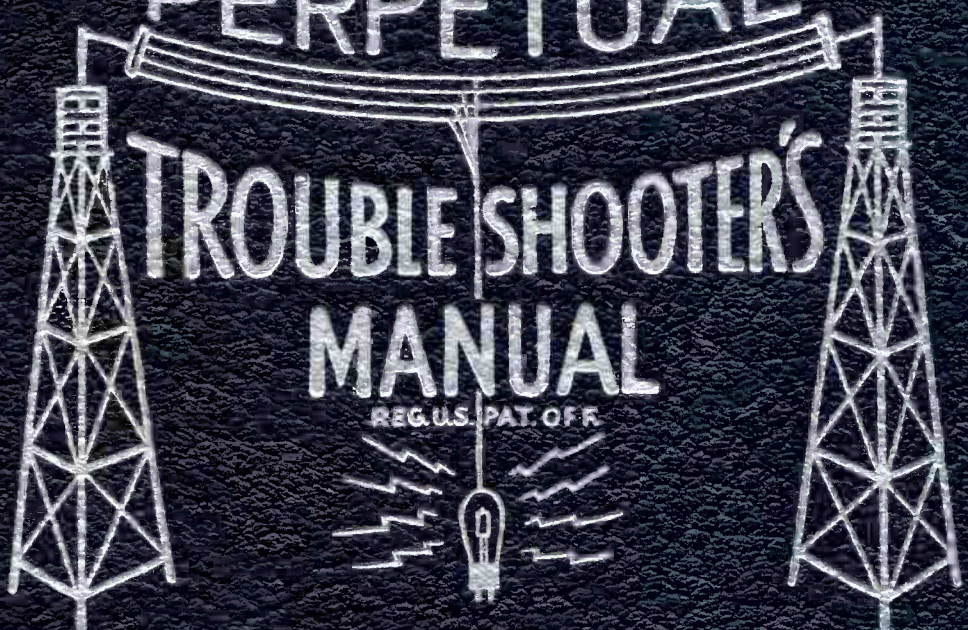
VOLUME XXI

PERPETUAL TROUBLE SHOOTER'S MANUAL

REG. U.S. PAT. OFF.



JOHN F. RIDER

SPECIFICATIONS

Intermediate frequency	455 kc.	10.7 mc.
Tuning frequency range:		
Broadcast Band	540	1620 kc.
Short Wave Band	5.9	17.3 mc.
FM Band	88	108 mc.
Tubes:		
R-F Amplifier		6BA6
Converter		6SB7Y
1st I-F Amplifier (AM-FM)		6SG7
2nd I-F Amplifier (AM-FM)		6SG7
Limiter		6SH7
Discriminator		6H6
Detector and AVC (AM) and Tuning Indicator Amplifier		6SQ7
First Audio		6J5
Second Audio		6J5
Noise Suppressor Input		6J7
Noise Suppressor AVC Amplifier and Detector		6SQ7
Noise Suppressor Reactance Tube		6SG7
Tuning Indicator		6U5
Dial Lamps		Mazda No. 44

GENERAL

Model CR-211 radio chassis is an AM-FM tuner that must be used in conjunction with a power amplifier such as the AMP-111 for speaker operation. Heater and plate voltages for the CR-211 radio chassis are supplied from the amplifier chassis; it is therefore essential that the radio and amplifier chassis be interconnected during alignment or for other electrical service operations.

METHOD OF REMOVING CHASSIS FROM CABINET

Model CR-211 radio chassis is designed for easy removal from the cabinet in which it is installed. As the radio panel is permanently fastened to the chassis, the control knobs need not be removed when the chassis is taken out of the cabinet for service.

To remove the chassis, first remove the antenna leads from their terminals and all plugs from the receptacles on the rear of the chassis. Then remove the two Phillips-head screws from the angular slots in the flange at the rear of the chassis. Lift the rear of the chassis about one inch and pull it straight back. Never remove the chassis tray from the cabinet it has been properly positioned to bring the radio panel in place when the chassis is replaced. In replacing the chassis, slide it so that the small hooks near the front ride inside the flanges on the sides of the chassis tray. Push the chassis forward as far as it will go and the hook should then engage the slots in the chassis tray. Replace the two Phillips-head screws and nuts and tighten securely. Replace all plugs in their receptacles and the antenna leads on their correct terminals. The antenna terminal board for the loop antenna connections is designated L-H. The two terminals on the loop are designated L and H; the leads connected to these terminals should be wired to the corresponding terminals (L and H) on the chassis.

ALIGNMENT PROCEDURE

Alignment of this receiver requires the use of an accurately calibrated RF signal generator, range 455 kc. to 107mc., an output meter, and a vacuum tube voltmeter of approximately 10 megohm input impedance. All trimmer condensers can be identified by stampings on the chassis and gang condenser cover and are shown on the chassis layout diagram.

The pointer on the radio dial should line up with the first horizontal mark on the low frequency end of the dial glass. If the pointer does not line up, loosen the screws on the pointer drive pulley at the end of the tuning gang and adjust the pointer setting; tighten the screws after this adjustment. Be sure the gang is fully meshed for this pointer alignment.

MODEL CR-211

AM ALIGNMENT

I-F ALIGNMENT

1. Set range control to position No. 1. Set volume, treble and bass controls to maximum, the Band Switch to Broadcast position, and dial pointer to 1000 kc.

2. Tune the signal generator to EXACTLY 455 kc.

3. Connect output of modulated signal generator to the signal grid of the 6SB7Y (pin 8) through a .01 mfd. capacitor and signal generator ground to radio chassis.

4. All i-f transformers on this chassis are slug-tuned. Both slug adjustments for 455 kc. are located on top of the transformers; the 10.7 mc. adjustments are accessible on the bottom.

5. Connect output meter across voice coil of 15-inch speaker and peak in order the third, second and first i-f transformers.

6. Use only enough signal input to give a readable indication on voltmeter so that the AVC will not operate and give false readings.

ALTERNATE VISUAL ALIGNMENT OF I-F STAGES

1. Connect 455 kc. sweep generator having approximately 40 kc. sweep to signal grid of 6SB7Y (pin 8) through a .01 mfd. capacitor. Connect an oscilloscope through a 1 megohm isolating resistor across the 220,000 ohm diode load resistor. Align for best possible peak with range switch in position No. 1, and symmetry in position No. 4.

BROADCAST BAND R-F ALIGNMENT

1. Connect signal generator through .00025 mfd. capacitor to antenna and ground terminals on antenna terminal strip on rear of chassis. Be sure "Ant-loop" switch on top of the chassis is in the ANT. position. Connect output meter as for AM i-f alignment.
2. Tune signal generator to 1400 kc.

3. Set dial to 1400 kc. and adjust oscillator, r-f and antenna trimmers for maximum indication on meter.

4. Set signal generator to 600 kc. and tune radio to signal. Adjust the 600 kc. padder to maximum output while simultaneously rocking the gang.

5. 1400 kc. calibration should then be checked and re-adjusted if necessary with the 1400 kc. oscillator trimmer.

SHORT WAVE BAND R-F ALIGNMENT

1. Set the Band Switch to Short Wave and replace the .00025 mfd. capacitor in series with the signal generator lead to the antenna terminal, with a 400-ohm resistor.

2. Set the signal generator and the receiver to 15 mc. and adjust the oscillator, r-f and antenna trimmers for maximum indication on the meter. While adjusting the 15 mc. oscillator trimmer, two peaks may be observed; only one is the correct peak for 15 mc. alignment. To obtain the correct peak, screw trimmer in to maximum capacitance, then decrease until the first peak is observed. This is the correct one.

Another method for checking for the correct peak is to tune the receiver to 15.91 mc. with signal generator at 15 mc. and with the output increased. If the 15 mc. oscillator trimmer is properly adjusted, the signal will be received at 15.91 mc.—if incorrectly aligned, the signal will be received at 14.09 mc.

FM ALIGNMENT

DISCRIMINATOR ALIGNMENT

1. Tune signal generator to EXACTLY 10.775 mc. and connect to pin 4 of the 6SH7 limiter tube socket through a .01 mfd. capacitor.

2. Connect a DC vacuum tube voltmeter from Pin 4 on 6H6 tube socket to ground through a 1 megohm isolating resistor..

3. Peak both discriminator slugs at 10.775 mc.

4. Retune signal generator to exactly 10.7 mc. and adjust bottom slug for zero volts.

5. The DC voltage at 10.625 mc. should be within 10% of the voltage at 10.775 mc. and of opposite polarity.

Note: If the signal generator is not capable of sufficient output to produce a readable DC voltage, the amplification of the last i-f stage can be used to increase the signal input to the limiter for discriminator alignment. To accomplish this, align the last i-f stage as indicated in "IF Alignment". Then align discriminator as above leaving the signal generator connected to the grid of the 6SG7 2nd i-f tube.

