**WELLS-GARDNER & CO.**

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Power Consumption</th>
<th>60 Watts (At 117 volts 60 cycles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Output</td>
<td>2.5 Watts Undistorted</td>
</tr>
<tr>
<td>3.5 Watts Maximum</td>
<td></td>
</tr>
<tr>
<td>Selectivity</td>
<td>40 KC Broad at 1000 times Signal</td>
</tr>
<tr>
<td>Intermediate Frequency</td>
<td>456 KC</td>
</tr>
<tr>
<td>Speaker</td>
<td>6” or 8” Electro-Dynamic</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tuning Frequency Range</th>
<th>B Range</th>
<th>C Range</th>
<th>D Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>528 to 3800 KC</td>
<td>2200 to 7000 KC</td>
<td>7000 to 22000 KC</td>
</tr>
<tr>
<td>Sensitivity—External Antenna (For 0.5 Watt output)</td>
<td>B Range</td>
<td>C Range</td>
<td>D Range</td>
</tr>
<tr>
<td></td>
<td>7 Microvolts Average</td>
<td>7 Microvolts Average</td>
<td>15 Microvolts Average</td>
</tr>
</tbody>
</table>

**ALIGNMENT PROCEDURE**

**Volume Control—Maximum All Adjustments.**

Connect Radio Chassis to Ground Post of Signal Generator with a Short Heavy Lead.

Allow Chassis and Signal Generator to "Heat Up" for several minutes.

**SIGNAL GENERATOR**

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>CONNECTION</th>
<th>DUMMY ANTENNA</th>
<th>BAND</th>
<th>TRIMMERS TO MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF</td>
<td>456 KC</td>
<td>Grid Terminal</td>
<td>.1 mf.</td>
<td>B Range</td>
</tr>
<tr>
<td></td>
<td>1600 KC</td>
<td>External Antenna</td>
<td>Clip or Lead</td>
<td>100 mmf.</td>
</tr>
<tr>
<td></td>
<td>1400 KC</td>
<td>External Antenna</td>
<td>Clip or Lead</td>
<td>100 mmf.</td>
</tr>
<tr>
<td></td>
<td>600 KC</td>
<td>External Antenna</td>
<td>Clip or Lead</td>
<td>100 mmf.</td>
</tr>
<tr>
<td></td>
<td>7000 KC</td>
<td>External Antenna</td>
<td>Clip or Lead</td>
<td>400 Ohm</td>
</tr>
<tr>
<td></td>
<td>6000 KC</td>
<td>External Antenna</td>
<td>Clip or Lead</td>
<td>400 Ohm</td>
</tr>
<tr>
<td></td>
<td>22,000 KC</td>
<td>External Antenna</td>
<td>Clip or Lead</td>
<td>400 Ohm</td>
</tr>
<tr>
<td></td>
<td>21,000 KC</td>
<td>External Antenna</td>
<td>Clip or Lead</td>
<td>400 Ohm</td>
</tr>
<tr>
<td>LOOP RANGE B</td>
<td>1400 KC</td>
<td>External Antenna</td>
<td>Clip or Lead</td>
<td>100 mmf.</td>
</tr>
</tbody>
</table>

**ATTENTION**

Connect the Signal Generator to the Signal generator, to prevent the leveling-off action of the AVC.

After each range is completed, repeat the procedure as a final check.

**NOTE A—**If the pointer is not at 1400 KC on the dial, remove pointer from drive cord. Set pointer at the 1400 KC mark on the dial scale. Attach pointer to drive cord.

**NOTE B—**[Table Model] By means of wooden blocks, stand the loop aerial assembly the same distance from the back of the chassis that it is normally when the chassis is assembled in the cabinet.

**NOTE C—**Turn the rotor back and forth and adjust the trimmer until the peak of greatest intensity is obtained.

**NOTE D—**Re-assemble chassis in cabinet. Replace back on cabinet [Table Model]. Connect ground post of signal generator to external ground clip on loop antenna [Table Model] or ground screw on chassis (Console Model).

**CAUTION—**When aligning the short wave bands, be sure NOT to adjust at the indicated frequency. This can be checked as follows:

Let us say the signal generator is set for 15,000 KC. The signal will then be heard at 15,000 on the dial of the radio. The image signal, which is much weaker, will be heard at 15,000 less 912 KC, or 14,088 KC on the dial. It may be necessary to increase the input signal to hear the image.

**DRIVE CORD REPLACEMENT**

Turn gang condenser to full open position—see illustration. Use a new drive cord 42 inches in length.

Tie one end of cord to tension spring. Pass other end of cord up through hole in groove of drive pulley. Pull cord through hole until spring is flush against inside of pulley rim.

Wind cord ¼ turn counter-clockwise (from pulley side of chassis) around drive pulley. Then wind ½ turn clockwise (from front of chassis) around tuning control shaft. This turn should progress toward chassis. Pass cord over idler studs A and B as shown, then wind cord ¾ turn counter-clockwise (from pulley side of chassis) around drive pulley. This turn should be on left side (from front of chassis) of pulley groove.

Pass cord through hole in groove of drive pulley. Tie cord to tension spring. Fasten other end of spring to hook on drive pulley.

**DIAMETER ATTACHMENT—**Tune in a signal of known frequency. Set pointer at this frequency mark on dial scale. Fasten pointer to drive cord—see illustration.

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MODEL 6B16

ALIGNMENT PROCEDURE

A Signal Generator which will provide an accurately calibrated signal at the test frequencies will be used for the following:

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>ANTENNA</th>
<th>GROUND</th>
<th>DUMMY</th>
<th>CONDENSER</th>
</tr>
</thead>
<tbody>
<tr>
<td>External</td>
<td>456 KC</td>
<td>Ground</td>
<td>Loop</td>
<td>456 KC</td>
</tr>
<tr>
<td>External</td>
<td>1600 KC</td>
<td>Ground</td>
<td>Loop</td>
<td>1600 KC</td>
</tr>
<tr>
<td>External</td>
<td>1400 KC</td>
<td>See Note A</td>
<td>Ground</td>
<td>1400 KC</td>
</tr>
</tbody>
</table>

If radio is equipped with special antenna coil for use in car, make the following additional adjustment after the radio is installed in the car; and the car antenna is connected.

Car Antenna Adjustment: Tune to weak signal near 1400 KC—Adjust Car Antenna Trimmer C2S for maximum output. This trimmer is in special antenna coil and can be left side of chassis (See Illustration in Auto Installation Sheet).

NOTE A—Reassemble chassis in cabinet. Close back on cabinet.

CALIBRATION—To obtain dial scale calibration, tune in an 800 KC signal. The pointer should be at the 800 KC mark on the dial. If it is not, set the pointer at the 800 KC mark. Release set screw.

REMOVING CHASSIS FROM CABINET—Pull off the 3 control knobs, take out the 4 screws, 2 at each side on the outside of the cabinet. Then pull the chassis out of the cabinet.

REPLACEMENT PARTS LIST

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>List</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>12X350</td>
<td>6&quot; P.M. Allot Mobile Speaker complete with Diaphragm, Basket, Special Washer and Screws</td>
<td>75.00</td>
<td>140.00</td>
</tr>
<tr>
<td>14X260</td>
<td>Diaphragm for Above Speaker</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X261</td>
<td>Speaker Cone for Above Speaker (Case No. 5)</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X262</td>
<td>Diaphragm for Above Speaker (Case No. 6)</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X263</td>
<td>Rotor Switch-All Mobile Speaker</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X264</td>
<td>Bracket, Molding for Above Speaker</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X265</td>
<td>4 Dial Switch for Above Speaker</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X266</td>
<td>3rd L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X267</td>
<td>1st L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X268</td>
<td>3rd L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X269</td>
<td>1st L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X270</td>
<td>2nd L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X271</td>
<td>3rd L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X272</td>
<td>1st L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X273</td>
<td>2nd L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>14X274</td>
<td>3rd L.F. Condenser</td>
<td>3.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

SPECIFICATIONS

| Input Voltages and Currents—Battery Operation | 9 Volts—60 Ma. "8" Battery | 90 Volts—11.5 Ma. |
| Power Consumption | (At 177 volts AC Supply) | 28 Watts |
| Battery Operation | 120 Watts—Undistorted |
| AC Operation | 400 Watts—Maximum |
| Selectivity | 50 KC Broad at 1000 Times Signal |
| Intermediate Frequency | "8" | 156 KC |
| Speaker Box | "8" | 4" P.M. Dynamic |
| Tuning Frequency Range | 50 to 1600 KC |
| Sensitivity | (For .5 Watt Output) | 10 Microwatts Average |

Use only GENUINE factory tested parts to insure service jobs you can depend on and to obtain original set performance.

Prices Subject to Change Without Notice.

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**ALIGNMENT PROCEDURE**

The following equipment is required for aligning:

- An All-Wave Signal Generator which will provide an accurately calibrated signal at the test frequencies as listed.
- Dummy Antennas — 1 m., 200 mm., and 400 ohms.

**MODEL A7**

**WELLS-GARDNER & CO.**

<table>
<thead>
<tr>
<th>STEP (follow the order of given)</th>
<th>BANDSWITCH SETTING</th>
<th>DUMMY ANTENNA</th>
<th>TRIMMERS</th>
<th>SIGNAL GENERATOR SET AT RADIO</th>
<th>FREQUENCY CONNECTION</th>
<th>INITIAL STEPS</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st F. Adj.</td>
<td>Range B</td>
<td>200 mm.</td>
<td>Range B</td>
<td>Range A</td>
<td>465 KC</td>
<td>1 mf.</td>
<td>ADJUST MEMBER OF L.F.'S ADJUSTMENT TO MAXIMUM OUTPUT.</td>
</tr>
<tr>
<td>RANGE A</td>
<td>Range B</td>
<td>200 mm.</td>
<td>Range B</td>
<td>Range A</td>
<td>165 KC</td>
<td>1 mf.</td>
<td>Adjust to Maximum Output.</td>
</tr>
<tr>
<td>RANGE B</td>
<td>Range A</td>
<td>200 mm.</td>
<td>Range B</td>
<td>Range A</td>
<td>380 KC</td>
<td>1 mf.</td>
<td>Turn Rotor to Full Open.</td>
</tr>
<tr>
<td>RANGE C</td>
<td>Range D</td>
<td>400 mm.</td>
<td>Range D</td>
<td>Range A</td>
<td>19800 KC</td>
<td>1 mf.</td>
<td>Adjust to Maximum Output.</td>
</tr>
<tr>
<td>RANGE D</td>
<td>Range D</td>
<td>400 mm.</td>
<td>Range D</td>
<td>Range A</td>
<td>16000 KC</td>
<td>1 mf.</td>
<td>Turn Rotor to Full Open.</td>
</tr>
<tr>
<td>RANGE E</td>
<td>Range D</td>
<td>400 mm.</td>
<td>Range D</td>
<td>Range A</td>
<td>6000 KC</td>
<td>1 mf.</td>
<td>Adjust to Maximum Output.</td>
</tr>
</tbody>
</table>

**NOTE A**

- Turn the rotor knob and form and adjust the trimmer until the indicator is set at the maximum output for the frequency of the signal generator.
- After each range is completed, repeat the procedure as indicated on the signal generator to prevent the heating of the AVC.
- After the final check, the trimmer and the pack of signal generator to prevent the heating of the AVC.

**NOTE B**

- Turn the rotor knob to form and adjust the trimmer until the indicator is set at the maximum output for the frequency of the signal generator.
- After each range is completed, repeat the procedure as indicated on the signal generator to prevent the heating of the AVC.

**NOTE C**

- In sets using the telephone dial tuning, the adjustment of the AVC should be checked as follows: Turn the dial to any frequency below or above the transmission frequency. The dial should be turned so that the pointer is at the zero reading of the scale. The correct setting of the AVC will be verified by the vernier scale reading of the pointer as shown on the scale of the AVC. The vernier scale reading of the pointer should be within the range of 0 to 0.0001 on the scale of the AVC. If the vernier scale reading of the pointer is outside this range, the AVC should be adjusted by turning the rotor knob to form and adjusting the trimmer until the vernier scale reading of the pointer is within the range of 0 to 0.0001 on the scale of the AVC.

**NOTE D**

- In sets using the variable condenser, the adjustment of the AVC should be checked as follows: Turn the variable condenser to any position below or above the transmission frequency. The variable condenser should be turned so that the pointer is at the zero reading of the scale. The correct setting of the AVC will be verified by the vernier scale reading of the pointer as shown on the scale of the AVC. The vernier scale reading of the pointer should be within the range of 0 to 0.0001 on the scale of the AVC. If the vernier scale reading of the pointer is outside this range, the AVC should be adjusted by turning the rotor knob to form and adjusting the trimmer until the vernier scale reading of the pointer is within the range of 0 to 0.0001 on the scale of the AVC.

**NOTE E**

- In sets using the variable condenser, the adjustment of the AVC should be checked as follows: Turn the variable condenser to any position below or above the transmission frequency. The variable condenser should be turned so that the pointer is at the zero reading of the scale. The correct setting of the AVC will be verified by the vernier scale reading of the pointer as shown on the scale of the AVC. The vernier scale reading of the pointer should be within the range of 0 to 0.0001 on the scale of the AVC. If the vernier scale reading of the pointer is outside this range, the AVC should be adjusted by turning the rotor knob to form and adjusting the trimmer until the vernier scale reading of the pointer is within the range of 0 to 0.0001 on the scale of the AVC.
**WELLs-GARDNER & CO.**

### CONDENSERS

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Code</th>
<th>Capacitance</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4X100</td>
<td>C2</td>
<td>.06 mf.</td>
<td>160</td>
</tr>
<tr>
<td>4X105</td>
<td>C3</td>
<td>.01 mf.</td>
<td>360</td>
</tr>
<tr>
<td>4X117</td>
<td>C4</td>
<td>.04 mf.</td>
<td>180</td>
</tr>
<tr>
<td>4X211</td>
<td>C5</td>
<td>.25 mf.</td>
<td>360</td>
</tr>
<tr>
<td>4X311</td>
<td>C6</td>
<td>.01 mf.</td>
<td>180</td>
</tr>
<tr>
<td>4X378</td>
<td>C7</td>
<td>.5 mf.</td>
<td>340</td>
</tr>
<tr>
<td>4X400</td>
<td>C8</td>
<td>.04 mf.</td>
<td>180</td>
</tr>
<tr>
<td>4X411</td>
<td>C9</td>
<td>.04 mf.</td>
<td>500</td>
</tr>
</tbody>
</table>

### TUBULAR

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Code</th>
<th>Capacitance</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>47X56</td>
<td>C10</td>
<td>35 mmf.</td>
<td></td>
</tr>
<tr>
<td>47X76</td>
<td>C11</td>
<td>25 mmf.</td>
<td></td>
</tr>
<tr>
<td>47X65</td>
<td>C12</td>
<td>100 mmf.</td>
<td></td>
</tr>
<tr>
<td>47X64</td>
<td>C13</td>
<td>250 mmf.</td>
<td></td>
</tr>
</tbody>
</table>

### MOLDED

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Code</th>
<th>Capacitance</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>17A71</td>
<td>C1</td>
<td>2.25 mmf.</td>
<td></td>
</tr>
<tr>
<td>17A72</td>
<td>C2</td>
<td>2.25 mmf.</td>
<td></td>
</tr>
<tr>
<td>17A73</td>
<td>C3</td>
<td>2.25 mmf.</td>
<td></td>
</tr>
<tr>
<td>17A49</td>
<td>C4</td>
<td>4.5 mmf.</td>
<td></td>
</tr>
<tr>
<td>17A48</td>
<td>C5</td>
<td>4.5 mmf.</td>
<td></td>
</tr>
<tr>
<td>17A67</td>
<td>C6</td>
<td>150 mmf.</td>
<td></td>
</tr>
<tr>
<td>17A70</td>
<td>C7</td>
<td>55 mmf.</td>
<td></td>
</tr>
<tr>
<td>17A75</td>
<td>C8</td>
<td>55 mmf.</td>
<td></td>
</tr>
</tbody>
</table>

### ELECTROLYTIC

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Code</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>47X95</td>
<td>C9</td>
<td>.04</td>
</tr>
<tr>
<td>47X69</td>
<td>C10</td>
<td>.02</td>
</tr>
<tr>
<td>47X89</td>
<td>C11</td>
<td>.04</td>
</tr>
</tbody>
</table>

### MISCELLANEOUS

### RESISTORS

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4805</td>
<td>R1</td>
<td>150 Ohm</td>
</tr>
<tr>
<td>A45505</td>
<td>R2</td>
<td>500 Ohm</td>
</tr>
</tbody>
</table>

### TRANSFORMERS AND COILS

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12A107</td>
<td>C1</td>
<td>100 uf.</td>
</tr>
<tr>
<td>12A106</td>
<td>C2</td>
<td>100 uf.</td>
</tr>
</tbody>
</table>

### VOLTAGES AT SOCKETS

<table>
<thead>
<tr>
<th>TUBE</th>
<th>FUNCTION</th>
<th>Prong No. 1</th>
<th>Prong No. 2</th>
<th>Prong No. 3</th>
<th>Prong No. 4</th>
<th>Prong No. 5</th>
<th>Prong No. 6</th>
<th>Prong No. 7</th>
<th>Prong No. 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>6K7</td>
<td>R.F.</td>
<td>0</td>
<td>6.2(1)</td>
<td>245</td>
<td>110</td>
<td>2.5</td>
<td>6.2(1)</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>6J7</td>
<td>1st Det.</td>
<td>0</td>
<td>6.2(1)</td>
<td>245</td>
<td>114</td>
<td>0</td>
<td>6.2(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6C5</td>
<td>Osc.</td>
<td>0</td>
<td>6.2(1)</td>
<td>114</td>
<td>0</td>
<td>6.2(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6K7</td>
<td>I.F.</td>
<td>0</td>
<td>6.2(1)</td>
<td>245</td>
<td>118</td>
<td>2.5</td>
<td>6.2(1)</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>6H6</td>
<td>2nd Det.</td>
<td>0</td>
<td>6.2(1)</td>
<td>0</td>
<td>0</td>
<td>6.2(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6F5</td>
<td>1st A.F.</td>
<td>0</td>
<td>6.2(1)</td>
<td>155</td>
<td>0</td>
<td>6.2(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6F6</td>
<td>Power.</td>
<td>0</td>
<td>6.2(1)</td>
<td>230</td>
<td>245</td>
<td>16(3)</td>
<td>6.2(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5Y3G</td>
<td>Rectifier</td>
<td>0</td>
<td>5.0(4)</td>
<td>680(5)</td>
<td>680(5)</td>
<td>5.0(4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### VOLTAGE BETWEEN SOCKET PRONG AND GROUND (Unless otherwise indicated)

<table>
<thead>
<tr>
<th>TUBE</th>
<th>FUNCTION</th>
<th>Plate to Ground</th>
<th>Target to Ground</th>
<th>Cathode to Ground</th>
<th>Across Heater</th>
</tr>
</thead>
<tbody>
<tr>
<td>6G6</td>
<td>Tuning Indicator</td>
<td>20</td>
<td>245</td>
<td>0</td>
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</tbody>
</table>

**Note:**

1. A.C. voltage as read across heater terminals 2 and 7.
2. Bias (1.5 volts) as read across resistor R25.

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Wells-Gardner, Page 147
**32 Volt Power Supply**

This radio is designed for use on farms and in those places where the power supply consists of a 32 volt direct current generating plant.

**Polarity of Power Supply**

There is a red mark on the plug at the end of the power supply cord of the radio. The prong of the plug at which the red mark is placed must be plugged into the positive side of the line.

Use a receptacle on the 32 volt line from which the plug will not have to be removed after it has once been inserted correctly.

If the polarity of the line is not known, that is, if it is not known which side of the line is positive, a meter may be used to indicate the polarity. A voltmeter of 50 volt range or up is used. Connect the meter across the line. If the pointer deflects correctly, then the positive post of the meter is connected to the positive side of the line.

If the polarity of the line is not known and there is no way of determining it, insert the power supply plug, turn on the set, advance the volume control and proceed to tune the radio. If no sounds are heard from the speaker after the plug has been in two minutes, withdraw the plug, turn it around and re-insert it. This time sounds should be heard after the tubes have been heated.

**Caution**

If used on any other type of power supply than 32 volt DC, severe damage may be done to the receiver.

Do not turn the radio on unless all of the tubes and the dial lamps are in the proper sockets. Use only No. 51 bayonet pin base lamps.

Do not leave the plug inserted for more than five minutes if it is found that the radio does not operate.

**Line Voltage Range**

The radio will operate satisfactorily within a line voltage range of 25 to 42 volts.

**Series Resistor**

If the line voltage is higher than 42, it will be necessary to use a series resistor to cut it down. If the voltage varies, a variable resistor may be required.

**Starting Current**

When first turned on, the drain for a few seconds is slightly higher than normal until the tubes heat up. Some automatic plants are adjusted to start under a load of 200 to 300 watts. If a number of devices such as lights or motors are being used and the radio set is turned on, the total drain may be sufficient to start the plant.

**Dial Lamps**

For the dial lamps, No. 51 bayonet pin base lamps must be used. These lamps are part of one section of the tube heater circuit (See Fig. 7) and any other lamps having a different current drain would upset the voltage system of this section.
I. F. Adjustment

Set the signal generator for a signal of 456 KC.
Connect the output of the signal generator through a .1 mf. condenser to the grid of the 1st detector (G1).
Connect the ground lead of the radio to the ground post of the signal generator.
Turn the band switch to the Range B position (standard wave band).
Turn the volume control to the maximum position.
Attenuate the signal from the signal generator to prevent the levelling-off action of the AVC.
Then adjust the five I.F. trimmers until maximum output is obtained. The adjusting screws for these condensers are reached from the top of the chassis, and the location is shown in Fig. 3.

Range B Alignment

After the procedure for the alignment of each range, as explained below, is completed, it is advisable to repeat the procedure as a final check.

1730 KC Adjustment

Set the signal generator for 1730 KC.
Turn the rotor of the tuning condenser to the full open position.
Keep the band switch in the standard wave position.
Connect the antenna lead of the radio through a 200 mmf. condenser to the output of the signal generator.
For this and all subsequent adjustments keep the volume control at the maximum position and attenuate the signal from the signal generator to prevent AVC action.
Adjust the oscillator Range B trimmer (C32) until maximum output is obtained. The location of this trimmer is shown in Fig. 3.

1500 KC Adjustment

Set the signal generator for 1500 KC.
Turn the rotor of the tuning condenser carefully until maximum output is obtained.
Loosen the pointer screw and set the pointer at the 1500 KC mark on the standard wave band scale. Retighten the screw.
Adjust the interstage Range B trimmer (C110) and antenna Range B trimmer (C2) to maximum.
Do not change the setting of the oscillator Range B trimmer.

600 KC Adjustment

Set the signal generator for 600 KC.
Turn the tuning condenser rotor until maximum output is obtained.

Range D Alignment

CAUTION—When aligning the short wave band be sure NOT to adjust at the image frequency. This can be checked as follows: Let us say the signal generator is set for 15,000 KC. The signal will then be heard at 15,000 on the dial of the radio. The image signal, which is much weaker, will be heard at 15,000 less 912 KC, or 14,088 KC. It may be necessary to increase the input signal to hear the image.

16,000 KC Adjustment

Set the signal generator for 16,000 KC.
Connect the antenna lead of the radio through a 400 ohm resistor to the output of the signal generator.
Turn the rotor of the tuning condenser to the full open position.
Turn the band switch to the Range D position (short wave band).
Adjust the oscillator Range D trimmer (C31) until maximum output is obtained. See Fig. 3 for location of this trimmer.

15,000 KC Adjustment

Set the signal generator for 15,000 KC.
Turn the rotor of the tuning condenser carefully until maximum output is obtained.
Adjust the interstage Range D trimmer (C9) and antenna Range D trimmer (Cl) to maximum. When adjusting these trimmers, it will be necessary at the same time to turn the tuning condenser rotor slowly back and forth until the peak of greatest intensity is obtained.
Do not change the setting of the oscillator Range D trimmer.

6000 KC Adjustment

Set the signal generator for 6000 KC.
Turn the tuning condenser rotor until maximum output is obtained.
Turn the rotor slowly back and forth at the same time adjusting the 6000 KC (C28) trimmer until the peak of greatest intensity is obtained. See Fig. 3 for location of this trimmer.
Wells-Gardner & Co.

Voltages

Check the voltages at the sockets to see if correct values are being delivered to the tubes. The antenna and ground should be disconnected and the antenna and ground leads from the set connected together. The volume control should be turned to the right or maximum position.

The voltage chart gives the voltages with all tubes in, the speaker connected and the set in operating condition. These voltages are typical of the sets but will vary slightly with variations in individual radios, tubes, test equipment used and battery voltage.

Fig. 5—Abridged wiring diagram showing filament wiring system and points at which no-signal bias voltages are obtained.

Tubes

The tubes used in this radio are of the 2 volt series. All of them are of the filament or directly heated types. The filaments are connected in the series-parallel arrangement shown in Fig. 5.
The radio is properly aligned at the factory with precision instruments and realignment should not be attempted unless all other possible causes of the faulty operation have first been investigated and unless the service technician has the proper equipment.

A signal generator that will provide an accurately calibrated signal at 416, 1750, 1900, 500, 6700, 6000, 2400, 16000, 17000 and 6800 kc and an output indicating meter is required. It will be practically impossible to align the receiver if unsatisfactory apparatus is used.

