
<td>50</td>
<td>1.5</td>
<td>.1</td>
</tr>
<tr>
<td>232 Detector</td>
<td>2.</td>
<td>15*</td>
<td>4*</td>
<td>4.5</td>
<td>Too low to read</td>
</tr>
<tr>
<td>233 Output</td>
<td>2.</td>
<td>112</td>
<td>120</td>
<td>1.1</td>
<td>3.</td>
</tr>
<tr>
<td>230 Oscillator</td>
<td>2.</td>
<td>44-50**</td>
<td>—</td>
<td>—</td>
<td>2.5 - 2**</td>
</tr>
<tr>
<td>230 AVC</td>
<td>2.</td>
<td>Used as rectifier with plate and grid joined.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* High resistance in series.

**Second value applies when tube is not oscillating. Stop oscillation by touching finger to grid.
Driver Input Auto-Transformer
Green - To 30000 ohm detector filter resistor

Red, Center Tap - To 10000 ohm detector plate supply resistor

Black - To tone control condenser
### Tube Voltage and Current Chart

**Model 71**

<table>
<thead>
<tr>
<th>Tube</th>
<th>Plate Voltage</th>
<th>Screen Voltage</th>
<th>Grid Voltage</th>
<th>Plate M.A.</th>
<th>Screen M.A.</th>
<th>Grid M.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>58 - Translator</td>
<td>190</td>
<td>60</td>
<td>-5</td>
<td>.4</td>
<td>.2</td>
<td></td>
</tr>
<tr>
<td>56 - Oscillator</td>
<td>65</td>
<td>--</td>
<td>-10</td>
<td>4</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>58 - 1st IF</td>
<td>170</td>
<td>65</td>
<td>*</td>
<td>3</td>
<td>.8</td>
<td></td>
</tr>
<tr>
<td>58 - 2nd IF</td>
<td>200</td>
<td>65</td>
<td>*</td>
<td>4.5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>57 - Detector</td>
<td>170</td>
<td>40a</td>
<td>*</td>
<td>2a</td>
<td>b</td>
<td></td>
</tr>
<tr>
<td>46 - Drivers</td>
<td>250</td>
<td>250</td>
<td>-10</td>
<td>18</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>46 - Class &quot;B&quot;</td>
<td>370</td>
<td>5</td>
<td>+5</td>
<td>21-50c</td>
<td>.5-5c</td>
<td>1.8-11c</td>
</tr>
<tr>
<td>57 - A.V.C.</td>
<td>50</td>
<td>80</td>
<td>-10</td>
<td>b</td>
<td>b</td>
<td></td>
</tr>
<tr>
<td>57 - Phantom</td>
<td>45a</td>
<td>65a</td>
<td>*</td>
<td>b</td>
<td>1.25d</td>
<td></td>
</tr>
<tr>
<td>83 - Rectifier</td>
<td>Max. d.c. 390</td>
<td>Volts</td>
<td>70 m.a. each plate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* High resistance in series
a "Phantom Tuning Control" knob turned all the way to the right
b Too low to read.
c The latter value when a loud signal is being received.
d "Phantom Tuning Control" knob turned all the way to the left, (but not so far as to switch set off).
THE AUTOMATIC VOLUME CONTROL ACTION

A portion of the signal existing at the plate of the second IF tube is impressed on the grid of the 57 A.V.C. tube. Normally, the A.V.C. grid is biased negatively by the voltage drop across R 1, and therefore no plate current flows through R 3. When the IF signal is impressed on the A.V.C. grid, the positive half of the cycle causes plate current to flow, creating a voltage drop across R 3. Since R 3 is also in the grid return circuits of the translator and IF tubes, the drop across it changes the amplification of these tubes by changing their grid bias. The stronger the IF signal, the greater the A.V.C. plate current, the larger the negative bias on the translator and IF tubes and consequently the less their amplification. The gain, then, varies inversely with the strength of the incoming signal, and the signal voltage at the plate of the second IF remains substantially constant. With no signal or very weak signal, the negative bias on the translator and IF is approximately two volts, provided by the drop across R 2. With a strong signal the negative bias may be twenty-five volts due to the combined drops across R 2 and R 3.

THE "PHANTOM TUNING CONTROL" ACTION

Anyone who has tuned a sensitive receiver having A.V.C. knows how extremely noisy reception is at those portions of the dial in between comparatively strong stations. This irritating noise is due to the fact that the A.V.C. action makes the receiver gain maximum when no carrier is being received. As a result, static, electrical disturbances, heterodyne whistles from weak, distant stations, and tube noises are tremendously amplified. But, in the Model 1640, the "Phantom Tuning Control" completely overcomes this objectionable feature. Instead of being at maximum when no station is received, the gain is automatically reduced to zero by the "Phantom" control. The dial can be turned from end to end without fear of having one's ears assailed by crashes of noise. The receiver automatically remains completely silent until a station powerful enough to insure satisfactory reception is tuned in. All noises and weaker stations are rejected. Yet, none of the desirable features of A.V.C. are sacrificed.

As may be seen from the diagram, the grid of the 57 "Phantom" tube receives its bias from the drop across the adjustable resistor R 4 plus the drop across R 3. The plate of the "Phantom" tube and the detector screen are supplied from a common 2 megohm resistor. When a signal is received, the drop across R 3 biases the "Phantom" tube grid negatively, no plate current flows, and the only drop across the 2 megohm resistor is that due to the very small detector screen current. But, when no signal is impressed on the antenna, and therefore no voltage developed across R 3, plate current flows through the "Phantom" tube, producing a large drop across the 2 megohm resistor. As a result, the detector screen does not have proper voltage, the detector is made inoperative and there is no response to static and other noises. By adjustment of R 4, the sensitivity of the detector with respect to the strength of the incoming signal can be varied. When all the resistance of R 4 is in the circuit, it provides bias high enough so that no "Phantom" tube plate current flows, even though the received signal is very weak and hence no drop developed at R 3. Accordingly, the detector will be sensitive and the receiver will respond to weak signals. When the resistance of R 4 is at its minimum value, plate current will flow through the "Phantom" tube, the detector will be insensitive and the receiver silent, until a signal is received of sufficient strength so that the drop across R 3 cuts off the "Phantom" tube plate current. The action is very sharp. If the control is set for satisfactory reception from a station of certain strength, the receiver will be silent to a signal of only 2 d.B. less strength.

In operation, turning the "Phantom Tuning Control" knob to the right increases the resistance of R 4. It should not be turned further right than necessary for satisfactory reception of the desired station. However, it must be turned far enough to prevent the desired station from fading in and out abruptly. This happens when the knob position is almost but not quite far enough to the right.

Simplified Schematic Diagram of A.V.C. and "Phantom Tuning Control"
This receiver tunes from 1765 kc to 520 kc.  * 530,000 ohms in series. Volume control at maximum.
Power Transformer
25-60 cycle.
Primary: Green and Black.
High Voltage: Red and Blue Slate center tap. Stranded wire leads.
Rectifier Fil: Red, Solid wire leads.
Heater: Yellow; Solid wire leads.

Polarity of speaker plug must be correct, otherwise bad hum will develop.
The diagram shows the circuitry of the Colonial Radio Model 76, which is a vintage radio receiver. The diagram is labeled as "EP PEAK 175 EC" and includes various components such as transformers, tubes, and wiring connections.

**Power Transformer**
- Primary -- Green and Black
- Hi-Voltage -- Red and Blue with Slate for center tap.
- Rectifier Fil. -- Red. Solid wire.
- Output Fil. -- Orange. Solid wire.
- Heater -- Yellow. Solid wire.

**AF Transformer (Input)**
- Primary -- Black to driver plate.
- Red to B' plus.
- Secondary -- Green to grid. Slate is center tap. In some sets the green lead has a tracer. Further, one of these leads (green) comes out singly from one side of the coil and connects to the grid of the 46 next to the translator.

**AF Transformer (Output)**
- Green and Blue to 46 plates.
- Red is center tap to B plus.
- See schematic for connections to speaker plug.
- Secondary -- #16 enamelled wire leads to voice coil.

**Speaker Field** -- Black and Slate.

By joining the anodes of the individual rectifiers, they are used as half wave rectifiers. The two tubes then constitute a full wave system.
Some sets of this model are wired as in Schematic "A"; others as in "B". Those wired as in "A" have four lugs on coil "P"; those wired as in "B" have five lugs.

Because constants must be correct for proper operation, substitute parts should not be used when replacements are needed. The polarity of the AF transformers is critical and must be maintained as shown in the illustration and Connection Chart when new transformers are installed.

By joining the anodes of the individual rectifiers, they are used as half wave rectifiers. The two tubes then constitute a full wave system.
COLONIAL RADIO CORP.

INSTRUCTIONS FOR ALIGNING SHORT WAVE COILS

It sometimes happens that all-wave receivers which are in perfect alignment at broadcast frequencies are out of alignment on short waves. Reception of the same station at two points a few divisions apart on the dial, or poor sensitivity, results. This condition will be most liable to occur on the shortest wave-range, for two reasons. First, the required accuracy of alignment is much greater on this range. For instance, assume a receiver tuned to 600 kc. with its oscillator high in its frequency setting by .2%. That means the IF signal generated will be 176.55 kc. instead of 175 kc. Satisfactory reception still is possible. Now suppose the receiver is tuned to 15,000 kc. The IF signal then becomes 205 kc and reception is impossible, although the oscillator is still "out" only the same .2%. The second reason is that the coils for the shortest wave-range have the fewest turns and lowest inductance. Consequently, a change in the position of a single turn means a change in a comparatively large percentage of the total turns on the coil, with resultant effect on frequency. If a coil with ten turns has one shifted, 10% of the total are thereby shifted. But if a coil has a hundred turns and one is shifted, only 1% of the total are shifted. Thus it is apparent why realignment most often is necessary on the shortest wave-range.

When realignment is called for, it can be done as follows: Tune in a station at about 6200 kc. If the station is heard at two points, tune to the one of higher frequency. If none can be picked up, the noise level will serve as an indication of sensitivity. Then shift an end turn of wire toward or away from the other turns on the high-range translator and band-pass coils until maximum signal or noise is heard. These coils are the lower two of the four mounted on the switch plate. (Coils "C" and "D" in Service Manual illustrations). When the best spacing of the turn for maximum volume is found, the wire should be secured in place with amberoid or similar substance.

If the receiver is equipped with automatic volume control, this should be rendered inoperative or else a small signal input used. One method is to twist the antenna lead-in around the receiver's antenna lead for a few inches instead of connecting it directly to the antenna lead clip. The input can then be varied by changing the length for which the leads are twisted.

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Plate</th>
<th>Screen</th>
<th>Grid</th>
<th>Plate</th>
<th>Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 Oscillator</td>
<td>75</td>
<td>-</td>
<td>-3</td>
<td>5</td>
<td>-.1</td>
</tr>
<tr>
<td>57 Translator</td>
<td>240</td>
<td>70</td>
<td>-6</td>
<td>-.4</td>
<td>.1</td>
</tr>
<tr>
<td>58 IF</td>
<td>240</td>
<td>70</td>
<td>-2</td>
<td>9</td>
<td>2.5</td>
</tr>
<tr>
<td>57 Detector</td>
<td>115</td>
<td>80</td>
<td>-2</td>
<td>-.6</td>
<td>.1</td>
</tr>
<tr>
<td>46 Driver</td>
<td>240</td>
<td>240</td>
<td>-10</td>
<td>12</td>
<td>2.5</td>
</tr>
<tr>
<td>46 Class &quot;B&quot;s</td>
<td>355</td>
<td>7</td>
<td>-7</td>
<td>30-65**</td>
<td>1.7-15**</td>
</tr>
<tr>
<td>280 Rectifier</td>
<td>Max. d.c.</td>
<td>390 volts</td>
<td>25 ma per plate of each tube</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 520,000 ohms in series
** Second value applies when a very loud signal is being received. Grid current is for both grids. Values are per tube.

Touching a finger to the grid of a tube will cause it to cease oscillating.
SERVICE NOTES

MODELS T-345 AND C-399

Model T-345 and C-399 receivers are six tube superhetedyne incorporating many advances from conventional design. The tubes, with the exception of the 280 rectifier, are of the highly efficient 0.3 amperes heater type. The receivers are over 30% more economical to operate than similar ones using the conventional 2½ volt tubes.

Type 236 screen grid tubes are used for the combination oscillator-translator and for the second detector; a type 237 super-control R.F. pentode for the R.F. amplifier stage. Litz wound coils insure keen selectivity and sensitivity throughout the extended tuning range of 1765 kc to 320 kc.

Two of the new, type 89 triple grid power output tubes in a paralleled pentode connection, and an efficient dynamic speaker provide excellent reproduction.

The Combination Oscillator-Translator is shown schematically in Fig. (12).

Coils (1) and (2) comprise the grid circuit; coils (3), (4) and (5) the plate circuit. The amplified broadcast signal is applied to the grid of the 236 tube by coil (1) which is tuned to the broadcast signal's frequency. Because coils (2) and (3) are coupled together through coil (4), feedback occurs and the tube is made to oscillate. The frequency of oscillation, determined by the tuned coil (4), is made 175 kc higher than the frequency of the broadcast signal and of coil (1). Since both the broadcast signal and a frequency 175 kc higher are impressed on the tube's grid, a 175 kc I.F. signal is created in the plate circuit of the tube. This 175 kc signal is selected by the tuned coil (3) and coupled to the detector grid.

If it becomes necessary to align the oscillator-translator and R.F. stages, it should be done at about 1250 kc and then "touched up" at about 1600 kc. Trouble may be experienced if an attempt is made to secure alignment at 1600 kc without having obtained approximate alignment at 1250 kc. At 1600 kc the capacity of the oscillator trimmer may be too high to make the oscillator-translator stage to the same frequency as the I.F. stage, resulting in feedback and violent oscillation.

The 2500 ohm speaker field is used as the filter choke. It carries the plate and screen currents of all the tubes as well as the blower current flowing through the screen supply resistors to ground. Should the output transformer, plug, or voice coil be replaced, it is important that it be reconnected with polarity correct as shown in the service illustration. Otherwise the hum due to the field will be in phase with that in the hum bucking coil, intensifying instead of eliminating the speaker hum.

The variable tuning condenser is floated on cushion rubber to prevent microphonics. Should there be trouble from microphonics which cannot be eliminated by changing the detector tube, the nuts on the four condenser mounting studs may be loosened. Neither the condenser shaft, dial, nor knob must be allowed to touch the chassis or cabinet lest the effect of the rubber mounting be lost.

The pilot light clip is pulled off of its mounting on the chassis for replacement of the bulb.

Power Transformer Color Code

PRIMARY: Green; Black.
RECTIFIER PLATE: Red; Blue; Slate.
HEATERS: Orange. Solid wire leads.