I-F ALIGNMENT

1. Connect high side of signal generator, through a .01 mfd. capacitor and a 1000 ohm resistor in series, to pin 4 of the 6SG7 2nd i-f tube. Connect low side of generator to chassis.

2. Close gang condenser and connect vacuum tube voltmeter across 220,000 ohm limiter grid resistor; (Points "A" to "X" on schematic). Adjust signal generator output until a reading of at least 3 volts is obtained. In order to reduce regeneration caused by the vacuum tube voltmeter leads, a 1-megohm isolating resistor, connected with as short leads as possible to point "A" should be used in series with the vacuum tube voltmeter. Align the 3rd i-f transformer for best peak as indicated on voltmeter.

3. Repeat above for the 2nd and 1st transformer by connecting signal generator to signal grid of first i-f tube 6SG7 then to the signal grid of 6SB7Y converter. The i-f stages should be aligned in this order.

WARNING—After each i-f stage has been individually aligned, do not repeak with the signal into the grid of the 6SB7Y.

ALTERNATE VISUAL ALIGNMENT OF I-F STAGES

1. Replace signal generator with sweep generator having approximately 300 kc. sweep and tune generator to 10.7 mc. Connect oscilloscope across 220,000 ohm limiter grid resistor through a 1-megohm isolating resistor. The order of alignment is the same as when using a vacuum tube voltmeter. Each i-f transformer should be individually aligned for best peak and symmetry.

R-F ALIGNMENT

1. Connect vacuum tube voltmeter across limiter grid resistor as in FM I-F alignment. Adjust signal generator output until a reading of at least 3 volts is obtained.

2. Ground one side of the FM Antenna by placing a wire jumper from one FM connection on the antenna terminal strip to the ground connection.

3. Connect unmodulated signal generator through a 300 ohm resistor to ungrounded antenna post and chassis, and tune signal generator to 107 mc.

4. Set radio dial to 107 mc. and tune oscillator trimmer to peak output on vacuum tube voltmeter.

5. Tune 107 mc. r-f and antenna trimmers for maximum indication on voltmeter—it may be necessary to rock the gang while adjusting the r-f trimmer.

THE NOISE SUPPRESSOR

This chassis incorporates an automatic noise suppressor to reduce scratch and noise from phonograph reproduction.

The noise suppressor functions only when the band control switch is in "Phono" position and is automatically switched out of the circuit when the band control switch is in any position except "Phono"

To turn the noise suppressor on press the noise suppressor button and release so that the white dot on the top side of the knob is visible. To disconnect the noise suppressor from the circuit press the button in and release so that the white dot is no longer visible.

Tube replacements in the noise suppressor circuit will usually necessitate an adjustment of the bias gain control.

ADJUSTMENT

It is recommended that the following equipment be used in making noise suppressor adjustments:

DC vacuum tube voltmeter, 10 megohm or greater input impedance.

Columbia No. 10004 test record.

1. Connect record changer to noise suppressor and noise suppressor to radio chassis. Obtain test signal by playing Columbia No. 10004 test record at 1500 cycles with radio band switch in "Phono" position. Set bias gain control to give −4.0 volts bias measured from pins 4 and 5 on 6SQ7 to ground with DC vacuum tube voltmeter.

2. If the recommended test equipment is not available the noise suppressor can be adjusted to a reasonably accurate degree by a listening test using a 12-inch record having a moderate amount of surface noise. Turn noise suppressor on, range and treble controls to maximum (clockwise) and bias gain control to extreme counter-clockwise position. Then place stylus in outside groove of record with the turn-table running and adjust bias gain control to a point where the surface noise is barely audible. In making this adjustment the stylus should not be permitted to run into the recorded section of the record.

SPECIAL SERVICE INFORMATION

The following information is provided for the service man who has a vacuum tube voltmeter or a similar measuring instrument available.

STAGE GAINS*

Antenna Post to R-F Grid at:	
600 kc.	5.8
6.5 mc.	2.9
98 mc.	1.0
R-F Grid to Converter Grid at:	
600 kc.	11.6
6.5 mc.	9.5
98 mc.	6.8
R-F on Converter Grid to 455 kc. on I-F Grid at:	
600 kc.	1.7
6.5 mc.	2.4
98 mc.	6.8

I-F on Converter Grid to 1st I-F Grid at:
455 kc. (dial pointer at 600 kc.) 2.6

1st I-F Grid to 2nd I-F Grid at:
455 kc. 20.5
10.7 mc. 37

2nd I-F Grid to Limiter Grid at:
10.7 mc. 34.5

AUDIO GAIN

Voltage required across the Volume Control to produce 0.1 watt speaker output** at 400 cycles is:
.013 volt with Amplifier AMP-111A
.008 volt with Amplifier AMP-111B or C
with Band Switch in BDCST setting.

OSCILLATOR OUTPUT VOLTAGE

The DC voltage developed across the Oscillator Grid Resistor (105) at:
600 kc. ..... 4.5V.
6.5 mc. ..... 4.6V.
98 mc. ..... 5.4V.

or 0.3 ma. through 15,000 ohm Oscillator Grid Resistor at 600 kc., 0.31 ma. at 6.5 mc. and 0.36 ma. at 98 mc.

*Variations of ± 20% are permissible. All AM readings made with sufficient input signal to provide 0.5 watt speaker output. 0.5 watt speaker output at 400 cycles is equivalent to a reading of 2.75V. as measured by a high resistance AC voltmeter across the voice coil of the 15-inch speaker.

**0.1 watt speaker output at 400 cycles is equivalent to a reading of 1.22 volts as measured by a high resistance AC voltmeter across the voice coil of 15-inch speaker.

10 KC. FILTER ADJUSTMENT

This chassis incorporates a 10 kc. filter circuit to eliminate the beat note heard as a whistle between stations on the broadcast band. If the trimmer is out of adjustment the following procedure should be observed:

1. Adjust the treble control switch to the No. 3 setting.

2. Remove the noise suppressor plug from the radio chassis and connect the output of an audio oscillator to the phonograph pickup socket. Adjust the oscillator to exactly 10,000 cycles.

3. Set the band selector to PHONO and adjust the 10 kc. trimmer for minimum output.

4. If an audio oscillator is not available for making this adjustment set the band selector to BDCST, set the range control to position 3, connect the antenna to the receiver and set the gang condenser to a point between two stations on adjacent channels having approximately the same power. If the 10 kc. trimmer is out of adjustment, a whistle will be heard. Adjust the trimmer until the whistle is eliminated.

DIAL CORD REPLACEMENT

Rotate the brass pulley designated "A" in Figure 1 until the dial pointer strikes the stop at the high frequency end of the dial calibration. In this condition the slot in pulley "A" should be approximately ten degrees to the left of being vertical—see Figure 1. If the slot in the pulley is in some other position under the above mentioned conditions, the pointer set screw is probably loose and has allowed the pointer to slip.

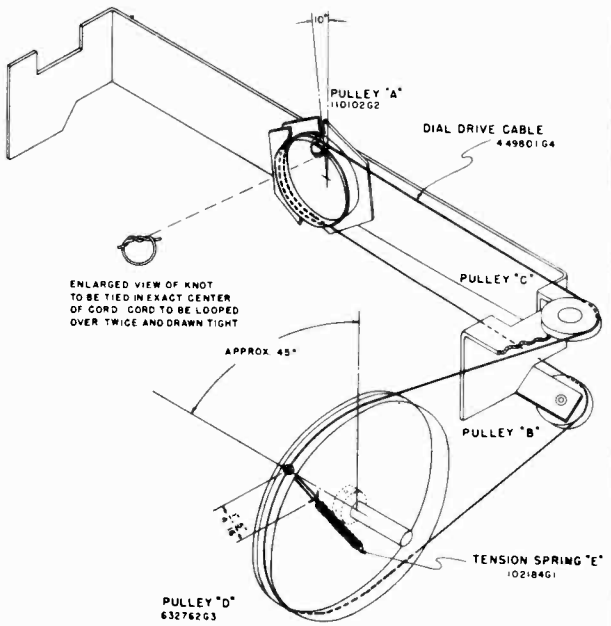


FIGURE 1

To correct this condition, first remove the glass dial and loosen the pointer screw. Then while holding pulley "A" so that its slot is approximately ten degrees to the left of vertical (when viewed from the rear) adjust the pointer until it is resting against the stop at the high frequency end of its travel. Then tighten the pointer set screw securely and replace the glass dial.