The complete procedure is as follows:

1. F. Adjustment

Set the signal generator for a signal of 416 kc. Connect the output of the signal generator through a 45 pf condenser to the grid of the 1st detector Gp.

Connect the ground lead of the receiver to the ground post of the signal generator.

Turn the band switch to the Range B position (standard wave band).

Turn the volume control to the maximum position.

Adjust the trimmer for the oscillator Range B trimmer (C2) to maximum output. The location of this trimmer is shown in Fig. 3.

7500 KC Adjustment

Set the signal generator for 7500 kc. Connect the antenna lead of the receiver through a 100 mmf condenser to the output of the signal generator.

For this and all subsequent adjustments keep the volume control at the maximum position and attempt to get the signal from the signal generator to prevent AVC action.

Adjust the oscillator Range B trimmer (C1) until maximum output is obtained. The location of this trimmer is shown in Fig. 3.

6000 KC Adjustment

Set the signal generator for 6000 kc. Turn the tuning condenser until maximum output is obtained. Turn the rotor slowly back and forth at the same time adjusting the 6000 kc trimmer until the peak of greatest intensity is obtained. See Fig. 3 for location of this trimmer.

Range C Alignment

CAUTION—When adjusting the short wave bands be sure NOT to adjust at the image frequency. This can be checked as follows: Let us say the signal generator is set for 5000 kc. The signal will then be heard at 6000 kc being the difference of the two signals. The image signal, which is much weaker, will be heard at 10000 kc plus 912 kc, or 10912 kc. It may be necessary to increase the input signal to hear the image.

6700 KC Adjustment

Set the signal generator for 6700 kc. Connect the antenna lead of the receiver through a 400 mmf condenser to the output of the signal generator.

When the rotor of the tuning condenser is on the 6700 kc trimmer the signal generator is adjusted to 6000 kc. When setting the 6700 kc trimmer the signal generator is being adjusted to 6700 kc. The trimmer is then adjusted for maximum output. See Fig. 3 for location of this trimmer.

General Service Data

Planetary Drive Assembly

The planetary assembly is the unit that is integral with the tuning shaft.

If the nut on the back end of this assembly is too tight, the drive will be jerky and will turn hard in high speed. If this condition exists, back off this nut one or two turns and note the effect.

If this nut is too loose, the drive will slip in slow speed. The remedy in this case, of course, is to tighten the nut.

Should the condenser drive cord slip when the planetary pulleys is turning, inspect the tuning condenser, slider and gears to see that they are turning properly and that they are not being obstructed in any way.

Circuit

The band switch connects to the code in use. In short circuits the R.F. transformer secondary and the coil grid cutoffs of lower frequencies not in use. In short circuits the interstage R.F. transformer Range B and C primaries when in the Range D position. The Range D oscillator plate coil is short circuited by the band switch when in the Range B and C positions.

The antenna transformer with tuned secondary feeds into a type 34, R.F., amplifier tube. The output of this tube is fed through the interstage R.F. transformer with tuned secondary into the control grid screen of a '6G5' cathode follower tube. The cathode follower tube is the oscillator and 1st detector.

The oscillator grid on the oscillator control grid of this tube modulates the electron stream from the cathode in such a manner as to impress on it the oscillator frequency which is always 46 kc above the frequency to which the R.F. transformer is tuned.

The electron stream is also modulated by the detector control grid. As a result of the beating of the two frequencies, the intermediate or beat frequency of 416 kc is present in the plate circuit of this tube.

Two stages of R.F. amplification are employed using type 34 tubes. The primaries and secondaries of the first and second R.F. transformers and the primary of the 3rd R.F. transformer are tuned by small trimmer condensers.

A type 3 tube functions as a doubling detector and as the automatic volume control tube. A.V.C. voltage is applied to the R.F. and 1st I.F. tubes.

The audio voltage developed across the volume control resistor is applied to the control grid of the type 30 1st A.F. tube.

The output stage employs a type 19 tube. This tube is a Class "B" power amplifier and combines 2 triodes in one envelope. A P.M. dynamic reproduction is used.

Filament Wiring—Fig. 5 is an abridged wiring diagram showing the tube filament and dial lamp wiring system and also indicates the points at which the no-signal bias voltages are obtained.

Synchronous Vibrator—The action of the synchronous vibrator used in the power unit is shown in the abridged wiring diagram Fig. 6. When the switch is closed, the armature is driven over as a result of the current through the armature coil. When this occurs, the two contacts at the lower right side of the armature are closed and the circuit through the vibrator coil is broken. The spring action then causes the armature to spring back and the two contacts at the lower left side are closed. This circuit, through the vibrator coil, is again completed and the armature is drawn over to start the motor again, etc.

The "A" current (heavy lines, Fig. 6) flows through the armature and back, through the winding of the motor and then through the other side in the opposite direction. The voltage is then rectified to standard or a result. That portion of the structure shown in heavy lines receives the current in the secondary circuit.
Switch Contact Location Numbering

A standard arrangement for switch contact location numbering has been adopted. This numbering is illustrated in Fig. 2. In contact locations not used, the number applying to that particular location is not employed.

Servicing Power Unit

The power unit is that portion of the chassis assembly contained within the large rectangular shield can and the circuit for which is shown within the dotted lines at the lower right side of the schematic diagram, Fig. 2.

Continuity Resistance Check—The power transformer, choke coil circuits and condenser shorts may be checked by utilizing the vibrator socket terminals and various points on the "A" or "B" lines, without removal of the shield can. For example: when checking the continuity or resistance of the upper half of the transformer secondary, contact may be made with the test prods at the proper vibrator socket terminal, as shown on the circuit diagram, and at the positive terminal of the 20 mfd electrolytic condenser, C44.

Removing Transformer and Vibrator Socket Assembly—Take off the filter unit shield can by removing the four self tapping screws at the right side (from front) of the chassis base and the five hex nuts from the bolts at the top of the chassis.

Unsolder the ground connections from the two lugs on the inside of the chassis base (right side from front). Unsolder the black and white coded wire from the terminal strip lug nearest the front of the chassis. This terminal strip is mounted on the transformer cover. Now unsolder the bracket holding the terminal strip to the transformer cover.

Remove the four nuts from the bolts holding the transformer assembly to the chassis. Do not remove these bolts from the transformer core. Then lift the assembly to free it from the chassis so that all parts of the assembly are readily accessible.

Proceed with replacement of the power transformer or with any other necessary service or replacements and then reassemble.

Replacement of Buffer Condenser C54—This condenser is located in the top of the transformer and vibrator assembly just underneath the vibrator socket. To replace, remove the assembly as explained in the preceding article.

In addition, the two screws holding the vibrator socket to the transformer cover assembly should be taken out. The condenser is then easily replaced.

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OPERATING THE RECORD MAKER

1. TO MAKE A RECORD FROM A RADIO PROGRAM

A. -Lift up hook on front support post and move indicator to Manual position.
B. -Recorder arm in rest position—See Fig. 2.
C. -Tone arm in rest position—See Fig. 1.
D. -Microphone Volume Control in OFF position—See Fig. 2.
E. -P.A.-Record Switch in RECORD position—See Fig. 2.
F. -Phono-Radio Knob (On radio panel) in PHONO position.
G. -Place in the desired radio program carefully to room volume.
H. -Place a blank record disc on the turntable with the label end in the turntable extending through the hole in the disc.
I. -The Tone Control on the radio panel should, for most recordings, be in the TREBLE position.
J. -Lift the cutting end of the recorder arm at the 7 O’CLOCK position to a straight-forward direction about 1/4 inch from the center of the cut out on the record. Move the recorder arm to the desired position and leave it in this position. When the cutting needle is properly in place the article “Cutting Needles” page 5.) The volume of the radio program will be reduced. Bring the cutting needle to the Radio Volume Control until the red indicator light, at left of the microphone volume control, just flashes on loud passages. Then back the volume down a slight amount in the ON position. Make the same light does not flicker.
K. -Push the Motor Switch to the ON position (Fig. 3) and allow the turntable to come up to full speed.

L. -Grap and rotate recorder arm towards turntable and carefully let it down with the needle point on the blank record about 1/4 inch from the outside edge of the blank record.
M. -Watch the volume indicator light as the recording is being made. It is not necessary to continuously adjust the position of the Radio Volume Control—probably make sure that the red light does not flicker. A slight flicker on very loud passages only will not be harmful.
N. -The thread which forms at the cutting needle may be polished away with a soft brush while the record is being cut. Considerable care must be taken that the operator does not damage the thread cut with the cutting needle or that he does not allow up the turntable by touching it with his hands, as either condition will cause poor recordings. After the recording is completed, remove the thread from the record.
O. -The record can be cut until the cutting needle is about 1/4 inches from the center of the record or until a short distance before the paper label is reached. Shortly before the needle reaches its final position, reduce the volume to zero with the Radio Volume Control (without turning the knob to the OFF position). Then lower the cutting needle to the blank grooves on the record. Then return the recorder arm to the rest position by lifting to the height of about 90° (Fig. 11). Rotate it counterclockwise as far as it will go and then let it down on the record. Push the Motor Switch Knob to the OFF position.

Turn the Microphone Volume Control past the point at which the speaker is to be turned on to the halfway mark. This will turn on the microphone and start the music of the microphone.

2. TO MAKE A RECORD USING THE MICROPHONE

A. -Place a blank record disc on the turntable with the label end in the turntable extending through the hole in the disc.
B. -The Tone Control on the radio panel should, for most recordings, be in the TREBLE position.
C. -Keep the microphone at least one foot away from the radio loudspeaker at all times. If the recording is made at 4 inches for cutouts away from the microphone. If the microphone is to be used at a slight distance, place the microphone near the sound source, moving it closer or further away as the volume requirements.
D. -Lift the cutting end of the recorder arm, at the same time as the tone arm. Then lift the hand to the cut. Then the cutting needle is properly in place (see article “Cutting Needles”, page 31).

N. -Rotate the record arm and carefully let it down with the needle point on the blank record about 1/4 inch from the outside edge of the blank record.
O. -After 1 or 2 blank grooves have been cut in the record, start the speaker. Place the microphone within about 3 feet of the speaker and turn the volume control up to the halfway mark. The volume indicator light will turn off. Then turn the microphone Volume Control until the speaker and sound are picked up by the red indicator light to flicker. Then the cut the microphone Volume Control down slowly until the red light just disappears.

R. -In reducing the microphone volume, the knob is turned below the point at which the switch is turned on to the halfway mark. This will turn on the microphone and start the music of the microphone.
S. -The thread which forms at the cutting needle may be polished away with a soft brush while the record is being cut. Considerable care must be taken that the operator does not damage the thread cut with the cutting needle or that he does not allow up the turntable by touching it with his hands, as either condition will cause poor recordings. After the recording is completed, remove the thread from the record.
T. -The record can be cut until the cutting needle is about 1/4 inches from the center of the record or until a short distance before the paper label is reached. Shortly before the needle reaches its final position, reduce the volume to zero with the Radio Volume Control (without turning the knob to the OFF position). Then lower the cutting needle to the blank grooves on the record. Then return the recorder arm to the rest position by lifting to the height of about 90° (Fig. 11). Rotate it counterclockwise as far as it will go and then let it down on the record. Push the Motor Switch Knob to the OFF position.

3. TO PLAY BACK THE HOME RECORDING: TO PLAY ORDINARY PHONOGRAPH RECORDS

The record made in Articles 1 and 2 may be played back immediately.

B. -Tone arm in rest position—See Fig. 1.
C. -Microphone Volume Control in ON position.
D. -P.A.-Record Switch in P.A. Position.
E. -Phono-Radio Knob (On radio panel) in PHONO position.
F. -Insert plug in the cutout end of the microphone cord in the microphone socket (Fig. 2) on the motor panel and push this plug all the way down.
G. -Turn the Radio On-Off Switch (On the radio panel) to the ON position.
H. -Turn the Microphone Volume Control to about 1/4. Balance the speaker volume to give an equal sound level at the microphone and the speaker. Reduce the radio or phonograph volume by means of the Radio Volume Control when making an announcement.

5. TO USE THE MICROPHONE FOR MAKING ANNOUNCEMENTS WHEN PLAYING THE RADIO OR PHONOGRAPH

Follow all the steps as given in Article 4 except that for radio reception the Phonophone Radio is in PHONO position.

6. TO USE THE MICROPHONE FOR SUPERIMPOSING AN ANNOUNCEMENT ON THE RECORD AT ANY TIME WHEN MAKING A RECORD OF A RADIO PROGRAM

A. -Be sure P.A.-Record Switch is in RECORDER position.
B. -Insert the plug in the cutout end of the microphone cord in the microphone socket (Fig. 2) on the motor panel and push this plug all the way down.
C. -Reduce the volume of the microphone to about 1/4 inch from the outside edge of the blank record. Reduce the radio or phonograph volume by means of the Radio Volume Control when making an announcement.
D—If an announcement or title is to be inserted, reduce the volume of the radio program with the Radio Volume Control to any desired level, just before the announcement is to be made or the title is to be put in.

If a musical instrument or dramatic voice is to be used to accompany the radio program, the latter may be recorded with the aid of the Microphone Volume Control, or may be left at normal volume.

8—Turn the Microphone Volume Control up to just below the point at which the speaker is driven to the punch. This will be about the middle of the half-tone mark on the control. (Continuing to turn this knob clockwise the sound will throw on the switch, and the sound could no longer be heard through the radio speaker but the recording would continue.)

F—Speak or start the sound on the microphone and observe the indicator light. To increase volume, speak louder and get closer to the microphone, or decrease volume, of course, reverse these procedures and turn down the Microphone Volume Control. Keep volume just below point at which red indicator lights flash.

Q—When the announcement or accompaniment is completed, turn the Microphone Volume Control to the OFF position and if additional radio program recording is wanted, turn up the Radio Volume Control to just below the point at which the red indicator lights flash.

7. TO MAKE A RECORD FROM ANOTHER RECORD WITH AN ELECTRIC RECORD PLAYER CONNECTED TO RADIO

If you have an electric record player, play the record to be copied on this record player, remove the phonograph from the back of the record changer, and insert plug from electric record player into phone socket. (See Fig. 4.)

Follow all the instructions as given in Article 1, except that radio-phonograph on the record should be in the PHONE position.

RECORDING TECHNIQUE

Making records has been likened to popular photography. It takes time to master the essentials of the art and learn how to do a real good job. The Federal Record-Raker has been so simplified that any one can start making satisfactory records right away, but to make the best, it is necessary to learn more of the technique of the art.

Follow the step-by-step instructions as given in this booklet, slowly and carefully. Track 7, page 11-17.

ADDITIONAL INFORMATION

RECORDING NEEDLES

IMPORTANT—Use only long-shank recording needles.

Handle recording needles carefully. They are very sharp and can be easily damaged. Every precaution must be taken to protect the cutting point at all times; in cutting, the arm should be lowered gently on the blank with the turntable running.

Note: These needles have a long "flat" on one side of the shank. To install a recording needle, first loosen the needle screw—see Fig. 2. Place the recording needle all the way on the undersurface of the record arm, with the flat portion of the needle shank toward the needle screw. Tighten the needle screw firmly. If the needle is in the wrong position or at an angle, it will not cut properly, and will damage the record and the needle.

A recording needle is considered worn when the background has become objectionable or when the thread becomes ragged. In general, the ordinary steel recording needle will have a satisfactory life from 11/2 to 2 hours, depending upon the original quality of the needle and the type of blank used.

Important: After a recording needle has been used for a short time, it may become loose in the cutting head. It is good practice to retain it all around recording.

TIMING YOUR RECORDS

The following is an approximate maximum time for each record:

3' size: Each side 1 1/2 min.

4' size: Each side 3 min.

10' size: Each side 5 1/2 min.

For best results, you should record your selection and time it for recording. This will permit you to space your selection nicely on the record and also insure against running up the record before your selection is finished. After your selection is finished, do not lift the needle all once but allow it to cut several extra grooves while you remain silent.

ADJUSTING THICKNESS OF THREAD (PRESSURE ADJUSTMENT)

The pressure on the cutting needle can be varied by the adjusting knob located inside the cutting arm, shown in Fig. 3. This pressure determines the thickness of the thread cut from the blank record.

All records are adjusted at the factory to cut grooves approximately 0.005 inches deep. When cut at this depth, the thread will be approximately as thick as a human hair.

You can get a fairly good idea of the depth of the cut by examining the record with a magnifying glass. The width of the groove should be about equal to the space between grooves if the cutting needle is sharp and the cutting head is correctly adjusted.

The thickness of the thread is increased by rotating the pressure adjusting knob in a clockwise direction, while looking down on arm. See Fig. 3. Turning this counter-clockwise will decrease the thickness of the thread. Before making any pressure adjustment, be sure that a good cutting needle is used and that it is properly inserted.

ADJUSTING HEIGHT OF RECORDER ARM

In Fig. 3 is shown the screw and locking nut for adjusting the height of the recorder arm above the turntable. This height is adjusted at the factory and ordinarily does not require readjustment.

To check for proper height, grasp the record screw and lift until the cartridge assembly is felt to hang from the recorder arm. The needle point will then be approximately 1/4 inch above the record surface.

If, by variation in the recording needle length, the height must be adjusted, loosen the locking nut, adjust the screw to the proper height and retighten the nut.

REPLACE PARTS LIST
WESTERN AUTO SUPPLY CO.

FOR CONVENTIONAL ALIGNMENT SEE
SPECIAL SECTION OF VOLUME V111

MODEL D721 Early
MODEL D909

MODEL D721

MODEL D909

FOR CONVENTIONAL ALIGNMENT SEE
SPECIAL SECTION OF VOLUME V111

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MODEL D746
2nd Production

TRUETONE PAGE 14-3

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**Models D1109, D2106**

**Bottom View of Chassis**

Voltages marked at socket terminals are measured with 1000 ohm per volt meter, on off volt line with no signal.

**Rear of Chassis**

**Parts List and Prices**

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<tr>
<td>580</td>
<td>C3</td>
<td>Condenser—Paper .05 mfd—200V</td>
<td>0.20</td>
<td>9016</td>
<td>L4</td>
<td>Transformer 2nd I.F.</td>
<td>1.75</td>
</tr>
<tr>
<td>1286</td>
<td>C7</td>
<td>Condenser—Mica 250 mfd</td>
<td>0.20</td>
<td>9017</td>
<td></td>
<td>Speaker—4&quot; P. M.</td>
<td>2.50</td>
</tr>
<tr>
<td>8036</td>
<td></td>
<td>Cord—AC Line</td>
<td>0.25</td>
<td>9018</td>
<td></td>
<td>Carton</td>
<td>0.60</td>
</tr>
</tbody>
</table>

**Prices Subject to Change Without Notice**

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ALIGNMENT PROCEDURE

- **Volume control—Maximum all adjustments.**
- **Connect radio chassis to ground post of signal generator with a short heavy lead.**
- **Connect dummy antenna value in series with generator output lead.**
- **Connect output meter across primary of output transformer.**
- **Allow chassis and signal generator to "heat up" for several minutes.**

The following equipment is required for aligning:

- An all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed.
- Output indicating meter.
- Non-metallic screwdriver.
- Dummy antenna—1 ft, 200 muf.

**BAND**

<table>
<thead>
<tr>
<th>Frequency Setting</th>
<th>Antenna</th>
<th>Connection to Radio</th>
<th>Variable Condenser Setting</th>
<th>Trimmer Adjusted to Use ( \text{in} ) Order Given</th>
<th>Adjust to maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>455 KC. 1 MFD.</td>
<td>INSIG</td>
<td>Grid at 1/4AG tube</td>
<td>Rotor full open (Plates out of mesh)</td>
<td>Two trimmers on top (See Fig. 1)</td>
<td>Output L.F.</td>
</tr>
</tbody>
</table>

**I.F.**

<table>
<thead>
<tr>
<th>Frequency Setting</th>
<th>Antenna</th>
<th>Connection to Radio</th>
<th>Variable Condenser Setting</th>
<th>Trimmer Adjusted to Use ( \text{in} ) Order Given</th>
<th>Adjust to maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>455 KC. 1 MFD.</td>
<td>INSIG</td>
<td>Grid at 1/4AG tube</td>
<td>Rotor full open (Plates out of mesh)</td>
<td>Two trimmers on top (See Fig. 1)</td>
<td>Input L.F.</td>
</tr>
</tbody>
</table>

**BROAD.**

<table>
<thead>
<tr>
<th>Frequency Setting</th>
<th>Antenna</th>
<th>Connection to Radio</th>
<th>Variable Condenser Setting</th>
<th>Trimmer—Top of front section of gang Oscillator</th>
<th>Adjust to maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1750 KC. 200 muf.</td>
<td>INST</td>
<td>Antenna lead</td>
<td>Rotor full open (Plates out of mesh)</td>
<td>Trimmer—Top of rear section of gang Antenna</td>
<td>See Fig. 3</td>
</tr>
</tbody>
</table>

**CAST.**

<table>
<thead>
<tr>
<th>Frequency Setting</th>
<th>Antenna</th>
<th>Connection to Radio</th>
<th>Variable Condenser Setting</th>
<th>Trimmer—Top of rear section of gang Antenna</th>
<th>Adjust to maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400 KC. 150 muf.</td>
<td>INST</td>
<td>Antenna lead</td>
<td>Set dial at 1400 KC</td>
<td>Trimmer—Top of rear section of gang Antenna</td>
<td>See Fig. 3</td>
</tr>
</tbody>
</table>

This is all that is necessary for the alignment unless the plates of the gang have been bent out of shape. In case of bent plates, set the signal generator and receiver to 500 KC. and bend the plates into the position for maximum output. The signal from the signal generator must prevent the leveling off action of the AVC After each band is completed, repeat the procedure as a final check.

**Power output 27 watt undistorted—35 watt maximum.**

Intermediate Frequency 455 KC.

**Frequency Range**

35 to 1750 KC.

**Oscillator Coil (Part No. 2412) (Red Dot).**

Looking at the connection end (with dot) starting at the chassis in a clockwise direction the terminals are: No. 1, AVC, No. 2, grid; No. 3, Ant., No. 4, ground. No. 4 is grounded to the mounting bracket.

Primary—No. 1 and No. 2—Resistance 2.2 ohms.
Secondary—No. 1 and No. 4—Resistance 245 ohms.

A grommet coil of 5.5 mfd. connects to terminals No. 2 and No. 3.

**Secondary L.F. Transformer (Part No. 2160).**

Primary—Blue white, plate: red white B+—Resistance 15.1 ohms.
Secondary—White, grid; black white, AVC—Resistance 11.8 ohms.

**First L.F. Transformer (Part No. 3548).**

Primary—Blue white, plate: red white B+—Resistance 12.1 ohms.
Secondary—White, grid; black white, AVC—Resistance 24.9 ohms.
ALIGNMENT DATA  
MODELS D-1125 and D-2121

To properly align, first align the I. F. transformers in the conventional manner applying a test oscillator adjusted to 456 kc through a .1 MFD condenser to the grid of 1A7 with tuning condenser at minimum capacity. For the balance of alignments it is advisable to remove chassis from cabinet and suspend the loop above the chassis by means of a cord maintaining same relative position it would normally occupy in the cabinet. The test oscillator is coupled very loosely to the loop, one means is to drape the lead from oscillator over the loop so that it is near the loop winding but not necessarily touching. The trimmer of oscillator (center section) is then adjusted to 1650 kc with the plates completely out of mesh. The antenna and R. F. sections are trimmed at 1500 kc. The padder is adjusted to 600 kc. The tuning condenser is rocked while the padder is being adjusted for maximum output.

ALIGNMENT CHART FOR MODELS D1126 and D1144

<table>
<thead>
<tr>
<th>Generator</th>
<th>Connection at Radio</th>
<th>Dummy Antenna</th>
<th>Range Switch</th>
<th>Dial</th>
<th>Trimmers to Tune</th>
<th>Sensitivity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. F. 416 K.C.</td>
<td>Center Motor of Variable</td>
<td>.1 MFD</td>
<td>A</td>
<td>H. F. Red</td>
<td>J. F. Transformers</td>
<td>60-70 MV</td>
<td>Note to Max</td>
</tr>
<tr>
<td>B. C. 131 K.C.</td>
<td>Antenna</td>
<td>100 M.MF.</td>
<td>A</td>
<td>H. F. Limit of Travel</td>
<td>B. C. Oscillator</td>
<td>See Note A</td>
<td></td>
</tr>
<tr>
<td>1400 K.C.</td>
<td>Antenna</td>
<td>200 M.MF.</td>
<td>A</td>
<td>1490</td>
<td>B. C. B. F. and Loop</td>
<td>3.5 MV</td>
<td>See Note A</td>
</tr>
<tr>
<td>600 K.C.</td>
<td>Antenna</td>
<td>200 M.MF.</td>
<td>A</td>
<td>Rock Rotor</td>
<td>Padder</td>
<td>1.5 MV</td>
<td>See Note A</td>
</tr>
<tr>
<td>P. D. 6.0 M. C.</td>
<td>Antenna</td>
<td>400 Ohm</td>
<td>B</td>
<td>6.0 M. C.</td>
<td>B. D. Osc.</td>
<td>35 MV</td>
<td>See Note B</td>
</tr>
<tr>
<td>3.2 M. C.</td>
<td>Antenna</td>
<td>400 Ohm</td>
<td>B</td>
<td>2.5 M. C.</td>
<td>P. D. Ant.</td>
<td>40 MV</td>
<td>See Note B</td>
</tr>
<tr>
<td>21M. 14 M. C.</td>
<td>Antenna</td>
<td>400 Ohm</td>
<td>C</td>
<td>9.4 M. C.</td>
<td>21M. Osc.</td>
<td>56 MV</td>
<td>See Note B</td>
</tr>
<tr>
<td>21M. 11.4 M. C.</td>
<td>Antenna</td>
<td>400 Ohm</td>
<td>D</td>
<td>11.4 M. C.</td>
<td>21M. Osc.</td>
<td>56 MV</td>
<td>See Note B</td>
</tr>
<tr>
<td>18M. 15.4 M. C.</td>
<td>Antenna</td>
<td>400 Ohm</td>
<td>E</td>
<td>15.4 M. C.</td>
<td>18M. Osc.</td>
<td>30 MV</td>
<td>See Note B</td>
</tr>
</tbody>
</table>

Note “A” — If the pointer is not at 1400 KC with a 1400 KC signal it may be loosened from the dial cord and moved to correct the calibration. This should be checked across the band to arrive at the optimum condition.

