COLOR WIRING CODE
1-RED
2-GREEN
3-BLUE
4-BLACK
5-YELLOW
6-GRAY

RECTIFIER TUBE

POWER TRANS.

POWER CHOKES
VOLTAGE DIVIDER
POWER COND. BLOCK

WIRING DIAGRAM FOR POWER FILTER ON 25 CYCLE RECEIVER

TUBE IN SET ANALYZER

<table>
<thead>
<tr>
<th>Type of Tube</th>
<th>Position of Tube</th>
<th>&quot;A&quot; Volts</th>
<th>&quot;B&quot; Volts</th>
<th>C.C. Grid &quot;C&quot; Volts</th>
<th>Screen Volts</th>
<th>Cathode Volts</th>
<th>Normal Plate Ma.</th>
<th>Gd. Test Ma.</th>
</tr>
</thead>
<tbody>
<tr>
<td>224</td>
<td>1-R. F.</td>
<td>2.2</td>
<td>145</td>
<td>-3</td>
<td>+66</td>
<td>+3</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>224</td>
<td>2-R. F.</td>
<td>2.2</td>
<td>145</td>
<td>-3</td>
<td>+66</td>
<td>+3</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>224</td>
<td>3-R. F.</td>
<td>2.2</td>
<td>145</td>
<td>-3</td>
<td>+66</td>
<td>+3</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>227</td>
<td>Det.</td>
<td>2.2</td>
<td>130</td>
<td>-13</td>
<td>+13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>245</td>
<td>A. F.</td>
<td>2.2</td>
<td>220</td>
<td>-8</td>
<td></td>
<td></td>
<td>32.0</td>
<td>37.0</td>
</tr>
<tr>
<td>245</td>
<td>A. F.</td>
<td>2.2</td>
<td>220</td>
<td>-8</td>
<td></td>
<td></td>
<td>32.0</td>
<td>37.0</td>
</tr>
<tr>
<td>280</td>
<td>Rect.</td>
<td>4.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>105.0</td>
<td></td>
</tr>
</tbody>
</table>

Line Voltage During Test —110 Volts
Volume Control —On Full
Position of Fuse —115 Volt Clips

www.americanradiohistory.com
<table>
<thead>
<tr>
<th>Illus. No.</th>
<th>Part Number</th>
<th>Description</th>
<th>Illus. No.</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26758</td>
<td>Screw</td>
<td>18</td>
<td>26568</td>
<td>Mounting Bracket</td>
</tr>
<tr>
<td>2</td>
<td>138164</td>
<td>Lock Washer</td>
<td>19</td>
<td>1201604</td>
<td>Resistor, 500,000 Ohms</td>
</tr>
<tr>
<td>3</td>
<td>14609</td>
<td>No. 1 R. F. Coil</td>
<td>20</td>
<td>21678</td>
<td>Screw</td>
</tr>
<tr>
<td>4</td>
<td>14650</td>
<td>Antenna Coil</td>
<td>21</td>
<td>138475</td>
<td>Shake-proof Washer</td>
</tr>
<tr>
<td>5</td>
<td>14556</td>
<td>Choke Coils</td>
<td>22</td>
<td>25591</td>
<td>Nut</td>
</tr>
<tr>
<td>6</td>
<td>14603</td>
<td>No. 2, 3, 4 R. F. Coils</td>
<td>23</td>
<td>1200473</td>
<td>Condenser, .1-.1-.1 Mfd.</td>
</tr>
<tr>
<td>7</td>
<td>14766</td>
<td>Trimmer Drive Pulley &amp; Pin</td>
<td>24</td>
<td>14597</td>
<td>Output Transformer</td>
</tr>
<tr>
<td>7</td>
<td>26682</td>
<td>Belt</td>
<td>25</td>
<td>1200167</td>
<td>Voltage Divider</td>
</tr>
<tr>
<td>8</td>
<td>14351</td>
<td>Knob</td>
<td>26</td>
<td>14594</td>
<td>Speaker Plug Receptacle</td>
</tr>
<tr>
<td>9</td>
<td>26679</td>
<td>Trimmer Shaft</td>
<td>27</td>
<td>24981</td>
<td>Strap</td>
</tr>
<tr>
<td>10</td>
<td>14591</td>
<td>Selector Bracket Assem.</td>
<td>28</td>
<td>26562</td>
<td>Spring</td>
</tr>
<tr>
<td>11</td>
<td>26175</td>
<td>Selector Shaft</td>
<td>29</td>
<td>24901</td>
<td>Spacer</td>
</tr>
<tr>
<td>12</td>
<td>14664</td>
<td>Knob-Tuning Condenser</td>
<td>30</td>
<td>1200195</td>
<td>Fuse Block Assem.</td>
</tr>
<tr>
<td>13</td>
<td>14662</td>
<td>Windlass</td>
<td>31</td>
<td>1200135</td>
<td>Power Choke</td>
</tr>
<tr>
<td>14</td>
<td>14688</td>
<td>Volume Control</td>
<td>32</td>
<td>14738</td>
<td>Line By-Pass Condenser</td>
</tr>
<tr>
<td>15</td>
<td>14556</td>
<td>Det. Plate Choke</td>
<td>33</td>
<td>13075</td>
<td>Condenser</td>
</tr>
<tr>
<td>16</td>
<td>1200413</td>
<td>Condenser</td>
<td>34</td>
<td>14566</td>
<td>Terminal Strip Assem.</td>
</tr>
<tr>
<td>17</td>
<td>1201610</td>
<td>Resistor, 25,000 Ohms</td>
<td>35</td>
<td>14624</td>
<td>Local and Distance Resistor.</td>
</tr>
<tr>
<td>17</td>
<td>14686</td>
<td>No. 4 Condenser</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MODELS 120, 130 and 140

The Models "A" and "B" chassis are divided into three groups having slightly different circuits.

Serial Numbers below 29100A and 1700B:
In the original models, with serial numbers below approximately 29100A and 1700B, one side of the Dual Volume Control is in the Antenna circuit between the antenna and the first R.F. coil, with a .0005 mfd. condenser between the antenna and the antenna choke.
The other side of the volume control, together with a 5000 ohm resistor is in the screen grid circuit of the R.F. stages. In these sets there are two R.F. choke in the cathode circuit of the R.F. tubes.

Sets with this circuit can be distinguished by the presence of five similar R.F. choke, one being located near the first 224 tube socket, and the other four between the second and third 224 tube R.F. Coil Shells.

Serial Numbers between 29100A and 62100A, and 1700B and 1946B:
In sets with serial numbers between approximately 29100A and 62100A, and 1700B and 1946B, the .0005 mfd. condenser is not used with the volume control in the antenna circuit. The volume control in these sets is in the cathode circuit of the three R.F. Stages. The two R.F. choke in the 224 cathode circuits are not used, but three 1250 Ohm resistors are used, one in series between the cathode of each 224 tube and the volume control.

Electrolytic Condensers:
To test the Electrolytic condensers used in chassis above 62100A and 1946B use an "Open Test" or "Continuity Test" meter with a 22½ volt battery. The test being made similar to other continuity tests.
It should be noted that by reversing the test leads, different readings will be obtained.
The condenser to be tested should be removed from the chassis and tested as follows:

<table>
<thead>
<tr>
<th>Pos. Test Point</th>
<th>Neg. Test Point</th>
<th>Correct Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center Terminal</td>
<td>Condenser Can</td>
<td>Hand Should Jump and Return</td>
</tr>
<tr>
<td>Condenser Can</td>
<td>Center Terminal</td>
<td>Hand Should Rise Slowly, Almost to Full Scale</td>
</tr>
</tbody>
</table>

If both readings are the same, the condenser is defective and should be replaced. When in doubt try replacing the condenser.

CHASSIS MODELS "A" and "B"

Trimmer Adjustment on Tuning Condensers:
A small trimmer condenser is located on each of the four variable condenser units which comprise the Gang Tuning. The trimmer screws may be adjusted by means of screw-driver, through the holes in the top of condenser shield.
The trimmer knob (Left side when viewed from the front), should be adjusted when the set is installed as it balances the antenna stage to proper frequency of the antenna used. This trimmer should be adjusted by tuning a station whose frequency is at the high end of the scale, near 1400 Kilocycles. No. 2, 3, and 4 trimmers should be adjusted only when the complaint is very definitely lacking in volume or broad tuning.
If the sensitivity or selectivity is not normal, the trimmer should be adjusted before attempting to calibrate the tuning Condenser. To adjust the trimmer, tune in a station around 1400 Kilocycles and turn the volume down by means of the volume control until the station is just audiable.
Start with the trimmer which is on the left side of the chassis, when viewed from the front, and adjust the screw either to the right or left until the loudest signal is obtained. This adjustment should bring the receiver back to normal operation. If not, the trimmer on the right should be adjusted in the same manner. The two center trimmers should not be adjusted except in rare cases, and extreme care should be taken when adjusting these trimmers so that the selector Pointer will not be thrown off adjustment and read incorrectly.

Condenser Adjustments:
If the selector pointer will cover only 1500 to 900 Kilocycles on the selector strip, the two-fingered washer has become bent so that the stop washer will slide over it. To correct this, remove the selector assembly and invert the flat, two-fingered washer.

If the Phenom-switch will not trip, set the selector pointer at 1490 Kilocycles, loosen the setscrews holding the switch lever and turn the switch lever until it just engages the switch. Tighten the set screws in this position.

Selector Strip Adjustment—Mechanical:
If the selector pointer appears to be off mechanically, i.e., if a station close to 700 Kilocycles is off ½ inch and a station close to 1400 Kilocycles is also off the same amount, the adjustment of the selector strip to log one station would bring them all into line.
To make such an adjustment, tighten all set screws, then tune in a station of known frequency, and adjust the selector strip to log one station would bring them all into line.

If the selector strip cannot be shifted far enough, loosen the set screws holding the selector strip and shift the strip until it indicates proper frequency of incoming signal.

If the selector strip cannot be shifted far enough, loosen the set screws holding the selector strip and shift the strip until it indicates proper frequency of incoming signal.

Volume Control:
Many instances of unsatisfactory volume control action are not caused by defective volume controls, but in reality the faulty action is due to variations in the cut-off points of the No. 224 screen grid tubes. It is necessary to have, in the first E.F. stage, one tube whose cut-off point.
If the compensation is not made to a volume control which is actually defective, it usually can be eliminated by switching the No. 224 tubes from one socket to the other (which transfers the compensation) and then

In chassis with serial numbers between 29100A and 62100A (also 1700B and 1946B) a 7000 Ohm Resistor (Black and Blue) is connected between the cathodes of the screen grid tubes and ground in parallel with one side of the volume control.
When a new powerful local broadcasting station, the volume control, because of this resistor, may not cut the volume down low enough. This can be improved by removing the resistor mentioned.
This is resistor No. R-21 shown in the wiring diagram.
PART 1. THE ELECTRIC PICK-UP & TRANSFORMER

Description:

The electric pick-up provides an electrical means for sound reproduction. The pick-up is composed of three major parts:

1. A permanent magnet.
2. A small generating coil.
3. A vibrating armature which is caused to vibrate by the phonograph needle.

The generating coil is located in the center of the field of the permanent magnet which causes a constant flow of magnetic lines of force through the coil. In order to generate current in the coil, it is necessary to vary the strength of the magnetic field. This is accomplished by placing a vibrating armature in the center of the coil with a needle inserted in the needle holder.

The needle rides in the grooves on the record and as it vibrates back and forth it also causes the armature to vibrate. By the vibration of the armature in the magnetic field, the field strength is varied accordingly and a pulsating current of electricity is generated in the coil. The pulsations of this current correspond to the sound waves of the music, but they are too weak to be audible in the speaker.

The generating coil is connected, through a volume control, to the radio wiring and the electrical pulsations are amplified many times by means of the radio amplifying tubes.

When the pulsations of current generated in the generating coil have passed through the amplifying tubes, they are carried to the speaker unit where they set the diaphragm in motion which generates audible sound waves in the air.

![Diagram of electric pick-up](image)

**Figure 1**

---

PART 1. THE ELECTRIC PICK-UP & TRANSFORMER (Continued)

in the center of the space between the two pole pieces.

If the vibrating armature is off center, loosen the two brass round head screws which hold the small brass plate in position on the pole pieces. Center the armature between the pole pieces and tighten the brass screws securely.

Testing for Open Coil or Wiring:

If there is no click at all, when tapping the needle, put the pick-up in place on the record and allow the record to rotate. Place the terminals of a set of ear phones on the two connections of the volume control to which leads from the pick-up connect. Reproduction of the record should be heard faintly.

If no sound is heard, remove the pick-up leads from the volume control and check for open circuit in those leads and the pick-up.

(Note: Inspect the contacts on the pick-up end of the leads, to insure good contact in the socket on the pick-up.)

Repair Instructions:

Pick-ups that cannot be adjusted properly or that have open coils, should be replaced with new ones and the old ones returned to the nearest service station for repair.