Completely unmesh the condenser gang and check the location of the hole or slot in pulley "D". If this hole is not approximately 45 degrees back from vertical as shown on Figure 1, loosen the two No. 6 Allen set screws in the hub of pulley "D" and slip the pulley on its shaft (while holding the condenser gang unmeshed) until the specified adjustment is obtained; then tighten one of the set screws securely. It will be shown later that this is a temporary setting. Next, tie a double knot in the exact center of a 25-inch length of dial cable and fold the cable back on itself so that the knot is at one end. The correct method for tying this knot is shown as an inset on Figure 1. Grasp the cable near the knotted end and slide it into the pulley slot so that the knot is against

the inside rim of the pulley as shown in the sketch. The piece of cable nearest the dial frame should be wound in the direction shown for one-half turn; then over the lower pulley "B", around the bottom of the large pulley "D" and into the hole. Pull the cable taut and wrap the end around the small hook on pulley "D" temporarily.

The remaining piece of cable should be wound around pulley "A" in the direction shown, for one complete turn, over the upper pulley "C", and over the top of pulley "D". Thread the end through the small hole in pulley "D" and pull both ends of the cable taut. With one end of tension spring "E" fastened to the hook on pulley "D" lace the two free ends of the cable through the opposite end of the spring and tie a knot at a point that will allow 1/4" to 5/16" of cable between the spring and the inside rim of pulley "D". Be sure to tie the knot around one coil of the spring in the manner shown.

Now with the condenser gang completely meshed, check the position of the dial pointer. If it is not in line with the last calibration mark at the low frequency end of the dial, loosen the set screw in pulley "D" and turn it until the pointer is in the specified position. Be sure that the condenser gang does not move during this adjustment. Then tighten the two screws in pulley "D" securely completing the operation.

CONDENSER GANG DRIVE ADJUSTMENTS

Whenever any of the mechanical parts in the condenser gang drive assembly require replacement due to rough handling or for any other reason, it is extremely important that clearances and adjustments shown on Figures 2 and 3 are correct; otherwise, the tuning mechanism will be sluggish or it may slip during operation.

In reassembling the mechanism after any part was replaced, follow the procedure outlined below:

1. Assemble the Tuning Shaft, Drive Collar, Compression Spring and Flywheel in the order shown on Figure 3. The distance between the front of the Drive Collar and the front of the Tuning Shaft must be 1 1/8 inches as specified on Figure 2. Install the Flywheel on the rear of the Tuning Shaft and slide it forward until it nearly touches the edge of the Drive Wheel; then tighten one of the set screws in the Flywheel hub. Insert a .010" gauge between the Flywheel and the Pin, and while holding the gauge in this position, loosen the set screw in the Flywheel hub that was previously tightened. The Compression Spring should force the Flywheel back against the gauge—when this occurs, tighten both set screws in the Flywheel hub.

2. Adjust the Muting Switch contact clearance by loosening the two screws in the Contact Bracket and

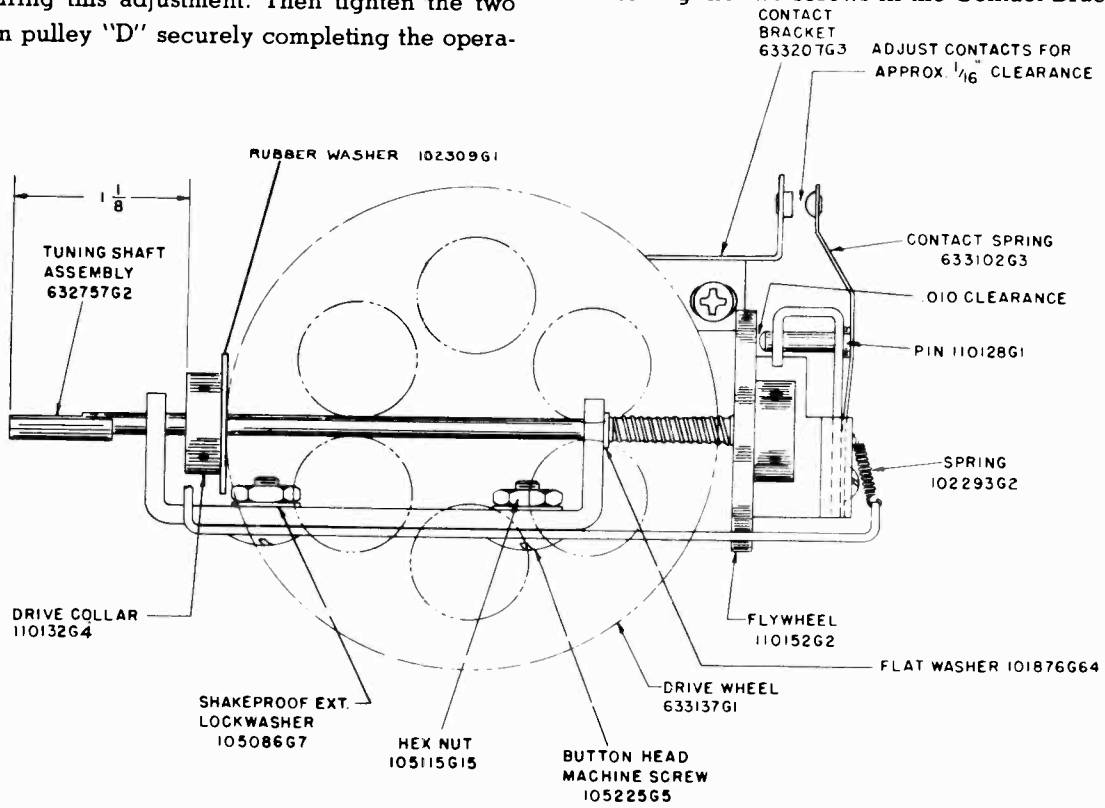


FIGURE 2

sliding the bracket in the required direction until a 1/16" clearance is obtained. If this adjustment cannot be obtained in the manner prescribed, bend the Contact Bracket until proper clearance is realized.

3. The Drive Wheel is properly located on its shaft when its edge nearest the hub is in line with the outside edge of the Drive Collar as shown on Figure 3. Two Allen set screws in the Drive Wheel hub provide a means of adjusting the position of this wheel.

4. When the adjustment outlined in paragraph 2 is correct, the proper contact clearance will automatically be obtained when the Muting Switch is to be "unmuted" while the push buttons are being set. While pressure is applied to any one of the push buttons while they are being set up, a pressure applied simultaneously to the Tuning Control knob will cause the Muting Switch contacts to open. Detailed instructions on setting up these push buttons are shown elsewhere in this bulletin.

5. If the push button shafts at both ends do not engage the Treadle Bar as shown on Figure 3, the three screws in the Treadle Bar must be loosened and the Treadle Bar should be moved until the required condition is obtained.