Note “B” — Care should be taken not to align on the image frequency. This may be checked by rotating the dial of the signal generator. Another signal should be heard at dial frequency plus 112 kc. This signal should be checked carefully on all short wave bands, making sure the lowest frequency signal agrees with the dial setting in frequency and that it is the strongest of the two.
TRUETONE PAGE 14-9

Fig. 1—Top View

VOLTAGE CHART

All voltages measured with a 1,000 ohm per volt meter on 150 volt scale. For the following voltages the "B" battery section of the power pack should read 9.15 volts under load.

1A7 TUBE

| Plate—P—to ground | 864 |
| Screen—G3 to ground | 31 |
| Grid—G1 to ground | — |
| Grid—G2 to ground | 864 |

INSG

| Plate—P—to ground | 864 |
| Screen—G3 to ground | 31 |

INSG

| Plate—P—to ground | 864 |
| Screen—G3 to ground | 31 |

Antenna Coil (Part No. P4572) 4" PM Type

D.C. voice coil resistance: 2.3 ohms
Voice coil impedance at 400 cycles: 6.0 ohms

Alignment Procedure

- Volume control: Maximum all adjustments.
- Connect radio chassis to ground post of signal generator with a short heavy lead.
- Connect dummy antenna value in series with generator output lead.
- Connect output meter across primary of output transformer.
- Allow chassis and signal generator to "heat up" for several minutes.
- The following equipment is required for aligning:
  - An all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed.
  - Output indicating meter.
  - Non-metallic screwdriver.
  - Dummy antennas—1 ml, 200 mfd.

<table>
<thead>
<tr>
<th>BAND</th>
<th>SIGNAL GENERATOR</th>
<th>TRIMMER ADJUSTED</th>
<th>TRIMMER ADJUSTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.F.</td>
<td>455 KC.</td>
<td>Grid of INSG tube (Plates out of mesh)</td>
<td>Two trimmers on top I.F.</td>
</tr>
<tr>
<td></td>
<td>455 KC.</td>
<td>Grid of INSG tube (Plates out of mesh)</td>
<td>Two trimmers on top I.F.</td>
</tr>
<tr>
<td>BROAD</td>
<td>1700 KC.</td>
<td>Antenna lead</td>
<td>Rotor full open (Plates out of mesh)</td>
</tr>
<tr>
<td>CAST</td>
<td>1400 KC.</td>
<td>Antenna lead</td>
<td>Set dial at 1400 KC.</td>
</tr>
</tbody>
</table>

This is all that is necessary for the alignment unless the plates of the gang have been bent out of shape. In case of bent plates, set the signal generator and receiver to "0000" and head the plates into the position for maximum output. Attenuate the signal from the signal generator to prevent the leveling-off of the AVC. After each band is completed, reset the procedure as a final check.

Intermediate Frequency 455 K.C.

Oscillator Coil (Part No. 2412) (Red Dot)

Looking at the connection end (with dot) starting at the chassis in a clockwise direction, the terminals are: No. 1, Ant.; No. 2, grid; No. 3, Amt.; No. 4, ground. No. 4 is grounded to the mounting bracket.

Primary—No. 3 and No. 4—Resistance 246 ohms
Secondary—No. 1 and No. 2—Resistance 2.2 ohms
A gimmick coil of 3.3 nanofarads connects to terminals No. 2 and No. 3.

Second I.F. Transformer (Part No. F2606)

Primary—Blue white; plate; red white B—Resistance 15.1 ohms
Secondary—White grid; black white, AVC—Resistance 11.8 ohms

First I.F. Transformer (Part No. F3048)

Primary—Blue white, plate; red white B—Resistance 12.1 ohms
Secondary—White grid; black white, AVC—Resistance 24.9 ohms
When removing the chassis it is first necessary to remove the "Protector Switch" located on the left side of the cabinet. When checking the chassis on AC or DC it is necessary to insert a piece of metal similar to the one on the cardboard back into the "Protector Switch" to close the line circuit.

Speaker (Part No. P5001) 8" PM Type.

D.C. voice coil resistance 53 ohms
Voice coil impedance at 400 cycles 60 ohms

B.C. and S.W. Oscillator Coil (Part No. P 4560)

In a clockwise direction starting at the mounting lug on the left side as single lug on other end, the connections are: No. 1; plate; No. 2; lead; No. 3; S.W. pad; No. 4; B.C. pad; No. 5; grid; No. 6; switch; other end; No. 7; B.C.

S.W. Primary-No. 1 and No. 6—Resistance 8 ohm
B.C. Primary-No. 7 and No. 6—Resistance 3.8 ohm
S.W. Secondary-No. 2 and No. 3—Resistance 0.05 ohm
B.C. Secondary-No. 5 and No. 4—Resistance 4.5 ohm

First I.F. Transformer (Part No. P 4569)
Primary—Blue white, plate; red white B+—Resistance 121 ohms
Secondary—White, grid; black white, AVC—Resistance 24.9 ohms

Second I.F. Transformer (Part No. P 4490)
Primary—Blue white, plate; red white B+—Resistance 151 ohms
Secondary—White, grid; black white, AVC—Resistance 11.8 ohms

B.C. and S.W. Antenna Coil (Part No. P4582)

Starting with the lug that is connected to ground lead in a clockwise direction, the terminals are: No. 1; ground; No. 2; cond.; No. 3; lead; No. 4; grid; No. 5; grid; No. 6, ant.

S.W. Primary-No. 6 and No. 2—Resistance 35 ohm
B.C. Primary-No. 1 and No. 2—Resistance 241 ohms
S.W. Secondary-No. 3 and No. 4—Resistance 0.07 ohm
B.C. Secondary-No. 3 and No. 5—Resistance 29 ohms

When checking the "Protector Switch" set it to ground and bring the lug to be tested to the terminal on the chassis with the lug removal/insertion switch pushed in. To test for resonance use an oscilloscope or a frequency counter. First test full signal in normal broadcast position. AC

**Installation and Operation**

1. **Power ON-OFF Switch**
   - Switch to "ON" to turn on the receiver

2. **Volume Control and On-Off Switch**
   - Adjust to desired volume level

3. **Switch to "OFF" to turn off the receiver

**Voltage Chart**

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A8G Tube</td>
<td>90 VAC</td>
</tr>
<tr>
<td>1A8G Tube (Main)</td>
<td>100 VAC</td>
</tr>
<tr>
<td>1A8G Tube (Sub)</td>
<td>110 VAC</td>
</tr>
<tr>
<td>3AG Tube</td>
<td>97 VAC</td>
</tr>
<tr>
<td>3AG Tube (Main)</td>
<td>100 VAC</td>
</tr>
</tbody>
</table>

**Condenser Value**

- 0.01 µF (100 VAC)
- 0.04 µF (500 VAC)
- 0.1 µF (1000 VAC)
- 0.25 µF (2000 VAC)
- 0.5 µF (5000 VAC)
- 0.1 µF (10000 VAC)
- 0.25 µF (20000 VAC)
- 0.5 µF (50000 VAC)
- 1 µF (100000 VAC)

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WESTERN AUTO SUPPLY CO.

**CIRCUIT LIST**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>List Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>9032</td>
<td>L-1 Coil-Loop Antenna Assembly</td>
<td>1.00</td>
</tr>
<tr>
<td>8031</td>
<td>L-2 Coil-Oscillator</td>
<td>.80</td>
</tr>
<tr>
<td>8051</td>
<td>R-6 Control-Volume and Switch</td>
<td>1.00</td>
</tr>
<tr>
<td>8033</td>
<td>C-1 Condenser-Variable</td>
<td>2.00</td>
</tr>
<tr>
<td>8525</td>
<td>C10, C11 Condenser-Elect.</td>
<td>1.00</td>
</tr>
<tr>
<td>824</td>
<td>C-8 Condenser-Paper .002 mfd.-400V</td>
<td>.20</td>
</tr>
<tr>
<td>583</td>
<td>C-3 Condenser-Paper .01 mfd. -400V</td>
<td>.20</td>
</tr>
<tr>
<td>576</td>
<td>C-9 Condenser-Paper .02 mfd.-400V</td>
<td>.20</td>
</tr>
<tr>
<td>580</td>
<td>C-2 Condenser-Paper .05 mfd.-200V</td>
<td>.20</td>
</tr>
<tr>
<td>572</td>
<td>C-4 Condenser-Paper .1 mfd.-200V</td>
<td>.20</td>
</tr>
<tr>
<td>1285</td>
<td>C-5, C-7 Condenser-Mica 250 mfd.</td>
<td>.20</td>
</tr>
<tr>
<td>8039</td>
<td>R-1, R-7 Resistor 1/3 W-15 Meg.</td>
<td>.15</td>
</tr>
<tr>
<td>8062</td>
<td>R-3 Resistor 1/3 W-3 Meg.</td>
<td>.15</td>
</tr>
<tr>
<td>6722</td>
<td>R-9, R-10 Resistor 1/3 W-1/4 Meg.</td>
<td>.15</td>
</tr>
<tr>
<td>7121</td>
<td>R12 Resistor 1/3 W-200M</td>
<td>.15</td>
</tr>
<tr>
<td>8393</td>
<td>R-8 Resistor 1 W-2 M.</td>
<td>.20</td>
</tr>
<tr>
<td>7325</td>
<td>R-11 Resistor 1/4 W-150 ohm</td>
<td>.15</td>
</tr>
<tr>
<td>6721</td>
<td>R-4, R-5 Resistor 1/3 W-200 M.</td>
<td>.15</td>
</tr>
</tbody>
</table>

**PHONO: PHONO PICK-UP**

**MODELS D1170, D2142**

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**PRICES SUBJECT TO CHANGE WITHOUT NOTICE**

Repeat above Alignment Procedure at least once more.

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VOLTAGE CHART

All voltages measured with a 1,500 ohm per volt meter on the 150 volt scale. Line voltage 117 volts A.C. Voltage control maximum and no signal tuned in. Power consumption 30 watts, radio only, with changeover 48 watts.

12AT7 TUBE
Plate (3) to ground.............. 95
Screen (4) to ground............ 95
12AT7 TUBE
Plate (3) to ground.............. 95
Screen (4) to ground............ 95
6SA7 TUBE
Plate (3) to ground.............. 118
Screen (4) to ground............ 85
Cathode (8) to ground........... 5.5
569 TUBE
Filament (B) to ground.......... 121

Speaker (Part No. P4798) 5" FM Type.
D.C. voice coil resistance........ 3.5 ohms
Voice coil impedance at 400 cycles..... 3.8 ohms
Oscillator Coil (Part No. P4790)
Looking at the connection end in a clockwise direction starting at the chassis the terminals are No. 1, and at winding: No. 2, start of winding; No. 3, top.
No. 2 and No. 1—Resistance 4.8 ohms.
No. 3 and No. 1—Resistance 4.9 ohms.
First LF Transformer (Part No. P3832)
Primary—Blue, plate; red, B+—Resistance.... 30.4 ohms
Secondary—White, grid; Black, AVC Resistance..... 20.3 ohms
Second LF Transformer (Part No. P3924)
Primary—Blue, plate; red, B+—Resistance.... 23.2 ohms
Secondary—White, diode; Black, AVC Resistance..... 21.1 ohms

ALIGNMENT PROCEDURE

* Volume control—Minimum all adjustments.
* Connect radio chassis to ground post of signal generator with a short heavy lead.
* Connect dummy antenna leads in series with generator output lead.
* Connect output meter across primary of output transformer.
* Allow chassis and signal generator to "bake up" for several minutes.

The following equipment is required for aligning:

- An all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed:
- Output indicating meter.
- Non-metallic screwdriver.
- Dummy antenna—1 mfd. 200 mmfd.

<table>
<thead>
<tr>
<th>BAND</th>
<th>SIGNAL GENERATOR</th>
<th>Dummy Antenna</th>
<th>Connection to Radio</th>
<th>Variable Condenser Setting</th>
<th>Trimmers Adjusted (In Order Shown)</th>
<th>Trimmer Function</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>455 K.C.</td>
<td>66 K.E.</td>
<td>Grid of 12AT7 I.F.</td>
<td>Rotom full open (Plates out of mesh)</td>
<td>One trimmer on top</td>
<td>Output I.F.</td>
<td>Adjust to minimum output</td>
<td></td>
</tr>
<tr>
<td>455 K.C.</td>
<td>66 K.E.</td>
<td>Grid of 12AT7 I.F.</td>
<td>Rotom full open (Plates out of mesh)</td>
<td>Two trimmers on top</td>
<td>Input I.F.</td>
<td>Adjust to maximum output</td>
<td></td>
</tr>
<tr>
<td>BROAD. CAST</td>
<td>1,600 K.C.</td>
<td>Antenna lead</td>
<td>Rotom full open (Plates out of mesh)</td>
<td>Trimmers—Top of gages</td>
<td>Oscillator</td>
<td>Adjust to maximum output</td>
<td></td>
</tr>
</tbody>
</table>

Frequency Range—535 to 1630 K.C.
Power output 1.3 watts undistorted—2.0 watts maximum.

Attenuate the signal from the signal generator to prevent the flowing-off action of the A.V.C.

Total Power Consumption—48 watts.
ALIGNMENT PROCEDURE

The following equipment is necessary to properly align this chassis:
1. A signal generator which will provide an accurately calibrated signal at the frequencies listed.
2. An output Meter.
3. A non-metallic screw driver.
4. Dummy Antenna—.1 mfd, 200 m.mf.

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### TRUETONE MODEL D2155

#### PARTS LIST AND PRICES

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>List Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>9231</td>
<td>Book</td>
<td>$25.00</td>
</tr>
<tr>
<td>9332</td>
<td>Base—Instruction</td>
<td></td>
</tr>
<tr>
<td>8862</td>
<td>Building-Steam-Motor Mounting</td>
<td></td>
</tr>
<tr>
<td>9234</td>
<td>Cabinet</td>
<td>$12.00</td>
</tr>
<tr>
<td>2163</td>
<td>Cycle-Drive</td>
<td>15</td>
</tr>
<tr>
<td>92761</td>
<td>Coil—Loop Antenna Assembly</td>
<td>1.00</td>
</tr>
<tr>
<td>92123</td>
<td>Coil—Oscillator</td>
<td>0.00</td>
</tr>
<tr>
<td>9322</td>
<td>Control—Volume and Switch</td>
<td></td>
</tr>
<tr>
<td>9224</td>
<td>Cord—AC Line</td>
<td>1.00</td>
</tr>
<tr>
<td>9562</td>
<td>Condenser—Antenna Transformer</td>
<td>20</td>
</tr>
<tr>
<td>9227</td>
<td>Condenser—Variable</td>
<td>0.00</td>
</tr>
<tr>
<td>9325</td>
<td>Condenser—Dust-Collector</td>
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<td>1751</td>
<td>Condenser—Paper—400 Volt</td>
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<td>Condenser—Paper—500 Volt</td>
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<td>Condenser—Paper—1500 Volt</td>
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<td>2750</td>
<td>Knob—Motor Switch</td>
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<td>9266</td>
<td>Knob—Tuning</td>
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<td>9415</td>
<td>Knob—Volume</td>
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<td>6138</td>
<td>Lamp—Plug No. 1470</td>
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<td>7510</td>
<td>Microphone No. 22100</td>
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<td>Needle—Cutting (Furnished by W. A.)</td>
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<td>9276</td>
<td>Needle—Flanging (Furnished by W. A.)</td>
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### Recorder Unit Parts

<table>
<thead>
<tr>
<th>Model</th>
<th>Name</th>
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<th>Part No.</th>
<th>List Price Each</th>
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<tbody>
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<td>Adjusting Screw (Follower Arm)</td>
<td>02</td>
<td>0.05</td>
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<tr>
<td>98445</td>
<td>Turntable Shaft Locking Screw</td>
<td>02</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>98447</td>
<td>Recorders Arm Foot</td>
<td>02</td>
<td>0.05</td>
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</tr>
<tr>
<td>98448</td>
<td>Follower Arm Complete</td>
<td>1.00</td>
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<td></td>
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<tr>
<td>98449</td>
<td>Pickup Cartridge</td>
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<td></td>
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<tr>
<td>98450</td>
<td>Tone Arm, Complete</td>
<td>0.05</td>
<td>0.05</td>
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</tr>
<tr>
<td>98451</td>
<td>Outer Head Tension Spring</td>
<td>0.05</td>
<td>0.05</td>
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<tr>
<td>98452</td>
<td>Recorder Arm, Complete</td>
<td>0.05</td>
<td>0.05</td>
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<tr>
<td>98453</td>
<td>Print Post return Spring</td>
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<tr>
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<td>Turntable Drive Disc Shaft</td>
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### TRUETONE MODEL DW 2090

#### PARTS LIST AND PRICES

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>List Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>9333</td>
<td>Parts—Instruction</td>
<td>20</td>
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<tr>
<td>9377</td>
<td>Parts—Motor control</td>
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<tr>
<td>9437</td>
<td>Plug—1 Prong Large (Plug)</td>
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<tr>
<td>9438</td>
<td>Plug—1 Prong Small (Cub)</td>
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<tr>
<td>9439</td>
<td>Plug—Photo Motor</td>
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<tr>
<td>9417</td>
<td>Puller</td>
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<td>9313</td>
<td>Puller—Drive</td>
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### Recorder Unit Parts

<table>
<thead>
<tr>
<th>Model</th>
<th>Name</th>
<th>Description</th>
<th>Part No.</th>
<th>List Price Each</th>
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</thead>
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<td>98466</td>
<td>Adjusting Screw (Follower Arm)</td>
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<td>0.05</td>
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<tr>
<td>98465</td>
<td>Turntable Shaft Locking Screw</td>
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<td>0.05</td>
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<td>98467</td>
<td>Recorders Arm Foot</td>
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<td>98468</td>
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<td>98469</td>
<td>Pickup Cartridge</td>
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<td>98470</td>
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<td>Outer Head Tension Spring</td>
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<td>98472</td>
<td>Recorder Arm, Complete</td>
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<td>Print Post return Spring</td>
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<tr>
<td>98474</td>
<td>Tone Arm Post</td>
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<td>98476</td>
<td>Turntable Drive Disc Shaft</td>
<td>3.00</td>
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</table>

### Recorders

1. 1:17 Converter (oscillator and first detector)
2. 1:111 F. Amplifier
3. 1:55 Second Detector and First Audio
4. 2:96 Power Output
FOR DETROLA N110
RECORD CHANGER
SEE RIDER'S
"AUTOMATIC RECORD
CHANGERS AND
RECORDERS"

### PARTS LIST AND PRICES

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Circuit Diagram</th>
<th>Description</th>
<th>List Price Each</th>
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<tbody>
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<td>N-200</td>
<td></td>
<td>Record Changer—Complete</td>
<td>$0.65</td>
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<tr>
<td>9575</td>
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<td>Capacity Plate Assembly</td>
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<tr>
<td>9736</td>
<td></td>
<td>Book—Instruction</td>
<td>$0.20</td>
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<tr>
<td>9031</td>
<td></td>
<td>Bracket-Indicator Back Plate</td>
<td>$0.30</td>
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<td>9480</td>
<td>L1, L2</td>
<td>Tuner—Permeability with Pulley</td>
<td>$1.50</td>
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<tr>
<td>9737</td>
<td></td>
<td>Cabinet</td>
<td>$18.00</td>
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<tr>
<td>2163</td>
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<td>Cable-Drive</td>
<td>$0.15</td>
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<tr>
<td>9722</td>
<td>L5</td>
<td>Coil—Cathode Choke</td>
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<td>9051</td>
<td>R6</td>
<td>Control—Volume and Switch</td>
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<td>9613</td>
<td>C1α, b</td>
<td>Condenser—Dual Trimmer</td>
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<td>9363</td>
<td>C10, C11</td>
<td>Condenser—Electrolytic 40 μf—20 μf—150V</td>
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<td>9672</td>
<td>C12</td>
<td>Condenser—Paper 0.0015 μf—400V</td>
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<tr>
<td>824</td>
<td>C6</td>
<td>Condenser—Paper 0.002 μf—600V</td>
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<td>563</td>
<td>C3</td>
<td>Condenser—Paper 0.05 μf—400V</td>
<td>$0.20</td>
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<td>576</td>
<td>C8, C9</td>
<td>Condenser—Paper 0.02 μf—400V</td>
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<td>580</td>
<td>C2</td>
<td>Condenser—Paper 0.05 μf—200V</td>
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<td>572</td>
<td>C4</td>
<td>Condenser—Paper 0.1 μf—200V</td>
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<td>C5, C7</td>
<td>Condenser—Mica 250 μmF</td>
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<td>1285</td>
<td>C1e</td>
<td>Condenser—Mica 1000 μmF</td>
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<td>Cord—AC Line</td>
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<td>Indicator</td>
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<td>Knob</td>
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<td>Lamp—Pilot—Marvel 447</td>
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<td>242</td>
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<td>Plug—Phono Motor</td>
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<td>3150</td>
<td>Pointer</td>
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<td>9086</td>
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<td>Pulley—Idler</td>
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<tr>
<td>8039</td>
<td>R1, R7</td>
<td>Resistor 1/4 W—15 Meg.</td>
<td>$0.15</td>
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</table>

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MODEL D 2269

ALIGNMENT PROCEDURE

- Volume control—Maximum all adjustments.
- Connect radio chassis to ground post of signal generator with a short heavy lead.
- Connect dummy antenna value in series with generator output lead.
- Connect output meter across primary of output transformer.
- Allow chassis and signal generator to "heat up" for several minutes.

The following equipment is required for aligning:
- An all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed.
- Output indicating meter.
- Non-metallic screwdriver.
- Dummy antenna—1 mf, .05 mf, 200 mmd.

<table>
<thead>
<tr>
<th>BAND</th>
<th>SIGNAL GENERATOR Frequency Setting Dummy Antenna Connection to Radio</th>
<th>Variable Condenser Setting</th>
<th>Trimmer Adjusted (In Order Shown)</th>
<th>Trimmer Function</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.F.</td>
<td>455 KC. .1 MFD. Grid of INSGT L.F. tube (Plates out of mesh) Rotor full open</td>
<td>C, D Output</td>
<td>Output</td>
<td>Adjust to maximum output</td>
<td></td>
</tr>
<tr>
<td>See Note &quot;A.&quot; 455 KC. .1 MFD. Grid of 1A7GT tube (Plates out of mesh) Rotor full open</td>
<td>A, B Input</td>
<td>Input</td>
<td>Adjust to maximum output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BROADCAST</td>
<td>1600 KC. .05 MFD. Grid of INSGT R.F. tube (Plates out of mesh) Rotor full open</td>
<td>E Gang-rear Oscillator</td>
<td>Output</td>
<td>Adjust to maximum output</td>
<td></td>
</tr>
<tr>
<td>1400 KC. .05 MFD. Grid of INSGT R.F. tube Set dial at 1400 KC.</td>
<td>F R.F.</td>
<td>R.F.</td>
<td>Adjust to maximum output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1400 KC. 200 MMD. ANT. LEAD Set dial at 1400 KC.</td>
<td>G Antenna</td>
<td>Antenna</td>
<td>Adjust to maximum output</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This is all that is necessary for the alignment unless the plates of the gang have been bent out of shape. In case of bent plates, set the signal generator and receiver to 600 KC and bend the plates into the position for maximum output.

ATTENUTATE the signal from the signal generator to prevent the leveling-off action of the AVC. After each band is completed, repeat the procedure as a final check.

NOTE "A"—Use battery operation for all adjustments.

D 3230

FORMERLY MODEL D 1211

PLEASE NOTE THAT ALTHOUGH OUR D3230 (FORMERLY D1281) AND OUR D3130 (FORMERLY D1181) USE THE SAME FACTORY MODEL NUMBER THEY DIFFER IN THAT THE D3230 USES A PERMEABILITY TUNED R.F. COIL.

ALIGNMENT PROCEDURE

- Volume control—Maximum all adjustments.
- Connect radio chassis to ground post of signal generator with a short heavy lead.
- Connect dummy antenna value in series with generator output lead.
- Connect output meter across primary of output transformer.
- Allow chassis and signal generator to "heat up" for several minutes.

The following equipment is required for aligning:
- An all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed.
- Output indicating meter.
- Non-metallic screwdriver.
- Dummy antenna—1 mf, .05 mf.