Tube Voltage and Current Chart

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>'39—R. F.</td>
<td>160</td>
<td>140</td>
<td>90</td>
<td>95</td>
<td>-2</td>
<td>-30</td>
<td>6</td>
<td>0</td>
<td>150</td>
<td>140</td>
<td>90</td>
<td>85</td>
<td>95</td>
</tr>
<tr>
<td>'36—Osc.-Transl.</td>
<td>160</td>
<td>160</td>
<td>85</td>
<td>115</td>
<td>-5</td>
<td>-6.7</td>
<td>.5</td>
<td>.65</td>
<td>.1</td>
<td>.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'36—Detector</td>
<td>75</td>
<td>75</td>
<td>30</td>
<td>30</td>
<td>-5</td>
<td>-5</td>
<td>(.15 actual)</td>
<td>.2</td>
<td>(.15)</td>
<td>(.15 actual)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'89—Output</td>
<td>150</td>
<td>155</td>
<td>165</td>
<td>170</td>
<td>*</td>
<td>*</td>
<td>15.5</td>
<td>18</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'80—Rectifier</td>
<td>Max. d.c. =295 v.</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) = High series resistance.
(a) = Too low to read.

Watts = 60.

Speaker field voltage = 110 v.

Control grid readings taken on a 150 volt scale of 1000 ohms per volt meter; others on 750 volt scale. Readings taken with antenna and ground shorted together and no signal received. These are average values. Ordinarily, deviations up to 20% are permissible and do not necessarily indicate a fault. Where series grid resistors prevent grid voltage readings, proper plate current at the rated plate voltage will serve as an indication of proper grid bias and normal functioning of the tube. Care must be used when readings are taken with an analyzer since the capacity of the cable may cause the circuit to oscillate and give erratic readings. Usually, touching a finger to the grid or plate will stop oscillation. These readings were taken with the speaker field hot. Readings taken when the field is cold will be higher because of the lowered field resistance.

Physical and Electrical Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
<th>Net Weight</th>
<th>Packing Case Dimensions</th>
<th>Weight Packed</th>
<th>Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-345</td>
<td>17½&quot;</td>
<td>14½&quot;</td>
<td>10½&quot;</td>
<td>25½ lbs.</td>
<td>19½&quot; x 15½&quot; x 12&quot;</td>
<td>32 lbs.</td>
<td>45</td>
</tr>
<tr>
<td>C-399</td>
<td>38¼&quot;</td>
<td>24&quot;</td>
<td>13&quot;</td>
<td>50 lbs.</td>
<td>42&quot; x 27&quot; x 16¼&quot;</td>
<td>65½ lbs.</td>
<td>45</td>
</tr>
</tbody>
</table>
COLONIAL RADIO CORP.

Circuit Diagram — Models T-345 and C-399

Condenser Ratings Are Max Voltage
Resistor Ratings Are Min Wattage

ILLUSTRATION FOR COIL REPLACEMENT AND CONTINUITY CHECKING

The Coils Are Numbered & Lettered To Correspond With The Service Illustrations & Connection Chart.

COIL 'A'
- To Volume Control & Antenna Lead
- To Model Number on Volume Control (One)
- To Grid of 89 Grid & Grid #3 of Variable Tuning Condenser (Left Internal Bit)

COIL 'B'
- To Screen of 89 Tubes (Eight)
- To Plate Winding of 36 Tube Socket
- To Grid of 36 Grid and Grid #2
- To Variable Tuning Condenser (One)
- To Grid of 39 Grid & Grid #2 of Variable Tuning Condenser
- To Grid of 39 Grid & Grid #2 of Variable Tuning Condenser

COIL 'C'
- To Grid & 39 Grid of R7713A I.F. Transformer
- To Grid & 39 Grid of R7713A I.F. Transformer
- To Grid & 39 Grid of R7713A I.F. Transformer
- To Grid & 39 Grid of R7713A I.F. Transformer
- To Grid & 39 Grid of R7713A I.F. Transformer
- To Grid & 39 Grid of R7713A I.F. Transformer

The Coils Are Numbered & Lettered in The Schematic To Correspond With This Chart.

(13). Service Illustration — Models T-345 and C-399
Models T-397 and C-495

### Tube Ratings

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>'24A—Oscillator</td>
<td>185 205</td>
<td>90 130</td>
<td>- 8 -13</td>
<td>1.1 1.9</td>
<td>.4 .7</td>
</tr>
<tr>
<td>58—Translator</td>
<td>185 170</td>
<td>80 95</td>
<td>-11 -37</td>
<td>1.6 .2</td>
<td>.36 0</td>
</tr>
<tr>
<td>58—IF</td>
<td>220 195</td>
<td>85 95</td>
<td>-2 -37</td>
<td>6 .2</td>
<td>1.7 0</td>
</tr>
<tr>
<td>'24A—Detector</td>
<td>135 125</td>
<td>60 95</td>
<td>-9 -11</td>
<td>51 .2</td>
<td>(a) (a)</td>
</tr>
<tr>
<td>'47—Output</td>
<td>215 225</td>
<td>230 240</td>
<td>(a) ^{\text{a}} (actual -14)</td>
<td>(a) ^{\text{b}} (actual -13)</td>
<td>28 33</td>
</tr>
<tr>
<td>'80—Rectifier</td>
<td>Max. d.c. = 365 v.</td>
<td></td>
<td></td>
<td>Plate Current = 25 m.a. per plate.</td>
<td></td>
</tr>
</tbody>
</table>

Watts = 70

Speaker field voltage = 120 v.

(a) = Too low to read.

(*) = Reading low because of high resistance in series.

Control grid readings taken on 150 volt scale of 1000 ohms per volt meter; others on 750 volt scale. Readings taken with antenna and ground shorted together and no signal received. These are average values. Ordinarily, deviations up to 20% are permissible and do not necessarily indicate a fault. Where series grid resistors prevent grid voltage readings, proper plate current at the rated plate voltage will serve as an indication of proper grid bias and normal functioning of the tube. Care must be used when readings are taken with an analyzer since the capacity of and the tube may cause the circuit to oscillate and give erratic readings. Usually, touching a finger to the grid or plate will stop oscillation. These readings were taken with the speaker field hot. Readings taken when the field is cold will be higher because of the lower field resistance.
MODEL T-397
C-495

COLONIAL RADIO CORP

Parts Coding

Power Transformer Color Code

PRIMARY: Green; Black.

RECTIFIER PLATE: Red; Blue; Slate - center tap. Stranded wire leads.

RECTIFIER FILAMENT: Red. Solid wire leads.

HEATERS: Yellow. Solid wire leads.
## REPLACEMENT PARTS AND PRICE LIST
### MODELS T-397 AND C-495

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-5509A</td>
<td>Board - Terminal</td>
<td>$0.03</td>
</tr>
<tr>
<td>R-7392A</td>
<td>Board - Terminal, double</td>
<td>$0.05</td>
</tr>
<tr>
<td>R-7630</td>
<td>Booklet - Instruction (T-397)</td>
<td>$0.08</td>
</tr>
<tr>
<td>R-7631</td>
<td>Booklet - Instruction (C-495)</td>
<td>$0.08</td>
</tr>
<tr>
<td>R-7027A</td>
<td>Bracket - Dial drive assembly</td>
<td>$0.39</td>
</tr>
<tr>
<td>R-695</td>
<td>Bushing - fibre</td>
<td>$1.62</td>
</tr>
<tr>
<td>R-747</td>
<td>Cabinet - Midget (T-397)</td>
<td>$15.48</td>
</tr>
<tr>
<td>R-715</td>
<td>Clamp - Antenna and ground</td>
<td>$0.02</td>
</tr>
<tr>
<td>R-7011A</td>
<td>Clip - Antenna and ground lead</td>
<td>$0.04</td>
</tr>
<tr>
<td>R-7031</td>
<td>Clip - Pilot light</td>
<td>$0.12</td>
</tr>
<tr>
<td>R-6381H</td>
<td>Clip - Screen grid</td>
<td>$0.07</td>
</tr>
<tr>
<td>R-6381F</td>
<td>Clip - Screen grid with 6&quot; lead</td>
<td>$0.04</td>
</tr>
<tr>
<td>R-6381N</td>
<td>Clip - Screen grid with 5/4&quot; lead</td>
<td>$0.04</td>
</tr>
<tr>
<td>R-6381S</td>
<td>Clip - Screen grid with 3/4&quot; lead</td>
<td>$0.04</td>
</tr>
<tr>
<td>R-6992G</td>
<td>Coil - Antenna</td>
<td>$0.79</td>
</tr>
<tr>
<td>R-6993V</td>
<td>Coil - Oscillator</td>
<td>$0.58</td>
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<tr>
<td>R-6993K</td>
<td>Coil - Transformer (lug type mounting)</td>
<td>$0.50</td>
</tr>
<tr>
<td>R-6993BD</td>
<td>Coil - Transformer (bracket type mtg.)</td>
<td>$1.19</td>
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<tr>
<td>R-6565</td>
<td>Condenser - Tuning, I.F. input tran.</td>
<td>$0.43</td>
</tr>
<tr>
<td>R-6216B</td>
<td>Condenser - Tuning, I.F. output tran.</td>
<td>$0.43</td>
</tr>
<tr>
<td>R-7119</td>
<td>Condenser - Variable tuning with suppressor</td>
<td>$4.12</td>
</tr>
<tr>
<td>R-7119A</td>
<td>Condenser - Variable tuning with suppressor, dial and drive assembly</td>
<td>$5.80</td>
</tr>
<tr>
<td>R-4303</td>
<td>Condenser - 300 mfd. mica</td>
<td>$0.14</td>
</tr>
<tr>
<td>R-4592</td>
<td>Condenser - .0025 mfd. mica</td>
<td>$0.14</td>
</tr>
<tr>
<td>R-6599</td>
<td>Condenser - .001 mfd. 500v. mica</td>
<td>$0.17</td>
</tr>
<tr>
<td>R-461</td>
<td>Condenser - .003 mfd. 600v.</td>
<td>$0.14</td>
</tr>
<tr>
<td>R-6741</td>
<td>Condenser - 02 mfd. 600v.</td>
<td>$0.15</td>
</tr>
<tr>
<td>R-6444</td>
<td>Condenser - 1 mfd. 200v.</td>
<td>$0.17</td>
</tr>
<tr>
<td>R-6418</td>
<td>Condenser - 1 mfd. 300v.</td>
<td>$0.20</td>
</tr>
<tr>
<td>R-6452</td>
<td>Condenser - 5 mfd.</td>
<td>$0.50</td>
</tr>
<tr>
<td>R-6762</td>
<td>Control - Volume</td>
<td>$0.83</td>
</tr>
<tr>
<td>R-6454</td>
<td>Control - Tone</td>
<td>$0.74</td>
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<tr>
<td>R-7566A</td>
<td>Cord - Extension</td>
<td>$0.34</td>
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<tr>
<td>R-7018D</td>
<td>Dial and indicator assembly</td>
<td>$0.50</td>
</tr>
<tr>
<td>R-7635</td>
<td>Etcetheron</td>
<td>$0.29</td>
</tr>
<tr>
<td>R-7055</td>
<td>Insulator - suppressor</td>
<td>$0.01</td>
</tr>
<tr>
<td>R-7636</td>
<td>Knob - Large</td>
<td>$0.17</td>
</tr>
<tr>
<td>R-7637</td>
<td>Knob - Medium</td>
<td>$0.16</td>
</tr>
<tr>
<td>R-5289</td>
<td>Lamp - 2-1/2 volt pilot</td>
<td>$0.20</td>
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<tr>
<td>R-5346B</td>
<td>Lead - Antenna (25')</td>
<td>$0.09</td>
</tr>
<tr>
<td>R-5345A</td>
<td>Lead - Ground (24')</td>
<td>$0.09</td>
</tr>
<tr>
<td>R-954</td>
<td>Nut - 4/36</td>
<td>$0.10 for 13</td>
</tr>
<tr>
<td>R-951</td>
<td>Nut - 6/32</td>
<td>$0.10 for 18</td>
</tr>
<tr>
<td>R-3760</td>
<td>Nut - 8/32</td>
<td>$0.10 for 18</td>
</tr>
<tr>
<td>R-6183</td>
<td>Resistor - 300 ohm, 3 watt vitreous</td>
<td>$0.38</td>
</tr>
<tr>
<td>R-6155</td>
<td>Resistor - 150 ohm, 1/2 watt carbon</td>
<td>$0.19</td>
</tr>
<tr>
<td>R-6510</td>
<td>Resistor - 5 M ohm, 1/2 watt carbon</td>
<td>$0.19</td>
</tr>
<tr>
<td>R-6152</td>
<td>Resistor - 10 M ohm, 1/2 watt carbon</td>
<td>$0.19</td>
</tr>
<tr>
<td>R-6156</td>
<td>Resistor - 30 M ohm, 1/2 watt carbon</td>
<td>$0.19</td>
</tr>
<tr>
<td>R-6489</td>
<td>Resistor - 30 M ohm, 1 watt carbon</td>
<td>$0.19</td>
</tr>
<tr>
<td>R-6445</td>
<td>Resistor - 50 M ohm, 1/2 watt carbon</td>
<td>$0.19</td>
</tr>
<tr>
<td>R-5830</td>
<td>Resistor - 200 M ohm, 1/2 watt carbon</td>
<td>$0.19</td>
</tr>
<tr>
<td>R-5822</td>
<td>Resistor - 400 M ohm, 1/2 watt carbon</td>
<td>$0.19</td>
</tr>
<tr>
<td>R-7009</td>
<td>Screw - Drive lever</td>
<td>$0.03 for 0.05</td>
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<tr>
<td>R-7359</td>
<td>Screw - Etcetheron</td>
<td>$0.10 for 0.50</td>
</tr>
<tr>
<td>R-7413</td>
<td>Screw - Set. dial</td>
<td>$0.10 for 0.08</td>
</tr>
<tr>
<td>R-6332</td>
<td>Screw - 3/4 x 1/4 R. H.</td>
<td>$0.10 for 0.02</td>
</tr>
</tbody>
</table>

---

**Prices are F. O. B. Buffalo.**

Dealers should order replacement parts from their Graybar branch. Orders placed directly with the factory for replacement parts amounting to less than $2.00 net are subject to a 50 cents packing charge.

Material may not be returned to the factory for credit or replacement without written factory authorization.
TABLE VOLTAGE AND CURRENT CHARTS

**MODEL C-685**
**MODEL C-695**

<table>
<thead>
<tr>
<th>TUBE</th>
<th>Plate Voltage</th>
<th>Screen Voltage</th>
<th>Grid Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>56-402</td>
<td>200</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>56-402AF</td>
<td>200</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>56-402AB</td>
<td>200</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>56-402CD</td>
<td>200</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>56-402EF</td>
<td>200</td>
<td>150</td>
<td>75</td>
</tr>
</tbody>
</table>

**VT-32**

- Plate Current: 32 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-33**

- Plate Current: 33 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-34**

- Plate Current: 34 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-35**

- Plate Current: 35 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-36**

- Plate Current: 36 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-37**

- Plate Current: 37 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-38**

- Plate Current: 38 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-39**

- Plate Current: 39 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-40**

- Plate Current: 40 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-41**

- Plate Current: 41 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-42**

- Plate Current: 42 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-43**

- Plate Current: 43 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-44**

- Plate Current: 44 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-45**

- Plate Current: 45 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-46**

- Plate Current: 46 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-47**

- Plate Current: 47 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-48**

- Plate Current: 48 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-49**

- Plate Current: 49 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-50**

- Plate Current: 50 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-51**

- Plate Current: 51 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-52**

- Plate Current: 52 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-53**

- Plate Current: 53 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-54**

- Plate Current: 54 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.