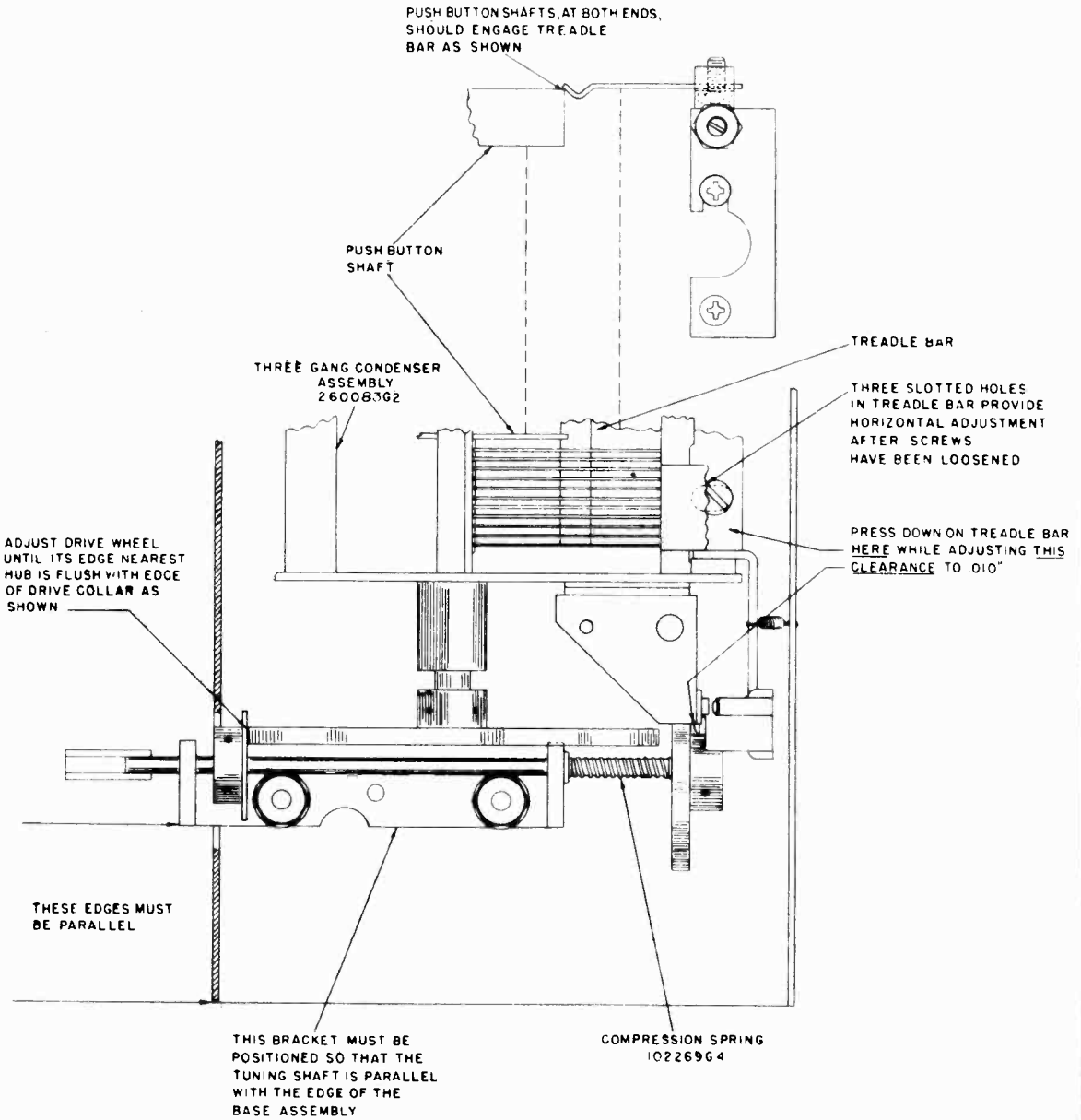
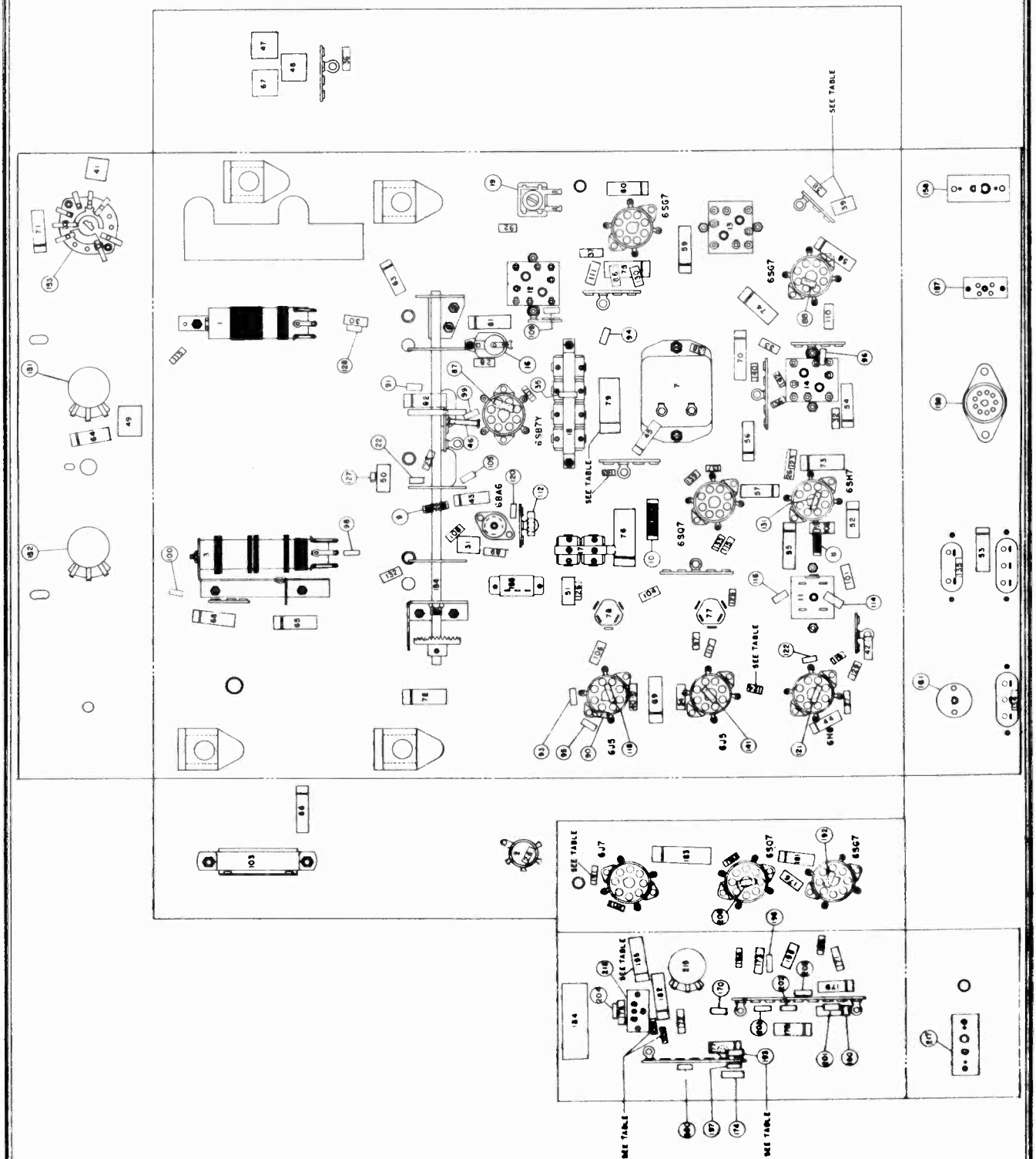
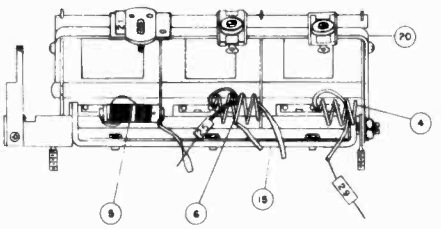