<table>
<thead>
<tr>
<th>BAND</th>
<th>SIGNAL GENERATOR Frequency Setting Dummy Antenna Connection to Radio</th>
<th>Variable Condenser Setting</th>
<th>Trimmer Adjusted (In Order Shown)</th>
<th>Trimmer Function</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.F.</td>
<td>455 KC. .1 MFD. Grid of INSGT L.F. tube (Plates out of mesh) Rotor full open</td>
<td>C, D Output</td>
<td>Output</td>
<td>Adjust to maximum output</td>
<td></td>
</tr>
<tr>
<td>See Note &quot;A.&quot; 455 KC. .1 MFD. Grid of 1A7GT tube (Plates out of mesh) Rotor full open</td>
<td>A, B Input</td>
<td>Input</td>
<td>Adjust to maximum output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BROADCAST</td>
<td>1600 KC. .05 MFD. Grid of INSGT R.F. tube (Plates out of mesh) Rotor full open</td>
<td>E Gang-rear Oscillator</td>
<td>Output</td>
<td>Adjust to maximum output</td>
<td></td>
</tr>
<tr>
<td>1300 KC. .05 MFD. Grid of INSGT R.F. tube Set dial at 1400 KC.</td>
<td>F R.F.</td>
<td>R.F.</td>
<td>Adjust to maximum output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>See Note &quot;B.&quot; 1400 KC. Loop Radiator No connection to radio</td>
<td>G Antenna</td>
<td>Antenna</td>
<td>Adjust to maximum output</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This is all that is necessary for the alignment unless the plates of the gang have been bent out of shape. In case of bent plates, set the signal generator and receiver to 600 KC and bend the plates into the position for maximum output.

ATTENUTATE the signal from the signal generator to prevent the leveling-off action of the AVC. After each band is completed, repeat the procedure as a final check.

NOTE "B"—Use three turn loop, in series with 400 ohm resistor, connected to signal generator output.

The following equipment is required for aligning:
- An all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed.
- Output indicating meter.
- Non-metallic screwdriver.
- Dummy antenna—1 mf, .05 mf.

The following is required for alignment:
- An all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed.
- Output indicating meter.
- Non-metallic screwdriver.
- Dummy antenna—1 mf, .05 mf.

Intermediate Frequency 455 KC. Power consumption 25 watts.

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WESTERN AUTO SUPPLY CO.

Fig. 1—Top View

VOLTAGE CHART

<table>
<thead>
<tr>
<th>TUBE</th>
<th>Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRS TUBE</td>
<td></td>
</tr>
<tr>
<td>Plate (2) to ground</td>
<td>66</td>
</tr>
<tr>
<td>Screen (3) to ground</td>
<td>45</td>
</tr>
<tr>
<td>Filament (7) to (1)</td>
<td>1.4</td>
</tr>
<tr>
<td>174 TUBE</td>
<td></td>
</tr>
<tr>
<td>Plate (2) to ground</td>
<td>98</td>
</tr>
<tr>
<td>Screen (3) to ground</td>
<td>45</td>
</tr>
<tr>
<td>Filament (7) to (1)</td>
<td>1.3</td>
</tr>
</tbody>
</table>

155 TUBE
Filament (7) to (1) | 1.3

354 TUBE
Plate (2) to (6) to ground | 66
Screen (4) to ground | 67.5
Filament (11 to 5) | 1.3
Filament (7 to 5) | 1.3

3525 TUBE
Cathode (8) to ground | 90
Filament (7) to ground | 37.5 (AC)

SERVICE INFORMATION

Speaker (Part No. P4620A) 3" PM Type
D.C. voice coil resistance | 2.8 ohms
Voice coil impedance at 400 cycles | 3.0 ohms

Capacitor Coin (Part No. P4722)
Looking at the connection end in a clockwise direction starting at the mounting bracket the terminals are:
No. 1, ground (direct to mounting bracket).
No. 2, plate.
No. 3, B: No. 4, grid.
Primary—No. 2 and No. 3—Resistance | 3.4 ohms
Secondary—No. 1 and No. 4—Resistance | 2.6 ohms

First I.F. Transformer (Part No. P4610)
The primary leads are on one end (opposite side) and the secondary leads on the other end. The red dots indicate the end of the windings. The primary and secondary windings are identical. Resistance (primary or secondary) | 16.7 ohms
Second I.F. Transformer (Part No. P4712)
Looking at the coil starting at the lug nearest the red dot in a clockwise direction, the terminals are: No. 1, start of pri.; No. 2, start of sec.; No. 3, end of sec.; No. 4, end of pri.
Primary—No. 1 and No. 4—Resistance | 43.3 ohms
Secondary—No. 2 and No. 3—Resistance | 34.2 ohms

Power Change Switch
The power change switch connects the tube filaments in series (3½ volt) on AC-DC operation and parallel (1½ volt) on battery operation.

© John F. Rider
NOTE: On some sets R3 is replaced by a speaker field; R3 is also eliminated and C11 and C12 are connected in parallel.

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>Description</th>
<th>Parts</th>
<th>Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001 C1</td>
<td>2 x 400 Volt Tubular Condenser</td>
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</tr>
<tr>
<td>1009 C2</td>
<td>2 x 300 Volt Tubular Condenser</td>
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</tr>
<tr>
<td>1011 C3</td>
<td>2 x 200 Volt Tubular Condenser</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1012 C10</td>
<td>0.02 x 050 Watt Tubular Condenser</td>
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</tr>
<tr>
<td>1013 C11</td>
<td>0.02 x 050 Watt Tubular Condenser</td>
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<tr>
<td>1014 C12</td>
<td>0.02 x 050 Watt Tubular Condenser</td>
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<tr>
<td>1590 C13</td>
<td>0.015 x 050 Watt Tubular Condenser</td>
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<tr>
<td>1840 C14</td>
<td>0.004 x 050 Watt Tubular Condenser</td>
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</tr>
<tr>
<td>1594 C15, C16, C17</td>
<td>2 Mfd—20 Mfd—20 Mfd—Electrolytic Capacitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1599 C18, C19, C20</td>
<td>0.001 x 050 Watt Tubular Condenser</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: 1951 not needed for 30 cycles when no wave-oscillator used.

Table:

<table>
<thead>
<tr>
<th>RESISTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10K Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>20K Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>30K Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>50K Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>100K Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>200K Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>1M Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>2M Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>5M Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>10M Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>50M Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>100M Ohm—5 Watt Resistors—20%</td>
</tr>
<tr>
<td>0.1 Ohm—1 Watt Resistors—20%</td>
</tr>
<tr>
<td>0.01 Ohm—1 Watt Resistors—20%</td>
</tr>
<tr>
<td>0.001 Ohm—1 Watt Resistors—20%</td>
</tr>
<tr>
<td>1 Megohm—Volume Control and Switch</td>
</tr>
</tbody>
</table>

Voltage measurement with 500 Ohm X 2000 Ohm voltmeter, between socket terminals and B with a line voltage of 60 volts.

Bottom view of Chassis:

12SK7 12SA7 12SK7 12SQ7

35Z5GT 35L6GT

12SQ7 35Z5GT 35L6GT

Rear of Chassis:

12SK7 12SA7 12SK7 12SQ7

Alignment Procedure:

<table>
<thead>
<tr>
<th>BAND</th>
<th>Frequency Setting</th>
<th>Dummy Antenna</th>
<th>Connection to Radio</th>
<th>Variable Condenser Setting</th>
<th>Trimmers Adjusted (In Order Shown)</th>
<th>Trimmer Position</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.F.</td>
<td>455 kHz</td>
<td>J MFD</td>
<td>Grid of 12SA7</td>
<td>Rotated full open (Plates out of mesh)</td>
<td>Four Trimmers on Top (See Fig. 1)</td>
<td>Output and Input L.F.</td>
<td>Adjust to maximum output</td>
</tr>
<tr>
<td>Broadcasting Band</td>
<td>1600 kHz</td>
<td>J MFD</td>
<td>Grid of 12SA7</td>
<td>Rotated full open (Plates out of mesh)</td>
<td>Trimmer bottom of rear section of gang (See bottom of table)</td>
<td>Broadcast Oscillator</td>
<td>Adjust to maximum output</td>
</tr>
<tr>
<td></td>
<td>1400 kHz</td>
<td>See Note &quot;A&quot;</td>
<td>Grid of 12SA7</td>
<td>Rotated full open (Plates out of mesh)</td>
<td>Front section of gang (See bottom of table)</td>
<td>Broadcast Antenna</td>
<td>Adjust to maximum output</td>
</tr>
</tbody>
</table>

Note: "A" Lay the output lead from the generator in both of the two antennas. Turn up the output of the generator, making sure the energy is in the low antenna without any electrical connection from the generator.

FREQUENCY RANGE

130 to 1600 K.C.

Power Consumption: 50 Watts

Power Output: 1 Watt Unmodulated, 0.7 Wat Maximum

Intermediate Frequency: 45 K.C.
WESTERN AUTO SUPPLY CO

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MAIN CHASSIS PARTS LIST

**CONDENSERS**

<table>
<thead>
<tr>
<th>Part/No.</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>10019</td>
<td>C1 .006 x 600 V, Tubular Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10013</td>
<td>C6 .05 x 600 V, Tubular Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10015</td>
<td>C12 .012 x 600 V, Tubular Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10016</td>
<td>C13 .02 x 600 V, Tubular Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10020</td>
<td>C14 .02 x 600 V, Bakelite Condenser</td>
<td>.35</td>
</tr>
<tr>
<td>10037</td>
<td>C31 .005 x 600 V, Tubular Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10039</td>
<td>C34 .001 200 V, Tubular Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10036</td>
<td>C36 1 x 400 V, Tubular Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>11991A</td>
<td>C27 25 Volts</td>
<td>.50</td>
</tr>
<tr>
<td>11991B</td>
<td>C19, C20, C25 Electrolytic Filter Condenser-15 Mfd. x 450 V; 15 Mfd. x 450 V; 10 Mfd. x 350 V.</td>
<td>1.50</td>
</tr>
</tbody>
</table>

**RESISTORS**

<table>
<thead>
<tr>
<th>Part/No.</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>10113</td>
<td>R1 Volume Control—Less Shaft—(8 Megohm)</td>
<td>1.00</td>
</tr>
<tr>
<td>10114</td>
<td>R12, R16 500 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10115</td>
<td>R3 3 Megohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10116</td>
<td>R17 240 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10117</td>
<td>R18, R25 500 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10118</td>
<td>R13 250 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10119</td>
<td>R19 1.5 Megohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10120</td>
<td>R20 Volume Control—Less Shaft—(8 Megohm)</td>
<td>1.00</td>
</tr>
<tr>
<td>10121</td>
<td>R21 480 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10122</td>
<td>R22 630 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10123</td>
<td>R23 1.9 Megohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10124</td>
<td>R24 3.6 Megohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10125</td>
<td>R25 30 Megohm—15 M.20</td>
<td></td>
</tr>
</tbody>
</table>

**TUNER CHASSIS PARTS LIST**

**CONDENSERS**

<table>
<thead>
<tr>
<th>Part/No.</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>10020</td>
<td>C6 .1 x 200 Volt Tubular Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10029</td>
<td>C2 .00125 Mica Type Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10037</td>
<td>C14 .002 Mica Type Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10039</td>
<td>C33 .0008 Mica Type Condenser</td>
<td>.25</td>
</tr>
<tr>
<td>10040</td>
<td>C34 .0005 Mica Type Condenser</td>
<td>.25</td>
</tr>
</tbody>
</table>

**RESISTORS**

<table>
<thead>
<tr>
<th>Part/No.</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>10013</td>
<td>R1 Volume Control—Less Shaft—(8 Megohm)</td>
<td>1.00</td>
</tr>
<tr>
<td>10014</td>
<td>R12, R16 500 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10015</td>
<td>R3 3 Megohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10016</td>
<td>R17 240 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10017</td>
<td>R18, R25 500 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10018</td>
<td>R13 250 Ohm—15 M.20</td>
<td></td>
</tr>
<tr>
<td>10019</td>
<td>R19 1.5 Megohm—15 M.20</td>
<td></td>
</tr>
</tbody>
</table>

**ALIGNMENT PROCEDURE**

- Tune control—Tight.
- Volume control—Maximum all adjustments.
- Use no all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed.

**BANDS**

<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency Setting</th>
<th>Frequency Setting</th>
<th>Frequency Setting</th>
<th>Frequency Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.F.</td>
<td>455 Kc. 1 MFD Grid at 6SK7 (I.F.)</td>
<td>Broadcast</td>
<td>455 Kc. 1 MFD Grid at 6SK7 (I.F.)</td>
<td>Broadcast</td>
</tr>
<tr>
<td>31 METER BAND</td>
<td>9.5 M. 400 ohms Antenna lead</td>
<td>31M</td>
<td>See Dial at 16 Mc.</td>
<td></td>
</tr>
<tr>
<td>49 METER BAND</td>
<td>6.1 M. 400 ohms Antenna lead</td>
<td>49M</td>
<td>See Dial at 16 Mc.</td>
<td></td>
</tr>
<tr>
<td>25 METER BAND</td>
<td>11.8 M. 400 ohms Antenna lead</td>
<td>25M</td>
<td>See Dial at 11.8 Mc.</td>
<td></td>
</tr>
<tr>
<td>19 METER BAND</td>
<td>15.2 M. 400 ohms Antenna lead</td>
<td>19M</td>
<td>See Dial at 15.2 Mc.</td>
<td></td>
</tr>
<tr>
<td>BROADCAST BAND</td>
<td>1600 Kc.</td>
<td>1600 Kc.</td>
<td>See Dial at 1600 Kc.</td>
<td></td>
</tr>
</tbody>
</table>

**IRON CORE ADJUSTMENT VIEW**

- See TRIMMER VIEW 1-3-10 for adjustment view.
MODELS D1215, D2210

WESERN AUTO SUPPLY CO.

Replacement Parts List

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDENSERS</td>
<td>1.0</td>
<td>25.00</td>
</tr>
<tr>
<td>RESISTORS</td>
<td>100 Ohm 25W</td>
<td>2.50</td>
</tr>
<tr>
<td>SOLENOIDS</td>
<td>12V DC</td>
<td>4.95</td>
</tr>
<tr>
<td>COILS</td>
<td>1.13</td>
<td>0.95</td>
</tr>
<tr>
<td>DIAL PARTS</td>
<td>100</td>
<td>0.75</td>
</tr>
</tbody>
</table>

**ALIGNMENT PROCEDURE**

- **IC Signal Generator**
  - Frequency Setting
  - Output Amplitude
  - Connection to Probe
  - Function of Time

<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency Setting</th>
<th>Output Amplitude</th>
<th>Connection to Probe</th>
<th>Function of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.F.</td>
<td>1 MFD</td>
<td>450</td>
<td>Gold of Base</td>
<td>2000</td>
</tr>
<tr>
<td>BROAD</td>
<td>0.65</td>
<td>200</td>
<td>Outside</td>
<td>1000</td>
</tr>
</tbody>
</table>

**NOTE A**
- The output of the signal generator must be adjusted for alignment.
- The generator is connected to the probe, and the output amplitude is adjusted to the desired level.

**NOTE B**
- After the generator has been turned on, the output amplitude should be adjusted to the required level.
- The generator should be connected to the probe, and the output amplitude should be adjusted to the desired level.

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ALIGNMENT PROCEDURE

The following equipment is required for aligning:
- Dummy antenna: 1000 mfd and 200 mfd.
- Connect ground lead of radio chassis to ground post of signal generator.

<table>
<thead>
<tr>
<th>SIGNAL GENERATOR</th>
<th>Frequency</th>
<th>Dummy Antenna Setting</th>
<th>Antenna Connection to Radio</th>
<th>Position of Iron Core (Dual Setting)</th>
<th>Trimmer Adj., Adjusted in Order Shown</th>
<th>Trimmer Function</th>
<th>Abnormality</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>455 Kc.</td>
<td>.1 MFD.</td>
<td>Connect to Grid of 1A2</td>
<td>Iron Core All the way out</td>
<td>Two trimmers on top of output I. F.</td>
<td>Output I. F.</td>
<td>maximum output</td>
</tr>
<tr>
<td></td>
<td>1 F.</td>
<td>.1 MFD.</td>
<td>Connect to Grid of 1A2</td>
<td>Iron Core All the way out</td>
<td>Two trimmers on top of output I. F.</td>
<td>Output I. F.</td>
<td>maximum output</td>
</tr>
</tbody>
</table>

NOTE "A"—The antenna coil assembly is made such that it is movable. When making the adjustments as given in the alignment procedure, move the coil assembly very slowly. It can be moved by hand or by carving one edge of the blade or a screwdriver in the hole and engaging the blade in the gear teeth of the coil form.

NOTE "B"—After the antenna coil has been tuned at 1400 Kc it is necessary to check the antenna trimmer coil adjustments again at 1700 Kc. If no appreciable changes in trimmer adjustment is made in the coil it is in track. If the trimmer requires considerable changes it will be necessary to again adjust the position of the antenna coil at 1400 Kc. These two adjustments should be tried several times until no change of trimmer adjustment is required at 1700 Kc.

Sockets

- Eight Prong Molded Octal Socket: 12210
- Four Inch F.M. Dynamic Speaker-Less: 18091C.5T
- Transformer: 18091C.T5

Miscellaneous

- Volume Control-Switch: 18110 R2, S1
- Battery Cable Assembly: 10764 S1
- Voltmeter: 10768 B1
- Switch: 10765 K1
- Knob—With Switch: 10585B
- Knob—With Socket: 10585B
- Knob—Without Switch: 10585B
- Knob—Without Socket: 10585B

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CONDENSERS

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Schematic Diagram Reference</th>
<th>Number Used in Set</th>
<th>Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1012B B</td>
<td>Three Way Variable Condenser</td>
<td>600 V Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>1005 C</td>
<td>C10, C16, C25</td>
<td>5 x 400 Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>1005 C</td>
<td>C10, C25</td>
<td>5 x 400 Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>1005 C</td>
<td>C10, C25</td>
<td>5 x 400 Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>1005 C</td>
<td>C10, C25</td>
<td>5 x 400 Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>1005 C</td>
<td>C16, C25</td>
<td>5 x 400 Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>1005 C</td>
<td>C16, C25</td>
<td>5 x 400 Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>1005 C</td>
<td>C16, C25</td>
<td>5 x 400 Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>1005 C</td>
<td>C16, C25</td>
<td>5 x 400 Volt Tubular Condenser</td>
<td>25</td>
</tr>
<tr>
<td>11012 C</td>
<td>C17, C19, C20</td>
<td>Electrolytic Filter Condenser-10 Mfd.</td>
<td>35</td>
</tr>
</tbody>
</table>

TRANSFORMERS

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Schematic Diagram Reference</th>
<th>Number Used in Set</th>
<th>Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1012B B</td>
<td>Transformer for Speaker</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>10448 B</td>
<td>T8</td>
<td>50 to 60 Cycles 105-125 V Volt Primary</td>
<td>4.50</td>
</tr>
<tr>
<td>10448 B</td>
<td>T10</td>
<td>Power Transformer</td>
<td>1</td>
</tr>
</tbody>
</table>

RECORD CHANGER COMPARTMENT

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Schematic Diagram Reference</th>
<th>Number Used in Set</th>
<th>Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>10129 C</td>
<td>Automatic Record Changer</td>
<td>500 A.C.</td>
<td>26</td>
</tr>
<tr>
<td>1074 P</td>
<td>Indicator Light Bulb</td>
<td>1</td>
<td>3.50</td>
</tr>
<tr>
<td>1078 A</td>
<td>Socket Assembly for Pilot Light</td>
<td>1</td>
<td>3.50</td>
</tr>
</tbody>
</table>

Speaker:

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Schematic Diagram Reference</th>
<th>Number Used in Set</th>
<th>Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>101278 R1, S2</td>
<td>Ten Inch Electrodynamic Speaker (Less Output Transformer)</td>
<td>1</td>
<td>6.00</td>
</tr>
</tbody>
</table>

Resistors:

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Schematic Diagram Reference</th>
<th>Number Used in Set</th>
<th>Price Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>10129 Y17</td>
<td>Volume Control and Switch (500M Ohms)</td>
<td>1</td>
<td>1.25</td>
</tr>
<tr>
<td>10129 T17</td>
<td>Tone Control (1 Megohm) Less Shaft</td>
<td>1</td>
<td>1.25</td>
</tr>
<tr>
<td>13019 R2, R18</td>
<td>Volume Control for Volume and Tone Controls</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td>13019 R18</td>
<td>1 Megohm=1 Watt Resistor-25%</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td>13019 R20</td>
<td>1 Megohm=1 Watt Resistor-25%</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td>13019 R23</td>
<td>1 Megohm=1 Watt Resistor-25%</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td>13019 R25</td>
<td>1 Megohm=1 Watt Resistor-25%</td>
<td>1</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Alignment Procedure:

- Connect to Radio:
  - Grid of 6SK7
  - Grid of 6SL7

- Position of Band Switch:
  - I.F. Mixer
  - I.F. Mixer

- Variable Condenser Setting:
  - Resistor full open (Plates out of mesh)
  - Resistor full open (Plates out of mesh)

- Trimmers Adjusted to Max mum (in Order Shown):
  - Two trimmers on top
  - Two trimmers on top

- BAND:
  - SHORT WAVE
  - BROADCAST
  - LOOP

- SIGNAL GENERATOR:
  - Frequency Setting:
    - 455 Kc.
    - 155 Kc.

- Connection to Radio:
  - Grid of 6SK7
  - Grid of 6SL7

- Position of Band Switch:
  - Broadcast
  - Broadcast

- Variable Condenser Setting:
  - Resistor full open (Plates out of mesh)
  - Resistor full open (Plates out of mesh)

- Alignment:
  - 1500 Kc.
  - 600 Kc.

- Note: "A"—Turn the dial back and forth slightly (rock) and adjust trimmer until the peak of maximum intensity is obtained.

- BOTTOM VIEW OF CHASSIS

- VOLTAGE CHART

- CHASSIS VIEW

This radio uses Detrola Model N100 record changer. Replacement parts should be ordered from the Detrola Corp.

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SERVICE DATA FOR PROFESSIONAL SERVICEMEN

VOLTAGES

Voltages taken from the different points of the circuit to chassis are measured with volume control in maximum position, all tubes in their sockets and with a volt meter having a resistance of 1000 ohms per volt. These voltages are clearly indicated on the voltage chart.

All voltages should be measured with 117.5 volt AC input to receiver. Resistance and actual connections of coils and transformers and speaker data are given under Service Information.

To check for open by-pass condensers, shunt each condenser with another condenser of the same capacity and voltage rating, which is known to be good until the defective unit is located.

ALIGNING INSTRUCTIONS

All of the adjustments have been very carefully set with signal generators at the factory and require no further adjustment, unless it becomes necessary to replace a coil or transformer, or if the adjustments have been tampered with in the field. Under no circumstances attempt any adjustments without first making certain that adjustment is necessary and only after voltages, tubes and condensers have been checked and found to be normal. To properly re-align this receiver, a signal generator as well as an output meter, must be used.

SEE INDEX FOR ALIGNMENT

FIG. 1 TOP VIEW

FIG. 2 VOLTAGE CHART
The following equipment is necessary to properly align this chassis:

1. A signal generator which will provide an accurately calibrated signal at the frequencies listed.
2. An output Meter.
3. A non-metallic screw driver.
4. Dummy antenna—.1 mfd., 200 mml.

<table>
<thead>
<tr>
<th>GENERATOR</th>
<th>CONNECTION AT RADIO</th>
<th>DUMMY ANTENNA</th>
<th>DIAL</th>
<th>TRIMMERS TO TUNE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF 455 KC.</td>
<td>1A7 GRID</td>
<td>.1 mfd.</td>
<td>H. F. End</td>
<td>IF Transformer</td>
<td>Tune to Max.</td>
</tr>
<tr>
<td>1620 KC.</td>
<td>Antenna</td>
<td>200 mml.</td>
<td>H. F. End</td>
<td>4 Trimmers</td>
<td>Set Limit</td>
</tr>
<tr>
<td>1400 KC.</td>
<td>Antenna</td>
<td>200 mml.</td>
<td>1400</td>
<td>Oscillator</td>
<td>of Band</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Antenna</td>
<td>Tune to</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Trimmer</td>
<td>Max.</td>
</tr>
</tbody>
</table>

Repeat above Alignment Procedure at least once more.

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ALIGNMENT PROCEDURE

<table>
<thead>
<tr>
<th>GENERATOR</th>
<th>CONNECTION AT RADIO</th>
<th>DUMMY ANTENNA</th>
<th>DIAL</th>
<th>TRIMMERS TO TUNE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1F 455 KC</td>
<td>125A7 GRID</td>
<td>.1 mld.</td>
<td></td>
<td>IF Transformers</td>
<td>Tune to Max</td>
</tr>
<tr>
<td>1700 KC</td>
<td>Antenna</td>
<td>200 mld.</td>
<td>H. F. End</td>
<td>1720 KC</td>
<td>Set Limit</td>
</tr>
<tr>
<td>1400 KC</td>
<td></td>
<td></td>
<td>H. F. End (1720)</td>
<td>Oscillator</td>
<td>Of Band</td>
</tr>
</tbody>
</table>

Repeat above Alignment Procedure at least once.

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WESTERN AUTO SUPPLY CO.

MODEL D2211

ALIGNMENT PROCEDURE

The following equipment is required for aligning:

- An all wave signal generator which will provide an accurately calibrated signal at the last frequency of interest.
- Output indicating meter.
- Non-inductive sounder.
- Frequency meter.
- Dummy antenna—1 Mfd., and 300 Mfd.