Next Step if Pick-Up is O. K.:

If reproduction of the record can be heard faintly through the ear phones, check the volume control or the connections between the pick-up and the radio unit for the trouble.

Testing Pick-Up Transformer:

![Pick-Up Wiring Diagram](image)

**Figure No. 3—Pick-Up Wiring Diagram**

Make the following tests with an open test meter. (See Figure 3 for contact numbers.)

<table>
<thead>
<tr>
<th>Cond.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Winding</td>
<td>Full Scale</td>
<td>¾ Scale</td>
<td>Full Scale</td>
<td>*Hand should jump and return to zero</td>
</tr>
</tbody>
</table>

*(Note: Condenser Lead must be disconnected from No. 4.)

---

**Notes:**

- Cord Assembly Part No. 1,200,866
- Choke coil Part No. 1,200,859
- Condenser Part No. 1,200,418
- (Cord Assembly Part No. 12,001,184 used on Models 150-A and B.)

**Pick up Transformer** Part No. 1,200,877

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**References:**

- [American Radio History](https://www.americanradiohistory.com)
- [General Motors Radio Corp.](https://www.gmradiohistory.com)
Combination Models No. 150 & 160

Part 2. Induction Disc Motor

Description:
The motor consists of an induction disc of aluminum arranged to revolve between the poles of two sets of field magnets. The coils of the field magnets, commonly called field coils, receive current from the house lighting circuit and are the only parts electrically connected to that circuit.

![Wiring Diagram of Induction Disc Motor](Image)

The main shaft of the motor operates in a vertical position, supported at the bottom by a single ball bearing, carries the induction disc and turntable, and drives the governor shaft through a set of gears. The speed of the shaft is controlled by a mechanical fly ball governor.

The induction disc motor has no commutator, slip rings, or other moving electrical contacts, and this, with the natural slow speed, makes it very well suited for the service for which it is used.

Servicing:
Any servicing which the motor may require is in general, of a minor nature, and in most cases, adjustments will be mechanical rather than electrical. Two of the most common causes of motor failure are incorrect power voltage and lack of lubrication.

Power Voltage Variation:
High voltage will cause the motor coils to heat excessively and thus destroy the insulation and dry the lubrication.

Low voltage will cause a lack of power and unstable operation. When servicing the induction disc motor, always check the power line voltage at the socket to which the motor is connected and, if possible, while the motor is running. This voltage should be between 105 and 120 volts A.C.

Lubrication:
It is important that the motor be lubricated at least once every six months with the proper lubricants. A motor lubricating chart is shown on the under side of the motor board.

A light grease should be used on the teeth of the drive gear and spiral. The governor bearings, governor friction sleeve and the upper and lower turntable spindle bearings should be lubricated with oil. For lubricating the governor friction leather use Neat's Foot Oil.

Motor Does Not Operate:
If the motor fails to start, first be sure that it is not binding in any place and that the turntable turns freely.

If it turns freely, check the wiring for open circuits with an open test meter.

With the switch closed, test across the contacts of the power plug. A full scale reading should be obtained. If not, this will indicate that the switch is defective or some part of the wiring is broken.

A visual inspection of the switch will show whether or not the trouble is in the switch. For information regarding the adjustments of the switch, see page 7.

If the switch is making good contact, check all wiring carefully for broken wires or loose connections.

If a full scale reading of the meter is obtained when testing across the light socket plug points, check the field coils. To determine which coil is defective, if any, it is necessary to test each coil separately.

Continuity Tests:
To do this, remove all connections from the two terminal strips, one located at each end of the motor. Refer to Figure 5 and take a reading across each coil with an open test meter as follows:

<table>
<thead>
<tr>
<th>Model</th>
<th>Current Reading</th>
<th>Internal Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A-1B</td>
<td>Full Scale</td>
<td>Open Upper Coil</td>
</tr>
<tr>
<td>2A-2B</td>
<td>Full Scale</td>
<td>Open Lower Coil</td>
</tr>
<tr>
<td>1C-1D</td>
<td>Full Scale</td>
<td>Open Upper Coil</td>
</tr>
<tr>
<td>2C-2D</td>
<td>Full Scale</td>
<td>Open Lower Coil</td>
</tr>
<tr>
<td>B-C</td>
<td>Full Scale</td>
<td>Open Wiring</td>
</tr>
</tbody>
</table>

When replacing coils it is necessary to replace both the upper and lower coils as a unit. The core and coil assembly may be taken off by removing the three screws holding the coils to the frame and top plate.

When the coils are returned, be sure that the wire terminals marked with the same letter are placed together. That is, 1A, 2A and 3A must be attached to the terminal strip at the point "A", etc. See Figure 5.

Failure to Maintain Constant Speed:
There are four points to be checked if the motor fails to maintain constant speed.

Hardened or Gunmetal Lubrication. Examine the moving parts. If necessary, remove them and wash with kerosene. Replace the parts and lubricate them.

Switching of Motor on Motor Board. In some cases a slight shifting of the motor on the motor board during shipment will cause binding. Loosen the three motor screws, and retighten alternately, while the motor is running until the binding has been eliminated and the motor runs steadily.

Weak Coils. If the lubrication and mounting of the motor have been examined as described above, and the condition still exists, replace one or both of the motor coils as described under subject "Motor Does Not Operate."

Mechanical Causes. All the points mentioned in subject entitled "Reducing Mechanical Noise" will have a certain effect upon the regulation of speed and should be taken into account even though there is no actual mechanical noise present.

Reducing Hum:
There are a number of causes for hum in the induction disc motor, but in most cases any existing hum can be eliminated by proper adjustment.

Loose Coil Winding on Iron Core. The condition can be corrected by forcing a small wooden wedge between the outside of the coil and the core. It may be necessary to wedge both the upper and lower sections of each coil.

Coil Loos on Top Plate. The three screws holding the coil on the top plate should be tightened securely.

Loose Laminations of Iron Core. The bolts clamping the iron laminations together should be tightened securely. In some cases, however, it may be found that the hum can be minimized by adjusting the tension of these bolts.
PART 2. INDUCTION DISC MOTOR (Continued)

Motor Not Fastened Securely to Motor Board.
Make certain that the nut holding the motor to the motor board are fastened securely and
with equal tension and that the felt washers between the motor and the motor board are not
injured.
Motor Not Properly Secured to Cabinet. In
many cases motor hum can be eliminated or
minimized by adjusting the four screws which
hold the motor board to the cabinet. Placing
a piece of felt between the motor board and the
motor board rail will often help to eliminate
hum.

Reducing Mechanical Noise:
There are several features which may cause
motor noise other than a hum.
Governor Springs. A noise or rattle may
sometimes be caused by loose or broken gov-
ernor springs. Tighten all the governor spring
screws. If this does not stop the noise, loosen
the screws on the disc end of the governor springs
and allow the motor to run for a minute or so
to allow the springs to assume their correct posi-
tion. Stop the motor and retighten the screws.
If any of the springs are broken or badly out
of balance, they should be replaced. Removal
of the governor may be accomplished by loosening
the two governor bearing screws, one at each end of the shaft, and lifting the governor
from the frame.
Governor Thrust Bearing. The thrust bear-
ing at the disc end of the governor may some-
times cause noise while the motor is running.
Hold one finger over the end of the bearing and
loosen the set screws which holds the bearing
in position. Adjust the bearing to the most
quiet running position, and retighten the set
screw.
Governor Spindle. A bent governor spindle
will cause binding in the gears and bearings as
well as a noise. The bent spindle should be
replaced with a new one.
Governor Driving Gear. Remove the turn-
table spindle as described above and examine
the gear for wear. If the wear on the teeth is
greater on one side than on the other, the turn-
table spindle is bent and should be replaced.
The gear should also be replaced.

Turntable Spindles and Disc. A bent turn-
table spindle or a bent or improperly adjusted
disc will cause noise. The bent spindle may
cause the disc to rub against the iron core of one
of the coils as described above. A bent spindle
can be detected by placing a pencil flat on the
motor board with the point against the spindle.
If the pencil point touches the spindle on one
side only while the motor is running, the spindle
is bent and should be replaced.

Speed Regulation:
The governor will maintain a constant speed
of the motor within a range of sudden voltage
changes of 15 volts, provided all parts are cor-
crctly adjusted.

The speed regulator is adjusted before leav-
ing the factory to that speed which is proper
for perfect reproduction, namely 78 revolutions
per minute.

However, if this adjustment is altered for any
reason it is possible to reset the speed regulator
by placing a small piece of white paper on the
outer edge of the turntable. By counting the
number of times the paper passes a given point
per minute, it can be determined whether the
speed should be increased or decreased. The
model of the latch plate 12 may be adjusted to the proper con-
tact by turning the speed regulator screw in the direc-
tion indicated on the regulator plate.

Removal of Disc:
The motor disc and the governor drive gear
each are fastened to the turntable spindle with
set screws. When removing the disc loosen the
set screws and pull the plate away from the
top plate. Care should be observed that the
ball bearing on which the lower end of the
spindle rests is not lost. When replacing the
disc, it will be noted that the spindle is spotted
for governor drive gear and disc set screws,
and that these spots are in line with the pin on
the turntable spindle.

Adjusting Position of Disc:
The disc should be properly aligned between
the upper and lower section of each coil so that
it does not touch the iron core of either and
does not cause binding of the governor gears.
In case the disc rubs against the iron, it should
be adjusted by means of the spindle adjusting
screw 11. See Figure 5, page 5. Loosen the
lock nut and turn the screw until the disc is
evenly spaced between the upper and lower
coils.

PART 3. THE AUTOMATIC SWITCH & BRAKE

Description:
The automatic switch and brake consists of a
system of cams and levers operating in such a
manner that the movements caused by the eccen-
tric groove at the end of the record trips the
switch, forcing a friction lever against the
turntable and, at the same time, cutting off the
power to the motor.

Servicing:
The switch will ordinarily require no adjust-
ment. In some cases, however, the upper spring
shown in Figure 6 may become bent upward far
enough to prevent the contacts from coming
together when the hand lever is turned.

When such a condition is found, bend the
upper spring down until the contacts make
a firm contact when the hand lever is turned
on. When replacing the switch on the brake
plate, care should be observed in properly locat-
ing the switch on the plate, so that the switch
will make and break contact when the hand
lever is turned on and off. The two adjusting
screws can be loosened and the switch moved in
the slot until the correct position is located.
When the hand lever is in the off position,
contact points should be at least 1/16 inch apart
to prevent excessive sparking when the switch
is turned off.

Adjustments:
The following adjustments will eliminate a
majority of the troubles encountered:
1. Switch Fails to Trip. Bend the lug B
(Figure 7) so that there will be less contact
at point A.

2. Switch Trips Before the Completion of a
Record. Bend the lug back, so that there will
be more contact at point A. (Figure 7)

Warning: Do not bend the lug too far, as
bending too often in opposite directions will
snap off the lug.

3. The two surfaces at the point A must be
square. If they have become worn, they
should be squared with a fine file.
4. If the switch lever 1 swings with the
eccentric groove, but the friction lever 2 fails
to swing, or swings but slightly, the latch trip 5
is probably caught in a burr on one of the teeth
of the latch plate 12. Rub the teeth of the latch
plate with a piece of emery cloth, taking off any
burrs that may be present.
5. If the latch trip does not engage with the
latch plate properly when the tone arm is swung
to the starting position, loosen the screw 11,
adjust the plate 12 the required amount,
and tighten the screws.

Note: The adjusting of the latch plate has
nothing to do with the tripping of the latch.

6. If the brake does not stop the turntable
soon enough the condition can be remedied by
one of the following:
   a. Examine the friction leather. Making cer-
tain it is not worn down too far to make proper
   contact with the inside rim of the turntable.
   b. Increase the tension of the spring 9 (Fig-
   ure 7) by cutting off one or more of the coils
   and then replacing the end of the spring over
   the lug.
7. If the latch 14 does not strike the lug A
when the hand lever is pulled to the ON position:
   a. Increase the tension of the spring 13 in
   the same manner as described above in "B" of 6.
   b. Decrease the tension of the spring 4 by
   stretching the coils if necessary.
MODEL 216, 217, 219, 250 SUPERHETERODYNE RECEIVERS.

ANTENNA AND GROUND CONNECTIONS

On Models 216, 217 and 219 a special antenna is installed in the cabinet and an antenna and ground terminal strip with three clips is located on the bottom of the speaker baffle board.

If an outside antenna and ground are used, connect the antenna lead-in wire to the clip marked "A" and the ground wire to the clip marked "G". The jumper wire provided should connect clips marked "G" and "X".

If the local reception special antenna in the cabinet is used, connect the special antenna lead to the clip marked "A". The jumper should connect clips marked "G" and "X".

If the power line is to be used as an antenna, simply connect clips "A" and "X" by means of the jumper. If possible connect a ground wire to clip marked "G".