**VT-55**

- Plate Current: 55 m.a. per plate
- Screen: 3 m.a.
- Grid: 0.1 m.a.
SUPPLEMENTARY SERVICE NOTES (A)

MODELS C-595 AND C-695

Certain alterations, indicated in the revised circuit diagram, Fig. (6A), have been made in Model C-595 and C-695 receivers built since the printing of the Service Manual. No attempt should be made by service men to incorporate these changes in the earlier production receivers.

The R7056D I.F. output transformer, which was tuned by a copper ring inductance adjuster, has been replaced by an R6415R transformer, tuned with condensers. Its connections are shown in Fig. (5A).

The 58 oscillator tube has been replaced by a 224A necessitating the circuit modifications shown in the revised schematic. The connection of lug 2, coil A is changed to the terminal board to which are also connected the 10 M ohm oscillator and translator plate supply resistor, and a .1 condenser. The addition to the replacement parts list is an R7854—15 M ohm, 2 watt carbon resistor listing at 31 cents. Receivers embodying these changes are somewhat more selective than those of the original production.

The voltage and current readings are obtained with the 224A oscillator. The readings for the other tubes are the same as given in the original voltage and current chart.

Plate Voltage 175 v.
Screen Voltage 90 v.
Grid Voltage -10 v.
Plate Current 1.3 ma.
Screen Current .4 ma.

It was mentioned in the Manual that those receivers using the R7725A I.F. input transformer are more selective than those with an R7411A transformer. This same selectivity improvement can be obtained with the R7411A transformer by removing the link coil (the smaller of the two coils) and replacing it with a .005 condenser, part No. R6954. See Fig. (5A). No other change is necessary although the I.F. stages will have to be returned to 175 kc. This change is recommended in instances of poor selectivity.

A slight amount of hum, which disappears when a carrier is tuned in, is normal to Models C-595 and C-695. Severe hum, which becomes increased when a carrier is tuned in, is definite indication of faulty type 56 detector tubes. Sometimes interchanging their positions will eliminate the hum. Otherwise the type 56 tubes must be replaced.
MODEL C-595

Schematic

Parts Coding

COLONIAL RADIO CORP.

IF PEAK 175 KC

The Numbering & Lettering of the Coils Corresponds To That in the Illustration & Connection Chart

Condenser Ratings Are Max Voltage
Resistor Ratings Are Min. Wattage

Those Sets Connected As Shown in The Schematic Use R7725A I.F. Input Transf.
Those Connected As in This Sketch (a coil and a 0M resistor in place of the .005 condenser) Use R7411A I.F. Input Transf.

Model C-595

OUTPUT TRANSFORMER 56317A

IF OUTPUT TRANSFORMER R7056D

1ST IF INPUT TRANSFORMER R775A

1ST IF INPUT TRANSFORMER R7378A

Illustration for Continuity Checking of Coil Winding and Connection Chart for Installing Replacement Coils

Models C-595 and C-695

Output Transformer 56317A

IF Output Transformer R7056D

1st IF Input Transformer R775A

1st IF Input Transformer R7378A

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The Numbering & Lettering Of The Coils Corresponds To That In The Illustration & In The Connection Chart.

Condenser Ratings Are Max Voltage
Resistor Ratings Are Min. Wattage.

IF PEAK 175 KC

Those Sets Connected As Shown In The Schematic Use R7725A I.F. Input Transf.
Those Connected As In This Sketch (a coil and a 200Ω resistor in place of the .006 condenser) Use R7411A I.F. Input Transf.

Those Sets Connected As Shown In The Schematic Use R7725A I.F. Input Transf.
Those Connected As In This Sketch (a coil and a 200Ω resistor in place of the .006 condenser) Use R7411A I.F. Input Transf.

Figure 6A revised drawing

Circuit Diagram — Model C-695
The C995 receivers are twelve tube de luxe superhetodynes embodying every proven advancement in design. Their frequency range extends from 530 kc to 1765 kc. High gain r. f. pentodes and two I. F. stages insure extreme selectivity and keen selectivity. Automatic Volume Control nullifies fading and prevents blasting. A push-pull Class "A" driver stage, a Class "B" output stage, two mercury vapor rectifiers, and a powerful 12" Class "B" dynamic speaker make for reproduction that is truly fascinating in its realism.

A 24A oscillator produces a voltage which is combined with the broadcast signal, creating a 175 kc signal in the plate circuit of the 58 translator tube. This 175 kc signal is transformer coupled to the first 58 I. F. tube and resistance-capacity coupled to the second 58 I. F. It is then transformer coupled to the 57 detector. The coupling between primary and secondary of this transformer is variable and is employed as the volume control. Since it is inductive, it is completely noiseless in operation.

The first I. F. transformer is mounted on the top of the chassis with its adjusting screws accessible through the holes in the top of the shield. (See illustration). The adjusting screws for the second I. F. transformer tuning condenser are accessible through the holes in the chassis to the right of the first I. F. transformer, facing the front of the chassis. A dummy tube, i.e., either a turned out one or one with a heater prong insulated from its socket contact, must be placed in the A.V.C. socket to render the A.V.C. action inoperative when peaking the I. F. stages. Be sure the flexible grid lead is connected to the grid cap of the 57 dummy tube and that the tube shield is in place.

The detector is coupled through an auto-transformer (mounted on the speaker) to two 406s connected as a Class "A" push-pull driver stage. This auto-transformer has a high permeability nickel-iron core. If for any reason excessive d. c. grid current flows through the transformer, the permeability of its core and hence the inductance of it may be greatly lowered. As a consequence, tone quality will be impaired and the transformer should be replaced.

The best quality of reproduction will be obtained when the type 46 tubes are well matched in their dynamic characteristics. Interchange their positions until the best combination is found.

The filaments of the 82 rectifiers are connected in series. Should one tube burn out the other will not light, preventing the overloading of the remaining tube which would result were they connected in parallel.

The A. V. C. Circuit — The A. V. C. circuit is shown schematically in Fig. (B) and its action will be easily understood if the following explanation is read carefully:

As revealed by the diagram, R1, R2, and R3 form part of a resistance network across the "B" supply. With reference to point (a), points (b), (c) and (d) are progressively more negative. Accordingly, the drop across R2 furnishes the plate voltage for the A. V. C. tube and the drop across R3 furnishes its negative grid bias. The values are such that no plate current flows. Since there is no plate current, no voltage drop exists across R4, and points (b) and (c) are at the same potential. The drop across R1 furnishes the grid bias for the transformer and I. F. tubes.

Now assume a signal at the plate of the second I. F. tube. It is impressed across R1 through C1. The positive half cycles of the signal voltage impressed on the A. V. C. tube's grid, cause plate current to flow, creating a voltage drop across R4. Point (e) now is more negative than point (b) by the amount of R4's drop. In other words the I. F. and the translator grids have been made more negative with respect to their cathodes and consequently their amplification has been decreased. The stronger the signal, the greater the translator and I. F. negative grid bias and the less the amplification of these tubes. The gain, then, varies inversely as the signal strength, and the signal voltage at the plate of the second I. F. tube is maintained at a substantially constant value.

The variable tuning condenser is floated on cushion rubber to prevent microphonic action. Should there be trouble from microphonics which cannot be eliminated by changing the detector tube, the nuts on the four condenser mounting studs may be loosened. Neither the condenser shaft, dial nor knob must be allowed to touch the chassis or cabinet lest the effect of the rubber mounting be lost.

There is a variable center-tap hum eliminating resistor mounted on the rear plate of the chassis near the speaker socket. Its grid drive adjustment is accessible through the hole in the chassis. Care must be used in making the adjustment since it is a fine one. In addition it sometimes is necessary to interchange the positions of the type 46 tubes until the combination resulting in minimum hum is found.

There is a condenser connected from one side of the power cord to ground for the prevention of line noise. The power cord plug should be tried in both possible positions in its receptacle and left in the one affording quieter reception.

The pilot light clip is pulled off of its chassis mounting for replacement of the bulb.

**SERVICE NOTES**

**MODEL C-995**

**TUBE**

<table>
<thead>
<tr>
<th>TUBE</th>
<th>Plate Voltage</th>
<th>Screen Voltage</th>
<th>Grid Voltage</th>
<th>Plate m. a.</th>
<th>Screen m. a.</th>
</tr>
</thead>
<tbody>
<tr>
<td>58—Translator</td>
<td>160</td>
<td>70</td>
<td>-3*</td>
<td>1.4</td>
<td>.3</td>
</tr>
<tr>
<td>24A—Oscillator</td>
<td>160</td>
<td>70</td>
<td>-6</td>
<td>.8</td>
<td>.3</td>
</tr>
<tr>
<td>58—1st IF</td>
<td>145</td>
<td>75</td>
<td>-4</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>58—2nd IF</td>
<td>185</td>
<td>75</td>
<td>-4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>57—Detector</td>
<td>160</td>
<td>65</td>
<td>*</td>
<td>.3</td>
<td>1</td>
</tr>
<tr>
<td>57—A. V. C.</td>
<td>50</td>
<td>70</td>
<td>-9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>46—Driver</td>
<td>240</td>
<td>4.5</td>
<td>-10*</td>
<td>17</td>
<td>3.5</td>
</tr>
<tr>
<td>46—Class &quot;B&quot;</td>
<td>365</td>
<td>+4.5</td>
<td>+4.5</td>
<td>18-7e (a)</td>
<td>17-13 (a) (b)</td>
</tr>
<tr>
<td>82—Rectifier</td>
<td>Max. d. c. = 365 v.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Data**

- Plate Current ~ 32 m.a. per plate per tube.

* (*) Reading low because of high series resistance.
COLONIAL RADIO CORP.

MODEL C-995
Parts Coding
SUPPLEMENTARY SERVICE NOTES (A)

MODEL C-995

ADDING A "HI-LO" SENSITIVITY SWITCH TO THOSE RECEIVERS WHICH DO NOT HAVE ONE BUILT IN.

THESE INSTRUCTIONS REPLACE SUPPLEMENT A, PAGE TWENTY-SIX, FORM R-7900 OF THE MANUAL.

In a great many locations a high level of noise is encountered when the Model C-995 is tuned between stations. This is due to the fact that in the absence of a carrier the A.C. action causes the receiver to attain its full sensitivity.

The maximum sensitivity of this receiver is needed only when tuning for exceptionally weak, distant stations. Accordingly, a sensitivity control switch has been incorporated in later production C-995's. This switch can be added easily to those receivers not having it built in.

The parts needed are contained in switch-resistor kit, part number R-516/BC, which can be ordered from the Colonial Radio Corporation, Buffalo, New York. This kit contains:
1-R-483A "Hi-Lo" switch with leads.
1-R-7187 100 ohm, 1 watt carbon resistor.
1—Blue print of instructions for making the change.
A 15/32" hole is to be drilled in the right hand side of the cabinet, as shown in Figure 9A. A wood bit, not a metal twist drill, must be used and care should be taken not to splinter the cabinet. The switch is then mounted as shown, with its terminals facing upward.

The wire lead between lugs 51 and 52 of the Condenser resistor, should be removed and the R-7187, 100 ohm resistor connected between these two lugs, as shown in the illustration. The ground connection to lug 51 must be opened and a new ground connection to lug 52. The two leads from the R-483A switch are to be connected to lugs 51 and 53 of Condenser resistor R-7261.

The action of the R-7187, 100 ohm resistor is to increase the residual, fixed grid bias on the i.f. tubes thereby reducing their gain. The "Hi-Lo" switch is in the open position then, marked "Lo". Ordinarily, the receiver should be operated with the switch left in the "Hi" position. When the switch is closed, the "Hi" position, the 30 ohm section of the R-7261 Condenser is shorted out, the bias is decreased and the gain increased. With the switch in this position, extremely distant reception is possible, but unless conditions are ideal, reception will be noisy.

Noise heard while the receiver is tuned to a station is due to the low ratio of signal strength to noise level. No amount of amplification can overcome this. Any receiver sensitive enough to pick up the station must pick up the noise.

The schematic diagram, Figure 10 of the Manual, should be changed to correspond with the sketch in Figure 9A. A ground should be shown from the junction of the .2 mfd. condenser and the 100 ohm resistor, and the "Hi-Lo" switch should be shown across the 50 ohm resistor instead of across the 100 ohm one.

TO FURTHER REDUCE THE BETWEEN STATION NOISE IN C-995'S HAVING THE SENSITIVITY SWITCH ALREADY BUILT IN.

Receivers having the "Hi-Lo" switch built in, have it connected across the 100 ohm resistor, i.e. between lugs 51 and 52. To still further reduce the between station noise when the switch is in the "Hi" position, remove the switch lead from lug 52 and connect it to lug 53. The switch lead to lug 51 remains the same, as do all other connections. Operation with the switch in the "Lo" position will be the same as it previously was.

It is important that the set owner be carefully instructed in the proper use of the "Hi-Lo" switch in order that he may obtain the finest performance from which this receiver is capable.

SUPPLEMENTARY SERVICE NOTES (A)

MODEL C-995

Model C-995 receivers built since the Service Manual was printed, have a sensitivity control switch mounted on the right side of the cabinet. Ordinarily, it should be left in the position marked "Lo". This position minimizes the between station noise, due to electrical disturbances, which in some localities is annoying. The position marked "Hi", should be used only when tuning for extremely weak, distant stations requiring the full sensitivity of the receiver.

As revealed by the schematic, this switch, in its closed position, shorts out a 100 ohm resistor. The residual bias on the i.f. tubes is thereby reduced from a value of -8 volts to approximately -3 volts, increasing sensitivity. A connection to ground from one side of the "Hi-Lo" switch should have been shown in Figure 10 of the Service Manual. This connection is shown in Figure 9A.

Receivers having the "Hi-Lo" switch built in use an R7602, 1300 ohm Condenser resistor which includes the 100 ohm resistor. The "Hi-Lo" Sensitivity Control switch can be added to receivers not having it, by connecting an R7187, 100 ohm, 1 watt carbon resistor to the R7281, 1300 ohm Condenser. See Figure 9A.