NOTE: "A"—The antenna coil assembly is made so that it is removable. When aligning, the correct tuned coil to ground post of signal generator through 1 Mfd. condenser, C1. Connect dummy antenna valve in series with generator output lead.

NOTE: "B"—After the antenna coil has been tracked at 1450 Kc, it is necessary to check the no load trimmer (C1) adjustment again at 1450 Kc. If no appreciable change in trimmer adjustment is made the coil is in track. If the trimmer requires considerable change it will be necessary to again adjust the portion of the antenna coil at 1450 Kc. These two adjustments should be made several times until no change of trimmer adjustment is required at 1450 Kc.

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In model P6 only, switch points 6, 7, 16, and 17 are not used. Power switch in line position. Common ground is chassis ground.

**SERVICE NOTES**

Voltages taken from the different points of the circuit to chassis are measured with volume control in maximum position, all tubes in their sockets and with a volt meter having a resistance of 1000 ohms per volt. These voltages are clearly indicated on the voltage chart.

All voltages should be measured with 117.5 volts AC input to receiver. Resistance and actual connections of coils and transformers and speaker data are given under Service Information.

To check for open by-pass condensers, shunt each condenser with another condenser of the same capacity and voltage rating, which is known to be good until the defective unit is located.

**ALIGNING INSTRUCTIONS**

All of the adjustments have been very carefully set at the factory and require no further adjustment, unless it becomes necessary to replace a coil or transformer, or if the adjustments have been tampered with in the field. Under no circumstances attempt any adjustments without first making certain that adjustment is necessary and only after voltages, tubes and condensers have been checked and found to be normal. To properly realign this receiver, a signal generator as well as an output meter, must be used.

---

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Alignment Procedure

Output Meter Alignment.—Connect the meter across the voice coil, and turn the receiver volume control to maximum.

Test Oscillator.—Connect the low side of the test-oscillator to the receiver chassis, through a .01 mfd. capacitor, and keep the output as low as possible.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Connect the high side of test-oscillator to—</th>
<th>Tune test-osc. to—</th>
<th>Turn radio dial to—</th>
<th>Adjust the following for max. peak output—</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1st Det. grid in series with .01 mfd.</td>
<td>455 kc</td>
<td>Quiet point</td>
<td>1,700 kc end of dial C8 and C9 1st I-F Transformer</td>
</tr>
<tr>
<td>2</td>
<td>1st Det. grid in series with .01 mfd.</td>
<td></td>
<td></td>
<td>C6 and C7 2nd I-F Transformer</td>
</tr>
<tr>
<td>3</td>
<td>Ant. terminal in series with 200 mfd.</td>
<td>1,720 kc</td>
<td>Gang at minimum</td>
<td>C3 (osc.)</td>
</tr>
<tr>
<td>4</td>
<td>Radiation loop consisting of two turns of wire 18 inches in diameter located 4 to 6 feet from receiver</td>
<td>1,300 kc</td>
<td>Signal Frequency</td>
<td>C1 (ant.)</td>
</tr>
<tr>
<td>5</td>
<td>Repeat steps 3 and 4.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adjustments for Push Button Tuning

The push buttons should be adjusted for five favorite stations after the receiver has been operating for a brief warm up period. Each button may be set up to any standard broadcast station. The preferable arrangement is to adjust stations in the order of frequency, from low to high. Proceed as follows:

1. Cut out the tabs for your five favorite stations and arrange them in order of frequency in the recesses on the push buttons.
2. Press down on the first push button and hold it down. The screw in back of the push button is now accessible and should be loosened one or two turns with a screwdriver.
3. While still holding down the push button, tune in the first station represented by the station tab with the tuning knob by Dial Tuning. When the station is heard at its best, tighten up the screw in back of the push button. Now let go of the push button, the tuning knob in order to detune and again press down the button and let go. The station should be heard again. If not, repeat the above adjustment process until reception is satisfactory.
4. Proceed to set up the other four push buttons in a similar manner.

A station may be changed at any time by following the above information.

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WESTINGHOUSE ELECTRIC SUPPLY CO.

**Alignment Procedure**

**Output Meter Alignment**—If this method is used connect the meter across the voice coil and turn the receiver volume control to maximum.

**Test Oscillator**—Connect the low side of the test oscillator to the receiver chassis through a .01 mfd. capacitor. With the output meter alignment method the test oscillator output should be kept as low as possible.

**Calibration Scale**—The glass tuning dial may be easily removed from the cabinet and temporarily attached to the dial backing plate for quick reference during alignment.

**Steps**

<table>
<thead>
<tr>
<th>Steps</th>
<th>Connect the high side of test oscillator to...</th>
<th>Tune test oscillator...</th>
<th>Turn radio dial to...</th>
<th>Adjust the following for max. peak output...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12SK7 grid in series with .01 mfd.</td>
<td>Quiet Point at 1,600 kc</td>
<td></td>
<td>C10, C9 2nd I.F. Transformer</td>
</tr>
<tr>
<td>2</td>
<td>12SK7 grid in series with .01 mfd.</td>
<td></td>
<td></td>
<td>C8, C7 1st I.F. Transformer</td>
</tr>
<tr>
<td>3</td>
<td>Antenna term. In series with .01 mfd.</td>
<td>10 mc</td>
<td>10 mc</td>
<td>C21 (esc.) C23 (ant.)</td>
</tr>
<tr>
<td>4</td>
<td>Antenna term. In series with .01 mfd.</td>
<td>1,600 kc</td>
<td>1,600 kc</td>
<td>C14 (esc.)</td>
</tr>
<tr>
<td>5</td>
<td>Radiation Loop</td>
<td>1,300 kc</td>
<td>Resonance on Signal</td>
<td>C15 (ant.)</td>
</tr>
<tr>
<td>6</td>
<td>Radiation Loop</td>
<td>600 kc</td>
<td>600 kc</td>
<td>C22 Osc. Rock in</td>
</tr>
</tbody>
</table>

*It is recommended that this step be repeated using a received station of known frequency.

**Use minimum capacity if two peaks can be obtained.**

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ADJUSTMENTS FOR PUSH BUTTON TUNING.

1. Cut out tabs for six stations, arrange them in order of freq.
2. Press down on first P.B. and hold it down. The screw in back of P.B. is now accessible and should be loosened 1 or 2 turns.
3. While still holding down P.B., tune in first station represented by station tab with tuning knob, by Dial Tuning. When station is heard at its best, tighten screw in back of push button. Let go of P.B., turn tuning knob in order to detune and again press down button and let go. Station should be heard again. If not, repeat above adjustment until reception is satisfactory.
4. Proceed to set up other five push buttons in similar manner.
**Alignment Procedure**

Output Meter Alignment.—Connect the meter across the voice coil, and turn the receiver volume control to maximum.

Test-Oscillator.—Connect the low side of the test-oscillator to the receiver ground, and keep the output as low as possible.

**Precautionary Lead Dress**

1. Dress I-F plate and grid leads against chassis and away from each other. Dress plate lead from 12SK7 closer to chassis.
2. Dress leads from terminal board on loop support away from loop.

**Calibration Scale**

Calibration Scale.—The glass tuning dial may be easily removed from the cabinet and temporarily attached to the chassis for quick reference during alignment. Or, if necessary, the calibration scale printed in this service note can be used in conjunction with an ordinary 12-inch ruler as an accurate and convenient substitute for the regular dial.

Using Calibration Scale.—

1. With gang in full mesh, move the dial pointer to the reference mark at the left-hand end of the dial backing plate.
2. Place a flat 6-inch ruler on the dial backing plate so the left end of ruler is at the reference mark at left-hand of backing plate. Temporarily fasten the ruler with scotch tape to the backing plate.
3. Refer to calibration scale printed in this service note. This is a reduced reproduction of the dial with an inch-scale drawn at the bottom. To find the correct pointer position in inches for any desired frequency, draw a vertical line through this frequency on the calibration scale. For example, 1,500 kc is approximately 3 1/2 inches from the reference mark.

**Dial-Indicator and Drive Mechanism**

**Steps** | Connect test-osc. output to | Tune test-osc. to | Turn radio dial to | Adjust the following for max. peak output—
---|---|---|---|---
1 | 1-F grid through 0.1 mfd. capacitor and ground | 455 kc | Quiet point between 550-750 kc | L-3 and L-4 (2nd I-F trans.)
2 | 1st det. grid through 0.1 mfd. capacitor and ground | 455 kc | | L-1 and L-2 (1st I-F trans.)
3 | Antenna terminal (open link between "A" and "C") in series with 47 mfd. | 15 mc | | C-1 oscillator
4 | Antenna terminal (open link between "A" and "C") in series with 47 mfd. | 15 mc | Rock at 15 mc | C-2 antenna while rocking
5 | 1,500 kc | 1,500 kc "A" band | C-3 oscillator C-4 antenna
6 | Antenna terminal (open link between "A" and "C") in series with 200 mfd. | 600 kc | Rock at 600 kc "A" band | L-5 oscillator while rocking
7 | 1,500 kc | 1,500 kc "A" band | C-3 oscillator C-4 antenna

Oscillator should track on high frequency side of signal. If two peaks are obtained use high frequency (minimum capacity) peak. If two peaks can be obtained use low frequency (maximum capacity) peak.

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**Model WR-13K5**

**Electrical and Mechanical Specifications**

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>540-1,200 kc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interchangeable Frequency</td>
<td>455 kc</td>
</tr>
</tbody>
</table>

**Tube Complement**

- 1st I.F. 12SQ7
- 2nd I.F. 12SK7
- 2nd I.F. 12SA7
- Half-Wave Rectifier

**Dial Lamp**

- 6 volts, 0.2 amp.

**Power Supply Ratings**

- Audio (120 volts, 60 cycle supply)
  - 75 milliamperes
  - 150 milliamperes

**Power Output**

- 0.8 watts
- 1.2 watts

**Condenser Tolerance**

- 120 volts, 0.01 mfd.
- 200 volts, 0.01 mfd.

**Alignment Procedure**

**Output Meter Alignment**

- Connect the meter across the voice coil, and turn the receiver volume control to maximum.

**Test Oscillator**

- Connect the low side of the test oscillator to the receiver chassis, through a 0.1 mfd. capacitor, and keep the output as low as possible.

**WR-177, WR-179, WR-180 Adjustments for Push Button Tuning**

**Push Button Adjustments**

- Connect the high side of the test oscillator to the receiver chassis, through a 0.1 mfd. capacitor, and keep the output as low as possible.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Connect the high side of test oscillator to—</th>
<th>Tune test osc. to—</th>
<th>Turn radio dial to—</th>
<th>Adjust the following for max. peak output—</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tuning condenser (osc.) in series with .01 mfd.</td>
<td>455 kc</td>
<td>Quiet point at 1,600 kc end of dial</td>
<td>C1, C2, C3, C4 (1st and 2nd I.F. transformers)</td>
</tr>
<tr>
<td>2</td>
<td>Antenna terminals in series with .01 mfd.</td>
<td>1,000 kc</td>
<td>Full clockwise (out of mesh)</td>
<td>C5 (oscillator)</td>
</tr>
<tr>
<td>3</td>
<td>1,500 kc</td>
<td>1,500 kc</td>
<td>Resonance at 5,500 kc signal</td>
<td>C6 (antenna)</td>
</tr>
</tbody>
</table>

**Electrical and Mechanical Specifications**

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>540-1,200 kc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Ratings</td>
<td>A.C. Rating: 105-125 volts, 50-60 cycles, 15 watts</td>
</tr>
<tr>
<td></td>
<td>D.C. Rating: 105-125 volts, direct current, 15 watts</td>
</tr>
<tr>
<td>Power Output (125 volts, 60 cycle supply)</td>
<td>Undistorted: 0.8 watts</td>
</tr>
<tr>
<td></td>
<td>Maximum: 1.2 watts</td>
</tr>
</tbody>
</table>

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ALIGNMENT PROCEDURE

The following equipment is necessary to properly align this chassis:
1. A signal generator which will provide an accurately calibrated signal at the frequencies listed.
2. An output meter.
3. A non-metallic screw driver
4. Dummy antennae—.1 mfd., 200 mmf.

<table>
<thead>
<tr>
<th>GENERATOR</th>
<th>CONNECTION AT RADIO</th>
<th>DUMMY ANTENNA</th>
<th>DIAL</th>
<th>TRIMMER TO TUNE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>455 kc</td>
<td>I.F. 455 kc</td>
<td>.1 mfd</td>
<td>H.F. End</td>
<td>I.F. Transformers</td>
<td>Tune to Max.</td>
</tr>
<tr>
<td>1720 kc</td>
<td>Ext. Ant. Wire</td>
<td>200 mmf</td>
<td>H.F. End</td>
<td>Oscillator Trimmer</td>
<td>Set limit of band</td>
</tr>
<tr>
<td>1400 kc</td>
<td>Ext. Ant. Wire</td>
<td>200 mmf</td>
<td>1400</td>
<td>Antenna Trimmer</td>
<td>Tune to Max.</td>
</tr>
</tbody>
</table>

VOLTAGES ARE MEASURED WITH 1000 OHM PER VOLT METER, ON 117 VOLT LINE WITH NO SIGNAL (ANTENNA LEAD SHORTED TO CHASSIS)

TUBES
12SA7 - Conv. osc.
12SK7 - I.F.
12SQ7 - Det. Avc.-A F
50L6GT - BP output
35Z5GT - Rectifier

LOUDSPEAKER 5" electro Dyn.
V.C. IMPEDANCE 3.2 ohms at 400 ~

POWER OUTPUT
Undistorted .75 watts
Maximum 1.4 watts

© John F. Rider
Alignment Procedure

Output Meter Alignment.—If this method is used, connect the meter across the voice coil, and turn the receiver volume control to maximum.

Test-Oscillator.—For all alignment operations, connect the low side of the test-oscillator to the common negative, and keep the output as low as possible to avoid a-c action.

1. Connect the high side of test-oscillator to Test Osc.
2. Connect the low side of test-oscillator to L6 and L10.
3. Connect the low side of the test-oscillator to the common negative, and turn the receiver volume control to maximum.

Calibration Scale.—The glass tuning dial may be easily removed from the cabinet and temporarily attached to the chassis for quick reference during alignment. In the event that only the chassis is returned for service, and the cabinet with its tuning dial is left in the customer’s home, the scale printed in this service note can be used as an accurate and convenient substitute for the regular dial.

2. First audio grid coupling capacitor C23 and C24 to be dressed close to chassis and away from heater wiring. Prevents hum.

Critical Lead Dress:
1. Lead from 6SK7 i-f plate to last i-f transformer to be dressed close to chassis and under all other leads. Prevents i-f beats.

For R.C.A. RP-162 Record Changer see Rider’s "Automatic Record Changers and Recorders"
ALIGNMENT PROCEDURE

ALIGNMENT OF I.F. (465 K.C.)
1. Set vol. cont. to max. pos., wave change sw. to std. B.C.
2. Connect output meter across voice coil terms. of the
spkr.
3. Set test osc. to 465 K.C. and adj. output for a
measureable reading on output meter when test sig-
ral is applied to the grid of 6A7 det. osc thru .05 mfd. blocking
cond.
4. Adjust trimmers No. 9 and No. 11 to maximum output.

ALIGNMENT OF OSCILLATOR AND R.F.
1. Check pointer setting, exactly horizontal when tuning cond. is
completely closed.
17 to maximum output.
3. Apply test to ant. of receiver thru .0001 mfd. blocking cond. and
adj. trimmer condenser No. 6 to maximum output.
4. Check sensitivity over the band.
5. Turn wave change sw. to S.W. band and check sensitivity over scale.

TUBE SOCKETS VIEWED
FRON BTTON

WESTINGHOUSE RADIO MODEL WR-102
Alignment Procedure

Output Meter Alignment.—Connect the meter across the voice coil, and turn the receiver volume control to maximum.

Test-Oscillator.—Connect the low side of test-oscillator to the receiver chassis through a 0.01 mfd. capacitor, and keep the output as low as possible.

Pre-Setting Pointer.—With gang condenser in full mesh, the pointer should be adjusted to a horizontal position.

Voltages should hold within + 20% with 117 V. AC supply.

*Starred voltages are operating voltages in circuits with high series resistance, the actual measured voltages will be lower, depending on the VM loading.

<table>
<thead>
<tr>
<th>Step</th>
<th>Connect high side of test oscillator to</th>
<th>Tune test oscillator to</th>
<th>Adjust following for max. output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grid 12SK7 in series with 0.01 mfd.</td>
<td>455 kc</td>
<td>C3 and C4 (2nd I-F Trans.)</td>
</tr>
<tr>
<td>2</td>
<td>Grid 125A7 in series with 0.01 mfd.</td>
<td>1,620 kc</td>
<td>C5 (osc.)</td>
</tr>
<tr>
<td>3</td>
<td>Antenna in series with 300 ohms</td>
<td>18 mc</td>
<td>C6 (ant.)</td>
</tr>
<tr>
<td>4</td>
<td>Antenna in series with 200 mfd.</td>
<td>600 kc</td>
<td>C7 (osc.)</td>
</tr>
</tbody>
</table>

Repeat steps 4 (rock in), 5 and 6.

* Use minimum capacity peak if two can be obtained.

Note: Oscillator tracks above signal on both bands.

Schematic Circuit Diagram for the Model WR182 is the same as that for WR182 except connections and parts as shown above.

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Alignment Procedure

Output Meter Alignment.—Connect the meter across the voice coil, and turn to the receiver volume control to maximum.

Test-Oscillator.—Connect the low side of the test-oscillator to the receiver ground, and keep the output as low as possible.

Precautionary Lead Dress
1. Dress 1st I-F plate and grid leads against chassis and away from each other. Dress plate lead from 125K7 close to chassis.
2. Dress leads from terminal board on loop support away from loop.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Connect the high side of test-oscillator to—</th>
<th>Tune test-osc. to—</th>
<th>Turn radio dial to—</th>
<th>Adjust the following for max. peak output—</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tuning condenser stat. (exc.) in series with .01 mfd.</td>
<td>455 kc</td>
<td>Quiet point at 1,600 kc end of dial</td>
<td>LI, L2, L3, L4 (1st and 2nd I-F transformers)</td>
</tr>
<tr>
<td>2</td>
<td>Antenna term. of ant. loop in series with 100 mmd.</td>
<td>1,500 kc</td>
<td>1,500 kc</td>
<td>CI (oscillator)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>600 kc</td>
<td>600 kc</td>
<td>L5 (oscillator)</td>
</tr>
<tr>
<td>4</td>
<td>Repeat steps 2 and 3.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calibration Scale.—The glass tuning dial may be easily removed from the cabinet and temporarily attached to the chassis for quick reference during alignment. Or, if necessary, the calibration scale printed in this service note can be used in conjunction with an ordinary 12-inch rule as an accurate and convenient substitute for the regular dial.

Receiver Dial Scale and Corresponding Calibration Scale

Using Calibration Scale.—
1. With gang in full mesh, move the dial pointer to the reference mark at the left-hand end of the dial backing plate.
2. Place a flat 12-inch ruler on the dial backing plate so the left-end of ruler is at the reference mark at left-end of backing plate. Temporarily fasten the ruler with scotch tape to the backing plate.
3. Refer to calibration scale printed in this service note. This is a reduced reproduction of the dial with an inch-scale drawn at the bottom. To find the correct pointer position in inches for any desired frequency, draw a vertical line through this frequency on the calibration scale. For example 1,500 kc is approximately 1½ inches from the reference mark.

Adjustments for Push Button Tuning

The push buttons should be adjusted for six favorite stations after the receiver has been operating for a brief warm-up period. Each button may be set up to any standard broadcast station. The preferable arrangement is to adjust for stations in the order of frequency, from low to high. Proceed as follows:

1. Cut out the tabs for your six favorite stations and arrange them in order of frequency in the recesses on the push buttons.
2. Press down on the first push button and hold it down. The screw in back of the push button is now accessible and should be loosened one or two turns with a screwdriver.
3. While still holding down the push button, tune in the first station represented by the station tab with the tuning knob, by Dial Tuning. When the station is heard at its best, tighten up the screw in back of the push button. Now let go of the push button. Turn the tuning knob in order to detune and again press down the button and let go. The station should be heard again. If not, repeat the above adjustment process until reception is satisfactory.
4. Proceed to set up the other five push buttons in a similar manner.

A station may be changed at any time by following the above information.

Dial-Pointer Adjustment.—After the chassis is replaced in cabinet, move the dial pointer (if necessary) so that it is at the left-hand graduation on the dial with the gang in full mesh.

INTERMEDIATE FREQUENCY 455 kc

POWER SUPPLY RATINGS

<table>
<thead>
<tr>
<th>A-C Rating</th>
<th>D-C Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>105-125 V.</td>
<td>105-125 V.</td>
</tr>
<tr>
<td>50-60 Hz</td>
<td>d.c. 30 W.</td>
</tr>
<tr>
<td>30 W.</td>
<td>455 kc</td>
</tr>
<tr>
<td>Undistorted</td>
<td>Maximum</td>
</tr>
<tr>
<td>1.1 watts</td>
<td>5-inch Permanent Magnet</td>
</tr>
<tr>
<td>1.4 watts</td>
<td>LOUDSPEAKER</td>
</tr>
</tbody>
</table>

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VOLTAGE ANALYSIS

Readings should be taken with a 1000 ohms-per-volt meter. Voltages listed below are from point indicated to ground (chassis) with the volume control turned off and no signal. Line voltage for these readings was 117.2 volts, 60 cycles, a.c.

Voltage across speaker field—70.
Voltage from B minus to chassis—80. B plus at 80 filament—262.

Location of Coils and Trimmer Adjustments

The two I-f transformers are located on top of the chassis deck. The first I-f transformer is the one directly behind the 6AC7 tube. The trimmers for the two I-f transformers are available through holes in the side of the case.

The trimmers for the antenna and oscillator coils are located on the variable condenser. The trimmer on the front section is for the antenna coil.

The 456 kc wave-trap is mounted on the rear chassis wall directly behind the wave-band switch. The trimmers for the 456 kc wave-trap is mounted on the coil and is accessible from the bottom of the chassis.

I-f and Wave-Trap Alignment

Rotate the wave-band switch (located on the rear wall of the chassis) to the broadcast position, clockwise, and swing the variable condenser to the maximum capacity position. Feed 456 kc through a dummy antenna (a 600 ohm resistor may be used as a substitute) to the antenna lead and adjust the wave-trap trimmer for maximum response (see General Rider, paragraph No. 1).

Broadcast Alignment

With the wave-band switch in the broadcast position, clockwise, set the dial pointer at 140. Feed 1600 kc through a standard dummy antenna (a 6000 ohm resistor may be used as a substitute) to the antenna lead and adjust first the oscillator trimmer (rear section of variable condenser) for maximum response. The police band is self-tracking and does not require any adjustment.

WAVE BAND SWITCH SHOWN IN

BROADCAST POSITION.

POSITION NO.1—POLICE

POSITION NO.2—BROADCAST

WESTINGHOUSE ELECTRIC SUPPLY CO.
WESTINGHOUSE RADIO MODEL WR-209

ELECTRICAL SPECIFICATIONS

Type and Number of Tubes: 1 #6Y7, 1 #6E6, 1 #72, 1 #82, 1 #80 - Total 5 tubes
Power Supply: 110V to 115V, 50 to 60 cycles A.C.
Power Consumption: 40 Watts
Tuning Ranges: 450 to 1600 K.C. and 1600 to 3000 K.C.
Maximum Undistorted Output: 0.5 Watts
Maximum Output: 0.2 Watts

GENERAL DESCRIPTION

This model is a five-tube, A.C. two-band superheterodyne receiver whose circuit comprises a combined first detector-oscillator, an intermediate frequency amplifier, a combined second detector, i.e.c., and a first audio amplifier, a power pentode output stage and a rectifier with its associated filter circuit and power transformer.

This model is designed to work over two bands, the broadcast band extending from 540 to 1600 K.C. and a police band which extends from 1400 to 3000 K.C.

LINE-UP CAPACITOR ADJUSTMENTS

To align the circuits of this receiver it is essential to use a high grade modulated test oscillator, the output of which can be continuously varied with a meter from over-load when the individual circuits of the receiver are brought into alignment.

A conventional output meter can be connected across the terminals of the audio output circuit and the voice coil to indicate when the circuits are aligned. The sensitivity of the output meter must be sufficient to give satisfactory reading with a low input signal.

Before attempting to align the receiver, the service man should familiarize himself with the general layout of the chassis, location of the tubes and various alignment condensers. Top and bottom views of the chassis are shown in Fig. #1 and #2 and should be carefully studied before the actual work is started.

ADJUSTMENT OF J.F. (465 K.C.)

1. Set volume control on full, turn tone control knob to right hand position. Set wave-change switch to broadcast position and the dial indicator at approximately 800 K.C.
2. Connect output meter across voice coil of speaker.
3. Adjust output to produce a measurable reading on output meter when test signal is applied to the grid of the 6K7 c.r. tube thru a .05 mfd. blocking condenser.
4. Adjust #6B (see Fig. #2) to maximum output reading or output of test oscillator as required.
5. Apply test signal to grid of 6K7 first detector-oscillator tube and adjust #18 and #20 (Fig. #1) to maximum output.