<table>
<thead>
<tr>
<th>NO.</th>
<th>CAPACITY</th>
<th>NO.</th>
<th>CAPACITY</th>
<th>LEAD COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>.00001 Mfd.</td>
<td>C7A</td>
<td>.25</td>
<td>Green</td>
</tr>
<tr>
<td>C2</td>
<td>.0005 Mfd.</td>
<td>C7B</td>
<td>.25</td>
<td>Green</td>
</tr>
<tr>
<td>C3</td>
<td>.002 Mfd.</td>
<td>C7C</td>
<td>.1</td>
<td>Brown</td>
</tr>
<tr>
<td>C4</td>
<td>.01 Mfd.</td>
<td>C7D</td>
<td>.25</td>
<td>Terminal</td>
</tr>
<tr>
<td>C5</td>
<td>.1-.1 Mfd.</td>
<td>C7E</td>
<td>.006</td>
<td>Red</td>
</tr>
<tr>
<td>C6</td>
<td>.1 Mfd.</td>
<td>C7F</td>
<td>.25</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C7G</td>
<td>.03</td>
<td>Blue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C7H</td>
<td>.03</td>
<td>White-White</td>
</tr>
<tr>
<td>C8</td>
<td>4-4 Mfd. (Electrolytic)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C9</td>
<td>8 Mfd. (Electrolytic)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Condensers C7A to C7H, inclusive, are included in the By-Pass Condenser Pack.

<table>
<thead>
<tr>
<th>NO.</th>
<th>BODY</th>
<th>END</th>
<th>SPOT</th>
<th>RESISTANCE</th>
<th>WATTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>4,500</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>Red</td>
<td>Green</td>
<td>Orange</td>
<td>28,000</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>Yellow</td>
<td>Black</td>
<td>Orange</td>
<td>40,000</td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>Brown</td>
<td>Black</td>
<td>Yellow</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>Green</td>
<td>Black</td>
<td>Yellow</td>
<td>500,000</td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>In Metal Cover</td>
<td></td>
<td></td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Position of Tube</th>
<th>Fill. Tube</th>
<th>Plate Volts</th>
<th>Control Grid Volts</th>
<th>Screen Grid Volts</th>
<th>Cathode Grid Volts</th>
<th>Pentode Screen Plate Volts</th>
<th>Normal Screen Plate Volts</th>
<th>M.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>224</td>
<td>1st Det.</td>
<td>2.1</td>
<td>225</td>
<td>2.0</td>
<td>85</td>
<td>7</td>
<td>--</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>235</td>
<td>1st I.F.</td>
<td>2.1</td>
<td>225</td>
<td>3.3</td>
<td>79</td>
<td>5</td>
<td>--</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>235</td>
<td>2nd I.F.</td>
<td>2.1</td>
<td>225</td>
<td>3.3</td>
<td>75</td>
<td>5</td>
<td>--</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>227</td>
<td>Oscillator</td>
<td>2.15</td>
<td>75</td>
<td>0</td>
<td>--</td>
<td>0</td>
<td>--</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>227</td>
<td>2nd Det.</td>
<td>2.15</td>
<td>125</td>
<td>15.0</td>
<td>--</td>
<td>15</td>
<td>--</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>247</td>
<td>A. F.</td>
<td>2.15</td>
<td>210</td>
<td>1.0</td>
<td>--</td>
<td>--</td>
<td>200</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>280</td>
<td>Rect.</td>
<td>4.5</td>
<td>300</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>25-25</td>
<td></td>
</tr>
</tbody>
</table>

Line Volts 110. Volume Control on Full.
GENERAL MOTORS RADIO CORP.

MODEL 251 SUPERHETERODYNE (CHASSIS MODELS S2A & S2B)

<table>
<thead>
<tr>
<th>Type of Tube</th>
<th>Position</th>
<th>Screen Fil.</th>
<th>Plate Grid</th>
<th>Control Grid</th>
<th>Cathode Volts</th>
<th>Pentode Normal Screen Plate</th>
<th>Rated Fil.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube</td>
<td>Voltage</td>
<td>Volts*</td>
<td>Volts</td>
<td>Volts</td>
<td>Volts</td>
<td>MA</td>
<td>Volts</td>
</tr>
<tr>
<td>224 1st Det.</td>
<td>2.1</td>
<td>255</td>
<td>1.9</td>
<td>77</td>
<td>6.0</td>
<td>--</td>
<td>1.0</td>
</tr>
<tr>
<td>235 1st I.F.</td>
<td>2.1</td>
<td>200</td>
<td>.3</td>
<td>100</td>
<td>95.0</td>
<td>--</td>
<td>1.6</td>
</tr>
<tr>
<td>235 2nd I.F.</td>
<td>2.1</td>
<td>200</td>
<td>.3</td>
<td>100</td>
<td>95.0</td>
<td>--</td>
<td>1.6</td>
</tr>
<tr>
<td>227 2nd Det.</td>
<td>2.15</td>
<td>145</td>
<td>.0</td>
<td>--</td>
<td>15.0</td>
<td>--</td>
<td>.5</td>
</tr>
<tr>
<td>227 Osc.</td>
<td>2.15</td>
<td>75</td>
<td>.0</td>
<td>--</td>
<td>0</td>
<td>--</td>
<td>7.0</td>
</tr>
<tr>
<td>227 A.V.C.</td>
<td>2.15</td>
<td>60</td>
<td>.0</td>
<td>--</td>
<td>0</td>
<td>--</td>
<td>.0</td>
</tr>
<tr>
<td>247 A.F.</td>
<td>2.15</td>
<td>235</td>
<td>1.0</td>
<td>--</td>
<td>--</td>
<td>215</td>
<td>30.0</td>
</tr>
<tr>
<td>230 Rect.</td>
<td>4.5</td>
<td>200</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>215</td>
<td>30-30</td>
</tr>
</tbody>
</table>

Line Volts 110
Volume on Full

* Use 600 Volt Scale.
# Measured from Cathode to Heater.

Pentode Bias

- Black Spot: 133,500 Ohms
- Brown Body: 23,000 Ohms
- Resistor: 21,500 Ohms

Voltage Divider

- 1st Det.: 255 Ohms
- 1st I.F.: 200 Ohms
- 2nd I.F.: 145 Ohms
- Osc.: 75 Ohms
- A.V.C.: 60 Ohms
- A.F.: 235 Ohms
- Rect.: 200 Ohms

Resistors

<table>
<thead>
<tr>
<th>No.</th>
<th>Body</th>
<th>End</th>
<th>Spot</th>
<th>Resistance</th>
<th>Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Orange</td>
<td>Black</td>
<td>Brown</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>4,500</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>Red</td>
<td>Green</td>
<td>Orange</td>
<td>25,000</td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>Yellow</td>
<td>Black</td>
<td>Orange</td>
<td>40,000</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>Brown</td>
<td>Black</td>
<td>Yellow</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>Red</td>
<td>Green</td>
<td>Yellow</td>
<td>250,000</td>
<td></td>
</tr>
<tr>
<td>R7</td>
<td>Green</td>
<td>Black</td>
<td>Yellow</td>
<td>500,000</td>
<td></td>
</tr>
<tr>
<td>R8</td>
<td>Red</td>
<td>Black</td>
<td>Green</td>
<td>2 Megohms</td>
<td></td>
</tr>
</tbody>
</table>

The dial light bulb is a Mazda No. 41, rated at 2.5 volts.
GENERAL MOTORS RADIO CORP.

MODEL 252, 253, 254, 255, 256, 257, 258
(S-3A, S-3B)

Schematic

S-3-A 110 Volts, 60 Cycles
S-3-B 110 Volts, 25 Cycles
108 Watts

Chassis Models S3A, S3B, S4A, S4B

2 DET 1 IF 1 IF
A VC 1 DET
70 35
RECT 1 AF
15 15
PILOT 25 V
FRONT
### General Motors Radio Corp.


*(Chassis models S3A & S3B)*

<table>
<thead>
<tr>
<th>Type</th>
<th>Position of Fil. Plate</th>
<th>Control Grid Volts</th>
<th>Screen Grid Volts</th>
<th>Cathode Normal Plate M.A.</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>227 Oscillator</td>
<td>2.1 65</td>
<td>.3</td>
<td>--</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>235 R.F.</td>
<td>2.1 230</td>
<td>.5</td>
<td>77</td>
<td>2.5</td>
<td>6</td>
</tr>
<tr>
<td>234 1st Det.</td>
<td>2.1 230</td>
<td>5.0</td>
<td>65</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>235 1st I.F.</td>
<td>2.1 230</td>
<td>.5</td>
<td>77</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>235 2nd I.F.</td>
<td>2.1 230</td>
<td>5.0</td>
<td>60</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>237 2nd Det.</td>
<td>2.2 205</td>
<td>23.0</td>
<td>--</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>227 A.V.C.</td>
<td>2.2 25</td>
<td>2.5</td>
<td>--</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>245 A.F.</td>
<td>2.2 230</td>
<td>20.0</td>
<td>--</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>245 A.F.</td>
<td>2.2 230</td>
<td>20.0</td>
<td>--</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>280 Rectifier</td>
<td>4.5 330</td>
<td>--</td>
<td>--</td>
<td>30-30</td>
<td>--</td>
</tr>
</tbody>
</table>

**Line Volts, 110**: Volume Control on Full

### Condensers

<table>
<thead>
<tr>
<th>No.</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>1.0 - 1.0 - .1 - .1 = .1 Mfd.</td>
</tr>
<tr>
<td>C2</td>
<td>.5 - .5 - .1 - .1 = .1 Mfd.</td>
</tr>
<tr>
<td>C3</td>
<td>5 Mfd.</td>
</tr>
<tr>
<td>C4</td>
<td>.0007 Mfd.</td>
</tr>
<tr>
<td>C5</td>
<td>.00075 Mfd.</td>
</tr>
<tr>
<td>C6</td>
<td>.002 Mfd.</td>
</tr>
<tr>
<td>C7</td>
<td>.02 Mfd.</td>
</tr>
<tr>
<td>C8</td>
<td>.5 Mfd.</td>
</tr>
<tr>
<td>C9</td>
<td>8.0 Mfd. (Electrolytic)</td>
</tr>
</tbody>
</table>

### Resistors

<table>
<thead>
<tr>
<th>No.</th>
<th>Body</th>
<th>End</th>
<th>Spot</th>
<th>Resistance</th>
<th>Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Brown</td>
<td>Green</td>
<td>Brown</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>R2</td>
<td>Lavender</td>
<td>Green</td>
<td>Brown</td>
<td>750</td>
<td>1</td>
</tr>
<tr>
<td>R3</td>
<td>Solid Lavender</td>
<td></td>
<td></td>
<td>1250</td>
<td>1</td>
</tr>
<tr>
<td>R4</td>
<td>Green</td>
<td>Black</td>
<td>Orange</td>
<td>50,000</td>
<td>1</td>
</tr>
<tr>
<td>R5</td>
<td>Blue</td>
<td>Black</td>
<td>Red</td>
<td>6,000</td>
<td>1</td>
</tr>
<tr>
<td>R6</td>
<td>Brown</td>
<td>Black</td>
<td>Orange</td>
<td>10,000</td>
<td>1</td>
</tr>
<tr>
<td>R7</td>
<td>Brown</td>
<td>Gray</td>
<td>Orange</td>
<td>18,000</td>
<td>1</td>
</tr>
<tr>
<td>R8</td>
<td>Yellow</td>
<td>Black</td>
<td>Orange</td>
<td>40,000</td>
<td>1</td>
</tr>
<tr>
<td>R9</td>
<td>Brown</td>
<td>Brown</td>
<td>Yellow</td>
<td>110,000</td>
<td>1</td>
</tr>
<tr>
<td>R10</td>
<td>Orange</td>
<td>Black</td>
<td>Yellow</td>
<td>300,000</td>
<td>1</td>
</tr>
<tr>
<td>R11</td>
<td>Green</td>
<td>Black</td>
<td>Yellow</td>
<td>500,000</td>
<td>1</td>
</tr>
<tr>
<td>R12</td>
<td>Red</td>
<td>Black</td>
<td>Green</td>
<td>2 Megohms</td>
<td>1</td>
</tr>
<tr>
<td>R13</td>
<td>Solid Orange</td>
<td></td>
<td></td>
<td>14,550</td>
<td>1</td>
</tr>
</tbody>
</table>

The dial light bulb is a Mazda No. 41, rated at 2 1/2 volts.
The single i-f trimmer is adjusted by means of a screw which is reached through a hole in the back of the chassis, below the i-f trans.
CONNECTIONS

(1) Connect the test oscillator to the control grid of the first detector tube, with a fixed .002 Mfd. condenser connected in series between the test oscillator and the grid terminal of the tube. The grid cap and lead must be left in place on the tube. Connect the GND terminals of both the test oscillator and the receiver to a common ground.

NOTE: DO NOT CONNECT TO THE GRID OF ANY OTHER TUBE BECAUSE IT WILL CHANGE THE BIAS VOLTAGE OF THE SET.

If the test oscillator has a dummy antenna which cannot be disconnected, connect a 1 megohm resistor between the test oscillator output terminal and ground.