The additions to the replacement parts and price list are:

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-762</td>
<td>Resistor-1300 ohm Condenser</td>
<td>70</td>
</tr>
<tr>
<td>R-7187</td>
<td>Resistor-100 ohm, 1 watt Carbon</td>
<td>39</td>
</tr>
<tr>
<td>R-483</td>
<td>Switch-&quot;Hi-Lo&quot;</td>
<td>55</td>
</tr>
</tbody>
</table>

(9A). Sensitivity Control Switch Connection

PHYSICAL AND ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
<th>Net Weight</th>
<th>Packing Case Dimensions</th>
<th>Weight Packed</th>
<th>Watts (105-125v, 50 cycles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-397</td>
<td>17½&quot;</td>
<td>14½&quot;</td>
<td>10&quot;</td>
<td>27 lbs.</td>
<td>19¼&quot; x 16½&quot; x 12½&quot;</td>
<td>35 lbs.</td>
<td>70</td>
</tr>
<tr>
<td>C-495</td>
<td>39½&quot;</td>
<td>22&quot;</td>
<td>11½&quot;</td>
<td>45½ lbs.</td>
<td>24½&quot; x 24½&quot; x 14½&quot;</td>
<td>60 lbs.</td>
<td>70</td>
</tr>
<tr>
<td>C-595</td>
<td>39½&quot;</td>
<td>24½&quot;</td>
<td>12½&quot;</td>
<td>51 lbs.</td>
<td>24½&quot; x 29½&quot; x 16½&quot;</td>
<td>80 lbs.</td>
<td>85</td>
</tr>
<tr>
<td>C-695</td>
<td>42½&quot;</td>
<td>24½&quot;</td>
<td>13½&quot;</td>
<td>56 lbs.</td>
<td>29½&quot; x 29½&quot; x 17½&quot;</td>
<td>87 lbs.</td>
<td>85</td>
</tr>
<tr>
<td>C-995</td>
<td>45&quot;</td>
<td>26&quot;</td>
<td>14½&quot;</td>
<td>91½ lbs.</td>
<td>31½&quot; x 31½&quot; x 18½&quot;</td>
<td>125 lbs.</td>
<td>150</td>
</tr>
</tbody>
</table>
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MODEL C-995
Schematic

(10). Circuit Diagram — Model C-995
COLUMBIA PHONOGRAPH COMPANY

MODEL C-80-A, C-80-B & C-80C-A CHASSIS

TABLE OF VOLTAGE AND CURRENT READINGS.

ALL D.C. VOLTAGE READINGS ARE TO GROUND.

<table>
<thead>
<tr>
<th>TUBE PURPOSE</th>
<th>TUBE Type</th>
<th>PLATE VOLTS</th>
<th>PLATE CUR. M.A.-D.C.</th>
<th>CATHODE SCREEN VOLTS</th>
<th>SCREEN CUR. M.A.-D.C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.F. Amp.</td>
<td>C-58-S</td>
<td>210</td>
<td>6.4</td>
<td>4</td>
<td>110</td>
</tr>
<tr>
<td>Osc.</td>
<td>C-58-S</td>
<td>110</td>
<td>2.2</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>1st Det.</td>
<td>C-58-S</td>
<td>210</td>
<td>4.0</td>
<td>6</td>
<td>110</td>
</tr>
<tr>
<td>I.F. Amp.</td>
<td>C-58-S</td>
<td>210</td>
<td>5.6</td>
<td>4</td>
<td>90</td>
</tr>
<tr>
<td>2nd Det.</td>
<td>C-4-S</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1st Audio</td>
<td>C-58-S</td>
<td>36</td>
<td>2.4</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>Output</td>
<td>C-47</td>
<td>200</td>
<td>25</td>
<td>-</td>
<td>210</td>
</tr>
<tr>
<td>Rect.</td>
<td>C-82</td>
<td>-</td>
<td>TOTAL 75</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

LINE VOLTS 115

VOLUME CONTROL MAXIMUM

CODE OF MODEL C-80-B POWER TRANSFORMER

Rectifier filament -- Terminals #1 and 3 -- Black
Heater center tap -- Terminal #2 -- - - - Green
*Not used -- - - - Terminals #4 and 6 --
47 filament -- - - - Terminals #5 and 3 -- Yellow
Start of Anode -- - Terminal #10 -- - - - Red
Center tap of Anode -- Terminal #11 -- - - - Black
Finish of Anode -- - Terminal #12 -- - - - Red
Primary -- - - - - Terminal #13 -- - - - Yellow
Dummy Lug -- - - - - Terminal #14
Primary -- - - - - Terminal #15 -- - - - Yellow

*NOTE:* Some power transformers were made without lugs on Terminals #4 and #6.

CODE OF MODEL C-90 POWER TRANSFORMER

Rectifier filament -- Terminals #1 & 3 -- Black
Heater center tap -- Terminal #2 -- - - - Green
47 Filament -- - - - Terminals #5 & 6 -- Yellow
Tuning light -- - - - Terminals #4 & 6 -- Black
Heaters -- - - - - Terminals #7 & 9 -- Black
Start of Anode -- - Terminal #10 -- - - - Red
Center tap of Anode -- Terminal #11 -- - - - Black
Finish of Anode -- - Terminal #12 -- - - - Red
Primary -- - - - - Terminal #13 & #15 -- Yellow
Dummy Lug -- - - - - Terminal #14

HUM ELIMINATOR

To insure humless operation, there is incorporated in the filament circuit a hum balancing potentiometer, R-8, which is located on top of the chassis directly in front of the by-pass condenser assembly. After the set has been installed, this hum balance should be adjusted for minimum hum in the speaker by turning right or left as required. In some cases, it may be necessary to readjust this control when any of the tubes are replaced.
MODEL CM-16-A and C-19-A DYNAMIC SPEAKERS

The model CM-16-A is a small dynamic speaker designed for use in conjunction with the Model C-80-A chassis in the table model receivers where comparatively small space is available. The field resistance of this speaker is 1260 ohms at 70° F.

The Model C-19-A is a large full sized dynamic speaker representing the latest in modern speaker development. The field resistance is the same as that of the CM-16-A.

TECHNICAL DATA PERTAINING TO MODEL C-80-B CHASSIS

The circuit of the Model C-80-B chassis is the same as that of the C-80-A except for the necessary changes to adapt it for dual speaker operation. The power transformer and choke coil are both larger to provide for the extra current necessary to energize two speaker fields. In addition, resistor R-21 is incorporated as a bleeder.

Speakers C-19C and C-19-E, both full sized dynamic speakers, having a field resistance of 520 ohms each, are employed in conjunction with the model C-80-B chassis.
AUTOMATIC SYNCHRO-SILENT TUNING CONTROL

Since the development of efficient automatic volume control receivers, there has been the objectionable noise when tuning from one station to another. The Model C-90 Chassis is equipped with an Automatic Synchro-Silent Tuning Control, which, when properly adjusted, entirely eliminates this noise.

The Automatic Synchro-Silent Tuning Control is located on the right hand side of the cabinet and may be adjusted as follows: Turn the receiver on and tune to a position between two broadcasting stations, preferably near the low frequency end of the dial (60 to 85). Turn the volume control to maximum position and the Automatic Synchro-Silent Tuning Control clockwise as far as possible. Now slowly rotate the Automatic Synchro-Silent Tuning Control in a counter-clockwise direction until no more noise is heard. The noise will stop rather suddenly, and it is desirable that the Automatic Synchro-Silent Tuning Control be set only in the position required to eliminate the noise.

The set is now ready for operation and it will be found that stations come in just as much volume as they would if the Automatic Synchro-Silent Tuning Control were not used but when tuning between stations the set is absolutely quiet.

If at any time it is desired to get maximum distance without regard to noise, between stations, simply turn the Automatic Synchro-Silent Tuning Control Knob as far clockwise as possible.

The function of the Automatic Synchro-Silent Tuning Control is as follows: One of the new type C-57-S tubes is used in the First Audio stage because of its sharp plate current cut-off characteristic. By inserting a high negative bias in the suppressor grid circuit of this tube, the tube is "blocked out" and no signal will come through.

To obtain this, a type C-57-S tube is used as a Synchro tube. This obtains its plate supply through resistor R-8, which is in the suppressor grid circuit of the audio amplifier tube. The Synchro tube obtains its grid voltage from the Automatic Volume Control circuit. When there is no station tuned in, there is no Automatic Volume Control voltage, and hence the grid of the Synchro Tube is approximately at zero bias. This causes its plate to draw current through resistor R-8. The voltage drop across this resistor biases the C-57-S audio amplifier tube so high that the audio amplifier is "blocked out", and hence no noise comes through.

When a station is tuned in, Automatic Volume Control voltage develops across resistor R-9 and this voltage is impressed in the form of a negative grid bias on the Synchro tube. The plate of the Synchro tube now draws little or no current, and hence the bias across resistor R-8 disappears, leaving nothing but normal operating bias on the audio amplifier tube. In this condition the entire set is operative just as though there were no Synchro tube in the circuit. In fact, it is possible to tune in a station; remove the Synchro tube, and notice no difference. On the other hand, if this tube is removed when no station is tuned in, the customary interstation noises will be heard. Because of the variations in antennas and noises in different localities, it is necessary to provide a variable control to govern the point at which the Synchro tube takes hold. A potentiometer, R-22, is therefore included in the screen grid circuit of the Synchro Tube.

SENSITIVITY

Because of the elimination of noise between stations by Columbia Automatic Synchro-Silent Tuning, it has been possible to improve the sensitivity of the C-90 chassis to several times that heretofore used. In cases where low sensitivity is encountered, the adjustment of the Automatic Synchro-Silent Tuning Control should be carefully checked, as well as all the tubes in the radio frequency end of the chassis. This should always be done before attempting to increase sensitivity by realigning the condensers.

PUSH-PULL RESISTANCE COUPLING CIRCUIT

This is a feature which has never before appeared in a broadcast receiver. The advantages of resistance coupling are so well known that it is unnecessary to point out how good tone quality and well designed resistance coupling are synonymous. The advantages of push-pull are also well known, the chief among these being that it is possible to get greater output with less distortion. Now, as mentioned above, for the first time we have both of these features in one chassis.

In push-pull amplification, it is necessary that the grids of the push-pull tubes be fed with voltages that are equal in magnitude, but exactly opposite in phase or polarity. When a transformer is used, this is accomplished simply by using the two extremes of the secondary winding to feed the push-pull grids, and if a center tap is provided, these voltages are bound to be equal, and opposite in value.

In the new Columbia circuit, phase rotation is accomplished by making use of the fact that a signal in passing through a vacuum tube is rotated in phase exactly 180° (complete reversal). Following the audio channel from the diode detector, we find that the audio voltage built up across Resistor R-9 is fed to the C-57-S audio tube through potentiometer R-22. The output of this audio amplifier follows two channels. The direct and conventional channel is through condensers C-13 and C-11 to the lower of the two C-47 push-pull output pentodes. The remaining channel is through condenser C-17, and the C-50-S phase rotating tube. The signal coming out of this tube built up across R-13 is reversed in polarity over that originally built up across R-11. This reversed signal is fed to the upper of the two C-47 output Pentodes. By suitable design, the C-50-S phase rotating tube and associated circuit is arranged so that no change in the magnitude of the signal takes place, the only change being a reversal of polarity or phase.

In this way, we have two voltages fed to the two C-47 output tubes which are equal in magnitude, but opposite in polarity and true push-pull resistance coupled operation results.

MODEL C-90
SILENT TUNING
Notes
COLUMBIA PHONOGRAPH COMPANY

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This is an entirely new feature in radio. By referring to the wiring diagram, it will be seen that the reactor used consists of three windings on three legs respectively, of the iron core. The windings on the two end legs are connected in series with the pilot light, while the winding on the center leg is connected in series with the plates of the R.F., First Detector, and I.F. tubes. An electrolytic condenser, C-5, is connected so as to shunt the center winding. Its purpose will be explained later.

The operation of the reactor is as follows:

When the set is turned on and the tubes are warmed up, but no station is tuned in, a relatively large plate current will flow through the center winding. This saturates the iron core so that the reactance of the two outer windings is quite low, and considerable current therefore flows through the pilot light. When a station is tuned in, it operates the C-4-S tube so that an automatic bias voltage is built up across Resistor R-9. This bias voltage is, in turn, impressed upon the control grids of the R.F., First Detector and I.F. tubes. When this bias is impressed on these amplifier tubes, the normal A.V.C. action takes place; namely, their amplification is decreased. It also happens, however, that their plate current is decreased, due to the higher negative bias on their grids. This reduced plate current flowing through the center winding of the reactor relieves the saturation in the iron core so that reactance of the outer windings increases and the current flowing through the pilot light is therefore reduced, causing the pilot light to dim when a station is tuned in.

It is, therefore, a simple and fascinating matter to adjust the dial until the pilot light is dimmest, with the perfect assuredness that exact resonance will be located.

The two outer windings are connected so that they buck each other so far as the center leg of the core is concerned. Hence, there will be induced no A.C. in the center winding, which is in the plate circuit of the amplifier tubes. Because of small unbalances which may occur, it has been found necessary that we place the electrolytic condenser, C-5, across the center winding so that there is no possible chance of any A.C. getting into the plate circuit of the amplifier tubes.

### MODEL C-90

<table>
<thead>
<tr>
<th>TUBE PURPOSE</th>
<th>TYPE</th>
<th>PLATE VOLTS</th>
<th>PLATE CUR.</th>
<th>CATHODE VOLTS</th>
<th>SCREEN VOLTS</th>
<th>SCREEN CUR.</th>
<th>M.A.-D.C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.F.Amp.</td>
<td>C-56-S</td>
<td>255</td>
<td>4.0</td>
<td>2</td>
<td>75</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Osc.</td>
<td>C-56</td>
<td>75</td>
<td>4.0</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1st Det.</td>
<td>C-58-S</td>
<td>255</td>
<td>2.6</td>
<td>9</td>
<td>75</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>I.F.Amp.</td>
<td>C-58-S</td>
<td>255</td>
<td>4.4</td>
<td>2</td>
<td>75</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>2nd Det.</td>
<td>C-4-S</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1st Audio</td>
<td>C-57-S</td>
<td>200</td>
<td>*</td>
<td>75</td>
<td>120</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Ph.Shifter</td>
<td>C-58-S</td>
<td>116</td>
<td>1.0</td>
<td>32</td>
<td>116</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>C-47</td>
<td>240</td>
<td>60</td>
<td>-</td>
<td>255</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>Rect.</td>
<td>C-82</td>
<td>-</td>
<td>TOTAL 160</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Synchro-</td>
<td>C-57-S</td>
<td>*</td>
<td>*</td>
<td>0</td>
<td>73</td>
<td>3.8</td>
<td></td>
</tr>
</tbody>
</table>
COLUMBIA PHONOGRAPh COMPANY

Model C-100

Voltage Limits

<table>
<thead>
<tr>
<th>Voltage Limits</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament Voltages</td>
<td></td>
</tr>
<tr>
<td>All tubes but rectifier</td>
<td>2.3 to 2.6</td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>4.6 to 5.2</td>
</tr>
<tr>
<td>Plate Voltages</td>
<td></td>
</tr>
<tr>
<td>R. F. tubes</td>
<td>170 to 190</td>
</tr>
<tr>
<td>Detector tube</td>
<td>95 to 105</td>
</tr>
<tr>
<td>1st Audio tube</td>
<td>130 to 150</td>
</tr>
<tr>
<td>Output tubes</td>
<td>220 to 250</td>
</tr>
<tr>
<td>Rectifier tube (A. C. voltage)</td>
<td>250 to 290</td>
</tr>
</tbody>
</table>

Control Grid Voltages

<table>
<thead>
<tr>
<th>Control Grid Voltages</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F. tubes</td>
<td>2.5 to 3.5</td>
</tr>
<tr>
<td>Detector tube</td>
<td>4.0 to 7.0</td>
</tr>
<tr>
<td>1st Audio tube</td>
<td>8.0 to 11.0</td>
</tr>
<tr>
<td>Output tubes</td>
<td>40.0 to 50.0</td>
</tr>
</tbody>
</table>

Screen Grid Voltages

<table>
<thead>
<tr>
<th>Screen Grid Voltages</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F. tubes</td>
<td>60 to 75</td>
</tr>
<tr>
<td>Detector tube</td>
<td>35 to 55</td>
</tr>
</tbody>
</table>

To be measured with speaker connected and line voltage of 127 1/2 (235 for 220 volt receivers) with fuse in "High" position or of 107 1/2 (215 for 220 volt receivers) with fuse in "Low" position. Measure plate and grid voltages with a high-resistance, D. C. voltmeter (600 ohms or more per volt) from plate or grid tube contact to emitter contact, except in the case of the grid voltage of the first audio tube, which should be measured from the emitter to the chassis.