ADJUSTMENT OF BROADCAST BAND

1. Leave test signal on grid of 6K7 tube and set the test oscillator to 1000 K.C.
2. Turn the dial condenser to its maximum position. Adjust dial indicator until either horizontal line is on the dial scale.
3. Then set dial indicator to 1400 K.C. and adjust #7 trimmer to maximum output.
4. Apply test signal to antenna of set and adjust trimmer #8 to maximum output.

ADJUSTMENT OF POLICE BAND

When adjustments as outlined under the broadcast band are completed, the police band requirements are quite similar. The only difference is that the coil had been changed. In this event, set test oscillator and station indicator to 1700 K.C. and apply test signal to antenna lead. The police band tuning is indicated by "A" in Fig. #2. Adjust the position of this winding by sliding it back and forth on the core until maximum output is indicated on the output meter. This winding should then be secured in place by applying a thin coat of coil cement.

SERVICES PARTS LIST

<table>
<thead>
<tr>
<th>Dia. #</th>
<th>Part #</th>
<th>Description of Parts</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RC 9560</td>
<td>Antenna coil assembly</td>
<td>$1.10</td>
</tr>
<tr>
<td>2</td>
<td>CI 958</td>
<td>400 mfd. mica condenser</td>
<td>$0.20</td>
</tr>
<tr>
<td>3</td>
<td>SA 10947</td>
<td>Police pre-selector coil - part of RC 9569</td>
<td>$0.80</td>
</tr>
<tr>
<td>4</td>
<td>SA 10947</td>
<td>Switch assembly</td>
<td>$0.65</td>
</tr>
<tr>
<td>5</td>
<td>CS 9542</td>
<td>Variable gang condenser</td>
<td>$0.45</td>
</tr>
<tr>
<td>6</td>
<td>SA 100197</td>
<td>Trimmer condenser - part of RC 9542</td>
<td>$0.15</td>
</tr>
<tr>
<td>7</td>
<td>SA 100197</td>
<td>Trimmer condenser - part of RC 9542</td>
<td>$0.15</td>
</tr>
<tr>
<td>8</td>
<td>SA 10958</td>
<td>Oscillator coil assembly</td>
<td>$0.25</td>
</tr>
<tr>
<td>9</td>
<td>SA 10958</td>
<td>100 mfd. mica condenser</td>
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<tr>
<td>10</td>
<td>SA 10958</td>
<td>50,000 ohm, 1/2 W. resistor</td>
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</tr>
<tr>
<td>11</td>
<td>SA 10958</td>
<td>100 mfd. mica condenser</td>
<td>$0.25</td>
</tr>
<tr>
<td>12</td>
<td>SA 10958</td>
<td>0.5 mfd., 200 V. condenser</td>
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</tr>
<tr>
<td>13</td>
<td>SA 10958</td>
<td>250,000 ohm, 1/2 W. resistor</td>
<td>$0.15</td>
</tr>
<tr>
<td>14</td>
<td>SA 10958</td>
<td>1500 mfd., 1/4 W. resistor</td>
<td>$0.15</td>
</tr>
<tr>
<td>15</td>
<td>SA 10958</td>
<td>0.5 mfd. 400 V. condenser</td>
<td>$0.15</td>
</tr>
<tr>
<td>16</td>
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<td>25,000, 1/2 W. resistor</td>
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</tr>
<tr>
<td>17</td>
<td>IC 9525</td>
<td>1st I.F. transformer (465 K.C.)</td>
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<tr>
<td>18</td>
<td>IC 9525</td>
<td>I.F. trimmer condenser - part of IC 9525</td>
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</tr>
<tr>
<td>19</td>
<td>IC 9525</td>
<td>(1 mfd., 400 V. condenser</td>
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<td>20</td>
<td>SA 10964</td>
<td>0.05 mfd., 200 V. condenser - part of IC 9530 (dual)</td>
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<tr>
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<td>SA 10964</td>
<td>100 mfd. mica condenser</td>
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</tr>
<tr>
<td>23</td>
<td>IC 9703</td>
<td>I.F. trimmer condenser - part of IC 9530</td>
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<tr>
<td>24</td>
<td>IC 9703</td>
<td>100 mfd. mica condenser</td>
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</tr>
<tr>
<td>25</td>
<td>IC 9703</td>
<td>Volume control and line switch - (600,000 ohm)</td>
<td>$1.25</td>
</tr>
<tr>
<td>26</td>
<td>IC 9703</td>
<td>1 mfd., 1/4 W. resistor</td>
<td>$0.15</td>
</tr>
<tr>
<td>27</td>
<td>IC 9703</td>
<td>0.05 mfd. 400 V. condenser</td>
<td>$0.15</td>
</tr>
<tr>
<td>28</td>
<td>IC 9703</td>
<td>1 mfd., 1/4 W. resistor</td>
<td>$0.15</td>
</tr>
<tr>
<td>29</td>
<td>IC 9703</td>
<td>100 mfd., 1/4 W. resistor</td>
<td>$0.15</td>
</tr>
<tr>
<td>30</td>
<td>IC 9703</td>
<td>250,000 ohm, 1/4 W. resistor</td>
<td>$0.15</td>
</tr>
<tr>
<td>31</td>
<td>IC 9703</td>
<td>500 mfd., 1/4 W. resistor</td>
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<tr>
<td>32</td>
<td>SA 10975</td>
<td>Tune control switch</td>
<td>$0.65</td>
</tr>
<tr>
<td>33</td>
<td>SA 10975</td>
<td>Tune control switch</td>
<td>$0.65</td>
</tr>
<tr>
<td>34</td>
<td>SA 10975</td>
<td>Speaker field coil - (1200 ohm)</td>
<td>$0.15</td>
</tr>
<tr>
<td>35</td>
<td>SA 10975</td>
<td>0.05 mfd. 200 V. condenser - part of IC 9525 (dual)</td>
<td>$0.30</td>
</tr>
<tr>
<td>36</td>
<td>SA 10975</td>
<td>Speaker field coil - (1200 ohm)</td>
<td>$0.15</td>
</tr>
<tr>
<td>37</td>
<td>SA 10975</td>
<td>100 mfd. electrolytic condenser (300 V.)</td>
<td>$1.25</td>
</tr>
<tr>
<td>38</td>
<td>SA 10975</td>
<td>100 mfd. electrolytic condenser</td>
<td>$1.25</td>
</tr>
<tr>
<td>39</td>
<td>SA 10975</td>
<td>0.05 mfd. 200 V. condenser - part of IC 9525 (dual)</td>
<td>$0.30</td>
</tr>
<tr>
<td>40</td>
<td>SA 10975</td>
<td>0.05 mfd. 200 V. condenser - part of IC 9525 (dual)</td>
<td>$0.30</td>
</tr>
<tr>
<td>41</td>
<td>SA 10975</td>
<td>8 mfd. electrolytic condenser (300 V.)</td>
<td>$1.25</td>
</tr>
<tr>
<td>42</td>
<td>SA 10975</td>
<td>8 mfd. electrolytic condenser</td>
<td>$1.25</td>
</tr>
<tr>
<td>43</td>
<td>SA 10975</td>
<td>30 mfd. resistor - part of IC 9525</td>
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</tr>
<tr>
<td>44</td>
<td>SA 10975</td>
<td>Power transformer 100-120 V. - 400 watts</td>
<td>$0.25</td>
</tr>
<tr>
<td>45</td>
<td>SA 10975</td>
<td>Line switch - part of RC 957</td>
<td>$0.25</td>
</tr>
<tr>
<td>46</td>
<td>SA 10975</td>
<td>Oscillator feed back coil - part of RC 9569</td>
<td>$0.20</td>
</tr>
<tr>
<td>47</td>
<td>SA 10975</td>
<td>Police oscillator coil - part of RC 9569</td>
<td>$0.20</td>
</tr>
<tr>
<td>48</td>
<td>SA 10975</td>
<td>10,000 ohm, 1/4 W. resistor</td>
<td>$0.15</td>
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<tr>
<td>49</td>
<td>SA 10975</td>
<td>0.05 mfd., 400 V. condenser</td>
<td>$0.15</td>
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<tr>
<td>50</td>
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<td>Speaker field coil - (1200 ohm)</td>
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<tr>
<td>51</td>
<td>SA 10975</td>
<td>Diaphragm and voice coil</td>
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</tr>
<tr>
<td>52</td>
<td>SA 10975</td>
<td>Dial lamp - part of RC 957</td>
<td>$0.25</td>
</tr>
<tr>
<td>53</td>
<td>SA 10975</td>
<td>Dial cable and plug</td>
<td>$0.25</td>
</tr>
</tbody>
</table>

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Alignment Procedure

1. Place the oscillator in alignment. Connect the low side of the oscillator to the receiver chassis, and keep the output as low as possible to avoid dazzle action.

2. Place a flat 12-inch ruler on the dial backing plate so the millimeter to the left of the ruler is at the reference mark at left-hand of dial. Temporarily fix the ruler with rubber tape to the dial backing plate.

3. To find the correct pointer position in inches for any desired frequency, draw a vertical line through this frequency on the calibration scale. For example, 1500 kc is approximately 4 inches from the reference mark.

4. Dial Pointer Adjustment.—After the chassis is replaced in cabinet, move the dial pointer till necessary, so that it is at the left-hand graduation on the dial, with the ganged full mesh.

5. Using Tuning Dial—
   1. Slide out the flat spring clamp at each end of the dial and remove the glass dial from the cabinet.
   2. With gang in full mesh, move the dial pointer to the reference mark at the left-hand end of the dial backing plate.
   3. Place the pointer to the left so that the extreme left scale graduations coincide with the pointer. Use stretch tape to hold the glass dial in this position.
   4. After completion of the alignment, replace the glass dial in cabinet, taking care that the fibre light shields are in correct position at ends of dial.

6. Using Calibration Scale—
   1. With gang in full mesh, move the dial pointer to the reference mark at the left-hand end of the dial backing plate.

Push Button Adjustment

The push buttons connect to separate magnetite-core oscillators and separate antenna trimmers which must be adjusted for the desired stations. Use an insulated screwdriver or alignment tool. Allow at least five minutes warm-up period before adjustments.

In the event that the receiver is to be used with an external antenna use one or two feet of wire (as an antenna) to ensure sharp tuning during the final calibration procedure. For loop operation, the link should be strapped across "A" and "G" terminals on back of set. In either case the procedure is as follows:

1. Make a list of the desired stations, arranged in order from low to high frequencies.
2. Turn the range selector to "A" band, and manually tune in the first station on the list.
3. Turn Range Control knob to "PB" and press push button No. 1, and adjust No. 1 oscillator core to receive this station. Screw the core all the way in, to lowest frequency, and then unscrew slowly until station is received.
4. Adjust No. 1 antenna trimmer for maximum output on the station.
5. Owing to the relatively high R.F. gain, it may be found that there are several settings of each push-button magnetic core which will bring in any particular station. In such cases it is advisable to un-screw the push button antenna trimmer to minimum capacity before adjusting the oscillator core.
6. Clockwise adjustment of cores and trimmers at the circuits to lower frequencies.
7. Adjust for each of the remaining stations in the same manner.
8. After all stations are tuned in on the buttons, make a final calibration of all core rods until reception is obtained for each. Outdoor antenna should now be reconnected if used.

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Westinghouse Electric Supply Co.
Alignment Procedure

Output Meter Alignment—If this method is used, connect the meter across the voice coil, and turn the receiver volume control to maximum.

Test-Oscillator—For all alignment operations, keep the output as low as possible to avoid a-v-c action. Connect the high side of the test-oscillator to one of the antenna loop primary leads. Connect the low side of the test-oscillator to the other antenna loop primary lead.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Tune test-osc. to—</th>
<th>Turn Radio dial to—</th>
<th>Adjust for max. peak output—</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>455 kc</td>
<td>Quiet point at 1700 kc end of dial</td>
<td>C1, C2, C3, C4 (1st and 2nd I-F transformers)</td>
</tr>
<tr>
<td>2</td>
<td>1700 kc</td>
<td>1700 kc</td>
<td>C5 osc.</td>
</tr>
<tr>
<td>3</td>
<td>1500 kc</td>
<td>1500 kc</td>
<td>C6</td>
</tr>
</tbody>
</table>

Frequency Range ................................................................. 540-1700 kc
Intermediate Frequency ......................................................... 455 kc

RCA TUBE COMPLEMENT
(1) RCA-1A7-GT .............................................................. 1st-Det.-Osc.
(2) RCA-1N5-GT .............................................................. I-F Amplifier
(3) RCA-1H5-GT .............................................................. 2nd-Det., A-F, and A.V.C.
(4) RCA-1T5-GT .............................................................. output
(5) RCA-35Z4G-GT ............................................................. Rectifier

LINE CURRENT SUPPLY
110 to 125 volts, AC 40 to 60 cycles, or DC ........................................... 20 watts

BATTERIES REQUIRED
"A" one 6 volt dry plug-in type (Eveready No. 747 or equivalent)
"B" two 45 volt dry plug-in type (Eveready No. 482 or equivalent)

CURRENT CONSUMPTION
"A," 0.05 ampere—"B," 10.5 milliamperes full power.

POWER OUTPUT
Undistorted ................................................................. 0.10 watt
Maximum ................................................................. 0.19 watt

LOUDSPEAKER
Type ................................................................. 3-inch permanent-magnet dynamic
Voice-coil Impedance ................................................ 3.5 ohms at 400 cycles

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ALIGNMENT PROCEDURE

A Signal Generator and Output Meter are necessary for proper alignment of this receiver.

Before proceeding with any re-alignment, see that the pointer is in a horizontal position when the plates are fully meshed. Be sure that the grid leads to the 1N5 tubes are not too close together, and move the lead from the loop antenna away from the IF grid.

THE INTERMEDIATE FREQUENCY is 455 KC. Connect the high side of the Signal Generator to the 1A7 grid with the grid cap removed and the low side to chassis. Set the Generator to this frequency. Adjust for maximum output as indicated on the output meter, which is connected across the Speaker Voice Coil. The I.F. trimmers are in the tops of the shield cans.

Replace the 1A7 grid cap. Couple the signal generator to the receiver by connecting to the A and G terminals on the back of the case. Turn the Signal Generator to 1400 KC, rotate the tuning knob to indicate this frequency and tune in the signal by means of the oscillator trimmer which is located on the right side (rear) of the variable condenser. Now adjust the antenna trimmer (front section of the variable condenser) for maximum output.

No further adjustments are required.

TUBES: 1A7GT - Det.-Osc.  
1N5GT - 1st I.F.  
1N5GT - 2nd I.F.  
1H5GT - Det. a.v.c. and A.F.  
3Q5GT - Output  
35Z5GT - Rectifier

POWER OUTPUT:

Undistorted .17 watt
Maximum .250 watt

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120 or 240 Volt Power Transformer Connections

All radios except those for use on 25 cycles are equipped with a dual voltage power transformer which may be connected for 120 volts or 240 volts operation on 50-60 cycles. See diagram on page 3.

Drive Cord Replacement

Turn gang condenser to completely closed position. Using a new drive cord 45" in length, tie one end to tension spring. Pass other end through hole in rim of drive pulley. Pull spring flush against inside of pulley rim. Wind cord around drive pulley and pass over idler pulleys “A”, “B”, and “C” — See illustration.

Continue cord around drive pulley to tuning control shaft. Cord should be on right side of pulley groove (from gang condenser end of chassis). Wind drive cord 2 turns around section of tuning control shaft directly below drive pulley —See illustration.

Continue cord around drive pulley. Pass cord through hole in pulley rim. Tie cord to tension spring. Stretch tension spring and secure free end to hook on pulley.

ALIGNMENT PROCEDURE

<table>
<thead>
<tr>
<th>SIGNAL GENERATOR</th>
<th>FREQUENCY CONNECTION</th>
<th>DUMMY SW.setScale</th>
<th>SETTING</th>
<th>ADJUST TRIMMERS TO MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.F.</td>
<td>456 KC Antenna Lead</td>
<td>.1 mf.</td>
<td>Broadcast (to left)</td>
<td>Turn Rotor to Full Open</td>
</tr>
<tr>
<td>S.W. [RANGE D]</td>
<td>18,000 KC Antenna Lead</td>
<td>400 Ohm</td>
<td>Shortwave (to right)</td>
<td>Turn Rotor to Full Open</td>
</tr>
<tr>
<td></td>
<td>17,000 KC Antenna Lead</td>
<td>400 Ohm</td>
<td>Shortwave (to right)</td>
<td>Turn Rotor to Max. Output</td>
</tr>
<tr>
<td>Broadcast (RANGE B)</td>
<td>1600 KC Antenna Lead</td>
<td>200 mlf.</td>
<td>Broadcast (to left)</td>
<td>Turn Rotor to Full Open</td>
</tr>
<tr>
<td></td>
<td>1400 KC Antenna Lead</td>
<td>200 mlf.</td>
<td>Broadcast (to left)</td>
<td>Turn Rotor to Max. Output</td>
</tr>
</tbody>
</table>

Attenuate the signal from the signal generator to prevent the leveling-off action of the AVC.

After each range is completed, repeat the procedure as a final check.

NOTE A — If the pointer is not at 1400 KC on the dial when maximum output is obtained, move the pointer to the 1400 KC mark on the dial scale.

NOTE B — Turn the rotor back and forth and adjust the trimmer until the peak of greatest intensity is obtained.

CAUTION — When aligning the short wave bands, be sure NOT to adjust at the image frequency. This can be checked as follows: Let us say the signal generator is set for 15,000 KC. The signal will then be heard at 15,000 on the dial of the radio. The image signal should be heard at 15,000 less 912 KC, or 14,088 KC on the dial. It may be necessary to increase the input signal to hear the image.

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Page 14-2 WEST. INT.
WAVE RANGES
BROADCAST RANGE
A Range 535 to 1610 Kilocycles

This range is calibrated in kilocycles and meters. Standard Broadcast stations are tuned in on this range.

SHORT WAVE RANGES

B Range 3.2 to 7.4 Megacycles
C Range 8.3 to 12.0 Megacycles
D Range 15.0 to 22.0 Megacycles

The Short Wave ranges are calibrated in megacycles and meters. Short Wave broadcasts will be heard best on the D range during the day and on the B and C ranges at night.
WESlNGrHOUSE ELEC. INTERNATIONAL CO.

100-120 Volts DC or 40-60 Cycle AC Operation

To adjust this receiver for operation on a 100-120 volt DC or 40-60 cycle power supply, the 220 volt Voltage Adapter tube (Part No. 6A250) must be replaced with a 110 volt Voltage Adapter tube (Part No. 6A251).

**SPECIFICATIONS**

<table>
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<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Consumption (120 Volt Operation AC)</td>
<td>45 Watts 60 Watts</td>
</tr>
<tr>
<td>Power Output (120 Volt Operation AC)</td>
<td>2 Watts Undistorted 4.5 Watts Undistorted</td>
</tr>
<tr>
<td>Sensitivity (For 0.5 Watt Output)</td>
<td>3 Watts Maximum 6 Watts Maximum</td>
</tr>
<tr>
<td>Selectivity</td>
<td>37 KC Broad at 1000 Times Signal</td>
</tr>
<tr>
<td>Intermediate Frequency</td>
<td>456 KC</td>
</tr>
<tr>
<td>Speaker</td>
<td>6&quot; Electro-Dynamic</td>
</tr>
</tbody>
</table>

**Tuning Frequency Range**

- A Range: 535 to 1610 KC
- B Range: 3.2 to 7.4 MC
- C Range: 8 to 12 MC
- D Range: 15 to 22 MC

**ALIGNMENT PROCEDURE**

Before aligning make certain that dial pointer is adjusted properly as instructed under "Drive Card Replacement" on page 5. Volume Control—Maximum All Adjustments. Connect Radio Ground Lead to Ground Post of Signal Generator with a Short Heavy Lead. Allow Chassis and Signal Generator to "Heat Up" for several minutes.

1. **SYNCHRONOUS GENERATOR**
   - Frequency Setting in Radio Antenna Setting
   - Dummy Antenna Setting
   - Pointer Setting
   - Adjust Trimmers to Maximum

   | SIGNAL GENERATOR FREQUENCY CONNECTION DUMMY ANTENNA BAND SWITCH SETTING AT RADIO SETTING POSITION ADJUST TRIMMERS TO MAXIMUM |
   |-------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------|
   | 456 KC Antenna Lead                            | .1 mf. A Range                                                  | Turn Tuning knobs until Position Is Reached      |
   | RANGE D .8 MC Antenna Lead                     | 400 Ohm D Range                                                | 2nd I.F. (C10) & (C11)                          |
   | Reset to 12.0 MC Antenna Lead                  | 400 Ohm D Range                                                | 1st I.F. (C17) & (C18)                          |
   | RANGE C 13.0 MC Antenna Lead                   | 400 Ohm C Range                                                | Antenna Range D (C4)                            |
   | Reset to 11.5 MC Antenna Lead                  | 400 Ohm C Range                                                | Rock Tune—See Note A                            |
   | RANGE B 7.4 MC Antenna Lead                    | 400 Ohm B Range                                                | Antenna Range C (C5)                            |
   | Reset to 7.0 MC Antenna Lead                   | 400 Ohm B Range                                                | Rock Tune—See Note A                            |
   | RANGE A 1610 KC Antenna Lead                   | 200 mfn. A Range                                               | Antenna Range A (C7)                            |

**POWER SUPPLY**

Radio shipped from factory for operation on a power supply of 200 to 240 volts D.C. or 40 to 60 cycles A.C. An adjustment can be made for operation on a line voltage of 100 to 120 volts D.C. or 40 to 60 cycles A.C.
DRIVE CORD REPLACEMENT

Turn drive shaft until cores are entirely within coil form. Pass cord through hole in tuning shaft and bring two ends together; evenly. CAUTION—Cord must remain centered on shaft. Wind one part of cord two turns on tuning shaft in a counterclockwise direction (from front of chassis). These turns should progress away from chassis. Hold both parts of cord and withdraw cores from within coils slowly by turning the tuning shaft. One part of cord should progress towards chassis and the other away from the chassis. Unwind the inside cord from shaft. Then wind this cord two turns in a clockwise direction (from front of chassis). These turns should progress towards rear of chassis.

Pass this cord over idle pulleys A—see illustration. Pass outer cord on tuning shaft over idle pulleys B, C, D and E, attaching it to tension spring. Secure other end of cord to opposite end of tension spring. This spring should be slightly stretched for tension.

ATTACHING DIAL POINTER

Turn tuning knob clockwise until extreme high frequency position is reached. (Cores completely out of coils.) Slip the pointer on the dial cord and move to high frequency end of dial scale. Carefully align pointer with end of printed scale and clamp securely into position.

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**Frequency Range**

545 to 1630 K.C.

**Intermediate Frequency**

455 K.C.

**Power Supply Ratings**

- **Alternating Current**
  - 106-125 volts, 50-60 cycles, 30 watts

- **Direct Current**
  - 105-125 volts, 30 watts

---

**Alignment Procedure**

A test oscillator or signal generator is required together with an output meter. Connect the output meter across the voice coil. For I.F. alignment connect the low side of the signal generator or test oscillator to the Negative bus. (This connection may be made at the line switch) The high side is then connected to the stator of the antenna section (rear) through a .01 mfd condenser. Then align the I.F. trimmers for maximum as indicated on the output meter. Should any station interfere while this adjustment is being made, turn the variable condenser to a quiet point on the dial.

Connect the test oscillator to antenna and ground leads of the receiver. Now open the variable condenser with the plates entirely out of mesh. Set the test oscillator to 1630 K.C. and adjust the oscillator trimmer (front section of the variable condenser) to this frequency. Now change to a clear spot on the dial at about 1400 K.C., set the test oscillator to this frequency and align the antenna trimmer (rear section) for maximum. No other adjustments are required.
Westinghouse Elec. International Co.

During the alignment procedure all adjustments should be made under the following conditions:

1. Line Voltage as indicated elsewhere in these instructions (or a fresh set of batteries)
2. Volume control at maximum.
3. Minimum input from the Signal Generator to give a good readable signal on the output meter.

If this procedure is not adhered to, all adjustments will appear very broad due to the action of the automatic volume control.

### SIGNAL GENERATOR FREQUENCY | BAND | ADJUST TRIMMERS FOR MAXIMUM OUTPUT IN SEQUENCE INDICATED (SEE SKETCH) | REMARKS
--- | --- | --- | ---
A | 455 MC | I.F. | 1--2--3--4 | I. F. Trimmers
B | 1500 KC | B.C. | 5--6 | Set dial to 1500 KC
C | 600 KC | B.C. | 7 | Recheck adjustment "B"

### POWER CONSUMPTION
(On 117 Volts AC) 20 Watts

### BATTERIES
2--45 Volt "B" and 2--4½ Volt "A"

### BATTERY DRAIN
"A"--300 Milliamperes
"B"--12 Milliamperes

### POWER OUTPUT
BATTERY OPERATION - 100 Milliwatts undistorted
200 Milliwatts maximum

A.C. OPERATION - 500 Milliwatts undistorted
1.5 Watts maximum

### INTERMEDIATE FREQUENCY
455 KC

### SPEAKER
5 inch P.M. dynamic

### FREQUENCY RANGE

- **broadcast** 540--1530 KC
- **short wave** #1 3--9 MC
- **short wave** #2 9--18 MC

### SENSITIVITY

- **broadcast-loop operation** 75 microvolts per meter (average) for 50 MW output
- **antenna** - 5 microvolts (average)
- **short wave-loop operation** 100 microvolts per meter (average)

©John F. Rider
Schematic Circuit—M-109 Receiver

M-109 25-60 cycle
115 volts

I.F. Peak
455 K.C.