(2) Remove the 227 oscillator and the 227 A.V.C. tube and plug the dummy oscillator and A.V.C. tubes in their sockets.

TRACKING PROCEDURE

(1) Feed a signal of exactly 1400 K.C. into the chassis from the test oscillator.

(2) Screw all parallel trimmers down tight and then adjust the oscillator parallel trimmer condenser to obtain a maximum output.

(3) Adjust the remaining parallel trimmer condensers to obtain maximum output.

NOTE: Models S10A or S10B chassis do not employ an oscillator series condenser. It is not necessary to make the tracking adjustment at 580 K.C.
Model 70-B Chassis

Bottom View of Terminal Board in 70-B Chassis, Showing Resistors Employed

Cable for 70-B Chassis, Showing Resistors, Grid Condenser and Leak, and Voltages at Terminals.
Model 180 Chassis

Top View of Model 8-P-6 – 8-P-3 Power Unit

Side View of 8-P-6 – 8-P-3 Power Unit, Showing Internal Wiring

Power Cable and Terminal Board of Model 180 Chassis, Showing Resistors, Grid Leak and Condenser, and Voltages Supplied.
GRIGSBY - GRUNOW CO.

MODEL 90
MODEL 100
Chassis

Position of Parts, and Wiring of Model 90 Receiver

Model 100

www.americanradiohistory.com
Model 15 Chassis
Employed in Havenwood, Ellswood and Sherwood Models
Model 15B Chassis Employed in Fyfewood Model
Model 25 Chassis
Employed in Brentwood, Cheltenwood and Brucewood Models
The audio system is tuned to give full bass response as low as forty cycles, also an image rejector circuit is used in the pre-selector to reduce image response.

Power Supply System

The power supply system on the Model 25B Chassis consists of a power transformer, G80 rectifier, filter choke (routed) speaker field 3 mfd paper condenser and two 8 mfd electrolytic condensers.

Color Code for Model 25-B Power Transformer

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>Color</th>
<th>Plate</th>
<th>Emitter</th>
<th>Collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-51-5</td>
<td>R.F. Amp.</td>
<td>Yellow</td>
<td>260</td>
<td>260</td>
<td>90</td>
</tr>
<tr>
<td>G-51-5</td>
<td>1st Det.</td>
<td>Yellow</td>
<td>260</td>
<td>260</td>
<td>90</td>
</tr>
<tr>
<td>G-51-5</td>
<td>2nd Det.</td>
<td>Yellow</td>
<td>260</td>
<td>260</td>
<td>90</td>
</tr>
<tr>
<td>G-51-5</td>
<td>3rd Det.</td>
<td>Yellow</td>
<td>260</td>
<td>260</td>
<td>90</td>
</tr>
<tr>
<td>G-27</td>
<td>2nd Det.</td>
<td>Yellow</td>
<td>260</td>
<td>260</td>
<td>90</td>
</tr>
<tr>
<td>G-47</td>
<td>Power</td>
<td>Yellow</td>
<td>260</td>
<td>260</td>
<td>90</td>
</tr>
<tr>
<td>G-47</td>
<td>Power</td>
<td>Yellow</td>
<td>260</td>
<td>260</td>
<td>90</td>
</tr>
<tr>
<td>G-80</td>
<td>Rect.</td>
<td>Yellow</td>
<td>260</td>
<td>260</td>
<td>90</td>
</tr>
</tbody>
</table>
Radio-Phonograph Switch

Both the COLLINGWOOD and ABBEYWOOD Models have a radio-phonograph switch which is located below the central control or station selector. This switch is turned to the right for radio operation and to the left for phonograph operation. There are pick-up terminals on the Model 35 chassis employed in both these sets, although the COLLINGWOOD Model is not a combination receiver. There should always be a jumper across the pickup terminals when the pickup is not attached.

Power Supply System

The power supply system of the Model 35 chassis consists of a power transformer, G-80 rectifier, a filter choke which is tuned to hum frequency, a 4 mfd. paper condenser, and two 8 mfd. electrolytic condensers. The condenser employed across the filter choke is a .15 mfd. for sixty cycle operation, and a .35 mfd. for twenty-five cycle operation. The output from this filter section passes through the fields of both dynamic speakers which act as additional chokes to the filter circuit.
**MAJESTIC PAGE**

**GRIGSBY - GRUNOW CO.**

**MODEL 25-B**

**MODEL 36**

**Alignment**

---

**Technical Data**

**Models 25B and 35 Chassis**

**Procedure for Alignment**

**WARNING**

The power line shall never be connected to the receiver until the speakers and tubes are connected.

**1.** Simply turn on the speaker and speaker and adjust the volume control to maximum output.

**2.** Set dial at 100 K.C. and tune for maximum output.

**3.** Set dial at 100 K.C. and adjust control for maximum output.

**Alignment**

- Be sure to adjust each control so that the receiver will be at maximum sensitivity.
- The receiver must be aligned for maximum sensitivity.
- The alignment should be taken at 100 K.C. and check calibration every 5 K.C.

**Automatic Volume Control System**

- The automatic volume control system is a 6000 ohm potentiometer between second detector and output tubes, operating on the 6L6 setting.

**Method of Biasing**

- In cases where low sensitivity is encountered, the first step taken to remedy the conditions should be to check the G51S tubes, which may be drawing abnormal grid current. This procedure should always be taken prior to any attempt to remedy by adjusting the condenser grids.

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**Model Diagram**

- Top View of Model 35 Chassis

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**Top View of Model 35 Chassis**

- 1. 3rd I. F. Transformer Alignment
- 2. G27S Push-Pull Detector Tubes
- 3. Phonograph Pickup Connections
- 4. G40 Pentode Tubes Gang Alignment Condensers
- 5. G27S Oscillator Tube
- 6. G80 Rectifier Tube
- 7. G115 R. F. Tube
- 8. 2nd I. F. Transformer
- 9. G15 2nd I. F. Tube
- 10. G15 1st I. F. Tube
- 11. 1st I. F. Transformer
- 12. G15 1st Detector Tube
- 13. G15 1st Detector Tube
- 14. Volume Control On
- 15. Station Selector
- 16. Acoustic Control

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View Showing Power Supply Circuit of Model 35 Chassis

1. 1-8 add. electrolytic capacitors
2. 43 V. to G47 Screen & add. Electrolytic Cond. Doc. Audio Choke and G14 Speaker Field
3. 2 add. Cond. Doc. Audio Choke and Sec. Doc. Plate
4. 2 add. Cond. and Volume Control

Interior View of Model 35 Chassis

1. G47 Plate and Input to Speakers
2. Power Filter Choke, G14 Speaker Field, 6 Cond. and 8 add. Electrolytic Cond.
3. GRIGSBY - GRUNOW CO.

11. G515 Filaments
12. G47 and G275 Filaments
13. Fuse
14. G47 Plate and Input to Speakers
15. Power
16. G50 Rectifier Socket
17. 210 Ohm Resistor
18. 125 V. Primary Tap
19. 115 V. Primary Tap
20. 105 V. Primary Tap
21. Line
22. Audio Frequency Choke
23. Junction G10C-G14 Speaker Fields
24. 250,000 Ohm Resistor
25. Push-Pull Diode Transformer
26. 25 Tone Control Condenser
27. Tone Control
28. 1,000 Cond. A
29. "Radio Phone" Switch
30. Manual Volume Control and (Off and On) Line Switch
31. 10,000 Ohm Resistor for
32. 13,000 Ohm Resistor
33. Auto F. Coil
34. R. F. Coil
35. Antenna Coil
36. Oscillator Coil
Models G-10-C, G-13-B, G-14 and G-14-B Dynamic Speakers

Employed in Models Collingwood and Abbeywood

Both the COLLINGWOOD and ABBEYWOOD Models are equipped with twin speakers. The COLLINGWOOD Model employs the G-10-C, a small dynamic speaker (field resistance 200 ohms) for the high notes and the G-14, a large dynamic speaker (field resistance 750 ohms) for the low notes. The ABBEYWOOD Model employs the G-13-B dynamic speaker (field resistance 300 ohms) for the high notes and the G-14-B dynamic speaker (field resistance 550 ohms) for the low notes. The voice coil of the G-14-B is excited by one-half of the secondary of the output transformer which is located in the base of the speaker, and the voice coil of the G-13-B is excited by the other one-half of the same secondary. These speakers operating simultaneously produce an almost flat audio frequency response curve that gives these receivers a truly faithful reproduction.

G-13 Speaker
BRENTWOOD and BRUCEWOOD Models

1 Field Coil Terminal
2 Voice Coil & Output Sec. Junct.
3 Field Coil & Primary Tap Junct.
4 Primary Plate Lead Terminals

G-14-B Speaker
ABBREYWOOD Model

1 Output Sec. & Voice Coil of G-14-B & G-13-B Junction
2 Voice Coil of G-14-B & Output Secondary Junction
3 Voice Coil of G-14-B & Output Secondary Junction
4 Field Coil & Primary Tap Junct.
5 Primary Plate Lead Terminals
6 Field Coil Terminals

G-14 Speaker

COLLINGWOOD Model

1 Voice Coil & Output Sec. Junct.
2 Field Coil & Primary Tap Junct.
3 Primary Plate Lead Terminals
Field Coil Terminal

Models G-11-B and G-13 Dynamic Speakers

Employed in Models Cheltenwood, Brentwood and Brucewood

The Models G-11-B and G-13 Dynamic Speakers have a field resistance of 570 ohms at 78° F. The G-11-B Speaker which is employed in the Cheltenwood Model, has a field structure of heavy "U" construction, and a 9.5" paper weight cone which responds readily to the slightest excitation. The output transformer with its terminal board is rigidly fastened to the cone housing. The G-13 speaker, which is employed in the Brentwood and Brucewood Models, has a field structure of heavy "U" construction mounted on a 6" base which is also used as a case for the output transformer. The 12" cone is a special molded paper weight cone which responds readily to the slightest excitation.

G-11-B Speaker
CHELTFENWOOD Model

1 Primary Plate Lead Terminals
2 Field Coil Terminal
3 Voice Coil & Output Secondary Junct.
4 Field Coil & Primary Tap Junct.
Instructions for Care and Operation of Automatic Record Changer Employed in the Majestic Model 353 Receiver

IMPORTANT — The following instructions should be used in operating the MAJESTIC Automatic Record Changer employed in the Model 353 Abbevood Receiver.

WARNING — Before attempting to operate the automatic record changer, three screws which pass through the base plate of the record changer and the wood shelf, should be loosened so that the chassis is resting freely on the rubber cushions.

WARNING — At no time for any reason should the turntable be stopped by hand. If this warning is not adhered to, serious damage may result.

RECORDS — It is possible to play the two types of records available for home entertainment, that is, the ordinary records and the new long playing records. Each of these two types can be obtained in both twelve and ten inch diameter. The approximate playing time of these records is as follows:

<table>
<thead>
<tr>
<th>Ordinary Records</th>
<th>New Long Playing Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 inch — 12½ minutes.</td>
<td>10 inch — 10 minutes.</td>
</tr>
<tr>
<td>12 inch — 15½ minutes.</td>
<td>12 inch — 15 minutes.</td>
</tr>
</tbody>
</table>

SPEED — The standard record turns at a speed of 78 revolutions per minute, whereas the long playing record turns at the rate of 33 1/3 revolutions per minute. The mechanism is provided with a speed control lever to give either of these speeds, as required.

SWITCHES — The line switch for the phonograph motor is located near the front of the turn table. Directly under the main tuning dial is the “Radio-Phonograph” switch, which should be thrown to phonograph position for record playing. The line switch for the radio receiver is incorporated in the volume control assembly, which is located to the left of the phonograph switch.

NEEDLES — The long playing records should be played using only the special needles designed for this type of record. After the special needle has once been removed from the pick-up head, do not use it again. Replace with a new one. Do not play ordinary records with the special needle designed for long playing records.

Instructions for Setting Selector Device

It will be noted that to the right of the turn table there is a selector lever for the purpose of playing ten inch records automatic, ten inch records repeat, twelve inch records repeat, and universal or manual operation.

10" AUTOMATIC — This is the only position in which the ten inch records are changed automatically.

10" REPEAT — In this position, the mechanism will repeat the playing of the same record as many times as desired.

12" REPEAT — The mechanism in this position will keep repeating a 12" standard record. Do not, however, attempt to repeat a 12" long playing record as it should be played manually with the lever in the universal position.

“UNIVERSAL” — In this position, the automatic changing and the repeat mechanism are not in operation, and the playing is controlled manually as with the ordinary phonograph. This position should always be used for playing the 12" long playing record and may be used for playing standard records.

Instructions for Operating Automatic Record Changer

Select the desired records and place them carefully in the record holder or magazine. The record at the bottom of the magazine will be the first one to be played.

The automatic changing magazine handles from one to ten of the 10" records. Do not mix standard records with long playing records in the magazine for automatic playing, as each type requires a different speed and a different type of needle.