To be measured with speaker disconnected and line voltage of 127 1/2 (235 for 220 volt receivers) with fuse in "High" position or of 107 1/2 (215 for 220 volt receivers) with fuse in "Low" position. Measure plate and grid voltages with a high-resistance, D. C. voltmeter (600 ohms or more per volt) from plate or grid tube contact to emitter contact, except in the case of the grid voltage of the first audio tube, which should be measured from the emitter to the chassis.
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NOTE: This chassis is used in the model 12X receiver.

MODEL 120-B
Schematic Notes

Alignment

Use an output meter. Supply a 175 kc signal to the grid of the first detector and align all i-f trimmers. Apply a 1500 kc signal to the input of the receiver and tune to this signal. Then adjust all r-f trimmers for maximum signal. Supply a 600 kc signal to the input of the receiver and tune to this signal. Then adjust the oscillator tracking condenser and tuning control simultaneously for maximum output. The combination of tracking condenser adjustment and dial setting with maximum output, disregarding calibration is the correct setting.
MODEL 120-B
Voltage
Notes

Note... This chassis is used in the model 123 receiver.

VOLTAGE TABLE

<table>
<thead>
<tr>
<th>Tube</th>
<th>Fil. Volts</th>
<th>Plate Volts</th>
<th>Plate Current</th>
<th>Screen Volts</th>
<th>Screen Current</th>
<th>Grid Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF</td>
<td>2.0</td>
<td>135</td>
<td>1.2ma</td>
<td>40</td>
<td>.3ma</td>
<td>-3 -11</td>
</tr>
<tr>
<td>Osc.</td>
<td>2.0</td>
<td>55</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>1st Det.</td>
<td>2.0</td>
<td>135</td>
<td>.2</td>
<td>55</td>
<td>.2</td>
<td>-8 -14</td>
</tr>
<tr>
<td>IF Amp.</td>
<td>2.0</td>
<td>135</td>
<td>.3</td>
<td>22</td>
<td>.3</td>
<td>-3 -3</td>
</tr>
<tr>
<td>2nd Det.</td>
<td>2.0</td>
<td>20</td>
<td>*</td>
<td>22</td>
<td>.4</td>
<td>-3 -8</td>
</tr>
<tr>
<td>Output</td>
<td>2.0</td>
<td>130</td>
<td>12</td>
<td>135</td>
<td>2.6</td>
<td>-13.5 -13.5</td>
</tr>
</tbody>
</table>

* Less than .1 ma.

Precautions When Using Other Than Air-Cell

1. It is recommended that the cell be mounted outside of the cabinet because of the creepage of the electrolyte which may spoil the cabinet and chassis. However, if the battery is mounted within the cabinet, the maximum overall dimensions should not exceed the following: Height 11 inches; Length 12 inches; Width 6 inches.

2. A rubber mat is also required. This mat should extend to the full height of the battery so as to protect the chassis and cabinet against the action of acid. Naturally, the battery rests on the mat.

3. Lead coated battery clips must be provided for the battery cable for connection to the battery.

4. The cell must be of the lead-sulphuric acid type and not of the Edison nickel iron type. It should have a flat discharge curve, which can be obtained by proper design. At least, the cell selected for the purpose must be of the proper design so as to afford the correct discharge characteristic.

5. The capacity of the cell should be at least 100 ampere-hours to a final voltage of 1.8. The desired voltage range is from 2.1 to 1.9 volts during the major portion of the period of discharge.

Resistors

Reference to the table of resistors will provide information concerning the arrangement of these units, that is their position upon terminal strip "A" or "B".

Condensers

Reference to the listing of condensers will furnish information with respect to the units housed within a single can and the condenser mounted upon the terminal strip "A".
TUNING CONDENSER AND ALIGNMENT NOTES

Recent chasses are equipped with tuning condensers mounted together as gangs in metal frames. On most of these chasses one or more small adjustable aligning condensers, called "padding condensers", are provided, mounted on the condenser frames. All of these chasses have tuning condensers with split end plates on either the rotors or stators for use in adjusting the condensers so that they track together—that is, so that they tune together throughout the entire range of the station selector dial.

See the accompanying chart to determine the method of aligning any particular chassis. Then refer to the section indicated on the chart.

I. Bandbox, Jr., Models 401, 401-A; Bandbox, Models 601 and 602; Jewelbox, Models 704, 704-A, 704-B.

These receivers are equipped with "acuminators", which are small, adjustable aligning condensers across the first and second tuning condensers. The acuminators are used as auxiliary tuning controls, being adjusted by small levers on the front of the receiver. The detector stage tuning condenser is aligned by means of a small adjustable aligning condenser (not operated as a tuning control) mounted on the chassis. This condenser should be so adjusted that all three condensers may be brought into sharp resonance, with the aid of the acuminators, at all settings of the station selector.

Proceed as follows to adjust the aligning condenser:
1. Set acuminators at approximately their middle positions.
2. Tune carefully to a weak signal of 1000 to 1500 kilocycles frequency, from a broadcasting station or local modulated oscillator.
3. If necessary, reduce volume by means of volume control or filament rheostat, retuning carefully to middle of signal band (maximum signal with retarded volume control).
4. Adjust aligning condenser by means of a balancing wrench or No. 4 socket wrench until signal is loudest with wrench removed (since capacity of wrench may change tuning).
5. Retune slightly if this improves volume; then readjust aligning condenser.
6. Tune to signals at various dial settings to see whether it is possible to tune sharply with acuminators to signals at all frequencies. If not possible, realign, as above.

II. Gembox, Model 608

This receiver has no acuminators or other aligning condensers across the first two tuning condensers, but has an adjustable aligning condenser across the detector-stage tuning condenser. The aligning condenser is mounted on top of the condenser frame.

To align, proceed as follows:
1. Tune carefully to a signal of moderate strength of 1000 to 1500 kilocycles frequency, from a broadcasting station or local modulated oscillator. If necessary, reduce volume by means of volume control. Be sure to tune to middle of signal band (loudest signal with retarded volume control).
2. Adjust aligning condenser by means of a balancing wrench or No. 4 socket wrench until signal is loudest with wrench removed (since capacity of wrench may change tuning).
3. Retune slightly if this improves volume, and readjust aligning condenser. Continue re-tuning and realigning until no further improvement is noted.

III. Gemchest, Model 609; Gembox, Model 610

These receivers have no aligning condensers. The tuning condensers have four-section split end plates on the stators, which are used for adjusting the tuning condensers so that they track together. In order to make this adjustment, a beat-frequency oscillator should be used. See section VIII-B.

IV. Showbox and Showchest, Models 705, 706, 708; Jewelbox, Model 804; Models 41-A and 42.

These receivers have aligning condensers across their detector-stage tuning condensers. In addition, the rotors of the tuning condensers have seven-section split end plates for adjusting so that the condensers track together. The aligning condenser on Jewelbox, Model 804 is mounted on the chassis, to the rear of the condenser gang, and is adjustable by means of a balancing wrench or No. 4 socket wrench. The aligning condenser on each of the other models is mounted inside the condenser frame, and is adjustable by means of a square head screw extending through the condenser frame just above the power switch.

A. Adjusting Rotor End Plates For Tracking.

A beat-frequency oscillator should be used for this purpose. See section VIII-A.

B. Adjusting Detector Stage Aligning Condenser.

Proceed as follows:
1. Tune to a signal of moderate strength of 1000 to 1500 kilocycles frequency (dial setting about 5 to 15) from a broadcast station or local modulated oscillator. Tune to middle of signal band (loudest signal with retarded volume control) reducing volume by means of volume control if necessary.
2. Adjust aligning condenser until signal is loudest. Retune slightly if this improves volume, and readjust aligning condenser.
3. Continue retuning and readjusting aligning condenser until no further improvement is noted.

V. Models 20, 21, 22, 40S, 41S, 42S, 82S, 80S, 61S, 68S, 62S.

These receivers are not equipped with aligning or padding condensers. The rotors of the tuning condensers have seven-section split end plates, for adjusting the condensers so that they track together. As explained below, these may also be adjusted on the chasses for aligning the three stages.

A. Adjusting Rotor End Plates For Tracking.

To adjust the condensers so that they track together, a beat-frequency oscillator should be used. See section VIII-A.

B. Aligning Tuning Condensers on Chassis.

Proceed as follows:
1. IMPORTANT! Cover the caps and clips on the tops of the screen grid tubes with tape, so that no metal is exposed.
2. Tune to a signal of moderate strength between 1200 and 1500 kilocycles (dial setting 5 to 15) from a broadcast station or local modulated oscillator. Carefully adjust station selector to middle of signal band (loudest signal with retarded volume control).
3. Procure a strip of copper or brass just narrow enough to slip easily into the louvres (ventilator openings) on the covers over the screen grid tubes.
Slide this piece of metal through one of the louvers toward the first-stage screen grid tube cap, keeping the metal grounded against the shield. Note whether the loudness increases or decreases. Try this for each screen grid tube.

4. If the volume increases in every case, or decreases in some cases, the receiver is not tuned sharply. Retune and check again.

5. If the volume increases in some cases but not in others, more capacity is needed in those stages showing increased volume. If the volume decreases in some stages but not in others, less capacity is needed in the stages exhibiting decreased volume. Note which condenser needs adjusting worst, and whether it requires increased or decreased capacity.

6. Remove shield cover from condenser frame and adjust interleaved split end plate of condenser out of alignment. Hold split end sheets adjacent stator plate to increase capacity, or slightly away from it to decrease capacity.

7. Retune and recheck as above.

8. Repeat until metal strip test fails to show lack of alignment.


These receivers have aligning or padding condensers for each tuned stage, but these condensers are not adjustable from outside the tuning-condenser frame. They are adjusted permanently with a special tool at the factory, and should not be changed. If realignment is necessary, this may be taken care of by adjusting the tracking with a beat-frequency oscillator as explained in section VIII-A. The rotors of the tuning condensers are equipped with seven-sector split end plates for this purpose.

VII. Models 30S, 31S, 33S, 34S—Late Production, Equipped With Padding Condensers Adjustable From Outside Condenser Frame.

These receivers are equipped with small adjustable padding or aligning condensers for two tuned stages, adjustable from outside the tuning condenser frames by means of screws extending through the frames. The rotors of the tuning condensers have seven-sector split end plates, for adjusting them so that they track together.

A. Adjusting Rotor End Plates For Tracking.

This should be done by means of a beat-frequency oscillator. See section VIII-A.

B. Adjusting Padding Condensers With Outside Station Signals.

Proceed as follows:

1. Tune to a weak signal between 1200 and 1500 kilocycles (dial setting 5 to 15). Carefully tune to middle of signal band (maximum signal with retarded volume control), reducing volume by means of volume control if necessary.

2. Loosen locknut with three-eighths inch end wrench and adjust padding condenser toward rear of chassis until signal is loudest. Retune slightly if this improves volume, and readjust padding condenser. Repeat all improvement is noted; then tighten locknut without permitting adjusting screw to turn.

3. Adjust the other padding condenser as in "2".

4. If when aligning signal becomes too strong to allow of accurate adjustment, tune to a weaker signal and repeat above procedure.

C. Adjusting Padding Condensers With Local Oscillator.

Follow above procedure, except:

1. Instead of adjusting for maximum signal loudness, adjustment may be made for maximum reading on a 250 volt D.C. voltmeter, having a resistance of about 250,000 ohms, connected across the detector grid bias resistance, from emitter to chassis. A small punched strip may be used to make the connection to the emitter prong of the tube, or this may be reached by removing the bottom of the chassis. The speaker must remain connected.

2. It is advisable to check the alignment for oscillator signals at two frequencies—at about 10 and 40 on the station selector dial.

VIII. Aligning Condensers For Tracking With Beat-Frequency Oscillator.

The following procedure is for the purpose of adjusting the tuning condensers so that they "track together"; that is, so that they exchange capacity by the same amount when the station selector is rotated. This insures uniform tuning throughout the entire range of the station selector, but does not align the condenser so that all circuits are tuned to the same frequency. The latter is accomplished by means of the aligning or padding condensers. The proper procedure, then, is: first, adjust condensers for tracking by means of beat-frequency oscillator; second, replace condenser gang on chassis and align circuits by means of padding condensers.

A. Condensers Having Seven Sector Split End Plates on Rotors.

Proceed as follows:

1. Take off cover from condenser frame. Unsolder leads and remove frame from chassis. Hold gang directly in front of you, with rotors entirely interleaved between stators, and note whether rotor plates of each condenser are centered between corresponding stators. If any require centering, loosen set screws and slide along shaft until properly centered. Then tighten set screws. When you are satisfied that all rotors are properly centered, tighten all set screws holding rotors to shaft.

<table>
<thead>
<tr>
<th>Number of Split Sectors Entered</th>
<th>Allowable Difference Between Any Two Condensers of Gang</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.5 mmf.</td>
</tr>
<tr>
<td>2</td>
<td>1.5 mmf.</td>
</tr>
<tr>
<td>3</td>
<td>2.0 mmf.</td>
</tr>
<tr>
<td>4</td>
<td>2.0 mmf.</td>
</tr>
<tr>
<td>5</td>
<td>2.5 mmf.</td>
</tr>
<tr>
<td>6</td>
<td>2.5 mmf.</td>
</tr>
<tr>
<td>7</td>
<td>2.5 mmf.</td>
</tr>
</tbody>
</table>

2. Place frame in jig on top of beat-frequency oscillator. Turn station-selector knob so that there is no interleaving of rotors and stators—that is, so that condensers are set for minimum capacity.

3. Check the capacity of each condenser. If there is a variation in capacity, adjust the compensators C1, C2, and C3 on the beat frequency oscillator so that the same reading is obtained with each condenser.

4. Turn station selector knob so that first sector of each split end plate is entered into stator. Check capacity of each condenser. If there is a variation
CROSLEY RADIO CORP.

greater than that given in Table 1, note which condenser is farthest out. Then rotate station selector until first split end plate of this condenser may be adjusted. Spring this sector slightly toward adjacent stator plate to increase capacity or slightly away from adjacent stator plate to decrease capacity. Adjust station selector so that first split sectors are again interleaved with stators, and recheck capacities. If there is too much variation, readjust as above. Repeat until variation of capacity is within the limits given in Table I.