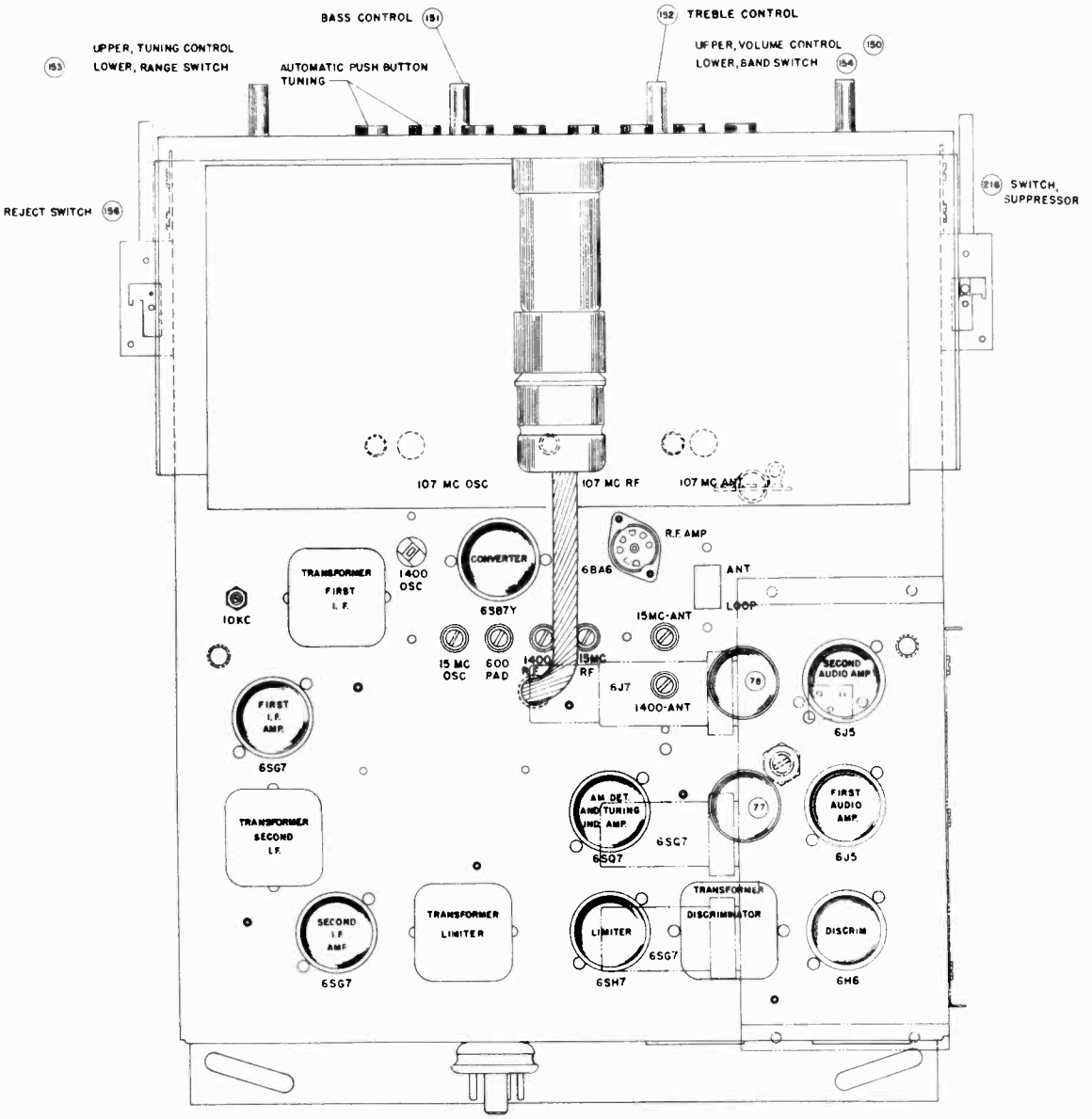
FIGURE 3

MODEL CR-211



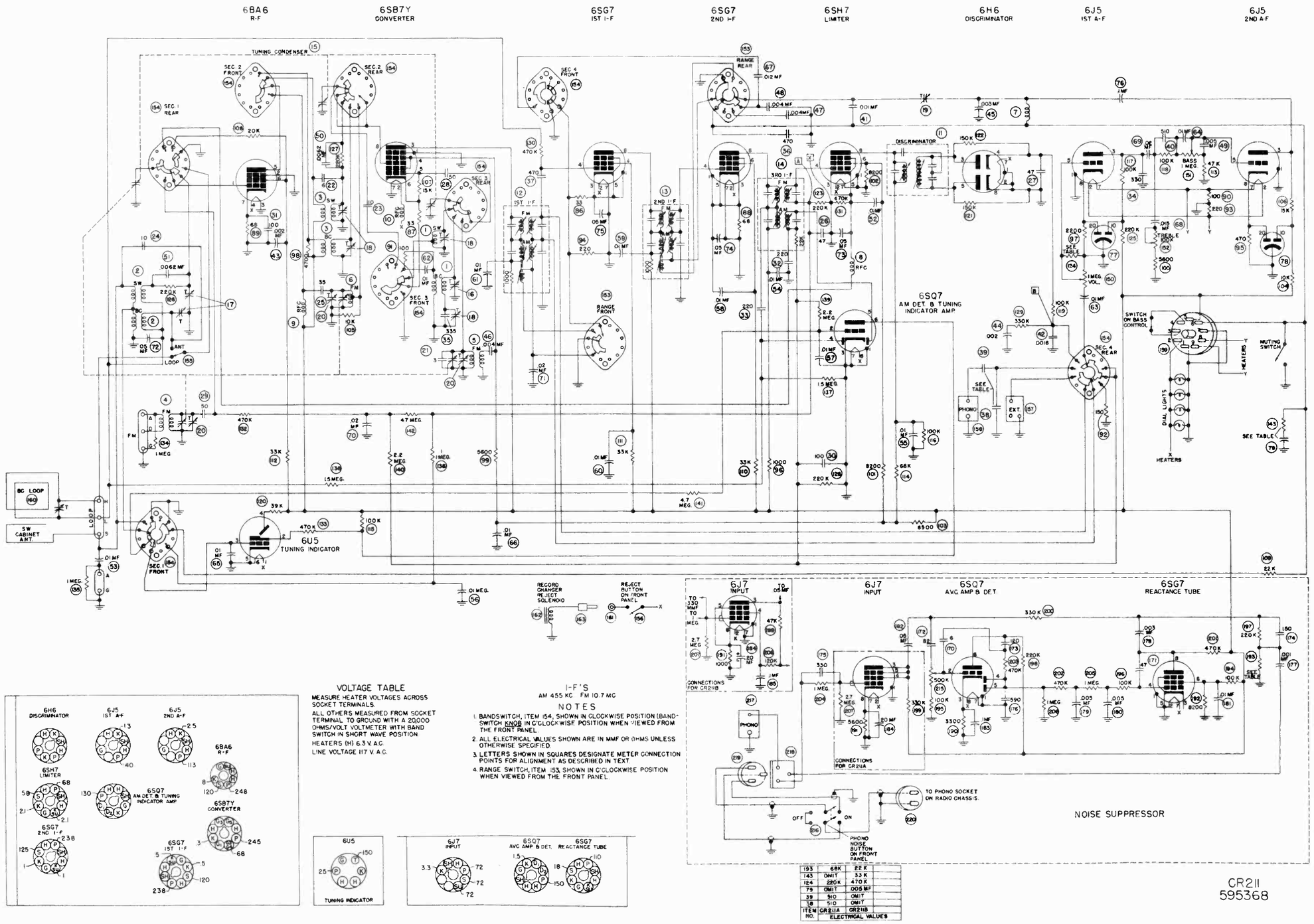
MODEL CR-211





ITEM NO	ELECTRICAL VALUES CR211A	CR211B	
38	510	OMIT	
39	510	OMIT	
79	OMIT	005	
124	220K	470K	
143	OMIT	33K	
185	OMIT	1 MFD	
191	5600	1000	
193	68K	22K	
199	330K	47K	
208	OMIT	120K	

FIGURE 4



VOLTAGE TABLE

MEASURE HEATER VOLTAGES ACROSS SOCKET TERMINALS.

ALL OTHERS MEASURED FROM SOCKET TERMINAL TO GROUND WITH A 20,000 OHMS/VOLT VOLTMETER WITH BAND SWITCH IN SHORT WAVE POSITION.

HEATERS (H) 6.3 V. A.C.

LINE VOLTAGE 117 V. A.C.

I-F'S

AM 455 KC FM 10.7 MC

NOTES

1. BANDSWITCH, ITEM 154, SHOWN IN CLOCKWISE POSITION (BAND-SWITCH KNOB IN C'CLOCKWISE POSITION WHEN VIEWED FROM THE FRONT PANEL.
2. ALL ELECTRICAL VALUES SHOWN ARE IN MMF OR OHMS UNLESS OTHERWISE SPECIFIED.
3. LETTERS SHOWN IN SQUARES DESIGNATE METER CONNECTION POINTS FOR ALIGNMENT AS DESCRIBED IN TEXT.
4. RANGE SWITCH, ITEM 153 SHOWN IN C'CLOCKWISE POSITION WHEN VIEWED FROM THE FRONT PANEL.