It is best to place the first record on the table by hand and start the needle very carefully in the first groove with the selector lever in the “Universal” position, then the lever may be turned to the automatic position if desired, after which the changer will operate as outlined in paragraph II under “Instructions for Setting Selector Device.” This procedure protects the needle and the record, and assures longer life for both.

REJECT LEVER — While playing in the automatic position, it is desired to interrupt the record and to play the following one, pull forward the reject lever which is located to the right of the turn table. This will cause the mechanism to go through a complete cycle of changing the record.

RELOADING — When all of the records have been played through, and the magazine is empty, the mechanism will repeat the last record over and over. In reloading the magazine, switch off the motor at the time the magazine has travelled to the extreme left position, and carefully remove the stack of records from the turn table.

Then replace them in the magazine in any desired sequence, with the side facing up which you desire to play. The magazine may be swung up and down, but do not try to force it sideways manually.

ARM REST — When changing records, the pick-up should be placed in the rest, to the right. If it cannot be placed there without straining, this is a sign that the automatic mechanism has not completed its cycle. In this case, hold the pick-up loosely, turn on the motor switch and wait until the record magazine has moved to the extreme left, which will allow the pick-up to be placed on its rest.

Instructions for Operating Manually

By placing the lever in the “UNIVERSAL” position, the records will be played manually. The 12 inch long playing records should always be played in this position.

Oiling

Every two or three months, the turntable should be removed and three or four drops of oil placed in each of the six holes provided.
All leads marked “A” plus signify the ungrounded side of the car battery, and not necessarily the positive side.

Note on Alignment of Gang Condenser: Should a receiver need realignment in the field, a station should be tuned in at approximately 1300 kilocycles and the alignment made in the usual manner. In case one alignment condenser will not indicate a peak of sensitivity, slightly advance or retard the tuning control and proceed to readjust the alignment condenser as before.

Note on Automatic Volume Control System: The Model 110 chassis utilizes an automatic volume control system in combination with a diode detector, the G-37 detector serving both functions.

Majestic Model 110
Auto Radio
Volume Control and Switch Connections

Antenna section of volume control—Red and Black.
"C" bias section of volume control—Blue and Yellow.
"A" battery side of switch—Red.
Jumper switch to volume control—Blue.
Switch to "C" bias—White.

Battery Connections

3 wire cable plus 135 volts—Red.
minus 22½ volts—Green.
plus "C" minus "B"—Black.

2 wire cable to speaker—Red and Black and Red.
minus "A" Black.

Model 120 Chassis
I. F. Transformers Alignment

1. Connect oscillator for intermediate frequency alignment and set it in operation.
2. Align each aligning condenser on the intermediate frequency transformers to give maximum signal output.
3. After all four condensers have been aligned at 175 kilocycles, this stage should not be again adjusted.

R. F. and Oscillator Alignment

1. Tune in station in the vicinity of 1,500 kilocycles, or put output of local oscillator (if available) into receiver.
2. Align R. F. stages and oscillator tuning condenser. The position of these condensers is shown on illustrated photograph in this manual.

Oscillator Tracking Condenser Alignment

1. Tune in local oscillator to 600 kilocycles.
2. Adjust both tuning control and tracking condenser simultaneously to give maximum signal as noted on output meter. This will be obtained by rocking tuning control across resonance point while adjusting tracking condenser to give maximum output at the point of resonance. This operation cannot be performed without local oscillator and output meter.

Check

Check the alignment previously made of R. F. and oscillator aligning condensers in the vicinity of 1,500 kilocycles.
SCHEMATIC DIAGRAM OF MAJESTIC SCREEN GRID SUPERHETERODYNE RECEIVER AND ELECTRIC PHONOGRAPH COMBINATION. MODEL 150 CHASSIS—
115 AND 230 VOLTS, 25-60 AND 50-60 CYCLES.
POWER REQD.—90 WATTS WITH MOTOR.

Model 150 Chassis Employed in Castlewood Phonograph Combination Model
GULBRANSEN CO.

POWER TRANSFORMER

One side of the 110 volt line is connected to the terminal marked "Pri. 2" and the other side to one switch terminal on the receiver. The switch completes the circuit to the "Pri. 1" terminal.

The 25 cycle transformer is especially designed for operation on 110 volt, 25 cycle current but may also be used on any 110 volt, A.C. supply having a higher frequency.

Receivers having a 220 volt, 40 to 60 cycle power transformer may also be operated on 110 volt, 40 to 60 cycle current when connections on the primary of the transformer have been changed.

The red and green wires shown in the sketch. (220 volt) must be disconnected and then connected as shown in the 110 volt sketch. No other changes are necessary.

CONDENSERS AND RESISTORS

Three blocks contain the majority of condensers. The choke in the plate circuit of the second detector tube is also contained in one of these blocks. The common leads of condenser blocks No. 1 and No. 2 are grounded. C1, C4, and C6 in block No. 3 have a common lead which is grounded, and the choke and C3 in this block have a common lead connected to the plate of the 2nd detector.

ANALYZER CHART

All voltages taken with a 1,000 ohm per volt voltmeter on the scale indicated in the column headed "Meter Scale." Turn the volume all the way on and connect the antenna and ground leads together. The grid, plate, and screen grid voltages are measured to cathode of the '24 and '35 tubes and to filament of the '47 tube.

The grid voltage on the '27 oscillator cannot be taken except with a very sensitive, low scale voltmeter. The voltage is approximately .05 volts when the A.C. line voltage is 110 volts.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>Meter Scale</th>
<th>110 V.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.F. (Ant.) '35</td>
<td>Grid</td>
<td>0—10</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Screen Grid</td>
<td>0—100</td>
<td>63.</td>
</tr>
<tr>
<td></td>
<td>Plate</td>
<td>0—250</td>
<td>225.</td>
</tr>
<tr>
<td>1st Det. '24</td>
<td>Grid</td>
<td>0—25</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td>Screen Grid</td>
<td>0—100</td>
<td>65.</td>
</tr>
<tr>
<td></td>
<td>Plate</td>
<td>0—250</td>
<td>220.</td>
</tr>
<tr>
<td>Int. '35</td>
<td>Grid</td>
<td>0—10</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Screen Grid</td>
<td>0—100</td>
<td>63.</td>
</tr>
<tr>
<td></td>
<td>Plate</td>
<td>0—250</td>
<td>225.</td>
</tr>
<tr>
<td>2nd Det. '24</td>
<td>Grid</td>
<td>0—25</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td>Screen Grid</td>
<td>0—100</td>
<td>65.</td>
</tr>
<tr>
<td></td>
<td>Plate</td>
<td>0—250</td>
<td>135.</td>
</tr>
<tr>
<td>Osc. '27</td>
<td>Grid</td>
<td>0—100</td>
<td>80.</td>
</tr>
<tr>
<td></td>
<td>Plate</td>
<td>0—100</td>
<td>80.</td>
</tr>
<tr>
<td>Aud. '47 (See Caution Above)</td>
<td>Grid</td>
<td>0—10</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>Accelerating</td>
<td>0—100</td>
<td>65.</td>
</tr>
<tr>
<td></td>
<td>Grid</td>
<td>0—250</td>
<td>225.</td>
</tr>
<tr>
<td></td>
<td>Plate</td>
<td>0—250</td>
<td>205.</td>
</tr>
<tr>
<td>'80 Rect.</td>
<td>Filament to Ground</td>
<td>0—1000</td>
<td>233.</td>
</tr>
</tbody>
</table>

SERIES 15 SUPERHETERODYNE
PHONO RADIO INSTALLATION

When phonograph equipment is to be connected to a receiver, the installation should be of a permanent nature. The circuit shown in Fig. 1 is the best possible method of permanently connecting phonograph equipment to this chassis. The circuit consists of a pickup with self-contained volume control, connected in the grid circuit of the second detector tube.

PICKUP AND PHONO TRANSFORMER

To obtain good tone and volume, a pickup with medium or low impedance and a transformer are recommended for use with this receiver. A pickup with high impedance should be used when a transformer is not available.

INSTALLATION

The following parts must be supplied from the factory to make the installation:

1 Volume control, Stock No. P-90976
2 7,000 ohm Resistor, Stock No. P-90979
3 Tip Jack Assembly, Stock No. P-9113

The volume control must be mounted in the same position as the original. The switch is operated by turning the volume control knob to the left as far as possible. The connections on the volume control are the same as on the original.

Removal of the license plate on the rear of the chassis will disclose a slot with small holes at each end. The tip jack assembly should be bolted to the chassis (inside), through the small holes. Bolt the license plate through the small holes, directly above its original position.

Locate the black wire under the chassis, leading from the secondary of the second intermediate transformer. This transformer is directly behind the gang condenser. Disconnect this wire where it is grounded on the chassis and solder the end to the tip jack nearest the center of the back of the chassis. If it does not reach to the tip jack, splice an extra length of wire to it but make the lead as short as possible. Solder and tape the splice to the chassis and well insulated.

Ground the OPPOSITE tip jack on the chassis by soldering one end of a short length of wire on the jack and the opposite end on a lug placed under the nut on the bolt holding the nearest end of the tip jack assembly.

Solder one end of the 7,000 ohm resistor (R17) to the cathode connection on the second detector tube socket.

Three wires, twisted together and long enough to reach from the switch on the volume control (around the closed ends of the R.F. transformer shields), to the tip jacks are connected as shown in Fig. 2.

Wire No. 1 connects the grounded tip jack and the switch terminal farthest from the center of the volume control.

Wire No. 2 connects the jack on which the black lead from the I.F. transformer is connected, and the raised switch terminal near the center.

Wire No. 3 connects one end of the 7,000 ohm resistor and the remaining open lug on the switch.

When the receiver volume control is turned to the left as far as possible, the S.P.D.T.; switch is thrown and opens the circuit from "A" (Fig. 2) to "B" and closes the circuit from "B" to "C".

This action places the pickup in the circuit and connects the 7,000 ohm resistor so that a proper grid bias is obtained for phonograph reproduction.

If a transformer is used, a ratio of 4 to 1 will prove satisfactory. The secondary is connected to the tip jacks and the primary to the pickup cords.

Reversing the pickup leads will determine the correct position in which they should be left. Some pickups have one side grounded and that side should be connected to the grounded pickup jack in the receiver.

If the pickup is disconnected, a wire "jumper" MUST be placed across the tip jacks before broadcast signals may be received. The receiver must never be turned on for even a moment without the jumper in place. A jumper will close the circuit between "A" and "B". This grounds the circuit, thereby placing the proper grid bias on the detector tube, even though the volume control may be thrown to the phonograph position. This jumper may be a piece of solid wire, the ends of which are bent at right angles and plugged into the tip jacks.

RESISTORS

<table>
<thead>
<tr>
<th>Key</th>
<th>Part No.</th>
<th>Resistance in ohms</th>
<th>Type</th>
<th>Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>P-90976</td>
<td>Vol. Cont.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>P-90978</td>
<td>Vol. Cont.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>P-90905-B</td>
<td>15,000</td>
<td>Carbon</td>
<td>Brown Green Orange</td>
</tr>
<tr>
<td>R4</td>
<td>P-90916-B</td>
<td>40,000</td>
<td>Carbon</td>
<td>Yellow Black Orange</td>
</tr>
<tr>
<td>R5</td>
<td>P-90927-A</td>
<td>25,000</td>
<td>Carbon</td>
<td>Red Green Orange</td>
</tr>
<tr>
<td>R6</td>
<td>P-90926-A</td>
<td>30,000</td>
<td>Carbon</td>
<td>Orange Black Orange</td>
</tr>
<tr>
<td>R7</td>
<td>P-90956</td>
<td>30,000</td>
<td>Carbon</td>
<td>Orange Black Orange</td>
</tr>
<tr>
<td>R8</td>
<td>P-90977</td>
<td>1 Meg</td>
<td>Tone Cont.</td>
<td>Green Black Yellow</td>
</tr>
<tr>
<td>R9</td>
<td>P-90938-A</td>
<td>50,000</td>
<td>Carbon</td>
<td>Green Black Orange</td>
</tr>
<tr>
<td>R10</td>
<td>P-90941-A</td>
<td>50,000</td>
<td>Carbon</td>
<td>Red Black Orange</td>
</tr>
<tr>
<td>R11</td>
<td>P-90959-A</td>
<td>20,000</td>
<td>Carbon</td>
<td>Brown Black Orange</td>
</tr>
<tr>
<td>R12</td>
<td>P-90930-C</td>
<td>20,000</td>
<td>Carbon</td>
<td>Red Black Red</td>
</tr>
<tr>
<td>R13</td>
<td>P-90906-B</td>
<td>20,000</td>
<td>Carbon</td>
<td>Orange Black Orange</td>
</tr>
<tr>
<td>R14</td>
<td>P-90956-A</td>
<td>30,000</td>
<td>Carbon</td>
<td>Orange Black Orange</td>
</tr>
<tr>
<td>R15</td>
<td>P-90975-A</td>
<td>270</td>
<td>Carbon</td>
<td>Brown Green Yellow</td>
</tr>
<tr>
<td>R16</td>
<td>P-90963-A</td>
<td>150,000</td>
<td>Carbon</td>
<td>Red Black Red</td>
</tr>
<tr>
<td>R17</td>
<td>P-90979</td>
<td>7,000</td>
<td>Carbon</td>
<td>Green</td>
</tr>
</tbody>
</table>
ALIGNMENT

A thorough check of the receiver should be made before any attempt is made to re-align any circuits. Examine the antenna and ground connections. Test all the tubes and check all voltages to determine if the failure of the receiver to operate properly is not due to some fault other than mis-alignment. A superheterodyne receiver must be accurately aligned to be selective and sensitive. This receiver has been accurately aligned at the factory and, due to the mechanical design of the gang and adjustable condensers, will not lose its alignment unless damaged by abuse or accident.