5. Rotate station selector until first two split sectors are entered into stators. Check capacity variation as above. If variation is greater than allowable limits given in Table I, adjust condenser farthest out by springing second split end plate sector of that condenser toward adjacent stator plate to increase capacity or away from adjacent stator plate to decrease capacity. Recheck and readjust until variation is within allowable limits of Table I, as outlined in "4".

6. Repeat above procedure with three, four, five, six, and seven sectors entered into stators. Remember that the sector to be adjusted in each case is the last one entered into the stators prior to checking. Thus, to compensate for variation found when five sectors are interleaving stators, the fifth sector should be adjusted, etc.

7. After completing adjustment, recheck in each position and readjust as necessary.

8. Replace frame on chassis, and align padding condensers.

B. Condensers Having Four Sector Split End Plates on Stators.

Follow the above procedure, except adjust the split stator sectors instead of rotor sectors, referring to Table III for allowable limits of variation.

Table III - Allowable Capacity Variation at Different Settings - Four Sector Stator Plates

<table>
<thead>
<tr>
<th>Number of Split Stator Sectors Interleaved by Rotors</th>
<th>Allowable Difference Between Any Two Condensers of Gang</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.0 mmf.</td>
</tr>
<tr>
<td>2</td>
<td>2.0 mmf.</td>
</tr>
<tr>
<td>3</td>
<td>2.5 mmf.</td>
</tr>
<tr>
<td>4</td>
<td>2.5 mmf.</td>
</tr>
</tbody>
</table>
Voltage Limits
To be measured with tubes in place, speaker connected, and line voltage of 117½ (235 for 220 volt receivers. Measure plate and grid voltages with a high-resistance D. C. volt-meter (600 ohms or more per volt) from plate or grid socket contact to emitter contact. Use a low-range A. C. meter to measure filament voltages.

<table>
<thead>
<tr>
<th>Filament Voltages</th>
<th>All tubes but rectifier</th>
<th>Rectifier tube</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.3 to 2.5</td>
<td>4.6 to 4.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plate Voltages</th>
<th>R. F. amplifier tubes</th>
<th>160 to 190</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector tube</td>
<td>105 to 125</td>
<td></td>
</tr>
<tr>
<td>A. F. amplifier tube</td>
<td>125 to 155</td>
<td></td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>230 A. C.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Screen Grid Voltages</th>
<th>R. F. amplifier tubes</th>
<th>80 to 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector tube</td>
<td>40 to 50</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control Grid Voltages</th>
<th>R. F. amplifier tubes</th>
<th>2.5 to 3.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector tube</td>
<td>6.0 to 7.0</td>
<td></td>
</tr>
<tr>
<td>A. F. amplifier tube</td>
<td>25 to 35</td>
<td></td>
</tr>
</tbody>
</table>

Installation Notes
Because of the low sensitivity of this chassis it is better to use a comparatively large aerial with it if possible. A good ground should, of course, be used.

One must be careful in inserting the speaker plug not to force it in when the prongs are improperly lined up with the socket holes.

This model employs the following tubes: two -24 screen grid amplifiers, a -24 screen grid detector, a -45 power output amplifier, and a -80 rectifier.
### Parts List

**INSTRUCTIONS FOR ORDERING**—Give part number, description of part, and serial number of receiver on which part is to be used. If article wanted is not listed separately, then that part of complete assembly containing this article should be ordered. Goods shipped on open account to Crosley Wholesale Distributors only. Cash must accompany Dealer and Consumer orders. Prices are subject to the usual trade discounts.

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Part No.</th>
<th>Description</th>
<th>List Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABINET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W-2185A</td>
<td>Housing</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>W-21857</td>
<td>Front Cover</td>
<td>.50</td>
<td></td>
</tr>
<tr>
<td>W-21553A</td>
<td>Drive Bracket Hole Cover</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>W-21551A</td>
<td>Drive Bracket Cover</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>B-21553A</td>
<td>Battery Bottom</td>
<td>.26</td>
<td></td>
</tr>
<tr>
<td>W-21774</td>
<td>Battery Plug Bracket</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>CHASSIS</td>
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<td></td>
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</tr>
<tr>
<td>C-21228</td>
<td>Chassis (4)</td>
<td>.75</td>
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</tr>
<tr>
<td>W-7871</td>
<td>Socket (4)</td>
<td>.25</td>
<td></td>
</tr>
<tr>
<td>W-7932</td>
<td>Socket (6)</td>
<td>.20</td>
<td></td>
</tr>
<tr>
<td>W-7971</td>
<td>Socket (1)</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>W-21553A</td>
<td>Socket (Speaker)</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>W-21623</td>
<td>Socket Guide (Volume Control)</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>W-21624</td>
<td>Socket Guide (Battery Access)</td>
<td>.10</td>
<td></td>
</tr>
<tr>
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<td>R. F. Transformer</td>
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**MODEL 91 AUTO**

### Parts List

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<th>List Price Each</th>
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**TYPE "B" DASH CONTROL COMPLETE**

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### 270 SPEAKER

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Schematic on page 282-1, Vol. I.
CROSLEY RADIO CORP.

MODEL 92 AUTO
Schematic

MODEL 95
Schematic, Voltage

CROSLEY MODEL 95 (ROAMIO) VOLTAGE DATA

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<th>Tube</th>
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<th>Screen</th>
<th>Grid</th>
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<td>70-80</td>
<td>-7 to -9</td>
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<td>I-F</td>
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<td>70-80</td>
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<tr>
<td>Output</td>
<td>150-170</td>
<td>160-180</td>
<td>-16 to -18</td>
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Plate and screen voltages measured from element to chassis.

Schematic diagram of the Crosley Model 95 (Roamio), with combination oscillator-detector.
Aligning Intermediate Frequency Stages

1. A local oscillator tuned accurately to 181.5 kilocycles is required.
2. Set the dial of the station selector to 550 kilocycles.
3. Connect the high side of the test oscillator output through a condenser of approximately 0.1 mF, capacity to the grid of the first detector tube, and the low side of the test oscillator to chassis. Do not remove the clip wire from the grid of the first detector tube.
4. Adjust the two padding condensers at either side of the first intermediate frequency transformer for maximum reading on the output meter.
5. Adjust the secondary padding condensers on the second and third intermediate frequency transformers for maximum reading on the output meter.

Filament Voltages

| All tubes | 5.8 to 6.2 |

Plate Voltages

| R.F., First Det., and I.F. tubes | 160 to 200 |
| Second Detector tube | 70 to 90 |
| Output tube | 150 to 190 |

Screen Grid Voltages

| R.F., First Det., and I.F. tubes | 85 to 105 |
| Output tube | 160 to 200 |

Operating Grid Voltages

| R.F and First I.F. tubes | -3.6 to -4.4 |
| First Detector tube | -6.3 to -7.7 |
| Second I.F. tube | -1.8 to -2.2 |
| Second Detector tube | -3.4 to -6.6 |
| Output tube | -13 to -15 |

Model 96 (Roamin-Auto) (1932)

- Secondary of 1st i-f trans.
- Secondary of 3rd i-f trans.
- Secondary of 2nd i-f trans.
- Primary of 1st i-f trans., mounted on side of chassis.
Aligning Tuning Condensers

The tuning condensers of the first radio-frequency, first detector, and oscillator stages must be aligned so that they track together. This is done by means of padding condensers, much the same as in the case of other Crosley receivers, except that both high and low frequency adjustments are provided.

The alignment of the tuning condensers is a process requiring considerable skill, and should only be undertaken when absolutely necessary, and only by those who have had extensive servicing experience. While station signals can be used for aligning, it is advised that a local modulated oscillator be employed. The procedure for aligning the tuning condensers of chassis 120 is as follows:

1. Leaving the shield cover in place, tune to a signal between 1300 and 1500 kilocycles.
2. Turn the volume control all of the way on. If all signals within the required range are too loud, connect a 0.00025 m. f. fixed condenser between the "A" and "G" terminals, and then couple the antenna very loosely to the local-distance switch leads.
3. If, when carefully tuned to the middle of the band, the dial reading does not correspond to the frequency of the signal, but is not more than two channels off, set the dial at the correct frequency, and adjust the padding condenser on the oscillator tuning condenser (the tuning condenser farthest toward the rear of the chassis) until the signal is loudest. Check the tuning by re-adjusting the station selector. It may not be possible to regulate the oscillator padding condenser so that the oscillator condenser is properly aligned with the exact dial setting, in which case align the padding condenser with a dial setting as close to the actual frequency as practicable.
4. After aligning the oscillator padding condenser, carefully adjust the padding condensers on the other two tuning condensers until the signal is received with greatest volume.
5. Tune to a signal of about 600 kilocycles frequency. If the dial setting, when carefully adjusted, is not more than one channel different from the actual frequency of the signal, it is possible to align the low frequency tracking, but do not make this adjustment unless absolutely necessary. The low frequency aligning adjustment is at the rear of the chassis, back of the shield, and is sealed at the factory. Break the seal, and insert a screwdriver made of bakelite or other insulating material in the adjusting screw. Set the tuning dial at the actual frequency of the signal, and adjust for best volume. If it is not possible to align the condenser with the dial set at the exact signal frequency, set the dial as close to the exact frequency as practicable.
6. If a screwdriver of insulating material is not available, adjustment may be made with an ordinary screwdriver by turning the screw slightly, removing the screwdriver, and retuning—repeating this process (being sure to turn the screw in such a direction that the tuning approaches more nearly the desired frequency, of course) until the dial setting agrees with, or approximates, the actual signal frequency.

Aligning Intermediate Frequency Stages

The intermediate amplifier and detector circuits must be tuned accurately to 175 kilocycles. They are aligned carefully at the factory, and no change should be necessary. In order to align them, an accurately tuned local oscillator operating at 175 kilocycles is essential.

Alignment of the intermediate frequency circuits should be undertaken only when absolutely necessary. The procedure for aligning the intermediate frequency amplifier, first detector output, and second detector output circuits to 175 kilocycles is as follows:

1. A local oscillator tuned accurately to 175 kilocycles frequency is required.
2. Remove the oscillator tube from the chassis. Remove the clip wire from the top of the intermediate frequency amplifier tube. Connect the test oscillator output from the control grid of the intermediate amplifier to ground. Adjust the two screws on either side of the rear r. f. coil (the coil between the intermediate frequency amplifier socket and the output tubes) until the oscillator signal gives the largest reading on the output meter.
3. Replace intermediate frequency amplifier tube, connecting screen grid clip to top of tube. Remove the first detector tube. Connect the oscillator output from the first detector grid to ground, and adjust the two screws at either side of the front r. f. coil for maximum reading on the output meter. Slight readjustment of the screws beside the rear coil may improve the output somewhat.
MODEL 124-1
Schematic
Voltage

CIRCUIT DIAGRAM, MODEL 124-1

FILAMENT VOLTAGES
All tubes but Rectifier ..... 2.2 to 2.5
Rectifier tube ........ 4.6 to 5.0

PLATE VOLTAGES
R.F. and I.F. Tubes 245 to 285
First Detector Tube 150 to 150
Oscillator Tube 80 to 100
Second Detector Tube 120 to 140
Output Tube 250 to 270
Rectifier 330 to 390

SCREEN GRID VOLTAGES
R.F. and I.F. Tubes 80 to 100
First Detector Tube 75 to 85
Output Tubes 230 to 280

GRID VOLTAGES
R.F. and I.F. Tubes -3.0 to -3.4
First Detector Tube -7.0 to -9.0
Oscillator Tube -10.0 to -12.0
Second Detector Tube -16.0 to -20.0
Output Tubes -15.0 to -17.0

CROSLEY RADIO CORP.
Alignment of I. F. Amplifiers and Tuning Condensers

Alignment Of I.F. Amplifiers
The primary and secondary circuits of the intermediate frequency transformers of these receivers must be tuned accurately to the intermediate frequency employed. For this purpose, small aligning condensers are shunted across the primaries and secondaries of the I.F. amplifier transformers in most instances. These condensers are adjusted carefully at the factory and normally no change in them should be necessary.

In order to align the I.F. stages, an accurately-tuned local oscillator and an output meter are required. The output meter used must be of the high impedance type (such as a Rectox or Vacuum Tube Voltmeter) and must have a range, either directly, or through a divider system, of 500 volts. Such equipment may be purchased from a number of manufacturers of electrical measuring instruments.

To align the I.F. stages, proceed as follows:
1. Connect the output meter in shunt across the primary of the speaker transformer. (Connections may be made by removing terminal cover from speaker).
2. Tune the test oscillator to the intermediate frequency used in the receiver aligned. Models 126-1, 128, and 131 use an intermediate frequency of 175 kilocycles. Models 129, 129-1, 130, 130-1, 132-1, 133, 134, 134-1, 135, 136-1, 137, and 141 use an intermediate frequency of 181.5 kilocycles.
3. Tune the receiver to approximately 550 kilocycles (gang condenser set at maximum capacity).
4. Connect the high side of the test oscillator through a .05 to .1 microfarad condenser to last I.F. transformer, and the low side of the the grid of the tube immediately preceding the oscillator to chassis. Do not remove the clip wire from the grid of the tube.
5. Adjust the aligning condenser (or condensers) shunted across the last I.F. transformer for maximum reading on the output meter.
6. Change the high side of the oscillator to the grids of the other tubes preceding the I.F. transformers and adjust these aligning condensers in the same manner.

After this procedure has been followed the I.F. stages will be properly aligned.

Alignment of Tuning Condensers
The alignment of tuning condensers is a process requiring considerable skill, and should be undertaken only when absolutely necessary.

Station signals may be used for aligning, but it is advisable to employ a local modulated oscillator.
1. Connect the high side of the oscillator through a dummy antenna or 0.00025 mf. condenser to the antenna and the low side to the ground terminal of the receiver, and adjust the oscillator to a frequency of approximately 1400 kilocycles.
2. Tune the receiver to the local oscillator signal, or to a station signal, of known frequency, between 1300 and 1400 kilocycles. Turn the volume control on full.
3. If when carefully tuned to give a maximum reading on the output meter the dial reading does not correspond to the frequency of the signal, adjust the padding condenser on the oscillator tuning condenser and retune the receiver until the setting is as nearly correct as it is possible to adjust it with the receiver properly tuned.
4. After adjusting the oscillator padding condenser, be sure that the station selector is adjusted to the middle of the signal band. Then adjust the other padding condensers for maximum output.
5. Adjustment should be made with a screwdriver of insulating material. If such a screwdriver is not available, adjust with an ordinary screwdriver so that the output is best, or the frequency setting best, with the screwdriver removed from the chassis.
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MODEL 127-1
Schematic Voltage Notes

- Circuit Diagram, Model 127-1

IF PEAK 175 KC

Alignment
To align the i.f. stages, use a local oscillator and adjust the condensers on either side of the Q2 grid and plate, and the i.f. amplifier, to give maximum reading on output meter.
Then adjust the condensers on each side of the 3rd and 4th i.f. transformers between the plates and grids, to give maximum reading on second meter, and to give maximum reading on output meter.