NORMAL VOLTAGE READINGS

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>6SK7</td>
<td>R. F. Amp.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+9*</td>
<td>+110</td>
<td>6.0</td>
<td>+265</td>
</tr>
<tr>
<td>6SA7</td>
<td>Mod. and Osc.</td>
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<td>6.0</td>
<td>+265</td>
<td>+110</td>
<td>-6*</td>
<td>0</td>
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<tr>
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<td>I. F. Amp.</td>
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<td>6.0</td>
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<td>+110</td>
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<td>+265</td>
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<td>Demod., A. V. C.</td>
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<td>0</td>
<td>+100</td>
<td>0.0</td>
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<td>6V0G</td>
<td>Output</td>
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<td>0</td>
<td>+310</td>
<td>+265</td>
<td>0</td>
<td>+100</td>
<td>6.0</td>
<td>+12*</td>
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<tr>
<td>80†</td>
<td>Rectifier</td>
<td>+410</td>
<td>390</td>
<td>390</td>
<td>+410</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>6U5</td>
<td>Tuning Indicator</td>
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<td>+25</td>
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<td>+265</td>
<td>0</td>
<td>6.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Speaker Socket</td>
<td>+320</td>
<td>+310</td>
<td>+320</td>
<td>+265</td>
<td>0</td>
<td>+410</td>
<td>0</td>
<td>+410</td>
<td>-</td>
</tr>
</tbody>
</table>

*Read on lowest possible scale of voltmeter.
†Between terminals 1 and 4 of rectifier socket: 4.5 volts A. C.

Models M-109 and M-113 series

VOLTAGE NOTES:
1. Take all readings with receiver operating and tuned to approx. 1000 Kc., no Sig.
2. Use line voltage of 120V (240 V. for "C" models), or make or allow for any slight variation.
3. Use a good high res. voltmeter having a res. of at least 1000 ohms per volt.
4. Take all D.C. readings on the 500 V. scale except when an asterisk appears.
5. Read from indicated terminals to chassis base.
6. A.C. voltages are indicated by italics.
Wiring Diagram—M-109 Receiver

©John F. Rider
Wiring Diagram—M-109-X Receiver

Tuning Ranges, Model M-109-X
A-150 to 400 Kc.; B-2.3 to 7.6 Mc.; C-7.6 to 23 Mc.

Intermediate Frequency .... 455 Kc.
Spkr. V.C. Impedance at 400 cycles
Approximately 3.2 ohms
Spkr. Field Coil Resistance
Approximately 900 ohms

Schematic Circuit—M-109-X Receiver

© John F. Rider
ALIGNING INFORMATION

Never Make Extra Absolutely Necessary.

1. Use a good calibrated signal generator (test oscillator) with variable output voltage and connect a sensitive output meter across the voice coil of the speaker.

Always align using the smallest possible signal from the signal generator. A strong signal makes adjustments inaccurate.

Always have receiver volume control turned off.

See location chart for location of all the aligning adjustment screws.

Aligning Procedure (follow this order exactly)

1. Dial pointer adjustment.

Make sure that the dial drive cord is in position on all pointers, otherwise it will be impossible to correctly set the dial pointers. To move the pointers on the dial pointer, first free the pointer ends from the drive cord then, with the gain control (fully extended), set the pointer to the bottom of the scale, then return to the top of the scale. Gently replace the pointer ends in the drive cord.

2. Intermediate frequency adjustments.

A. Set signal generator (frequency and the receiver tuning dial to 20 megacycles).

B. Adjust the "OSC. 20 MC." (air trimmer) aligner by sweeping the lock nut and moving the trimmer in or out, until the signal generator are equal. Always use the maximum frequency position (from output terminals of trimmer). Always be sure to tighten the lock nut after the aligning adjustment has been completed. An S, D adjustment (C) is premeasured for alignment of air trimmer capacitors of the plug type.

C. Adjust the "20 MC." R, F, and ATrim tuner aligner capacitors for maximum signal.

Ship Wave Range, Scale "B".

(Leave the receiver connected to the signal generator in the same manner as above.)

1. Set the range switch to the medium wave position ("C")

2. Tune for extreter low frequency end of the dial.

3. Connect the ground terminal of the signal generator to the ground terminal of the chassis.

4. Introduction a modulated signal of 650 KHz. (noises to the signal generator on the right-hand terminal strip) at the center frequency of the signal generator, using a 0.6 microfarad capacitor in series with the output load of the signal generator.

5. Adjust the L-14 aligner the medium wave signal in the following order:

A. Secondary of second L-F transformer.

B. Primary of second L-F transformer.

C. Secondary of first L-F transformer.

D. Primaries of both L-F transformers.

III. Radio frequency adjustments.

1. Set signal generator frequency to the output load of the signal generator with a 0.6 microfarad capacitor in series with the output load of the signal generator to the antenna terminal of the chassis.

2. Set the range switches to the "C" short-wave position.

With the receiver tuned in the medium wave position, turn the signal generator to the output load of the signal generator to a 0.6 microfarad capacitor in series with the output load of the signal generator while the receiver is tuned to the medium wave position.

3. Adjust the "L-14" OSC. aligner for maximum signal.

4. Set the signal generator frequency tuning dial to 2000 kHz.

5. Adjust the "L-14" OSC. (air trimmers) for maximum signal.

6. Adjust the "L-14" OSC. for maximum signal.

7. Repeat operation 3 and 4.

Alignment Procedure, WRM-109-X only.

Long Wave Range, Scale "A".

1. Connect signal generator to antenna connections of receiver with a 200 MHz. Capacitor in series with the high side of the signal generator input. Connect the ground terminal to the ground connection of the receiver.

2. Set signal generator and receiver dial to 2000 meters (375 Kc).

3. Turn range switch to "X2 range position" (extreme left).

4. With a screwdriver, adjust the long wave signal aligner until the 800 meter signal is brought in to exact resonance. (The series and shunt oscillator are located to the front of the chassis directly under the dial. The aligner is accessible through a top panel.)

POWER TRANSFORMER CONNECTIONS

Models 109, 110, 111, 113 and 114-C have a double primary power transformer which when connected to parallel will operate between 115 and 220 volts (A.C.) and when connected in series (Model 113-C and 114-C) will operate between 220 and 440 volts (A.C. If the primary voltage is required to change the operating voltage of these sets, the primary transformer should be adjusted on the chassis, as shown in plates 8 and 9 for correct connections. Three connections are used.

PHONO MOTOR

The phonograph motor for the M-113-C should be inspected to see that the small plug has a single jumper wire is in place for operation on a line voltage of 200 to 250 volts. If necessary, the small plug should be removed and the jumper wire attached to the smaller plug. the jumper wire should be attached to the small plug and the jumper wire should be attached to the small plug of the motor.

PHONOGRAPH MECHANISM

The instructions for the M-113-C should be inspected to see that the small plug has a single jumper wire is in place for operation on a line voltage of 200 to 250 volts. If necessary, the small plug should be removed and the jumper wire attached to the smaller plug. the jumper wire should be attached to the small plug and the jumper wire should be attached to the small plug of the motor.

INSTRUCTIONS FOR ADJUSTING PHONOGRAM MECHANISM

1. Adjusting Loading Position of Needle on Record.

A. If needle comes down too far from the edge of the record as it starts to move, turn adjusting screw "V" a very slight amount clockwise.

2. Adjusting Trimming Mechanism.

A. If trimmer mechanism is in the wrong position, moving record, adjust screw "V" to position where proper trimming is obtained. When this alignment cannot be accomplished by "V" alone, adjust nut "D" in manual adjusting unit "D" in this manual for adjusting with these nuts use the adjusting unit "D" in manual adjusting unit "D."
WESTINGHOUSE ELEC. INTERNATIONAL CO.

MODEL WRL-165

Schematic Diagram

Voltage Rating
105 to 125 Volts with W-32553 Ballast Resistor
200 to 240 Volts with W-32551 Ballast Resistor
Superhetodyne

Type of Circuit
A
B
C

Tuning Ranges
0.5 to 1.08 Mc.
2.2 to 7.6 Mc.
7.6 to 23 Mc.

Input Power Rating
30 Watts with a line voltage of 110 Volts
60 Watts with a line voltage of 220 Volts

Intermediate Frequency
455 Kilocycles

Speaker Voice Coil Impedance at 400 Cycles
Approximately 3.5 Ohms

Location Chart

©John F. Rider
### Normal Voltage Readings for 120 Volts Operation

These voltage readings are obtained by measuring from the single terminal block (located between the 12SK7 I.F. tube and the electrolytic capacitor) and the various tube socket contacts with the tubes in their respective sockets. See Location Chart on Page 3. Voltages are given for a line voltage of 120 volts, using the W-32531 Ballast Resistor. Allowance should be made for the difference when the line voltage is slightly higher or lower.

Use a good high resistance voltmeter having a resistance of at least 1,000 ohms per volt. Take all D.C. readings on the 500 volt scale except when an asterisk appears.

When the receiver is being operated from an alternating current power supply circuit it will be necessary to have a high resistance A.C. voltmeter for checking the A.C. voltages. A large paper capacitor (2 microfarads or larger) should be used in series with the A.C. voltmeter to prevent the D.C. component from affecting the readings.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>12SA7</td>
<td>Mod. and Osc.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.8*</td>
<td>92</td>
<td>86</td>
<td>107</td>
</tr>
<tr>
<td>12SK7</td>
<td>I.F. Amp.</td>
<td>39</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.8*</td>
<td>92</td>
<td>86</td>
<td>107</td>
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<tr>
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<td>90</td>
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<td></td>
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<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

*Read on the lowest possible scale of voltmeter. A.C. voltages are indicated by italics; when the receiver is operated from a D.C. power supply, D.C. voltages will be obtained in place of the A.C. voltages shown. Receiver tuned to 1000 K.C. no signal.

### Normal Voltage Readings for 240 Volts Operation

These readings are obtained by measuring from the single terminal block (located between the 12SK7 I.F. tube and the electrolytic capacitor) and the various tube socket contacts with the tubes in their respective sockets. See Location Chart on Page 3. Voltages are given for a line voltage of 240 volts, using the W-32551 Ballast Resistor. Allowance should be made for the difference when the line voltage is slightly lower.

Use a good high resistance voltmeter having a resistance of at least 1,000 ohms per volt. Take all D.C. readings on the 500 volt scale except when an asterisk appears.

When the receiver is being operated from an alternating current power supply circuit it will be necessary to have a high resistance A.C. voltmeter for checking the A.C. voltages. A large paper capacitor (2 microfarads or larger) should be used in series with the A.C. voltmeter to prevent the D.C. component from affecting the readings.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td>12SA7</td>
<td>Mod. and Osc.</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1.8*</td>
<td>92</td>
<td>86</td>
<td>107</td>
</tr>
<tr>
<td>12SK7</td>
<td>I.F. Amp.</td>
<td>39</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.8*</td>
<td>92</td>
<td>86</td>
<td>107</td>
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<td>12SQ7</td>
<td>Demod., A. V.C. and Audio</td>
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<td>0</td>
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<td>89</td>
<td>4.8*</td>
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</table>

*Read on the lowest possible scale of voltmeter. A.C. voltages are indicated by italics; when the receiver is operated from a D.C. power supply, D.C. voltages will be obtained in place of the A.C. voltages shown. Receiver tuned to 1000 K.C. no signal.

### Aligning Information

**Never Align Unless Absolutely Necessary**

Use a good modulated signal generator (test oscillator) with variable output voltage and connect a sensitive output meter across the valve coil of the speaker.

Always align using the smallest possible signal from the signal generator. A strong signal makes adjustments inaccurate.

Always have receiver volume control full on. See Location Chart also for location of all the aligning adjustment screws.

**Aligning Procedure (follow this order exactly)**

1. **Dial pointer adjustment.**
   - Make sure that the dial drive cord is in position on all pulleys, otherwise it will not be possible to correctly set the dial pointer. To correct the position of the dial pointer, first free the pointer ends from the drive cord, then, with the gang capacitor fully engaged, set the pointer directly on the index marks nearest to the letters "A" and "C" on the dial. Carefully re-tighten the pointer ends to the drive cord.

2. **Intermediate frequency adjustments.**
   1. Set the range switch to the medium wave position ("A").
   2. Tune set to extreme low frequency end of the dial.
   3. Connect the ground terminal of the signal generator to the ground lead of the chassis.
   4. Introduce a modulated signal of 455 Kilocycles to the grid of the 12SA7 Tube (Television No. 8), using a 0.1 microfarad capacitor in series with the output lead of the signal generator.
   5. Adjust the I.F. Transformers for maximum output in the following order:
      b. Primary of second I.F. transformer.
      d. Primary of first I.F. transformer.

3. **Radio frequency adjustments.**
   - Short Wave Range, Scale "C".
     1. Replace the 0.1 microfarad capacitor in series with the output lead of the signal generator, with a 400 ohm carbon type resistor, and connect it to the antenna lead of the chassis.

4. **Adjust the "OSC, 15 Me." and the "ANT, 15 Me." aligning capacitors for maximum signal.**

   - Short Wave Range, Scale "B".
     1. Replace the 400 ohm carbon type resistor in series with the output lead of the signal generator, with a 200 microfarad capacitor.
     2. Set the range switch to the medium wave position ("A").
     3. Set the signal generator frequency and the receiver tuning dial to 1.5 Megacycles.

**Note:** The calibration at the low frequency end of each range should be checked after the alignment of each range is completed. If the calibration is too inaccurate, repeat the aligning procedure, changing the dial setting slightly at the high-frequency end of the dial to compensate for the low frequency dial error.
**WRL-250 RADIO RECEIVER**

**ATTACHMENTS**

1. **I-F and Wave-Trap Alignment**
   - Rotate the wave-band switch (located on the rear panel of the chassis) to the broadcast position, clockwise, and swing the variable condenser to the minimum capacity position. Feed 450 kc to the grid-cap of the 6AT tube and adjust the three I-f trimmers for maximum response. Feed 450 kc through a dummy antenna (a .0002 mc condenser may be used as a substitute) to the antenna lead and adjust the wave-trap trimmer for minimum response.

2. **B-F Alignment**
   - With the wave-band switch in the broadcast position, clockwise, set the dial pointer at 1400. Feed 1400 kc through a standard dummy antenna (a .0002 mc condenser may be used as a substitute) to the antenna lead and adjust the first trimmer on the front panel of the variable condenser to the minimum capacity. The police band is self-tracking and does not require any adjustment.

**REPLACEMENT PARTS**

<table>
<thead>
<tr>
<th>Capacitors</th>
<th>Resistors</th>
</tr>
</thead>
</table>

**Miscellaneous**

- **SD-272**
  - Brews for Cabinet Back Panel: 30.
- **SD-173**
  - Phonograph Motion: 30.
- **W-2400**
  - Power Supply Cord: 40.
- **W-2401**
  - Phonograph Headshaft: 30.
- **W-2402**
  - Turntable Assembly: 10.
- **W-2403**
  - E-spring Tube Socket: 10.
- **W-2404**
  - Speaker: 10.
- **W-2405**
  - Speaker: 10.
- **W-2406**
  - Cabinet: 10.
- **W-2407**
  - Cabaret Iron Accessories: 10.
- **W-2408**
  - Back Plate and Dial: 50.
- **W-2409**
  - Back Plate for Cabinet: 20.
- **W-2410**
  - Grill Cloth: 10.
- **W-2411**
  - Aligning Tool: 10.
CONTINUITY TEST

Caution: Disconnect the receiver from the power supply and remove all tubes before making continuity test. Use a good ohmmeter capable of measuring accurately up to several megohms. The resistances given are often approximate owing to electrolytic capacitors in the circuit. When this is the case, be sure to reverse the test leads and read the highest resistance.

Read from indicated terminals to chassis base except when an asterisk appears. See location chart above for position and numbering of terminals.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>12SA7</td>
<td>Mod. and Osc.</td>
<td>S</td>
<td>O</td>
<td>*600</td>
<td>*650</td>
<td>270000</td>
<td>270000</td>
<td>O</td>
<td>8M</td>
</tr>
<tr>
<td>12SK7</td>
<td>I. F. Amp.</td>
<td>S</td>
<td>O</td>
<td>270000</td>
<td>7M</td>
<td>270000</td>
<td>*650</td>
<td>O</td>
<td>*600</td>
</tr>
<tr>
<td>12SQ7</td>
<td>Demod.—A. V. C. Audio Amp.</td>
<td>S</td>
<td>O</td>
<td>10M</td>
<td>1.3M</td>
<td>1.3M</td>
<td>*270000</td>
<td>O</td>
<td>270000</td>
</tr>
<tr>
<td>50L6GT</td>
<td>Output</td>
<td>S</td>
<td>O</td>
<td>*450</td>
<td>*650</td>
<td>1.2M</td>
<td>O</td>
<td>O</td>
<td>270000</td>
</tr>
<tr>
<td>35Z5GT</td>
<td>Rectifier</td>
<td>S</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>7M</td>
<td>O</td>
<td>O</td>
<td>400000</td>
</tr>
</tbody>
</table>

Symbols used on chart are as follows: %—Ohms; M—Megohms; S—Short; O—Open.

*These readings should be made from indicated terminals to Terminal No. 8 of the rectifier socket (Type 35Z5GT Tube).

Other tests not shown on chart:
Antenna Terminal to Chassis Base—"Open"
Ground Terminal to Chassis Base—"Open"
Between Antenna and Ground Terminals—50 Ohms

NORMAL VOLTAGE READINGS

These voltage readings are obtained by measuring between the various tube socket contacts and the negative "B" supply (Terminal No. 3 of the 12SK7 Socket) with the tubes in their respective sockets. The receiver is, therefore, in operation when the measurements are made. (See location chart above for the terminal layout of sockets with their proper terminal numbers.)

Voltages are given for a line voltage of 120 volts A.C. Allowance should be made when the line voltage is slightly higher or lower.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>12SA7</td>
<td>Modulator and Oscillator</td>
<td>0</td>
<td>25</td>
<td>+95</td>
<td>+95</td>
<td>-10*</td>
<td>0</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td>12SK7</td>
<td>I. F. Amp.</td>
<td>0</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+95</td>
<td>12</td>
<td>+95</td>
</tr>
<tr>
<td>12SQ7</td>
<td>Demod., A. V. C, Audio Amp.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+50</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>50L6GT</td>
<td>Output</td>
<td>0</td>
<td>88</td>
<td>+105</td>
<td>+95</td>
<td>0</td>
<td>—</td>
<td>37</td>
<td>+6*</td>
</tr>
<tr>
<td>35Z5GT</td>
<td>Rectifier</td>
<td>0</td>
<td>180</td>
<td>115</td>
<td>—</td>
<td>115</td>
<td>0</td>
<td>88</td>
<td>+120</td>
</tr>
</tbody>
</table>

A.C. voltages are indicated by italics; when the receiver is operated from a D.C. power supply, all voltages will be D.C. Receiver tuned to 1000 kc, no signal.

*Read on lowest possible scale of Voltmeter.

© John F. Rider
Voltage Rating: 105-130 Volts; (See Adapting Receiver to 200-225 Volts Operation)
Type of Circuit: Superheterodyne
Tuning Range: 0.54 to 1.65 Megacycles (182 to 550 Meters)
Input Power Rating at 130 Volts; 60 Cycles: 30 Watts
Intermediate Frequency: 455 Kilocycles
Speaker Voice Coil Impedance at 400 Cycles: Approximately 3.5 Ohms

Wiring and Schematic Diagram

© John F. Rider
MODEL WRL-258, WRL-258C, WRL-259, WRL-259C, WESTINGHOUSE ELEC. INTERNATIONAL CO.
WRL-451, WRL-451C, WRL-451D

BLK    R-14    C-10
BLK
BLK    BRAD
BLK    BLK

BLK-C-14
L-12
L-11
L-3
L-4

C-3
C-2
C-1
R-15

ANTE

BLUE

R-12

RED    SL-RED

RED

RED

SL-RED

3000 GT

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SPECIFICATIONS

<table>
<thead>
<tr>
<th>Tuning Ranges</th>
<th>A: 0.5 to 1.5 MHz; B: 2.25 to 7.5 MHz; C: 7.5 to 25 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Tubes</td>
<td>5</td>
</tr>
<tr>
<td>Input Power Ratings</td>
<td>WRL-258, WRL-259</td>
</tr>
<tr>
<td>Intermediate Frequency</td>
<td>WRL-451</td>
</tr>
<tr>
<td>Speaker Voice Coils Impedance</td>
<td>300 Ohms</td>
</tr>
</tbody>
</table>

POWER TRANSFORMER CONNECTIONS

Models WRL-258, WRL-258-C, WRL-259, and WRL-259-C Receivers have a double primary power transformer which, when connected in series, will operate between 105 and 130 volts A.C., and when connected in parallel, the WRL-258-C and WRL-259-C will operate between 210 and 250 volts A.C. If it is desired to change the operating voltage of a WRL-258, WRL-258-C, WRL-259, and WRL-259-C, see the wiring diagram for the correct connections. These connections are located underneath the chassis and must be soldered.

All WRL-451 Models can be changed from one voltage to another with the same manner as above, but it will also be necessary to change the photophone motor connections as shown. It should be remembered that the WRL-451 and WRL-451-C are for 60 cycles only. The WRL-451-D is for 50 cycles only, and a change in voltage connections does not change the frequency.

ALIGNING INFORMATION

Never Align Unless Absolutely Necessary

1. Dial pointer adjustment.
   Make sure that the dial drive cord is in position otherwise it will not be possible to correctly set the dial pointer. To correct the position of the dial pointer, first free the pointer ends from the drive cord, then, with the gang capacitor fully engaged, set the pointer directly on the index marks nearest to the letters "A" and "C" on the dial. Carefully re-tighten the pointer ends to the drive cord.

2. Intermediate frequency adjustments.
   1. Set the range switch to the medium wave position ("A").
   2. Tune set to extreme low frequency end of the dial.
   3. Connect the ground terminal of the signal generator to the ground terminal of the chassis.
   4. Introduce a modulated signal of 455 kilocycles to the grid of the 6SA7 Tube (Terminal No. 8), using a 0.1 microfarad capacitor in series with the output lead of the signal generator.
   5. Adjust the I.F. aligners for maximum output in the following order:

   b. Primary of second I.F. transformer.
   d. Primary of first I.F. transformer.

3. Short Wave Range, Scale "C".
   1. Replace the 0.1 microfarad capacitor in series with the output lead of the signal generator, with a 400 ohm carbon type resistor, and connect it to the antenna lead of the chassis.
   2. Set the range switch to the "C" short wave position.
   3. Set the signal generator frequency and the receiver tuning dial to 7 megacycles.
   4. Adjust the "OSC, 7 MC," and the "ANT. 7 MC" aligning capacitors for maximum signal.

4. Medium Wave Range, Scale "A".
   1. Replace the 400 ohm carbon type resistor in series with the output lead from the signal generator with a 200 microfarad capacitor.
   2. Set the range switch to the medium wave position ("A").
   3. Set the signal generator frequency and the receiver tuning dial to 1.5 MC.

NORMAL VOLTAGE READINGS

Take all readings with chassis operating and tuned to approximately 3000 kc — no signal. Use a line voltage of 120 volts (240 volts for "C" models), or make allowance for any slight variation.

Use a good high resistance voltmeter having a resistance of at least 1000 ohms per volt. Take all D.C. readings on the 500 volt scale except when otherwise specified.

CONTINUITY TEST

CAUTION: Remove all tubes and disconnected parts, owing to electrolytic capacitors in the circuit. When this is the case, be sure to reverse the test leads and read the highest resistance.

Read from indicated terminals to chassis base. See location chart on page 5 for position of terminals.

A.C. voltages are indicated by italics.

CONTINUITY TEST

Symbols used are as follows: T—ohms; M—megohms; B—short; O—open.

4 Tests Not Shown on Chart

A—Range Switch in "A" position; B—Range Switch in "B" position; C—Range Switch in "C" position.

Other Tests Not Shown on Chart

Antenna lead to Chassis Base:

- Range switch in "A" medium wave position — 60 Ohms
- Range switch in "B" short wave position — 4 Ohms

Between Terminals of A.C. Plug:

- A.C. plug closed (WRL-258, WRL-259, and WRL-451) — 10 Ohms
- A.C. plug closed (WRL-258-C, WRL-259-C, and WRL-451-C) — 4 Ohms
Models WRL-263 and WRL-263-C Receivers have a double primary power transformer which, when connected in parallel (WRL-263) will operate between 105 and 130 Volts A. C., and when connected in series (WRL-263-C) will operate between 210 and 250 volts A. C.

Tuning Ranges .......... A—0.54 to 1.68 Mc; B—2.25 to 7.5 Mc; C—7.5 to 23 Mc

Input Power Rating ..... 50 Watts
Intermediate Frequency ..... 455 Kilocycles
Speaker Voice-Coil Impedance—At 400 Cycles. Approximately 3.5 Ohms
ALIGNING INFORMATION
Never Align Unless Absolutely Necessary

I. Dial pointer adjustment.
Make sure that the dial drive cord is in position on all pulleys, otherwise it will not be possible to correctly set the dial.
To correct the position of the dial pointer, first free the pointer ends from the drive cord, then, with the gang capacitor fully engaged, set the pointer directly on the index marks nearest to the letters “A” and “C” on the dial. Carefully re-tighten the pointer ends to the drive cord.