A modulated test oscillator and an output meter MUST be used when aligning this receiver to insure accurate alignment. It is important that the oscillator deliver a signal at exactly 175 K.C. in addition to frequencies in the broadcast band.

The adjustable condensers which tune the secondaries of the I. F. transformers are located under the hole in top of the shield where the grid lead to the tube is brought out. The condensers which tune the primaries of the first and third I. F. transformers are located under the small hole opposite. The capacity of each condenser is varied by rotating the small adjustment screw under the hole.

A trimmer condenser is mounted over each condenser in the gang and is adjusted by turning the screw located under the hole in top of the gang shield. The shield should not be removed.

The oscillator 600 K. C. tracking condenser is located under the hole in the oscillator unit shield.

Make each adjustment in the order given below or the receiver may be thrown further out of alignment and it will then be a difficult task to align it properly.

The receiver and test oscillator must be well grounded and the output kept within the range of the output meter at all times. All shields must be in place when making the adjustments.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>Meter Scale</th>
<th>90 V.</th>
<th>100 V.</th>
<th>110 V.</th>
<th>120 V.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.F '35</td>
<td>Screen</td>
<td>0—100</td>
<td>67</td>
<td>75</td>
<td>82</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Grid Plate</td>
<td>0—250</td>
<td>136</td>
<td>151</td>
<td>166</td>
<td></td>
</tr>
<tr>
<td>1st Det '35</td>
<td>Screen</td>
<td>0—100</td>
<td>63</td>
<td>70</td>
<td>77</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Grid Plate</td>
<td>0—250</td>
<td>132</td>
<td>147</td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>Oscillator '27</td>
<td>Plate</td>
<td>0—100</td>
<td>70</td>
<td>77</td>
<td>85</td>
<td>92</td>
</tr>
<tr>
<td>1st I.F '35</td>
<td>Screen</td>
<td>0—100</td>
<td>67</td>
<td>75</td>
<td>82</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Grid Plate</td>
<td>0—250</td>
<td>136</td>
<td>151</td>
<td>166</td>
<td></td>
</tr>
<tr>
<td>2nd I.F '35</td>
<td>Screen</td>
<td>0—100</td>
<td>65</td>
<td>72</td>
<td>79</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>Grid Plate</td>
<td>0—1000</td>
<td>227</td>
<td>252</td>
<td>277</td>
<td></td>
</tr>
<tr>
<td>1st A.F '27</td>
<td>Plate</td>
<td>0—100</td>
<td>87</td>
<td>95</td>
<td>104</td>
<td>115</td>
</tr>
<tr>
<td>2nd A.F '47</td>
<td>Grid</td>
<td>0—25</td>
<td>12.7</td>
<td>14</td>
<td>15.4</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Accelerating Grid Plate</td>
<td>0—1000</td>
<td>192</td>
<td>208.</td>
<td>235</td>
<td>252.</td>
</tr>
<tr>
<td>(See below)</td>
<td>Plate to Plate voltage</td>
<td>0—1000</td>
<td>547</td>
<td>568.</td>
<td>690.</td>
<td>712.</td>
</tr>
</tbody>
</table>
Referring to sections C6 and C13 in the above list, it will be noted that these have two leads each with the same color code. This was changed in a later model to one lead each, the other lead of each section being connected to the common black lead.

At a later date, two further changes in this condenser block were made. Section C6 which bypassed the grid return of the first I.F. tube to ground was discontinued and section C4 was changed to .25 mfd. These changes bring the block up to date.

The key numbers (C5, etc.) in the above description of the condenser block refer to the key numbers as shown in the schematic circuit diagram of the early chassis. The key numbers of the condenser block as shown in the parts list in the foregoing service manual conform with the key numbers as shown in the schematic of the present chassis, Fig. 1. As explained at the beginning of this supplement, the two sets of key numbers do not coincide.

### Resistors

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Resistor Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-90914-B</td>
<td>Carbon</td>
<td>250,000</td>
</tr>
<tr>
<td>P-90915-A</td>
<td>Carbon</td>
<td>250,000</td>
</tr>
<tr>
<td>P-90918</td>
<td>Carbon</td>
<td>300,000</td>
</tr>
<tr>
<td>P-90912-A</td>
<td>Carbon</td>
<td>100,000</td>
</tr>
<tr>
<td>P-90923-A</td>
<td>Carbon</td>
<td>2 meg.</td>
</tr>
<tr>
<td>P-90923-B</td>
<td>Carbon</td>
<td>2 meg.</td>
</tr>
<tr>
<td>P-90936-B</td>
<td>Carbon</td>
<td>2,000</td>
</tr>
<tr>
<td>P-90945</td>
<td>Carbon</td>
<td>4,000</td>
</tr>
<tr>
<td>P-90912-A</td>
<td>Carbon</td>
<td>100,000</td>
</tr>
<tr>
<td>P-90947</td>
<td>Carbon</td>
<td>2,000</td>
</tr>
<tr>
<td>P-90964</td>
<td>Carbon</td>
<td>2,000</td>
</tr>
<tr>
<td>P-90949</td>
<td>Carbon</td>
<td>2,000</td>
</tr>
</tbody>
</table>

### Condensers

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-80862</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80863</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80865</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80866</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80867</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80868</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80869</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80870</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80871</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80872</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80873</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80874</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
<tr>
<td>P-80875</td>
<td>160 V.</td>
<td>50.30</td>
</tr>
</tbody>
</table>

### Lead Color

- **Yellow**: Common Black, White, Red Tr., Green Tr.
- **White**: Common Black, White, Red Tr., Green Tr.
- **Black**: Common Black, White, Red Tr., Green Tr.

[Diagram and schematic circuit diagram provided]
PHONO PICKUP INSTALLATION

The following parts must be supplied from the factory to make the installation:

1. S. P. D. T. Switch, Stock No. P-1011
2. Tip Jack Assembly, Stock No. P-1193

Removal of the license plate on the rear of the chassis will disclose a slot with small holes at each end. The tip jack assembly should be bolted inside, through the small holes.

Drill a 3/16" hole one inch from the tip jack nearest the center of the rear of the chassis and place the barrel of the switch through the hole with the body of the switch in a horizontal position.

The terminal strip mounted in the left front corner of the base has the resistor, R7. (Red body, green end, yellow dot), connected to the first and second terminals on the end of the strip nearest the center of the chassis. One end of the .05 mfd. condenser, C10, is also connected to the second terminal. See Fig. 4.

Disconnect the resistor, R7, at the second terminal of the strip. Splice a piece of wire to the disconnected end of the resistor and connect the other end of the wire to two terminals, one on each end of the switch.

Connect another wire to the terminal where the resistor was disconnected and connect the other end to one of the two open terminals on the switch. The remaining open terminal on the switch is then connected to the tip jack nearest the corner of the chassis base.

Ground the opposite tip jack on the grounded terminal of the candohm resistor.

Make all wires and connections short, firm, and well insulated.

When the switch is thrown so that the circuit from "A" to "B" is open and the circuit from "B" to "C" is closed, the pickup is then properly connected for phonograph reproduction. The switch is thrown in the opposite direction for the reception of broadcast signals.

Reversing the pickup leads will determine the correct position in which they should be left. Some pick-ups have one side grounded and that side should be connected to the grounded pickup jack in the receiver.

---

**RESISTORS**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Value</th>
<th>Type</th>
<th>Color</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-90954-A</td>
<td>100000</td>
<td>Carbon</td>
<td>Brown</td>
<td>2 watt</td>
</tr>
<tr>
<td>P-90954-B</td>
<td>250000</td>
<td>Carbon</td>
<td>Brown</td>
<td>2 watt</td>
</tr>
<tr>
<td>P-90954-C</td>
<td>500000</td>
<td>Carbon</td>
<td>Brown</td>
<td>2 watt</td>
</tr>
</tbody>
</table>

**CONDENSERS**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Value</th>
<th>Type</th>
<th>Color</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-90954-A</td>
<td>100000</td>
<td>Carbon</td>
<td>Brown</td>
<td>2 watt</td>
</tr>
<tr>
<td>P-90954-B</td>
<td>250000</td>
<td>Carbon</td>
<td>Brown</td>
<td>2 watt</td>
</tr>
<tr>
<td>P-90954-C</td>
<td>500000</td>
<td>Carbon</td>
<td>Brown</td>
<td>2 watt</td>
</tr>
</tbody>
</table>

---

**COMPLETE GANG ASSEMBLY WITH SHELL AND DIAL ASSEMBLY**

P-80866

---

**SERIES 23 SUPERHETERODYNE**

www.americanradiohistory.com
POWER TRANSFORMER

Fig. 4 shows the 110 volt power transformer connections. One side of the 110 volt A. C. line is connected to the terminal marked "Pri. 1" and the other side to the open terminal, on the opposite side of the winding, which is in turn connected to one terminal of the switch on the receiver. The switch completes the circuit to the "Pri. 2" terminal.

The 25 cycle transformer is especially designed to operate on 110 volt, 25 cycle current, but may also be operated on any 110 v. A. C. supply having a higher frequency, after the condensers C17 and C23 have been disconnected.

Receivers having a 220 volt, 40 to 60 cycle power transformer may also be operated on 110 volt, 40 to 60 cycle current when connections on the primary of the transformer have been changed.

The red and green wires shown in the 220 volt sketch must be disconnected and then connected as shown in the 110 volt sketch. No other changes are necessary.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>Meter Scale</th>
<th>110 V.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.F. '35</td>
<td>Screen Grid Plate</td>
<td>0—100 82.</td>
<td>0—250 166.</td>
</tr>
<tr>
<td>1st Det '35</td>
<td>Screen Grid Plate</td>
<td>0—100 77.</td>
<td>0—250 163.</td>
</tr>
<tr>
<td>Oscillator '27</td>
<td>Plate</td>
<td>0—100 85.</td>
<td></td>
</tr>
<tr>
<td>1st I.F. '35</td>
<td>Screen Grid Plate</td>
<td>0—100 82.</td>
<td>0—250 166.</td>
</tr>
<tr>
<td>2nd I.F. '35</td>
<td>Screen Grid Plate</td>
<td>0—100 79.</td>
<td>0—1000 277.</td>
</tr>
<tr>
<td>1st A.F. '27</td>
<td>Grid Accelerating Grid Plate</td>
<td>0—25 15.4</td>
<td>0—1000 235. 0—1000 220.</td>
</tr>
<tr>
<td>2nd A.F. '47</td>
<td>Current (Both Plates) Plate to Plate voltage</td>
<td>0—100 108 M.A.</td>
<td>0—1000 690.</td>
</tr>
</tbody>
</table>

The '80 rectifier plate voltages shown are the totals of both plates, measured from each plate to center tap of high voltage secondary.

All voltages taken with a 1,000 ohm per volt voltmeter on the scale in the column headed "Meter Scale."

Turn the volume all the way on, connect the antenna and ground leads together and turn the gang condenser plates all the way out. CHECK THE LINE VOLTAGE.

The measurement of grid bias voltages (except on the 47 pentodes) is not recommended, as this causes an abnormal rise in plate current which is injurious to the tube. Further, the measurement of actual grid bias voltages is impossible due to the high resistance in the grid circuits. When the receiver does not function properly and the trouble is apparently due to improper grid bias on any tube or tubes, the cause of the trouble may be determined by applying the proper continuity tests.

CAUTION: IN ORDER THAT THE EFFICIENCY OF EACH TUBE MAY BE COMPARED WITH THAT OF OTHER TUBES OF THE SAME TYPE, THEY MUST NOT BE TESTED IN THE SOCKET IN WHICH THEY ARE USED. TEST ALL '35 TUBES IN THE SECOND I. F. SOCKET AND TEST THE '27 TUBES IN THE FIRST A. F. SOCKET. TAKE THE VOLTAGE READINGS AT THE SOCKET IN WHICH THE TUBE IS USED.
REVISED MODEL
A green paint mark on the left rear corner of a chassis indicates the following changes:

1. Combination tone control and "On-Off" switch replaced by two separate units. The tone control is mounted and connected as previously but "On-Off switch is on side of cabinet.