Connect a 1,400 kc oscillator through a 0.0025-mfd. condenser to the antenna post of the first i.f. stage. Connect the antenna to the first i.f. stage of the receiver, and the output meter to the second meter of the receiver.

Voltage Data
The voltages should be measured with the r.f. stage disconnected and the non-linear i.f. stages connected. The values given are approximate and may not be exactly the same as specified in the service manual.

Crosley Model 127-1 receiver

Speaker connections for the Crosley Model 127-1 receiver

The speaker connections are as follows:
- Black wire: negative (-) to speaker
- White wire: positive (+) to speaker

Crosley Voltage Data

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Plate</th>
<th>Grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>800</td>
<td>300</td>
</tr>
</tbody>
</table>

The voltage values are measured in volts.

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MODEL 128
MODEL 131
Schematic

Circuit Diagram, Model 128

Circuit Diagram, Model 131

IF PEAK 175 KC

www.americanradiohistory.com
Specifications

Models 129 and 129-1 are six-tube superheterodynes for operation from A.C. electrical circuits, differing only in that Model 129 is adapted to the operation of a single speaker, and Model 129-1 to the operation of dual speakers. The tubes used are: a -24 type oscillating first detector, a -58 type I.F. amplifier, a -57 type second detector, two -42 type push-pull output tubes, and a -80 type rectifier.

Voltage Limits

The following are the approximate voltages which should be measured with the tubes in place, speakers connected, and a line voltage of 117½ (235 for 220 volt receivers). Measure plate and screen grid voltages with a high-resistance D.C. voltmeter (1000 ohms per volt) from plate or screen grid tube contact to emitter contact. Measure bias voltages as shown in table. Use a low-range A.C. voltmeter for filament or heater voltages.

<table>
<thead>
<tr>
<th>Plate Voltages</th>
<th>First Detector tube</th>
<th>I.F. Amplifier tube</th>
<th>Second Detector tube</th>
<th>Output tubes</th>
<th>Rectifier tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>175 to 215</td>
<td>260 to 320</td>
<td>72 to 88</td>
<td>240 to 300</td>
<td>335 to 385</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Screen Grid Voltages</th>
<th>First Detector and I.F. Amplifier tubes</th>
<th>Second Detector tube</th>
<th>Output tubes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>85 to 105</td>
<td>27 to 33</td>
<td>240 to 300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating Grid Voltages</th>
<th>First Detector tube (cathode to chassis)</th>
<th>I.F. amplifier tube (cathode to chassis)</th>
<th>Second Detector tube (across 6000 ohm bias resistor)</th>
<th>Output tubes (cathode to chassis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>7 to 9</td>
<td>2.7 to 3.3</td>
<td>6.3 to 7.7</td>
<td>18 to 22</td>
</tr>
</tbody>
</table>
Specifications

Models 129 and 129-1 are six-tube superheterodynes for operation from A.C. electrical circuits, differing only in that Model 129 is adapted to the operation of a single speaker, and Model 129-1 to the operation of dual speakers. The tubes used are: a -24 type oscillating first detector, a -58 type I.F. amplifier, a -57 type second detector, two -42 type push-pull output tubes, and a -80 type rectifier.

Voltage Limits

The following are the approximate voltages which should be measured with the tubes in place, speakers connected, and a line voltage of 117½ (235 for 220 volt receivers). Measure plate and screen grid voltages with a high-resistance D.C. voltmeter (1000 ohms per volt) from plate or screen grid tube contact to emitter contact. Measure bias voltages as shown in table. Use a low-range A.C. voltmeter for filament or heater voltages.

<table>
<thead>
<tr>
<th>Heater Or Filament Voltages</th>
<th>First Detector, I. F. Amplifier, and Second Detector tubes</th>
<th>Output tubes</th>
<th>Rectifier tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Detector tube</td>
<td>175 to 215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. F. Amplifier tube</td>
<td>360 to 330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>7.2 to 8.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output tubes</td>
<td>240 to 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>335 to 365</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Screen Grid Voltages</th>
<th>First Detector and I. F. Amplifier tubes</th>
<th>Second Detector tube</th>
<th>Output tubes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>85 to 105</td>
<td>37 to 53</td>
<td>240 to 300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating Grid Voltages</th>
<th>First Detector tube (cathode to chassis)</th>
<th>I. F. amplifier tube (cathode to chassis)</th>
<th>Second Detector tube (across 6,000 ohm bias resistor)</th>
<th>Output tubes (cathode to chassis)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 to 9</td>
<td>2.7 to 3.3</td>
<td>63 to 7.7</td>
<td>10 to 13</td>
</tr>
</tbody>
</table>
Specifications

This is a twelve-tube superheterodyne for operation from A.C. electric circuits. It employs a -58 type R.F. amplifier tube, a -58 type first detector tube, a -56 type oscillator tube, two -58 type I.F. amplifier tubes, a -56 type diode second detector tube, a -56 type automatic volume control tube, two -42 type push-pull A.F. amplifier tubes, two -46 type push-pull output tubes, and a -82 mercury vapour rectifier tube.

Voltage Limits

The following are the approximate voltages which should be measured with the tubes in place, speakers connected, and a line voltage of 117½ (235 for 220 volt receivers). Measure plate and screen grid voltages with a high-resistance D.C. voltmeter (100 ohm per volt) from plate or screen grid tube contact to emitter contact. Measure bias voltages as shown in table. Use a low-range A.C. voltmeter for heater voltages.

Heater Or Filament Voltages

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. F. Amplifier tubes</td>
<td>2.3 to 2.5</td>
</tr>
<tr>
<td>Rectifier</td>
<td>2.4 to 2.6</td>
</tr>
</tbody>
</table>

Plate Voltages

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F., First Detector, and First I. F. tubes</td>
<td>18 to 22</td>
</tr>
<tr>
<td>Oscillator tube</td>
<td>13 to 19</td>
</tr>
<tr>
<td>Second I. F. tube</td>
<td>190 to 240</td>
</tr>
<tr>
<td>A. V. C. tube</td>
<td>190 to 230</td>
</tr>
<tr>
<td>A. F. Amplifier tubes</td>
<td>380 to 430</td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>390 to 440</td>
</tr>
</tbody>
</table>

Screen Grid Voltages

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F. and First I. F. tubes</td>
<td>50 to 70</td>
</tr>
<tr>
<td>First I. F. tube</td>
<td>150 to 180</td>
</tr>
<tr>
<td>A. F. tubes</td>
<td>200 to 240</td>
</tr>
</tbody>
</table>

Bias Voltages

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F. and First I. F. Tubes (cathode to grid)</td>
<td>4 to 6</td>
</tr>
<tr>
<td>First Detector tube (cathode to grid)</td>
<td>2 to 8</td>
</tr>
<tr>
<td>Oscillator (cathode to chassis)</td>
<td>2 to 15</td>
</tr>
<tr>
<td>Second I. F. tube (cathode to chassis)</td>
<td>7 to 9</td>
</tr>
<tr>
<td>A. V. C. tube (cathode to chassis)</td>
<td>70 to 85</td>
</tr>
<tr>
<td>Output tubes (cathode to chassis)</td>
<td>25 to 32</td>
</tr>
<tr>
<td>A. F. Amplifier tubes (cathode to chassis)</td>
<td>20 to 27</td>
</tr>
</tbody>
</table>
MODEL 133
Schematic
Voltage
Notes
CROSLEY RADIO CORP.

Specifications
Model 133 is a seven-tube superheterodyne for operation from A.C. electric circuits. It employs the following tubes: a -35 type R.F. tube, a -24 type first detector, a -27 type oscillator, a -35 type I.F. tube, a -27 type second detector, a -47 type output tube, and a -80 type rectifier.

Voltage Limits
The following are the approximate voltages which should be measured with the tubes in place, speaker connected, and a line voltage of 117½ (235 for 220 volt receivers). Measure plate and screen grid voltages with a high-resistance D.C. voltmeter (1000 ohm per volt) from plate or screen grid tube contact to emitter contact. Measure bias voltages from cathode to chassis. Use a low-range A.C. voltmeter for filament or heater voltages.

<table>
<thead>
<tr>
<th>Heater Or Filament Voltages</th>
<th>Rectifier tube</th>
<th>Rectifier tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>All tubes but Rectifier</td>
<td>2.3 to 2.7</td>
<td>4.4 to 5.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plate Voltages</th>
<th>Rectifier tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F., First Detector, and I. F. tubes</td>
<td>Rectifier tube</td>
</tr>
<tr>
<td>Oscillator tube</td>
<td>Rectifier tube</td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>Rectifier tube</td>
</tr>
<tr>
<td>Output tube</td>
<td>Rectifier tube</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Screen Grid Voltages</th>
<th>Rectifier tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F., First Detector, and I. F. tubes</td>
<td>Rectifier tube</td>
</tr>
<tr>
<td>Output tube</td>
<td>Rectifier tube</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bias Voltages</th>
<th>Rectifier tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F. and I. F. tubes</td>
<td>Rectifier tube</td>
</tr>
<tr>
<td>First Detector tube</td>
<td>Rectifier tube</td>
</tr>
<tr>
<td>Oscillator tube</td>
<td>Rectifier tube</td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>Rectifier tube</td>
</tr>
<tr>
<td>Output tube</td>
<td>Rectifier tube</td>
</tr>
</tbody>
</table>

IF PEAK 181.5 KΩ

Circuit Diagram, Model 133
Model 133 (1932)

www.americanradiohistory.com
Specifications

Models 134 and 134-1 are both eight-tube chasses for operation from A.C. electrical circuits. They employ similar superheterodyne circuits, the essential differences being due to the fact that Model 134 is used with a single speaker and Model 134-1 with dual speakers. Both employ a -35 or -51 type first detector tube, a -27 type oscillator tube, a -35 or -51 type first I.F. amplifier tube, a -24 type second I.F. amplifier tube, a -27 type second detector and automatic volume control tube, a -27 type first A.F. amplifier tube, a -47 type output tube, and a -80 type rectifier tube.

Voltage Limits

The following are the approximate voltages which should be measured with the tubes in place, speakers connected, and a line voltage of 117½ (225 for 220 volt receivers). Measure plate and screen grid voltages with a high-resistance D.C. voltmeter (1000 ohms per volt) from plate or screen grid tube contact to emitter contact. Measure bias voltages from cathode contact to chassis.

Model 134

<table>
<thead>
<tr>
<th>Heater Or Filament Voltages</th>
<th>Plate Voltages</th>
<th>Screen Grid Voltages</th>
<th>Bias Voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>All tubes but Rectifier</td>
<td>First Detector and I. F. Amplifier tubes</td>
<td>First Detector and I. F. Amplifier tubes</td>
<td>Oscillator tube</td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>Oscillator tube</td>
<td>Output tube</td>
<td>First A. P. tube</td>
</tr>
<tr>
<td></td>
<td>First A. P. tube</td>
<td>Rectifier tube</td>
<td>Second I. P. tube</td>
</tr>
<tr>
<td></td>
<td>Output tube</td>
<td></td>
<td>First A. F. Amplifier tube</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Output tube</td>
</tr>
<tr>
<td>2.3 to 2.7</td>
<td>250 to 310</td>
<td>77 to 93</td>
<td>11 to 13</td>
</tr>
<tr>
<td>4.5 to 5.5</td>
<td>77 to 93</td>
<td>50 to 60</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>240 to 290</td>
<td>250 to 310</td>
<td>0.4 to 0.8</td>
</tr>
<tr>
<td></td>
<td>350 to 410</td>
<td></td>
<td>4 to 6</td>
</tr>
</tbody>
</table>

www.americanradiohistory.com
Model 134-1

Schematic Voltage

Model 134 (1932)

Heater Or Filament Voltages
All tubes but Rectifier ......................... 2.3 to 2.7
Rectifier tube ................................ 4.5 to 5.5

Plate Voltages
First Detector and First I. F. tubes ....... 240 to 290
Oscillator tube ............................... 77 to 93
Second I. F. Amplifier tube ................. 235 to 275
First A. F. Amplifier tube ................... 125 to 155
Output Tube .................................. 230 to 280
Rectifier tube (measured from each plate to chassis) .................. 340 to 400

Screen Grid Voltages
First Detector and I. F. tubes ............... 77 to 93
Output Tube .................................. 240 to 295

Bias Voltages
Oscillator tube ................................ 13 to 14
First Detector and First I. F. Amplifier tubes .... 0
Second I. F. tube ............................ 0.5 to 0.7
First A. F. tube .............................. 11 to 13
Output Tube .................................. 14 to 18

- Circuit Diagram, Model 134-1
Specifications

Model 135 is a five tube superheterodyne for operation from A.C. electric circuits. It employs the following tubes: a -24 type oscillating first detector, a -35 or -51 type I.F. amplifier, a -24 type second detector, a 147 output pentode, and an -80 type rectifier.

Voltage Limits

The following are the approximate voltages which should be measured with tubes in place, speaker connected, and a line voltage of 117½ (235 for 220 volt receivers). Measure plate and screen grid voltages with a high-resistance D.C. voltmeter (1000 ohms per volt) from plate or screen grid tube contact to emitter contact. Measure bias voltages from cathode to chassis. Use a low-range A.C. voltmeter for filament or heater voltages.

<table>
<thead>
<tr>
<th>Heater Or Filament Voltages</th>
<th>Rectifier tube</th>
<th>Rectifier tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>All tubes but Rectifier</td>
<td>2.2 to 2.8</td>
<td>4.4 to 5.4</td>
</tr>
<tr>
<td>Plate Voltages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Detector and I.F. tubes</td>
<td>250 to 290</td>
<td></td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>40 to 60</td>
<td></td>
</tr>
<tr>
<td>Output tube</td>
<td>220 to 270</td>
<td></td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>250 to 400</td>
<td></td>
</tr>
<tr>
<td>Screen Grid Voltages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Detector and I.F. tubes</td>
<td>70 to 90</td>
<td></td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>20 to 25</td>
<td></td>
</tr>
<tr>
<td>Output tube</td>
<td>225 to 275</td>
<td></td>
</tr>
<tr>
<td>Bias Voltages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Detector tube</td>
<td>6 to 9</td>
<td></td>
</tr>
<tr>
<td>I.F. tube</td>
<td>2.7 to 3.5</td>
<td></td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>4 to 6</td>
<td></td>
</tr>
<tr>
<td>Output tube</td>
<td>18 to 21</td>
<td></td>
</tr>
</tbody>
</table>

Circuit Diagram, Model 135
Specifications

Model 137 is a four-tube superheterodyne for operation from A.C. electric circuits. The tubes employed are as follows: a -24 type oscillating first detector, a -35 or -51 type I.F. amplifier, a -47 type second detector and output tube, and an -60 type rectifier.

Voltage Limits

The following are the approximate voltages which should be measured with the tubes in place, speaker connected, and a line voltage of 117½ (235 for 220 volt receivers). Measure plate and screen grid voltages with a high-resistance D.C. voltmeter (1000 ohms per volt) from plate or screen grid tube contact to emitter contact. Measure bias voltages from cathode to chassis. Use a low-range A.C. voltmeter for filament or heater voltages.