ITEM NO.	CR21A	CR21B
ELECTRICAL VALUES		
193	68K	22 K
143	OMIT	33 K
124	220K	470 K
79	OMIT	.005 MF
39	510	OMIT
38	510	OMIT

CR21I
595368

FIGURE 5

MODEL CR-211

REFERENCE NO.	MAGNAVOX PART NO.	DESCRIPTION
1	Coil Assembly, Oscillator (AM)	
2	Coil Assembly, Antenna (AM)	
3	Coil Assembly, R.F. (AM)	
4	Coil Assembly, Antenna (FM)	
5	Coil Assembly, Oscillator (FM)	
6	Coil Assembly, R.F. (FM)	
7	Coil Assembly, 10 K.C.	
8	Coil, Choke	
9	Coil, Choke	
10	Coil, Choke Filament	
11	Transformer, Discriminator	
12	Transformer, I.F.	
13	Transformer, I.F.	
14	Transformer, Limiter	
15	Capacitor, Variable, Three Gang Tuning	
16	Capacitor, Variable, Oscillator Trimmer (Broadcast)	
17	Capacitor, Variable, 2 Gang Trimmer	
18	Capacitor, Variable, 4 Gang Trimmers and Oscillator Padder	
19	Capacitor, Variable, 10 K.C. Trimmer	
20	Capacitor, Trimmer Assembly	
21	Capacitor, Ceramic, 3 mmf.	
22	Capacitor, Ceramic & Composition, 6 mmf.	
23	Capacitor, Ceramic & Composition, 10 mmf.	
24	Capacitor, Ceramic & Composition, 10 mmf.	
25	Capacitor, Ceramic, 35 mmf.	
26	Capacitor, Mica, 47 mmf.	
27	Capacitor, Mica, 47 mmf.	
28	Capacitor, Ceramic, 50 mmf.	
29	Capacitor, Ceramic, 50 mmf.	
30	Capacitor, Mica, 100 mmf.	
31	Capacitor, Mica, 100 mmf.	
32	Capacitor, Mica, 220 mmf.	
33	Capacitor, Mica, 330 mmf.	
34	Capacitor, Mica, 330 mmf.	
35	Capacitor, Silver Mica, 335 mmf., ± 1%	
36	Capacitor, Mica, 470 mmf.	
37	Capacitor, Mica, 470 mmf.	
38	Capacitor, Mica, 510 mmf., ± 5% (Used on CR 211A Only)	
39	Capacitor, Mica, 510 mmf., ± 5% (Used on CR 211B Only)	
40	Capacitor, Mica, 510 mmf., ± 5%	
41	Capacitor, Mica, 1000 mmf.	
42	Capacitor, Mica, 1800 mmf., ± 10%	
43	Capacitor, Paper, .002 mfd., 600 V.	
44	Capacitor, Paper, .002 mfd., 600 V., ± 10%	
45	Capacitor, Paper, .003 mfd., 600 V., ± 10%	
46	Capacitor, Ceramic, .004 mfd.	
47	Capacitor, Molded Paper, .004 mfd., 600 V.	
48	Capacitor, Molded Paper, .004 mfd., 600 V.	
49	Capacitor, Molded Paper, .005 mfd., 400 V.	
50	Capacitor, Mica, .0062 mfd., ± 5%	
51	Capacitor, Mica, .0062 mfd., ± 5%	
52	Capacitor, Paper, .01 mfd., 400 V.	
53	Capacitor, Paper, .01 mfd., 400 V.	
54	Capacitor, Paper, .01 mfd., 400 V.	
55	Capacitor, Paper, .01 mfd., 400 V.	
56	Capacitor, Paper, .01 mfd., 400 V.	
57	Capacitor, Paper, .01 mfd., 400 V.	
58	Capacitor, Paper, .01 mfd., 400 V.	
59	Capacitor, Paper, .01 mfd., 400 V.	
60	Capacitor, Paper, .01 mfd., 400 V.	
61	Capacitor, Paper, .01 mfd., 400 V.	
62	Capacitor, Paper, .01 mfd., 400 V.	
63	Capacitor, Paper, .01 mfd., 400 V.	
64	Capacitor, Paper, .01 mfd., 400 V.	
65	Capacitor, Paper, .01 mfd., 400 V.,	
66	Capacitor, Paper, .01 mfd., 400 V.	
67	Capacitor, Molded Paper, .012 mfd., 200 V.	
68	Capacitor, Paper, .015 mfd. ± 10%, 200 V.	
69	Capacitor, Paper, .02 mfd. 400 V.	
70	Capacitor, Paper, .02 mfd. 400 V.	
71	Capacitor, Paper, .02 mfd. 400 V.	
72	Capacitor, Paper, .05 mfd. 200 V.	
73	Capacitor, Paper, .05 mfd. 200 V.	
74	Capacitor, Paper, .05 mfd. 200 V.	
75	Capacitor, Paper, .05 mfd. 200 V.	
76	Capacitor, Paper, .1 mfd., 400 V.	
77	Capacitor, Electrolytic, 10 mfd., 450 V. 20 mfd., 25 V.	
78	Capacitor, Electrolytic, 10 mfd., 450 V. 20 mfd., 25 V.	
79	Capacitor, Molded Paper, .005 mfd., 400 V. (Used on CR 211B Only)	
86	Resistor, Composition, 33 Ohms, ½ W.	
87	Resistor, Composition, 33 Ohms, ½ W.	
88	Resistor, Composition, 68 Ohms, ½ W.	
89	Resistor, Composition, 68 Ohms, ½ W.	
90	Resistor, Composition, 100 Ohms, ½ W., ± 10%	
91	Resistor, Composition, 100 Ohms, ½ W.	
92	Resistor, Composition, 150 Ohms, ½ W.	
93	Resistor, Composition, 220 Ohms, ½ W., ± 10%	
94	Resistor, Composition, 220 Ohms, ½ W.	
95	Resistor, Composition, 470 Ohms, ½ W.	
96	Resistor, Composition, 1000 Ohms, ½ W.	
97	Resistor, Composition, 2200 Ohms, ½ W.	
98	Resistor, Composition, 4700 Ohms, ½ W.	
99	Resistor, Composition, 5600 Ohms, ½ W., ± 10%	
100	Resistor, Composition, 5600 Ohms, ½ W., ± 10%	
101	Resistor, Composition, 8200 Ohms, 1 W., ± 10%	
102	Resistor, Composition, 8200 Ohms, 1 W., ± 10%.	
103	Resistor, Strip, 8500 Ohms	
104	Resistor, Composition, 10,000 Ohms, 1 W.	
105	Resistor, Composition, 10,000 Ohms, 1 W.	
106	Resistor, Composition, 15,000 Ohms, 1 W.	
107	Resistor, Composition, 15,000 Ohms, ½ W.	
108	Resistor, Composition, 20,000 Ohms, 1 W., ± 5%	
109	Resistor, Composition, 22,000 Ohms, ½ W.	
110	Resistor, Composition, 33,000 Ohms, 1 W.	
111	Resistor, Composition, 33,000 Ohms, ½ W.	
112	Resistor, Composition, 33,000 Ohms, 2 W., ± 10%	
113	Resistor, Composition, 47,000 Ohms, ½ W.	
114	Resistor, Composition, 68,000 Ohms, ½ W., ± 10%	
115	Resistor, Composition, 100,000 Ohms, ½ W.	
116	Resistor, Composition, 100,000 Ohms, ½ W.	
117	Resistor, Composition, 100,000 Ohms, ½ W.	
118	Resistor, Composition, 100,000 Ohms, ½ W., ± 10%	
119	Resistor, Composition, 100,000 Ohms, ½ W., ± 10%	
120	Resistor, Composition, 39,000 Ohms, ½ W., ± 10%	
121	Resistor, Composition, 150,000 Ohms, ½ W., ± 10%	
122	Resistor, Composition, 150,000 Ohms, ½ W., ± 10%	
123	Resistor, Composition, 220,000 Ohms, ½ W.	
124	Resistor, Composition, 220,000 Ohms, ½ W., (Used on CR 211A Only)	
	Resistor, Composition, 470,000 Ohms, ½ W., ± 10%, (Used on CR 211B Only)	
125	Resistor, Composition, 220,000 Ohms, ½ W.	
126	Resistor, Composition, 220,000 Ohms, ½ W.	
127	Resistor, Composition, 220,000 Ohms, ½ W.	
128	Resistor, Composition, 220,000 Ohms, ½ W.	
129	Resistor, Composition, 330,000 Ohms, ½ W., ± 10%	
130	Resistor, Composition, 470,000 Ohms, ½ W.	
131	Resistor, Composition, 470,000 Ohms, ½ W.	
132	Resistor, Composition, 470,000 Ohms, ½ W.	
133	Resistor, Composition, 470,000 Ohms, ½ W.	
134	Resistor, Composition, 1 Megohm, ½ W.	
135	Resistor, Composition, 1 Megohm, ½ W.	
136	Resistor, Composition, 1 Megohm, ½ W.	
137	Resistor, Composition, 1.5 Megohm, ½ W.	
138	Resistor, Composition, 1.5 Megohm, ½ W.	
139	Resistor, Composition, 2.2 Megohm, ½ W.	
140	Resistor, Composition, 2.2 Megohm, ½ W.	
141	Resistor, Composition, 4.7 Megohm, ½ W.	
142	Resistor, Composition, 4.7 Megohm, ½ W.	
143	Resistor, Composition, 33,000 Ohms, ½ W., ± 10%, (Used on CR 211B Only)	
150	Control, Volume, 1 Megohm	
151	Control, Bass, 1 Megohm with Switch	
152	Control, Treble	
153	Control, Balance	
154	Switch, Rotary, Band Switch	
155	Switch, Slide SPDT	
156	Switch, Reject	
157	Socket, External Input	
158	Socket, Phono.	
159	Socket, Amplifier	
160	Antenna Loop Assembly	
161	Socket, Solenoid	
162	Solenoid	
163	Plug, Solenoid	
	Dial Glass Assembly	
	Push Button Assembly for Gang	
	NOISE SUPPRESSOR	
170	Capacitor, Ceramic & Composition, 6 mmf. ± 1 mmf., 500 V.	
171	Capacitor, Mica, 47 mmf., 500 V.	
172	Capacitor, Mica, 82 mmf., ± 10%, 500 V.	
173	Capacitor, Mica, 120 mmf., ± 10%, 500 V.	
174	Capacitor, Mica, 150 mmf., ± 10%, 500 V.	
175	Capacitor, Mica, 330 mmf., 500 V.	
176	Capacitor, Ceramic, 590 mmf.	
177	Capacitor, Paper, .001 mfd., ± 10%, 600 V.	
178	Capacitor, Paper, .003 mfd., ± 10%, 600 V.	
179	Capacitor, Paper, .005 mfd., 400 V.	
180	Capacitor, Paper, .005 mfd., 400 V.	
181	Capacitor, Paper, .01 mfd., 200 V.	
182	Capacitor, Paper, .05 mfd., 200 V.	
183	Capacitor, Paper, .1 mfd., 200 V.	
184	Capacitor, Electrolytic, 20 mfd., 25 V.	
185	Capacitor, Paper, .1 mfd., 400 V. (Used on Amp. 1198 Only)	
190	Resistor, Composition, 3300 Ohms, ½ W.	
191	Resistor, Composition, 5600 Ohms, ½ W., ± 10%, (Used on 119A Only)	
	Resistor, Composition, 1000 Ohms, ½ W., (Used on 119B Only)	
192	Resistor, Composition, 8200 Ohms, ½ W., ± 10%	
193	Resistor, Composition, 68,000 Ohms, ½ W., ± 10%, (Used on 119A Only)	
	Resistor, Composition, 22,000 Ohms, ½ W., ± 10%, (Used on 119B Only)	
194	Resistor, Composition, 100,000 Ohms, 1 W., ± 10%	
195	Resistor, Composition, 100,000 Ohms, ½ W.	
196	Resistor, Composition, 100,000 Ohms, ½ W., ± 10%	
197	Resistor, Composition, 220,000 Ohms, ½ W., ± 10%	
198	Resistor, Composition, 220,000 Ohms, ½ W.	
199	Resistor, Composition, 47,000 Ohms, ½ W., ± 10%, (Used on 119A Only)	
	Resistor, Composition, 330,000 Ohms, ½ W., (Used on 119B Only)	
200	Resistor, Composition, 330,000 Ohms, ½ W.	
201	Resistor, Composition, 470,000 Ohms, ½ W.	
202	Resistor, Composition, 470,000 Ohms, ½ W.	
203	Resistor, Composition, 470,000 Ohms, ½ W.	
204	Resistor, Composition, 1 Megohm, ½ W.	
205	Resistor, Composition, 1 Megohm, ½ W.	
206	Resistor, Composition, 1 Megohm, ½ W.	
207	Resistor, Composition, 2.7 Megohm, ½ W., ± 10%	
	Resistor, Composition, 120,000 Ohms, ½ W., ± 10%, (Used on 119B Only)	
215	Potentiometer, Control Channel Gain	
216	Switch	
217	Socket, Phono. Input	
218	Socket, Switch	
219	Plug, Switch	
220	Plug, Phono.	