2. Intermediate transformers assembled together with their adjustable tuning condensers in a round shield. Condensers are adjusted by inserting screwdriver through the holes provided underneath base, directly below transformer assembly. Early models are adjusted through hole in top of (rectangular) shield.

3. The oscillator coil, its shield, and the 600 K.C. tracking condenser are all mounted separately on the base. The tracking condenser adjustment screw will be found near the left rear corner of the oscillator coil shield. The .0005 mfd. condenser (C14) is not used and the 30,000 ohm resistor (R12) is replaced by a 40,000 ohm resistor mounted between a coil lug and the tracking condenser. The revised oscillator circuit is shown herewith.

The parts affected by the change, are listed below with corresponding parts numbers:

<table>
<thead>
<tr>
<th>OLD NUMBER</th>
<th>NEW NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tone Control &amp; &quot;On-Off&quot; Switch</td>
<td>&quot;On-Off&quot; Switch-P-1054</td>
</tr>
<tr>
<td>1st L.F. Transformer</td>
<td>&quot;Tone Control&quot;-P-90986-A</td>
</tr>
<tr>
<td>Assembly</td>
<td>1st I.F. Assembly-P-1424</td>
</tr>
<tr>
<td>2nd L.F. Transformer</td>
<td>2nd I.F. Assembly-P-1425</td>
</tr>
<tr>
<td>Assembly</td>
<td>3rd I.F. Assembly-P-1426</td>
</tr>
<tr>
<td>3rd I.F. Transformer</td>
<td>Oscillator Coil-P-1400</td>
</tr>
<tr>
<td>Assembly</td>
<td>Coil Shield-P-40412</td>
</tr>
<tr>
<td>Oscillator Unit</td>
<td>600 K.C. Tracking Cond-P-1385-A</td>
</tr>
<tr>
<td>Assembly</td>
<td>40,000 Ohm Carbon Resistor-P-90945</td>
</tr>
</tbody>
</table>
GULBRANSEN CO.
ALIGNMENT

A thorough check of the receiver should be made before any attempt is made to re-align any circuits. Examine the antenna and ground connections. Test all the tubes and check all voltages to determine if the failure of the receiver to operate properly is not due to some fault other than mis-alignment. A superheterodyne receiver must be accurately aligned to be selective and sensitive. This receiver has been accurately aligned at the factory and, due to the mechanical design of the gang and adjustable condensers, will not lose its alignment unless damaged by abuse or accident.

A modulated test oscillator and an output meter MUST be used when aligning this receiver to insure accurate alignment. It is important that the oscillator deliver a signal at exactly 175 K.C. in addition to frequencies in the broadcast band.

The adjustable condensers which tune the secondaries of the intermediate transformers are located under the hole in top of the shield where the grid lead to the tube is brought out. The condensers which tune the primaries are located under the small hole opposite. The capacity of each condenser is varied by rotating the small adjustment screw under the hole.

Make each adjustment in the order given below or the receiver may be thrown further out of alignment and it will then be a difficult task to align it properly.

The receiver and test oscillator must be well grounded and the output kept within the range of the output meter at all times.

All shields must be in place when making the adjustments.

INTERMEDIATE CIRCUITS

Tune the test oscillator to exactly 175 K.C. and connect its output to the grid of the first detector tube after removing the clip on the lead from the gang condenser.

Adjust the primary and secondary of the first intermediate transformer for greatest volume.

Follow the same procedure on the second intermediate transformer and then turn the receiver off.

Disconnect one end of the speaker voice coil and connect the output meter across the secondary of the speaker coupling transformer. Short the oscillator tuning condenser (in the gang) by grounding the stator plates with a screw driver.

Turn the receiver on and adjust the output until the output meter shows a small or medium scale deflection.

Adjust the primary of the first intermediate transformer for the greatest deflection on the output meter.

Adjust the secondary in the same manner.

Follow the same procedure on the second intermediate transformer and then check the settings of all condensers to make certain the maximum output has been obtained.

When the above instructions have been followed, remove the test oscillator coupling and replace the grid lead on the first detector, and also remove the screw driver shorting the oscillator tuning condenser.

GANG CONDENSERS

Couple the test oscillator output to the antenna, (white wire), on the receiver.

Tune the oscillator to 1400 K.C. and carefully tune the receiver to the signal.

A trimmer condenser is mounted over each condenser in the gang and is adjusted by turning the screw located under the hole in top of the gang shield. The shield should not be removed. Adjust each trimmer condenser for maximum deflection on the output meter.

OSCILLATOR

Tune the test oscillator to 600 K.C. and tune the receiver to the signal. Then after turning the receiver off, disconnect the output meter and replace the voice coil lead which was disconnected.

Turn the receiver on and rotate the adjusting screw on the 600 K.C. tracking condenser under the hole in top of the oscillator transformer shield. Rock the gang condenser back and forth across the signal at the same time and listen closely until the maximum volume is obtained. The tracking condenser is then properly adjusted and remains fixed thereafter.

The receiver should be accurately aligned if the above instructions have been followed and no further adjustments need be made.
GULBRANSEN CO.

MODEL 362

IF PEAK 262 K.C.

VOLTAGE DATA

<table>
<thead>
<tr>
<th>Tube</th>
<th>Plate</th>
<th>Screen</th>
<th>Grid</th>
<th>Plate MA.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.F</td>
<td>177</td>
<td>80</td>
<td>3</td>
<td>3.6</td>
</tr>
<tr>
<td>1st Det.</td>
<td>173</td>
<td>76</td>
<td>7*</td>
<td></td>
</tr>
<tr>
<td>I.F.</td>
<td>177</td>
<td>80</td>
<td>3</td>
<td>3.6</td>
</tr>
<tr>
<td>2nd Det.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1st A.F.</td>
<td>54</td>
<td>77</td>
<td>6</td>
<td>1.2</td>
</tr>
<tr>
<td>Output</td>
<td>159</td>
<td>165</td>
<td>15.5</td>
<td>10.0</td>
</tr>
</tbody>
</table>

* Will vary with dial setting.
CHARLES HOODWIN CO. MODEL Aero Auto Radio
MODEL Aero 1932 Converter

(Above)

MODEL Aero 1932 Converter

www.americanradiohistory.com
MODEL Tiffany Tone 101, 110

HERBERT H. HORN

ALIGNMENT DATA

VOLTAGE TABLE

No Signal Input To Receiver

<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>Function</th>
<th>Plate</th>
<th>Screen</th>
<th>Cathode</th>
<th>Heater</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>335</td>
<td>RF Amp</td>
<td>187</td>
<td>80</td>
<td>2.8*</td>
<td>2.1</td>
</tr>
<tr>
<td>2</td>
<td>335</td>
<td>Trans</td>
<td>187</td>
<td>80</td>
<td>2.8*</td>
<td>2.1</td>
</tr>
<tr>
<td>3</td>
<td>327</td>
<td>Osc.</td>
<td>80</td>
<td>-</td>
<td>4.2*</td>
<td>2.1</td>
</tr>
<tr>
<td>4</td>
<td>335</td>
<td>IF Amp</td>
<td>187</td>
<td>80</td>
<td>2.8*</td>
<td>2.1</td>
</tr>
<tr>
<td>5</td>
<td>327</td>
<td>Det.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.1</td>
</tr>
<tr>
<td>6</td>
<td>327</td>
<td>1st AF</td>
<td>30*</td>
<td>-</td>
<td>4.9*</td>
<td>2.1</td>
</tr>
<tr>
<td>7</td>
<td>227</td>
<td>2nd AF</td>
<td>115</td>
<td>-</td>
<td>7.2*</td>
<td>2.1</td>
</tr>
<tr>
<td>8</td>
<td>347</td>
<td>Output</td>
<td>210</td>
<td>205</td>
<td>13.1*</td>
<td>2.3</td>
</tr>
<tr>
<td>9</td>
<td>347</td>
<td>Output</td>
<td>210</td>
<td>205</td>
<td>13.1*</td>
<td>2.3</td>
</tr>
<tr>
<td>10</td>
<td>280</td>
<td>Rect.</td>
<td>4.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Voltmeter resistance 50,000 ohms. All other voltages measured with 250,000 ohm voltmeter. Chassis is negative for all readings.

IF TRANSFORMER ADJUSTMENT

There are four i-f transformers. Both the grid and plate circuits of each must be tuned sharply to 175 kc. The condenser adjusting screws are accessible from the underside of the chassis; there being two slotted screws protruding through the insulated base of each transformer.

LINE UP OF GANG CONDENSERS

The four sections of the gang condenser function as follows: The first section, looking at the rear of the chassis tunes the selector stage. The second section tunes the grid circuit of the r-f amplifier. The third section tunes the grid circuit of the translator tube and the fourth section tunes the oscillator. The fourth section is that nearest the front of the chassis. The first three must track together at signal frequency, which is the desired signal frequency. The oscillator section on the other hand must track 175 kc higher than the signal frequency.

THE SHORT WAVE TUNER

The short wave tuner consists fundamentally of two tuned circuits and two tubes, one of which is a 224 operating at short wave signal frequency as a first detector and the other tube is a 227 oscillator tuned to 550 kc higher than the desired short wave signal frequency. The resultant beat of 550 kc is fed into the antenna post of the broadcast part of the complete receiver chassis, which operates as an 550 kc intermediate frequency amplifier during short wave reception. The dial of the broadcast receiver must be set to 550 kc during short wave reception.

To balance: Set band selector switch on position C - set dials on about 10. The front section of the two gang condenser tunes the detector stage to signal frequency; the back section tunes the oscillator coils to a frequency 560 kc greater than signal frequency. If the small variable condenser, which is paralleled with the detector condenser, will not resonate its circuit within its capacity range, it will be necessary to change the trimmer located on the oscillator section of the main tuning condenser. This may be done by tuning in a signal and rotating the variable trimmer to maximum resonance; if this point is reached with the balancing condenser plates at maximum capacity, it will be necessary to reduce the oscillator trimmer capacity, and if the resonance point is approached with the balancing condenser at minimum capacity, it will be necessary to add capacity to the oscillator trimmer. This should be regulated so the balancing condenser peaks with the plates about half way out, with the short wave tuning dial set at 50.

The approximate setting of the oscillator trimmer may be obtained by turning the adjusting screw down tight and then releasing it two full turns.
HOWARD RADIO CO.

MODEL A-5
MODEL A-6

Diagram of Howard Radio Co.'s Model A-5 and Model A-6 radio receivers. The diagrams include various components such as tubes, capacitors, and coils, arranged in a typical radio circuit layout. The diagrams are labeled for both Model A-5 and Model A-6, indicating differences in design or function. The text on the diagram includes references to specific parts and connections, which are standard in radio schematics for clarity and ease of construction.

Model A-5 (1923)
Model A-6 (1927)

The diagrams are detailed and include annotations that would be necessary for a technician or engineer to build or repair the radio receivers. The labels indicate areas such as 'RF,' 'AF,' 'GT,' 'ST,' 'FT,' and 'MF,' which are typical in radio schematics to denote the different frequency regions of the radio receiver.
Alignment Data.

HOWARD RADIO CO.

MODEL “H”

ADJUSTMENTS The 175 kc. oscillator must be accurately tuned to 175 kc. and only 175 kc. If this precaution is not observed it will be impossible to align the oscillator to the rest of the set and the set will not operate correctly as the oscillator is designed for exact 175 kc. operation.

The second intermediate frequency amplifier transformer shield can is removed and one side of the small variator condenser is disconnected from the primary coil. This coil is connected so that it still is in the plate circuit of the tube but the tuning condenser is not connected in the circuit. Now remove the grid cap from the intermediate amplifier tube and connect a 3 meghom resistor from the control grid to ground. Now connect the output from the 175 kc. oscillator to the grid of the intermediate frequency amplifier tube and tune the secondary for maximum deflection of the output meter. (Low voltage alternating current meter, 0 to 3 volts, connected across the voice coil of speaker). Now remove the shield can and connect the small tuning condenser that was previously removed back across the primary coil. With the 175 kc. oscillator connected the same as before, tune the primary for a maximum deflection of the output meter. (Caution: Do not under any circumstances try to retune the secondary after having tuned the primary. This is important.) After having tuned this stage proceed to the next intermediate frequency:

(b) Replace the grid cap on the intermediate frequency amplifier and proceed to the first detector tube. Remove this tube cap and connect the 175 kc. oscillator as before, being sure to connect the 3 meghom resistor from control grid to ground. Now proceed to tune the intermediate frequency transformer by tuning the secondary first for maximum deflection of the output meter and then tuning the primary for maximum deflection. Tuning this transformer must be done very carefully as the selectivity of the whole receiver depends entirely on the tuning of this transformer.