<table>
<thead>
<tr>
<th>Heater Or Filament Voltages</th>
<th>2.3 to 2.6</th>
<th>4.4 to 6.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>All tubes but Rectifier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectifier tube</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plate Voltages</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First Detector and I. F. tubes</td>
<td>220 to 260</td>
<td></td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>210 to 250</td>
<td></td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>380 to 430</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Screen Grid Voltages</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First Detector and I. F. tubes</td>
<td>90 to 110</td>
<td>220 to 260</td>
</tr>
<tr>
<td>Second Detector tube</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bias Voltages</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First Detector tube</td>
<td>8 to 10</td>
<td></td>
</tr>
<tr>
<td>I. F. tube</td>
<td>2.7 to 3.3</td>
<td></td>
</tr>
<tr>
<td>Second Detector tube (with no signal)</td>
<td>25 to 30</td>
<td></td>
</tr>
</tbody>
</table>
Specifications

Model 141 is a five tube superheterodyne for operation from A.C. electric circuits. It employs the following tubes: a -24 type oscillating first detector, a -58 type I.F. amplifier, a -57 type second detector, a -47 type output tube, and a -80 type rectifier.

Voltage Limits

The following are the approximate voltages which should be measured with the tubes in place, speaker connected, and a line voltage of 117½ (235 for 220 volt receivers). Measure plate and screen grid voltages with a high resistance D.C. voltmeter (1000 ohms per volt) from plate or screen grid tube contact to emitter contact. Measure bias voltages from cathode to chassis. Use a low range A.C. voltmeter for filament or heater voltages.

Heater or Filament Voltages

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>All tubes but Rectifier</td>
<td>2.2 to 2.6</td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>4.3 to 5.3</td>
</tr>
</tbody>
</table>

Plate Voltages

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Detector and I.F. tubes</td>
<td>230 to 270</td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>30 to 50</td>
</tr>
<tr>
<td>Output tube</td>
<td>230 to 360</td>
</tr>
<tr>
<td>Rectifier tube</td>
<td>340 to 380</td>
</tr>
</tbody>
</table>

Screen Grid Voltages

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Detector and I.F. tubes</td>
<td>90 to 110</td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>30 to 50</td>
</tr>
<tr>
<td>Output tube</td>
<td>235 to 265</td>
</tr>
</tbody>
</table>

Bias Voltages

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Detector tube</td>
<td>8 to 10</td>
</tr>
<tr>
<td>I.F. tube</td>
<td>3.1 to 3.9</td>
</tr>
<tr>
<td>Second Detector tube</td>
<td>9 to 12</td>
</tr>
<tr>
<td>Output tube</td>
<td>16 to 21</td>
</tr>
</tbody>
</table>
Model 146-1 uses two speakers. The intermediate frequency used in both models is 181.5 kilocycles.
Specifications

Model 147 is a four tube tuned radio frequency receiver designed for operation from 110 volt, 25 or 60 cycle A. C. and 110 volt D. C. electric circuits.
Model 148 is a five tube superheterodyne for operation from A. C. electric circuits. The intermediate frequency used is 456 kilocycles.
Specifications

Model 150 is a six tube superheterodyne for operation from A. C. electric circuits. The intermediate frequency used is 181.5 kilocycles.

Tubes And Voltage Limits

The following are the voltages measured with the receiver in operating condition but with no signal to the antenna circuit. Use a high resistance D. C. voltmeter (1000 ohms per volt or more) for all but the filament voltages. In measuring filament or heater voltages use a low range A. C. meter. The voltage limits are \(+\) or \(-10\%\) of the values given in the following table.

Line voltage 117½ volts (235 for 220 volt receivers).

Plate voltage measured from plate contact to cathode contact.

Screen grid voltage measured from screen grid contact to cathode contact.

Suppressor grid voltage measured from suppressor grid contact to cathode contact.

Bias voltage measured from cathode contact to chassis.

<table>
<thead>
<tr>
<th>Tube Position</th>
<th>Plate</th>
<th>Screen Grid</th>
<th>Voltages Supp. Grid</th>
<th>Bias</th>
<th>Fil</th>
</tr>
</thead>
<tbody>
<tr>
<td>-58 R. F. Amplifier</td>
<td>260</td>
<td>90</td>
<td>0</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>-57 Oscillating detector</td>
<td>240</td>
<td>80</td>
<td>0</td>
<td>5.0</td>
<td>2.5</td>
</tr>
<tr>
<td>-58 I. F. Amplifier</td>
<td>275</td>
<td>100</td>
<td>0</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>-55 Detector</td>
<td>95</td>
<td>250</td>
<td>0</td>
<td>22.0</td>
<td>6.3</td>
</tr>
<tr>
<td>-42 Output</td>
<td>255</td>
<td>260</td>
<td>0</td>
<td>22.0</td>
<td>6.3</td>
</tr>
<tr>
<td>-80 Rectifier</td>
<td>360</td>
<td></td>
<td></td>
<td>5.0</td>
<td></td>
</tr>
</tbody>
</table>
Specifications

Model 155 is a four tube superheterodyne designed for operation from D. C. electric circuits. The intermediate frequency used is 456 KC.

Tubes And Voltage Limits

The following are the voltages measured with the receiver in operating condition, but with no signal to the antenna circuit. Use a high resistance D. C. voltmeter (1000 ohms per volt, or more) for all voltages. The voltage limits are + or − 10% of values given in the following table.

- Line voltage—117.5 volts.
- Plate voltage measured from plate contact to cathode contact.
- Screen grid voltage measured from screen grid contact to cathode contact.
- Bias voltage measured from grid contact or negative of D. C. supply to cathode contact.

<table>
<thead>
<tr>
<th>Tube Position</th>
<th>Plate</th>
<th>Screen Grid</th>
<th>Bias</th>
<th>Fil</th>
</tr>
</thead>
<tbody>
<tr>
<td>-36 Oscillating Detector</td>
<td>92</td>
<td>60</td>
<td>5.0</td>
<td>6.3</td>
</tr>
<tr>
<td>-39 I. F. Amplifier</td>
<td>96</td>
<td>96</td>
<td>3.5</td>
<td>6.3</td>
</tr>
<tr>
<td>-37 2nd Detector</td>
<td>92</td>
<td>96</td>
<td>3.5</td>
<td>6.3</td>
</tr>
<tr>
<td>-48 Output</td>
<td>65</td>
<td>80</td>
<td>15.0</td>
<td>30.0</td>
</tr>
</tbody>
</table>
Specifications

Model 156 is a five tube battery superheterodyne designed for operation from a 2 volt "A" battery, three 45 volt "B" batteries, and a 22½ "C" battery. The intermediate frequency used is 456 KC.

Tubes And Voltage Limits

The following are the voltages measured with the receiver in operating condition, but with no signal to the antenna circuit. Use a high resistance D.C. voltmeter (1000 ohm per volt, or more) for all voltages. The voltage limits are + or − 10% of values given in the following table.

Battery voltage should be that specified above.

Plate voltage measured from plate contact to filament contact, except as specified.

Screen grid voltage measured from screen grid contact to filament contact.

Bias voltage measured from grid contact to negative filament contact.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Position</th>
<th>Plate</th>
<th>Screen Grid</th>
<th>Bias</th>
<th>Fil</th>
</tr>
</thead>
<tbody>
<tr>
<td>-34</td>
<td>1st Detector</td>
<td>135</td>
<td>67.5</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>-30</td>
<td>Oscillator</td>
<td>22.5</td>
<td></td>
<td>0</td>
<td>2.0</td>
</tr>
<tr>
<td>-34</td>
<td>I. F. Amplifier</td>
<td>135</td>
<td>67.5</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>-32</td>
<td>2nd Detector</td>
<td>135*</td>
<td>22.5</td>
<td>0</td>
<td>2.0</td>
</tr>
<tr>
<td>-33</td>
<td>Output</td>
<td>135</td>
<td>135</td>
<td></td>
<td>2.0</td>
</tr>
</tbody>
</table>

* Measured to battery side of 300,000 ohm Plate Resistor.
Specifications

Model 157 is a ten tube superheterodyne for operation from A.C. electric circuits. The intermediate frequency used is 181.5 kilocycles.

Tubes And Voltage Limits

The following are the voltages measured with the receiver in operating condition but with no signal to the antenna circuit. Use a high resistance D.C. voltmeter (1000 ohms per volt, or more) for all but filament voltages. In measuring filament or heater voltages use a low range A.C. meter. The voltage limits are ± or — 10% of values given in the following table.

Line voltage—117.5 volts (235 for 220 volt receivers).
Plate voltage measured from plate contact to cathode contact.
Screen grid voltage measured from screen grid contact to cathode contact.
Suppressor grid voltage measured from suppressor grid contact to cathode contact.
Bias voltage measured from cathode contact to chassis.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Position</th>
<th>Plate</th>
<th>Screen Grid</th>
<th>Volatages</th>
<th>Bias</th>
<th>Fil.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F. Amplifier</td>
<td>-58</td>
<td>240</td>
<td>210</td>
<td>0</td>
<td>0</td>
<td>2.5</td>
</tr>
<tr>
<td>1st Detector</td>
<td>-57</td>
<td>240</td>
<td>110</td>
<td>0</td>
<td>6.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Oscillator</td>
<td>-56</td>
<td>110</td>
<td></td>
<td>20.0</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>I. F. Amplifier</td>
<td>-58</td>
<td>240</td>
<td>110</td>
<td>0</td>
<td>2.8</td>
<td>2.5</td>
</tr>
<tr>
<td>Detector</td>
<td>-56</td>
<td>0</td>
<td></td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVO Rectifier</td>
<td>-56</td>
<td></td>
<td></td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. F. Amplifier</td>
<td>-56</td>
<td>40</td>
<td></td>
<td>2.0</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Parallel Output</td>
<td>-42</td>
<td>250</td>
<td>260</td>
<td>17.5</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Parallel Output</td>
<td>-42</td>
<td>250</td>
<td>200</td>
<td>17.5</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>Rectifier</td>
<td>-90</td>
<td>350</td>
<td></td>
<td>4.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Specifications

Model 158 is a seven tube superheterodyne designed for operation from A. C. electric circuits. The intermediate frequency used is 181.5 KC.

Tubes And Voltage Limits

The following are the voltages measured with the receiver in operating condition, but with no signal to the antenna circuit. Use a high resistance D. C. Voltmeter (1000 ohms per volt, or more) for all but filament voltages. In measuring filament or heater voltages use a low range A. C. meter. The voltage limits are + or − 10% of values given in the following table.

Line voltage—117.5 (235 for 220 volt receivers).

Plate voltage measured from plate contact to cathode contact.

Screen grid voltage measured from screen grid contact to cathode contact.

Suppressor grid voltage measured from suppressor grid contact to cathode contact.

Bias voltage measured from cathode contact to chassis.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-58</td>
<td>R. F. Amplifier</td>
<td>270</td>
<td>85</td>
<td>0</td>
<td>0</td>
<td>2.5</td>
</tr>
<tr>
<td>-57</td>
<td>Oscillating Detector</td>
<td>270</td>
<td>80</td>
<td>0</td>
<td>6.0</td>
<td>2.5</td>
</tr>
<tr>
<td>-58</td>
<td>I. F. Amplifier</td>
<td>275</td>
<td>80</td>
<td>0</td>
<td>4.0</td>
<td>2.5</td>
</tr>
<tr>
<td>-65</td>
<td>Detector</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-66</td>
<td>A. F. Amplifier</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>1.6</td>
<td>2.5</td>
</tr>
<tr>
<td>-42</td>
<td>Output</td>
<td>245</td>
<td>250</td>
<td>0</td>
<td>22.0</td>
<td>6.3</td>
</tr>
<tr>
<td>-80</td>
<td>Rectifier</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
<td>4.8</td>
</tr>
</tbody>
</table>
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MODEL 160
Schematic
Voltage
Layout

SPECIFICATIONS

Model 160 is a twelve tube superheterodyne for operation from A.C. electric circuits. The intermediate frequency used is 181.5 KC.

VOLTAGE DATA

All voltages, except filament, measured from tube contact to chassis. Filament voltages measured between heater contacts.
Model 163 is a five tube superheterodyne designed to operate on 100 to 130 volts, D.C. or any frequency A.C., electric circuits. The intermediate frequency is 456 KC.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Position</th>
<th>Plate</th>
<th>Screen</th>
<th>Cathode</th>
<th>Supp.</th>
<th>Fil.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-78</td>
<td>Oscillator Modulator</td>
<td>105</td>
<td>105</td>
<td>2.5</td>
<td>20</td>
<td>6.3</td>
</tr>
<tr>
<td>-78</td>
<td>I.F. Amplifier</td>
<td>105</td>
<td>105</td>
<td>3.0</td>
<td>3.0</td>
<td>6.3</td>
</tr>
<tr>
<td>-77</td>
<td>2nd Detector</td>
<td>5</td>
<td>5</td>
<td>4.0</td>
<td>4.0</td>
<td>6.3</td>
</tr>
<tr>
<td>-38</td>
<td>Output</td>
<td>102</td>
<td>105</td>
<td>8.0</td>
<td>8.0</td>
<td>6.3</td>
</tr>
<tr>
<td>12Z3</td>
<td>Rectifier</td>
<td>117.5 AC</td>
<td>120</td>
<td>12.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Voltages with D.C. operation are about 10% lower than those with A.C. operation.
Specifications

Model 154 is a midget four tube superheterodyne designed for operation from A. C. electric circuits. The intermediate frequency used is 456 KC. In addition to the combination volume control-switch and the tuning control, there is a regeneration control, a short fibre rod with a screw driver slot, located at the rear of the chassis. This should be adjusted for the most sensitive operation without oscillation in the receiver.

Tubes and Voltage Limits

The tubes and their functions and voltages are shown in the following chart. All tube voltages are to be measured with the set in operating condition, but with no signal to the antenna circuit. Use a high resistance D. C. voltmeter (1000 ohms per volt or more) for measuring all but filament voltages. Measure filament voltages with a low range A. C. meter. The voltage limits are + or — 10% of values given in the following table.

Line voltage—117.5 volts (235 for 220 volt receivers).

All voltages, except filament, measured from tube contact to chassis.

Filament voltages measured between filament contacts.

<table>
<thead>
<tr>
<th>Tube Position</th>
<th>Tube</th>
<th>Plate</th>
<th>Screen Grid</th>
<th>Cathode</th>
<th>Control Grid</th>
<th>Fil.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-36 Oscillator modulator</td>
<td>-58</td>
<td>290</td>
<td>100</td>
<td>16</td>
<td>-14</td>
<td>2.5</td>
</tr>
<tr>
<td>-57 2nd Detector</td>
<td>25</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>-42 Output</td>
<td>190</td>
<td>200</td>
<td>12</td>
<td>0</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>-80 Rectifier</td>
<td>310</td>
<td></td>
<td></td>
<td></td>
<td>5.0</td>
<td></td>
</tr>
</tbody>
</table>

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