MODEL CR-213

SPECIFICATIONS

Intermediate frequency	455 kc./10.7 mc.
Tuning frequency range:	
Broadcast Band	540—1620 kc.
Short Wave Band	5.9—17.3 mc.
FM Band	88—108 mc.
Tubes:	
R-F Amplifier	6BA6
Converter	6SB7Y
1st I-F Amplifier (AM-FM)	6SG7
2nd I-F Amplifier (AM-FM)	6SG7
Limiter	6SH7
Discriminator	6H6
Detector and AVC (AM) and Tuning Indicator Amplifier	6SQ7
First Audio	6J5
Second Audio	6J5
Noise Suppressor Input	6J7
Noise Suppressor AVC Amplifier and Detector	6SQ7
Noise Suppressor Reactance Tube	6SG7
Tuning Indicator	6U5
Dial Lamps	Mazda No. 44

GENERAL

Model CR-213 radio chassis is an AM-FM tuner that must be used in conjunction with a power amplifier such as the AMP-116 for speaker operation. Heater and plate voltages for the CR-213 radio chassis are supplied from the amplifier chassis; it is therefore essential that the radio and amplifier chassis be interconnected during alignment or for other electrical service operations.

METHOD OF REMOVING CHASSIS FROM CABINET

Model CR-213 radio chassis is designed for easy removal from the cabinet in which it is installed. As the radio panel is permanently fastened to the chassis, the control knobs need not be removed when the chassis is taken out of the cabinet for service.

To remove the chassis, first remove the antenna leads from their terminals and all plugs from the receptacles on the rear of the chassis. Then remove the two Phillips-head screws from the angular slots in the flange at the rear of the chassis. Lift the rear of the chassis about one inch and pull it straight back. Never remove the chassis tray from the cabinet—it has been properly positioned to bring the radio panel in place when the chassis is replaced. In replacing the chassis, slide it so that the small hooks near the front ride inside the flanges on the sides of the chassis tray. Push the chassis forward as far as it will go and the hook should then engage the slots in the chassis tray. Replace the two Phillips-head screws and nuts and tighten securely. Replace all plugs in their receptacles and the antenna leads on their correct terminals. The antenna terminal board for the loop antenna connections is designated L-H. The two terminals on the loop are designated L and H; the leads connected to these terminals should be wired to the corresponding terminals (L and H) on the chassis.

ALIGNMENT PROCEDURE

Alignment of this receiver requires the use of an accurately calibrated RF signal generator, range 455 kc. to 107mc., an output meter, and a vacuum tube voltmeter of approximately 10 megohm input impedance. All trimmer condensers can be identified by stampings on the chassis and gang condenser cover and are shown on the chassis layout diagram. The pointer on the radio dial should line up with the first horizontal mark on the low frequency end of the dial glass. If the pointer does not line up, loosen the screws on the pointer drive pulley at the end of the tuning gang and adjust the pointer setting; tighten the screws after this adjustment. Be sure the gang is fully meshed for this pointer alignment.

AM ALIGNMENT

I-F ALIGNMENT

1. Set range control to position No. 1. Set volume, treble and bass controls to maximum, the Band Switch to Broadcast position, and dial pointer to 1000 kc.

2. Tune the signal generator to EXACTLY 455 kc.

3. Connect output of modulated signal generator to the signal grid of the 6SB7Y (pin 8) through a .01 mfd. capacitor and signal generator ground to radio chassis.

4. All i-f transformers on this chassis are slug-tuned. Both slug adjustments for 455 kc. are located on top of the transformers; the 10.7 mc. adjustments are accessible on the bottom.

5. Connect output meter across voice coil of 15-inch speaker and peak in order the third, second and first i-f transformers.

6. Use only enough signal input to give a readable indication on voltmeter so that the AVC will not operate and give false readings.

ALTERNATE VISUAL ALIGNMENT OF I-F STAGES

1. Connect 455 kc. sweep generator having approximately 40 kc. sweep to signal grid of 6SB7Y (pin 8) through a .01 mfd. capacitor. Connect an oscilloscope through a 1 megohm isolating resistor across the 220,000 ohm diode load resistor. Align for best possible peak with range switch in position No. 1, and symmetry in position No. 4.

BROADCAST BAND R-F ALIGNMENT

1. Connect signal generator through .00025 mfd. capacitor to antenna and ground terminals on antenna terminal strip on rear of chassis. Be sure "Ant-loop" switch on top of the chassis is in the ANT. position. Connect output meter as for AM i-f alignment.

2. Tune signal generator to 1400 kc.

3. Set dial to 1400 kc. and adjust oscillator, r-f and antenna trimmers for maximum indication on meter.

4. Set signal generator to 600 kc. and tune radio to signal. Adjust the 600 kc. padder to maximum output while simultaneously rocking the gang.

5. 1400 kc. calibration should then be checked and re-adjusted if necessary with the 1400 kc. oscillator trimmer.