(c) To line up the radio frequency amplifier and detector stages, remove the oscillator tube and the second detector tube. Unsolder the connection on the plate terminal of first detector tube socket and solder a wire from this terminal to the plate terminal of the second detector tube socket. Now set the Test Oscillator (R. F. Generator) which tunes over the broadcast frequency range to 1400 kcs. Connect the output of this oscillator to the aerial and ground wires of the receiver. Now make sure that when the tuning condensers are all in maximum capacity that the pointer on the escutcheon lines up with the line just beyond the 550 kc. dial mark and then turn the dial until the escutcheon pointer lines up with the 1400 kc. line on the dial. The tuning condenser trimmers should now be adjusted until a maximum deflection is shown by the output meter. Now set the oscillator to 1000 kcs. Turn the dial to 1000 kcs. and then secure maximum deflection on the output meter by moving the serated plates of the variable condenser in or out as the case may be. Repeat the same procedure at 600 kcs. as was used at 1000 kcs. (Do not touch the trimmer condensers after having once set them at 1400 kcs.). Unsolder the wire connecting the first detector plate terminal to the second detector plate terminal. Resolder the wire that was originally unsoldered from the first detector plate terminal. Now replace the oscillator and second detector tubes.

(d) To line up the oscillator tune the set to 1400 kcs. and adjust the oscillator tuning condenser trimmer (the last hole of the three holes in a line on the top of the tuning condenser housing) as viewed from the front of the set, (see Fig. 1) until a maximum reading is secured on the output meter. Adjust the Test Oscillator to 600 kcs. and tune the receiver to 600 kcs. Now adjust the oscillator series condenser trimmer (the hex. nut in the hole to the left of the oscillator tuning condenser trimmer hole) until a maximum deflection is secured on the output meter. Now reset the Test Oscillator to 1400 kcs. and return the set to 1400 kcs. and make adjustments if any are necessary on the oscillator tuning condenser trimmer. It is very seldom necessary to make any readjustments at 1400 kcs. after they have once been made.

Now tune the Test Oscillator to 1000 kcs. and tune the set to 1000 kcs. Try adjusting the antenna trimmer condenser to determine whether the oscillator aligns at this frequency. If the antenna trimmer must increase capacity to give maximum deflection of output-meter the oscillator tuning condenser serated plates should be moved out. If the antenna trimmer condenser is decreased in capacity the oscillator tuning condenser serated plates should be bent in towards the stator plates.

The Test Oscillator must again be set to 1400 kcs. and the set returned to 1400 kcs. to make sure that the antenna trimmer condenser has been correctly reset after the oscillator adjustment has been made at 1000 kcs.

In making tests after having made adjustments according to the foregoing paragraphs, it is necessary to replace the tube and coil can shields before making the tests.
1. Specifications.

The Howard Model AVH receiver is a superheterodyne receiver similar to the Model H receiver with the addition of an Automatic Volume Control.

2. Schematic Circuit.

Draw a 1451 shows a schematic diagram of the Model AVH. Since the Model H and Model AVH are almost identical, it will only be necessary to show where the two differ.

In the radio chassis the following differences are noted:

A non-inductive 1 μf condenser is connected between the end of the coil and ground. This condenser provides an attenuation as far as direct current is concerned for the grid of the radio frequency amplifier tube. From the radio frequency amplifier to the condenser offers a low impedance path to ground for the radio frequency voltage. Since this condenser and the tuning condenser are in series across the tuning coil it is necessary that this condenser be large in order to have small effect on the tuning capacity.

The second radio frequency transformer SA 1269 is connected in the same manner as the first radio frequency transformer SA 1267 is not grounded as in the Model "H". This condenser, or a non-inductive 1 μf condenser offers a low impedance path to ground for the radio frequency voltage. Since this condenser and the tuning condenser are in series across the tuning coil it is necessary that this condenser be large in order to have small effect on the tuning capacity.

The first intermediate frequency transformer SA 1278 also has an isolating condenser in the grid circuit. This condenser serves the same purpose as those in the radio frequency transformers.

The initial operating bias for the various tubes is secured by means of individual resistors in each cathode circuit. The plate current flowing through the resistor causes a voltage drop across it which places the cathode positive with respect to ground. Since the grid is effectively at ground potential this is the same as placing a negative voltage on the grid. It is necessary to bias these tubes individually so that there is no common impedance which might give rise to reaction between the tubes. Each resistor is bypassed to form a low impedance path for radio frequency around the resistor.

3. Automatic Volume Control.

The Automatic Volume Control is activated by means of a type 277 tube and in order to explain its operation it is necessary to express its action under condition of no signal being received and its action when a signal is being received.

The tube is connected so that the grid is at absolute. B potential by means of a 2 Megohm resistor R (L 895) referred to the ground. The cathode of this tube is connected to the plate via a grid negative bias voltage. This bias voltage is regulated by two tubes that are 100,000 ohm resistors (P 1888). The plate current is 1.24 volts with respect to A or thrad. There exists then between the cathode and the plate a potential of 40 volts with the grid negative bias voltage. The plate is connected in series with the plate supply voltage of the three control tubes. As the bias voltage on these tubes the plate is negative the plate current decreases. This decrease in plate current is reflected in the cathode of the tube. By drawing their minimum plate current for a given signal strength. At this condition the best tonal qualities are restored to the output signal. It is important that the service man and dealer both understand this tuning so that the customer may be instructed in the correct manner of tuning his radio set.

This action is explained fully in the instruction booklet with each receiver and should be thoroughly understood so that an explanation can be given the customer.

7. The Pack.

The power pack of the conventional type is and is similar to the Model H with a few exceptions.

The power transformers have a separate winding for the heater of the AVC tube. This is necessary because if the heater were grounded as in the other receivers it would place 100 volts potential difference between cathode and heater and it is possible that rectification might take place. Therefore here the 

The HV secondary of this power transformer is also changed to give an increased high voltage. This increase is necessary because the AVC tube requires an additional 124 volts.

Since an additional 124 volts is required above the usual 180 volts for plate operation the plate voltage divides exists there is a total of 304 volts. As our power tubes require only 250 volts plate and 16.5 volts bias it is at once apparent that they may be connected between B and D with suitable resistors to drop the voltage to the correct operating voltages.

The speaker field is connected the same as in the Model "H" but since the current of the set is not fixed through the speaker field the resistance of the field is only 350 ohms instead of 2400 ohms as on the standard Model H.

The filter condensers on the Model AVH are of the dry electrolytic type since there would be the potential difference between the case and the chassis if the wet electrolytic condensers were used which might shock the user if he happened to touch the case of the condenser and the chassis. These dry electrolytic condensers increase the capacitance in a container which is at ground or chassis potential so that this danger is eliminated.

Two pilot lights are used on the Model AVH, one for illuminating the dial and the other for indicating the meter.
HOWARD RADIO

Model 20,26,30,32
Alignment Data

1. After aligning IF transformers, replace 1st detector grid cap. Un solder the wire connecting the plate of the 1st detector tube to the IF transformer. Remove oscillator tube and 2nd detector tube. Connect the plate terminal of 1st detector tube to the plate terminal of the second detector socket.

2. Rotate the condenser in clockwise direction as far as they will go. Make sure that when the pots of the condenser are all in, that the starting mark on the dial aligns with the coins on the escutcheon. This starting mark is a line just beyond the 350 kc. line on the dial (See Fig. 1.)

3. Set test oscillator (RF Generator) which tunes over broadcast band to 1400 kc. Antenna and ground wire to oscillator. Tune set to 1400 as shown on dial. Adjust trimmer on first and third variable condensers for maximum deflection of output meter.

4. Note tune oscillator 1000 kc. and tune set to 1000 as shown on dial. Adjust for maximum deflection on output meter by moving series plates on rotor of tuning condensers in or out as the case may be. Do not adjust trimmer condensers at this frequency.

5. Repeat process in paragraph 4 at 600 kc.

6. Remove wire soldered from 1st detector plate terminal to second detector plate terminal and resolder wire from intermediate frequency transformer to plate terminal of 1st detector as originally connected.

Oscillator Alignment

1. Set test oscillator to 1400 kc. Tune set to 1400 kc. and adjust oscillator or second (middle) tuning condenser trimmer for maximum output as shown on the output meter. (Oscillator trimmer condenser second hole of the three in line)

2. Set test oscillator to 600 kc. Tune set to 600 kc. Adjust oscillator padding trimmer (angle hole to left of three holes in line) for maximum deflection of output meter.

3. Reset test oscillator again to 1400 kc. and retune set to 1400 kc. Readjust oscillator trimmer if necessary. This adjustment is very seldom necessary if the other adjustments are made correctly.

4. Now tune test oscillator to 1000 kc. and tune set to 1000 kc. Try adjusting antenna trimmer condenser to determine whether the oscillator aligns at this frequency. If the antenna trimmer must increase in capacity to give maximum deflection of output meter the oscillator tuning condenser series plates should be moved out. If the antenna trimmer is decreased in capacity the oscillator tuning condenser series plates should be bent in towards the statior plates. It must be remembered that a small capacity change in the oscillator circuit means a tremendous frequency change, and this adjustment must be made very carefully.

5. Now adjust test oscillator to 1400 kc. and retune set to 1400 kc. to make sure the antenna trimmer condenser has been reset to its original position after Test 4 has been made properly.

In making the above tests it is necessary before making each test, to replace all shielding.

The foregoing tests are of a delicate nature, and it is essential that each one be made carefully before going to the next test.
R.F. Amplifiers:

The secondary of the first radio frequency transformer is connected between the grid of the 1st amplifier tube and ground. This secondary is tuned by means of one section of a three-gang variable condenser.

The cathode of this tube connects directly to the volume control. The volume control will be discussed under a separate section.

The screen grids of the radio frequency amplifier tubes connect together and then to a point on the voltage divider resistor which applies the correct operating potential on the screens. In order to prevent common coupling impedance these screens are by-passed to ground by means of a condenser. This eliminates a possibility of oscillation from this source.

Connected between the source of B voltage and the plate of the first radio frequency amplifier tube is a high inductance choke coil. This coil is located in the top of the second radio frequency transformer but in physical relation to the secondary of this transformer so that there is no electromagnetic coupling. Connected to the plate end of this choke is a wire which is in close physical relation to the grid end of the secondary of this transformer. As in the case of the 1st r.f. transformer, this turn gives a small capacity coupling. The combination of the choke and small capacity formed by the single turn of wire gives a frequency characteristic which is substantially flat over the frequency range.

The secondary of the second transformer is similar to the one used in the 1st r.f. transformer and is tuned by means of the second section of the variable tuning condenser. It is connected between grid and ground of the second radio frequency amplifier tube.

The cathode and screen of this tube are connected the same as the first radio frequency amplifier and need no further description.

The third radio frequency transformer is a duplicate of the second, radio frequency transformer and therefore, needs no description. On export models, the ground lead of this transformer is connected to a phonograph jack, and the other terminal of the phonograph jack is connected to ground. In the radio position these jacks are shorted by means of a switch. In the phonograph position, this switch is opened and the pick-up is plugged into the jack. It is necessary to tune the radio set to some point on the dial where there is no signal from a broadcast station coming in. Otherwise the radio signals will feed through and interfere with the phonograph music.
<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Value</th>
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<td>1263</td>
<td>IF transformer coils 11/16 spacing</td>
<td>247</td>
</tr>
<tr>
<td>1264</td>
<td>IF transformer coils 1 spacing</td>
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<td>1318</td>
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<tr>
<td>1767</td>
<td>Condenser, 01 mf.</td>
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</tr>
<tr>
<td>1772</td>
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<td>1829</td>
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<td>Fuse 2 amp, A.G.</td>
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<tr>
<td>1834</td>
<td>Resistor, 2,000 ohms, 1/2 watt</td>
<td>1997</td>
</tr>
<tr>
<td>1835</td>
<td>Resistor, 3,000 ohms, 1/2 watt</td>
<td>1999</td>
</tr>
</tbody>
</table>

- **Socket No. 247**: Oscillator picking condenser
- **Filter cond. 2 section 6 mid. ea**: Filter cond. 1 section 4 mid. ea
- **Pilot light 2.5 volt**: Pilot light 2.5 volt
- **Resistor 10 ohm center-tapped**: Power transformer
- **Power transformer**: Power transformer
- **Tone control and power switch**: Tone control and power switch
- **IF transformer tuning condenser (variators)**: IF transformer tuning condenser (variators)
- **Choke coil, power pack**: Choke coil, power pack
- **Volume control**: Volume control
- **Resistor 300 ohm, 3 watt**: Resistor 300 ohm, 3 watt
- **By-pass condenser block**: By-pass condenser block
- **Audio transformer**: Audio transformer
- **Resistor (voltage divider)**: Resistor (voltage divider)

**Sub-Assemblies**

- SA-1247: Antenna radio frequency transformer
- SA-1249: Oscillator tuning coil
- SA-1252: Radio frequency transformer
- SA-1253: Detector radio frequency choke coil
MODEL Insulette & Mascot
4 Tube Midget AC
Broadcast—Long Wave
4 Tube Midget AC

"INSULETTE" & "MASCOT"
4 TUBE MIDGET RECEIVER

"INSULETTE" & "MASCOT"
4 TUBE COMBINATION B’CAST & L.W.
MIDGET RECEIVER
"CONQUEROR" SHORT WAVE A.C. MODEL RECEIVER