II. Intermediate frequency adjustments.
1. Set the range switch to the medium wave position (“A”).
2. Tune set to extreme low frequency end of the dial.
3. Connect the ground terminal of the signal generator to the ground terminal of the chassis.
4. Introduce a modulated signal of 155 Kilocycles to the stator terminal of the center section of the gang capacitor, using a 0.1 microfarad capacitor in series with the output lead of the signal generator.
5. Adjust the I. F. Aligners for maximum output in the following order:
   b. Primary of second I. F. transformer.
   d. Primary of first I. F. transformer.

III. Radio frequency adjustments.
Short Wave Range, Scale “C”.
1. Replace the 0.1 microfarad capacitor in series with the output lead of the signal generator, with a 400 ohm carbon type resistor, and connect it to the antenna lead of the chassis.
2. Set the range switch to the “C” short wave position.
3. Set the signal generator frequency and the receiver tuning dial to 20 megacycles.
4. Adjust the “OSC. 20 Me.” aligning capacitor for maximum signal. Two positions will be found at which maximum signal occurs. Always use the minimum capacitance (most counter-clockwise) position.
5. Adjust the “ANT. 20 Me.” aligning capacitor for maximum signal. Two positions may be found at which maximum signal occurs. Always use the maximum capacitance (most clockwise) position.

Short Wave Range, Scale “B”.
(Leave the receiver connected to the signal generator in the same manner as above.)
1. Set the range switch to the “B” short wave position.
2. Set the signal generator frequency and the receiver tuning dial to 20 megacycles.
3. Adjust the “OSC. 7 Me.” and the “ANT. 7 Me.” aligning capacitance for maximum signal.

Medium Wave Range, Scale “A”.
1. Replace the 400 ohm carbon type resistor in series with the output lead from the signal generator with a 200 micro-microfarad capacitor.
2. Set the range switch to the medium wave position (“A”).
3. Set the signal generator frequency and the receiver tuning dial to 1.5 MC.
4. Adjust the “OSC.” “BI-RESONATOR” and “ANT.” Aligning Capacitors for maximum signal (the “Bi-Resonator” Aligning Capacitor is located on the side of the variable gang capacitor).
5. Set the signal generator frequency and the receiver tuning dial to 0.6 megacycles.
6. Adjust the 0.6 megacycle “Bi-Resonator” (iron core) for maximum signal.
7. Repeat operations 3 and 4.

Note: The calibration at the low frequency end of each range should be checked after the alignment of each range is completed. If the calibration is too inaccurate, repeat the aligning procedure, changing the dial setting slightly at the high-frequency end of the dial to compensate for the low frequency dial error.

NORMAL VOLTAGE READINGS
Take all readings with chassis operating and tuned to approximately 1000 Kc. no signal. Use a good high resistance voltmeter having a resistance of at least 1000 ohms per volt. Take all D. C. readings on the 500 volt scale except when an asterisk appears.

<table>
<thead>
<tr>
<th>Terminals of Sockets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube Circuit</td>
</tr>
<tr>
<td>8SA7 Mod. and Osc.</td>
</tr>
<tr>
<td>6SK7 I. F. Amp.</td>
</tr>
<tr>
<td>6SQ7 Demod., A. V. C., Audio Amp.</td>
</tr>
<tr>
<td>6K6G Output</td>
</tr>
<tr>
<td>6N5 Tuning Ind.</td>
</tr>
<tr>
<td>304 Rectifier</td>
</tr>
</tbody>
</table>

*Read on lowest possible scale of voltmeter.
†Between terminals 1 and 4 of rectifier socket: 4.5 volts A.C.
A. C. voltages are indicated by italics.
NORMAL VOLTAGE READINGS

Take all readings with receiver operating and tuned to approximately 1000 Kc.—no signal.

Use a line voltage of 120 volts, or make allowance for any slight variation.

Use a good high resistance voltmeter having a resistance of at least 1000 ohms per volt.

Take all D. C. readings on the 500 volt scale except when an asterisk appears.

Read from indicated terminals to chassis base.

See location chart above for position of terminals.

A. C. voltages are indicated by *italics*.

---

**TERMINALS OF SOCKETS**

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>6SK7</td>
<td>R. F. Amp.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+2*</td>
<td>+105</td>
<td>6.0</td>
<td>+265</td>
</tr>
<tr>
<td>6SA7</td>
<td>Mod. and Osc.</td>
<td>0</td>
<td>0</td>
<td>265</td>
<td>105</td>
<td>-5*</td>
<td>0</td>
<td>6.0</td>
<td>0</td>
</tr>
<tr>
<td>6SK7</td>
<td>I. F. Amp.</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>+3*</td>
<td>+105</td>
<td>6.0</td>
<td>+265</td>
</tr>
<tr>
<td>6SQ7</td>
<td>Demod., A. V. C., Audio Ampl.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>6.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6V6G</td>
<td>Output</td>
<td>0</td>
<td>0</td>
<td>250</td>
<td>265</td>
<td>0</td>
<td>6.0</td>
<td>+12*</td>
<td>-</td>
</tr>
<tr>
<td>80†</td>
<td>Rectifier</td>
<td>380</td>
<td>370</td>
<td>370</td>
<td>380</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>6U5</td>
<td>Tuning Ind.</td>
<td>0</td>
<td>25</td>
<td>0</td>
<td>265</td>
<td>0</td>
<td>6.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Speaker Socket</td>
<td>265</td>
<td>0</td>
<td>0</td>
<td>380</td>
<td>0</td>
<td>+380</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Read on lowest possible scale of voltmeter.
†Between terminals 1 and 4 of rectifier socket: 4.5 volts A. C.
SERVICE NOTES
WESTINGHOUSE WRL-277, WRL-371 AND WRL-471

RADIO RECEIVERS

ALIGNING INFORMATION

Never Align Unless Absolutely Necessary

1. Dial pointer adjustment.
   - Make sure that the dial drive cord is in position on all pulleys, otherwise it will not be possible to correctly set the dial pointer.
   - To correct the position of the dial pointer, first free the pointer ends from the drive cord, then with the gang capacitor fully engaged, set the pointer directly behind the horizontal line at the top of the dial. Carefully reposition the pointer to the desired position.

2. Intermediate frequency adjustments.
   - Set the range switch to the medium wave position (“A”).
   - Tune set to extreme low frequency position.
   - Connect the ground terminal of the signal generator to the ground terminal of the chassis.
   - Introduce a modulated signal of 455 Kilocycles to the stator terminal (top) of the center section of the gang capacitor, using a 0.1 microfarad capacitor in series with the output lead of the signal generator.
   - Set the range switch to the medium wave position (“A”).
   - Adjust the Id. F. Aligners for maximum signal in the following order:
     A. Secondary of second F. transformer.
     B. Primary of second F. transformer.
     C. Secondary of first F. transformer.
   - Primary of first F. transformer.

3. Short wave range, scale “G”.
   - Replace the 0.1 microfarad capacitor in series with the output lead of the signal generator with a 200 microfarad capacitor.
   - Set the range switch to the medium wave position (“A”).
   - Adjust the signal generator frequency and the receiver tuning dial to 1.5 M. C.
   - Adjust the “0.5 M.C.” OSCillator and the receiver tuning dial to 0.6 M.C.
   - Adjust the “0.6 M.C.” OSCillator for maximum signal.

4. Adjust the receiving system in these receivers is adjustable for operation on 150 to 2450, 40-60, 90-120, 120-150, 150-200, 200-240, 240-300, 300-480, 480-600, 600-1200, 1200-1500, 1500-2000, 2000-2400, 2400-3000, 3000-4000, and 4000-6000 cycles.

5. To adjust the receiver for a Line Voltage of 130 to 150, 120-150, 90-120, 60-90, 40-60 cycles.
   - Loosen the screw and bracket so that the voltage changer plug can be removed from its socket on top of the power transformer.

6. Remove the voltage changer plug and insert a W-32-877 Plug-in Resistor into the socket on top of the power transformer.

7. To Model WRL-471 it is also necessary to remove the single jumper plug from the socket of the phonograph motor and insert the double jumper plug, which will be found attached to the back of the cabinet. Model WRL-471 is equipped with an automatic record changer using a crystal pickup. This record player shifts and plays the standard 10 or 12 inch records.

CARE OF THE CABINET

The finish of Westinghouse Radio cabinets should be protected by using a good cabinet polish regularly. It is available in pint cans, designated as W-29601.

Nicks and scratches of most kinds can be repaired quickly and easily with the use of the W-29602 Touch-Up Kit. Complete instructions are provided with each kit.

INSTRUCTIONS FOR ADJUSTING PHONOGRAPH MECHANISM USED IN WRL-471 RECEIVER

A. Adjusting Landing Position of Needle on Record
   - If needle comes down too far from the edge of the record so that record does not start at the beginning, turn adjusting screw “A” very slightly counter-clockwise.

B. Adjusting Tripping Mechanism
   - If trip mechanism fails to trip or operate during playing of record, adjust screw “B” to position where proper triggering is obtained.

VARIABLE LINE VOLTAGES TO ADJUST THE RECEIVER FOR A LINE VOLTAGE OF 130 TO 150, 120-150, 90-120, 60-90, 40-60 CYCLES.

Loosen the screw and bracket so that the voltage changer plug can be removed from its socket on top of the power transformer.

Remove the voltage changer plug and insert a W-32-877 Plug-in Resistor into the socket on top of the power transformer.

To Model WRL-471 it is also necessary to remove the single jumper plug from the socket of the phonograph motor and insert the double jumper plug, which will be found attached to the back of the cabinet. In addition, W-32-885 Resistor must be inserted between the phonograph power cord and the radio chassis.

Playing a record equipped with a high impedance pickup, tuneful records can be obtained by adjusting the receiver on the receiver to tune the receiver to a quiet place on one of the short wave ranges and proceed to operate. Model WRL-277 has a phonograph position incorporated on the range switch, which requires a record player in conjunction with this receiver. The controls should be set so that the points to the star. A shielded cable of the low-capacity type should be connected to the pickup to the receiver. The shield must be connected to the ground terminal of the receiver.

The volume may be controlled with the volume control at the receiver, or if such is provided with the volume control on the record player.

L.Powell-277, WRL-277B, WRL-277C

WESTINGHOUSE EL HC
INTERNATIONAL CO.
MODELS WRL-277, WRL-371, WRL-471

WESTINGHOUSE ELHC INTERNATIONAL CO.
MODELS WRL-277, WRL-371, WRL-471

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INT. PAGE 11
SPECIFICATIONS

Voltage Rating: Adjustable for 100 to 120 or 200 to 240 Volts A.C.

Type of Circuit: Superheterodyne

Tuning Ranges: A—0.54 to 1.62 Mc.; B—2.3 to 7.2 Mc.; C—8.6 to 12.1 Mc.; D—14.7 to 18.2 Mc.

Input Power Rating:
- WRL-295: 105 Watts
- WRL-493: 135 Watts

Intermediate Frequency: 455 Kilocycles

Speaker Voice Coil Impedance at 400 cycles: Approximately 1.5 Ohms

Speaker Field Coil Resistance: Approximately 505 Ohms
Location and I. F. Aligning Chart

Model | Input Power Frequency | Chassis | Cabinet | Speaker | Phono Equipment
--- | --- | --- | --- | --- | ---
WRL-295 | 40-60 Cycles | 32922 | 33128 | 33135 | —
WRL-295-B | 25-60 Cycles (115 Volts only) | 32856 | 33128 | 33135 | —
WRL-193 | 60 Cycles only | 33183 | 33185 | 27504 | 32777
WRL-493-D | 50 Cycles only | 33183 | 33185 | 27504 | 32834
ALIGNING INFORMATION—WRL-295

Never Align Unless Absolutely Necessary

Use a good modulated signal generator (test oscillator) with variable output voltage and connect a sensitive output meter across the voice coil of a speaker.

It is essential that the exact frequencies of 18, 15, and 12 megacycles be obtained from the signal generator in order to assure proper calibration of the D and C scales. The sensitivity of the signal generator may be checked by "tuning" within known short wave stations using the same receiver that is in good operating condition.

Always tune along the unused positions possible from the signal generator. A strong signal makes alignment more difficult.

Always have receiver volume control full on throughout the tuning process. The volume control should be set to the high position (most clockwise position)?

See location chart on Page 3 for location of all the aligning adjustment screws.

Aligning Procedure (follow this order exactly)

1. Power adjustments
   a. Make sure that the dial drive cord is in position on all pointers. To correct the position of the dial pointer, first set the gang capacitor so that it is fully engaged, and remove the two clips which held the dial cord and the drive cord together. Then, without disturbing the drive cord, move the dial cord so that the pointer is directly behind the two diamond-shaped index marks at the low-frequency end of the dial scale. Now, fasten the dial cord and drive cord together at the extreme left (when viewed from the rear of the cabinet) to prevent the two small clips.
   b. Insert signal frequency adjustments
      i. Set the range switch to the "C" short-wave position.
      ii. Set the signal generator frequency and the receiver tuning dial to 15 megacycles.
      iii. Set the D-OFC PARALLEL 15 MC dial for maximum signal.
      iv. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
      v. Set the D-OFC PARALLEL 12 MC dial for maximum signal.
      vi. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
      vii. Set the D-OFC PARALLEL 9 MC dial for maximum signal.
      viii. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
      ix. Repeat operations 2, 3, 5, 6, and 7 until no further improvement is noted.

2. Short Wave Range, Scale "C" (the receiver connectors to the signal generator in the same manner as above)
   a. Set the range switch to the "G" short-wave position.
   b. Set the signal generator frequency and the receiver tuning dial to 15 megacycles.
   c. Set the D-OFC PARALLEL 15 MC dial for maximum signal.
   d. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   e. Set the D-OFC PARALLEL 12 MC dial for maximum signal.
   f. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   g. Set the D-OFC PARALLEL 9 MC dial for maximum signal.
   h. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   i. Repeat operations 2, 3, 5, 6, and 7 until no further improvement is noted.

3. Radio Frequency adjustments (See R. F. Alignment Card for position of tuning adjustment screws)
   a. Set the range switch to "D" short-wave position.
   b. Set the signal generator frequency and the receiver tuning dial to 15 megacycles.
   c. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   d. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   e. Set the range switch to "D" short-wave position.
   f. Set the signal generator frequency and the receiver tuning dial to 15 megacycles.
   g. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   h. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   i. Repeat operations 2, 3, 4, 5, 6, and 7 until no further improvement is noted.

4. Short Wave Range, Scale "B" (Leave the receiver connected to the signal generator in the same manner as above)
   a. Set the range switch to the "D" short-wave position.
   b. Set the signal generator frequency and the receiver tuning dial to 15 megacycles.
   c. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   d. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   e. Set the range switch to "D" short-wave position.
   f. Set the signal generator frequency and the receiver tuning dial to 15 megacycles.
   g. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   h. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   i. Repeat operations 2, 3, 4, 5, 6, and 7 until no further improvement is noted.

5. Set the signal generator frequency and the receiver tuning dial to 6 megacycles.
   a. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   b. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   c. Set the range switch to "D" short-wave position.
   d. Set the signal generator frequency and the receiver tuning dial to 6 megacycles.
   e. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   f. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   g. Repeat operations 5, 6, and 7 until no further improvement is noted.

6. Set the signal generator frequency and the receiver tuning dial to 15 megacycles.
   a. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   b. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   c. Set the range switch to "D" short-wave position.
   d. Set the signal generator frequency and the receiver tuning dial to 15 megacycles.
   e. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   f. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   g. Repeat operations 6, 7, and 8 until no further improvement is noted.

7. Set the signal generator frequency and the receiver tuning dial to 6 megacycles.
   a. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   b. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   c. Set the range switch to "D" short-wave position.
   d. Set the signal generator frequency and the receiver tuning dial to 6 megacycles.
   e. Adjust the "D" OSC PARALLEL 15 MC dial for maximum signal.
   f. Set the receiver tuning dial to the maximum capacitance position (most clockwise position of the knob).
   g. Repeat operations 7, 8, and 9 until no further improvement is noted.

8. Repeat operations 1, 2, 3, 4, and 5 until no further improvement is noted.

Alignment Procedure (follow this order exactly)

4. In order to align the WRL-493, the chassis must be removed from the cabinet. Therefore, it is necessary to use an auxiliary (outside) setup and an adjustable input, allowing the receiver to be fully engaged.

ADJUSTMENT OF RECEIVER TO

The power transformer used in these receivers is adjustable for operation on 100 or 150 Volts, 40-60 Cycles, or 200 or 250 Volts, 40-60 Cycles. Polarity is also made for operation on 120 or 130 Volts, 40-60 Cycles, or 110 or 120 Volts, 60 Cycles, by using the proper "Plugin Receptor." To properly adjust the receiver to any of the line voltages given below, an accurate A.C. volt- meter should be used to measure the "V" line voltage at the location where the receiver is to be installed.

CAUTION: Never make any adjustments of the power transformer until the receiver is fully engaged. Do not make any adjustments until the receiver is fully engaged. Do not make any adjustments until the receiver is fully engaged.

Operation of Line Voltage of 200 to 240 Volts When shipped from the factory, these receivers are adjusted for a line voltage of 200 to 240 Volts. Changes may be taken to see that the white dot on the voltage changer indicates the "220 V" mark, top of the power transformer.

The photoform motor of Model WRL-493 should also be inspected to see that the small white dot on the voltage changer is in place. A shielded cable of the low-capacity type should be used to connect the pickup to the receiver.

To Adjust the Receiver for a Line Voltage of 106 to 120 Volts

Loosen the screw and bracket so that the voltage changer plug may be removed from its socket on top of the power transformer.

Remove the voltage changer plug from its socket on top of the power transformer.

Plug the photoform motor of Model WRL-493 into the receiver and connect the small white dot on the voltage changer to the receiver.

To Adjust the Receiver for a Line Voltage of 120 to 130 Volts

Loosen the screw and bracket so that the voltage changer plug may be removed from its socket on top of the power transformer.

Remove the voltage changer plug from its socket on top of the power transformer.

The photoform motor of Model WRL-493 should also be inspected to see that the small white dot on the voltage changer is in place. A shielded cable of the low-capacity type should be used to connect the pickup to the receiver.

To Adjust the Cabinet

The finish of Wellingham Radio cabinets should be protected by using a high quality, durable, and easy-to-apply finish. It is made available in pastels or gloss finishes, and is available in WRL-493.

Nicks and scratches of most kinds can be removed quickly and easily by use of the WRL-493 Touch-up Kit. Complete instructions are provided with each kit.
Page 14-36 WEST. INT.

MODELS WRL-295, WRL-295B, WRL-493, WRL-493B

WESTINGHOUSE ELEC. INTERNATIONAL CO.

INSTRUCTIONS FOR ADJUSTING PHONOGRAPH MECHANISM
USED IN WRL-493 RECEIVER

A. Adjusting Landing Position of Needle on Record

If needle comes down too far from the edge of the record so that record does not start at the beginning, turn adjusting screw “A” very slightly counter-clockwise.

If needle comes down too close to the edge of the record so that it slips off, turn adjusting screw clockwise.

B. Adjusting Tripping Mechanism

If trip mechanism fails to trip or operates during playing of record, adjust screw “B” to position where proper tripping is obtained.

C. Adjusting Height to Which Pick-up Arm Rises

The arm should rise during the change cycle so that it clears the record above it by only 1/8”. To make this adjustment, loosen the locknut “C” on pick-up sleeve and turn sleeve to lengthen or shorten the plunger. Be sure to tighten locknut again after adjustment.

No adjustment of the record separating knives is required as they are arranged to compensate for slight differences in record thickness automatically.

Handle the mechanism with care. Do not lift it by the record holding knives.

---

NORMAL VOLTAGE READINGS

Take all readings with receiver operating and tuned to approximately 1000 Kc.—no signal. Use a line voltage of 120 volts, or make allowance for any slight variation. Use a good high resistance voltmeter having a resistance of at least 1000 ohms per volt.

Take all D. C. readings on the 500 volt scale except when an asterisk appears. Read from indicated terminals to chassis base. See location chart on Page 3 for position of terminals.

A. C. voltages are indicated by italics.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Circuit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tbody>
<tr>
<td>6SK7</td>
<td>B. F. Amp.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+1.5*</td>
<td>+100</td>
<td>6.0</td>
<td>+270</td>
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<tr>
<td>6SA7</td>
<td>Mod. and Osc.</td>
<td>0</td>
<td>6.0</td>
<td>+270</td>
<td>+100</td>
<td>-4*</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>6SK7</td>
<td>I. F. Amp.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+8*</td>
<td>+100</td>
<td>6.0</td>
<td>+270</td>
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<tr>
<td>6SQ7</td>
<td>Demod., A. V. C.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>60</td>
<td>0</td>
<td>6.0</td>
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<tr>
<td>6SQ7</td>
<td>Audio Ampl.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-70</td>
<td>6.0</td>
<td>0</td>
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<tr>
<td>6V6GT</td>
<td>Output</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+315</td>
<td>+270</td>
<td>0</td>
<td>0</td>
<td>6.0</td>
</tr>
<tr>
<td>80T</td>
<td>Rectifier</td>
<td>+390</td>
<td>380</td>
<td>380</td>
<td>+390</td>
<td>---</td>
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<tr>
<td>6U5</td>
<td>Tuning Ind.</td>
<td>6.0</td>
<td>25</td>
<td>0</td>
<td>+270</td>
<td>0</td>
<td>0</td>
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<tr>
<td></td>
<td>Speaker Socket</td>
<td>+330</td>
<td>0</td>
<td>0</td>
<td>+380</td>
<td>+390</td>
<td>0</td>
<td>+380</td>
<td>---</td>
</tr>
</tbody>
</table>

* Read on lowest possible scale of voltmeter. † Between terminals 1 and 4 of rectifier socket: 5 volts A. C.
NOTE:
All measurements with 1000 ohms per voltmeter — loop antenna not connected — volume at minimum — All readings made with fresh Zenith pack with speaker in circuit.

NOTE: "A" Bias for IC5 measured across 1000 ohm resistor at points marked X-X. Bias is neg. 10 volts.

LEGEND
F = FILAMENT
P = PLATE
S = SCREEN
G = GRID
D = DIODE
NC = NO CONNECTION

MODELS 4K400D, 4K400L, 4K400M, 4K400S
Chassis 5416

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ALIGNMENT PROCEDURE

<table>
<thead>
<tr>
<th>Operation</th>
<th>Connect Test Oscillator to</th>
<th>Dummy Antenna</th>
<th>Set Test Osc. to</th>
<th>Band</th>
<th>Set Dial At</th>
<th>Adjust Trimmers</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1st Det. Grid</td>
<td>1/2 Mfd.</td>
<td>455</td>
<td>Br'dc't</td>
<td>600</td>
<td>ABCD</td>
<td>I. F. Alignment</td>
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<td>2</td>
<td>Separate 3 foot antenna</td>
<td>1500</td>
<td>&quot;</td>
<td>1500 F</td>
<td>Set Osc. to Scale</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Separate 3 foot antenna</td>
<td>1500</td>
<td>&quot;</td>
<td>1500 G</td>
<td>Alignment of Ant</td>
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<td></td>
</tr>
</tbody>
</table>

PARTS LIST

Chassis 5416
MODELS 4K400D, 4K400S, 4K400L, 4K400M

Dial Assembly
22-220 Dial scale ........................................... $ .20
79-75 Dial pointer ........................................... .10
76-278 Dial drive shaft ...................................... .10
80-69 Dial cord tension spring ............................. .02
93-371 Dial spacer bakelite washer ........................ .25
102-39 Dial crystal .......................................... .15
MS-418 Pulley and bracket assembly ........................ .10
S-6870 Indicator disc and bushing ........................ .15
S-6893 Dial cord and eyelet assembly ........................ .15

Coils
95-593 1st I. F. Transformer ................................ 1.00
95-594 2nd I. F. Transformer ................................ 1.00
S-6869 Oscillator coil assembly ................................ .60
S-6888 Loop antenna assembly ................................ 1.35

Condensers
22-162 .0001 mfd. ........................................... .15
22-165 .00025 mfd. ........................................... .15
22-243 .01 mfd. .............................................. .15
22-244 .004 mfd. .............................................. .18
22-264 8. mfd. .............................................. .45
22-280 Two gang variable ..................................... 2.00
22-800 30 mfd. .............................................. 1.00
22-826 .01 mfd. .............................................. .12

Resistors
63-238 1000 ohm .............................................. .07
63-271 1 megohm .............................................. .07
63-593 47 M ohm .............................................. .07
63-600 2.2 megohm ........................................... .07
63-604 10 megohm ............................................. .07
63-654 180 M ohm ............................................. .07
63-660 9.9 megohm ........................................... .07
63-1026 Volume control and switch ........................ 1.50

Miscellaneous
46-273 Tuning control knob .................................. .10
49-294 Speaker—5½" PM—all models ........................ 6.25
208-294 cone and voice coil ................................ 1.50
206-294 output transformer ................................ 1.25
78-208 Speaker plug socket .................................. .10
78-246 Socket 1A7G tube ..................................... .10
78-247 Socket 1NSG tube ..................................... .10
78-248 Socket 1HSG tube ..................................... .10
78-249 Socket 1CSG tube ..................................... .10
83-658 Pin jack terminal strip ................................ .06
126-297 Tube shield ......................................... .10
S-6872 Battery cable and plugs ............................. .45

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APRIL 4, 1939

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