SHORT WAVE BAND R-F ALIGNMENT

1. Set the Band Switch to Short Wave and replace the .00025 mfd. capacitor in series with the signal generator lead to the antenna terminal, with a 400-ohm resistor.

2. Set the signal generator and the receiver to 15 mc. and adjust the oscillator, r-f and antenna trimmers for maximum indication on the meter. While adjusting the 15 mc. oscillator trimmer, two peaks may be observed; only one is the correct peak for 15 mc. alignment. To obtain the correct peak, screw trimmer in to maximum capacitance, then decrease until the first peak is observed. This is the correct one.

Another method for checking for the correct peak is to tune the receiver to 15.91 mc. with signal generator at 15 mc. and with the output increased. If the 15 mc. oscillator trimmer is properly adjusted, the signal will be received at 15.91 mc. if incorrectly aligned, the signal will be received at 14.09 mc.

FM ALIGNMENT DISCRIMINATOR ALIGNMENT

1. Tune signal generator to EXACTLY 10.775 mc. and connect to pin 4 of the 6SH7 limiter tube socket through a .01 mfd. capacitor.

2. Connect a DC vacuum tube voltmeter from Pin 4 on 6H6 tube socket to ground through a 1 megohm isolating resistor.

3. Peak both discriminator slugs at 10.775 mc.

4. Retune signal generator to exactly 10.7 mc. and adjust bottom slug for zero volts.

5. The DC voltage at 10.625 mc. should be within 10% of the voltage at 10.775 mc. and of opposite polarity.

Note: If the signal generator is not capable of sufficient output to produce a readable DC voltage, the amplification of the last i-f stage can be used to increase the signal input to the limiter for discriminator alignment. To accomplish this, align the last i-f stage as indicated in "IF Alignment". Then align discriminator as above leaving the signal generator connected to the grid of the 6SG7 2nd i-f tube.

I-F ALIGNMENT

1. Connect high side of signal generator, through a .01 mfd. capacitor and a 1000 ohm resistor in series, to pin 4 of the 6SG7 2nd i-f tube. Connect low side of generator to chassis.

2. Close gang condenser and connect vacuum tube voltmeter across 220,000 ohm limiter grid resistor; (Points "A" to "X" on schematic). Adjust signal generator output until a reading of at least 3 volts is obtained. In order to reduce regeneration caused by the vacuum tube voltmeter leads, a 1-megohm isolating resistor, connected with as short leads as possible to point "A" should be used in series with the vacuum tube voltmeter. Align the 3rd i-f transformer for best peak as indicated on voltmeter.

3. Repeat above for the 2nd and 1st transformer by connecting signal generator to signal grid of first i-f tube 6SG7 then to the signal grid of 6SB7Y converter. The i-f stages should be aligned in this order.

WARNING—After each i-f stage has been individually aligned, do not repeak with the signal into the grid of the 6SB7Y.

ALTERNATE VISUAL ALIGNMENT OF I-F STAGES

1. Replace signal generator with sweep generator having approximately 300 kc. sweep and tune generator to 10.7 mc. Connect oscilloscope across 220,000 ohm limiter grid resistor through a 1-megohm isolating resistor. The order of alignment is the same as when using a vacuum tube voltmeter. Each i-f transformer should be individually aligned for best peak and symmetry.

R-F ALIGNMENT

1. Connect vacuum tube voltmeter across limiter grid resistor as in FM I-F alignment. Adjust signal generator output until a reading of at least 3 volts is obtained.

2. Ground one side of the FM Antenna by placing a wire jumper from one FM connection on the antenna terminal strip to the ground connection.

3. Connect unmodulated signal generator through a 300 ohm resistor to ungrounded antenna post and chassis, and tune signal generator to 107 mc.

4. Set radio dial to 107 mc. and tune oscillator trimmer to peak output on vacuum tube voltmeter.

5. Tune 107 mc. r-f and antenna trimmers for maximum indication on voltmeter—it may be necessary to rock the gang while adjusting the r-f trimmer.

THE NOISE SUPPRESSOR

This chassis incorporates an automatic noise suppressor to reduce scratch and noise from phonograph reproduction.

The noise suppressor functions only when the band control switch is in "Phono" position and is automatically switched out of the circuit when the band control switch is in any position except "Phono"

To turn the noise suppressor on press the noise suppressor button and release so that the white dot on the top side of the knob is visible. To disconnect the noise suppressor from the circuit press the button in and release so that the white dot is no longer visible.

Tube replacements in the noise suppressor circuit will usually necessitate an adjustment of the bias gain control.

ADJUSTMENT

It is recommended that the following equipment be used in making noise suppressor adjustments:

DC vacuum tube voltmeter, 10 megohm or greater input impedance.

Columbia No. 10004 test record.

1. Connect record changer to noise suppressor and noise suppressor to radio chassis. Obtain test signal by playing Columbia No. 10004 test record at 1500 cycles with radio band switch in "Phono" position. Set bias gain control to give −4.0 volts bias measured from pins 4 and 5 on 6SQ7 to ground with DC vacuum tube voltmeter.
2. If the recommended test equipment is not available the noise suppressor can be adjusted to a reasonably accurate degree by a listening test using a 12-inch record having a moderate amount of surface noise. Turn noise suppressor on, range and treble controls to maximum (clockwise) and bias gain control to extreme counter-clockwise position. Then place stylus in outside groove of record with the turn-table running and adjust bias gain control to a point where the surface noise is barely audible. In making this adjustment the stylus should not be permitted to run into the recorded section of the record.

SPECIAL SERVICE INFORMATION

The following information is provided for the service man who has a vacuum tube voltmeter or a similar measuring instrument available.

STAGE GAINS*

Antenna Post to R-F Grid at:

600 kc.	5.8
6.5 mc.	2.9
98 mc.	1.0

R-F Grid to Converter Grid at:

600 kc.	11.6
6.5 mc.	9.5
98 mc.	6.8

R-F on Converter Grid to 455 kc. on I-F Grid at:

600 kc.	1.7
6.5 mc.	2.4
98 mc.	6.8

I-F on Converter Grid to 1st I-F Grid at:
455 kc. (dial pointer at 600 kc.) 2.6

1st I-F Grid to 2nd I-F Grid at:
455 kc. 20.5
10.7 mc. 37

2nd I-F Grid to Limiter Grid at:
10.7 mc. 34.5

AUDIO GAIN

Voltage required across the Volume Control to produce 0.1 watt speaker output** at 400 cycles is:
.013 volt with Amplifier AMP-116A
with Band Switch in BDCST setting.

OSCILLATOR OUTPUT VOLTAGE

The DC voltage developed across the Oscillator Grid Resistor (105) at:
600 kc. ..... 4.5V.
6.5 mc. ..... 4.6V.
98 mc. ..... 5.4V.

or 0.3 ma. through 15,000 ohm Oscillator Grid Resistor at 600 kc., 0.31 ma. at 6.5 mc. and 0.36 ma. at 98 mc.

*Variations of ± 20% are permissible. All AM readings made with sufficient input signal to provide 0.5 watt speaker output. 0.5 watt speaker output at 400 cycles is equivalent to a reading of 2.75V. as measured by a high resistance AC voltmeter across the voice coil of the 15-inch speaker.

**0.1 watt speaker output at 400 cycles is equivalent to a reading of 1.22 volts as measured by a high resistance AC voltmeter across the voice coil of 15-inch speaker.

10 KC. FILTER ADJUSTMENT

This chassis incorporates a 10 kc. filter circuit to eliminate the beat note heard as a whistle between stations on the broadcast band. If the trimmer is out of adjustment the following procedure should be observed:

1. Adjust the range control switch to the No. 3 setting.

2. Remove the noise suppressor plug from the radio chassis and connect the output of an audio oscillator to the phonograph pickup socket. Adjust the oscillator to exactly 10,000 cycles.

3. Set the band selector to PHONO and adjust the 10 kc. trimmer for minimum output.

4. If an audio oscillator is not available for making this adjustment set the band selector to BDCST, set the range control to position 4, connect the antenna to the receiver and set the gang condenser to a point between two stations on adjacent channels having approximately the same power. If the 10 kc. trimmer is out of adjustment, a whistle will be heard. Adjust the trimmer until the whistle is eliminated.

DIAL CORD REPLACEMENT

Rotate the brass pulley designated "A" in Figure 1 until the dial pointer strikes the stop at the high frequency end of the dial calibration. In this condition the slot in pulley "A" should be approximately ten degrees to the left of being vertical—see Figure 1. If the slot in the pulley is in some other position under the above mentioned conditions, the pointer set screw is probably loose and has allowed the pointer to slip.

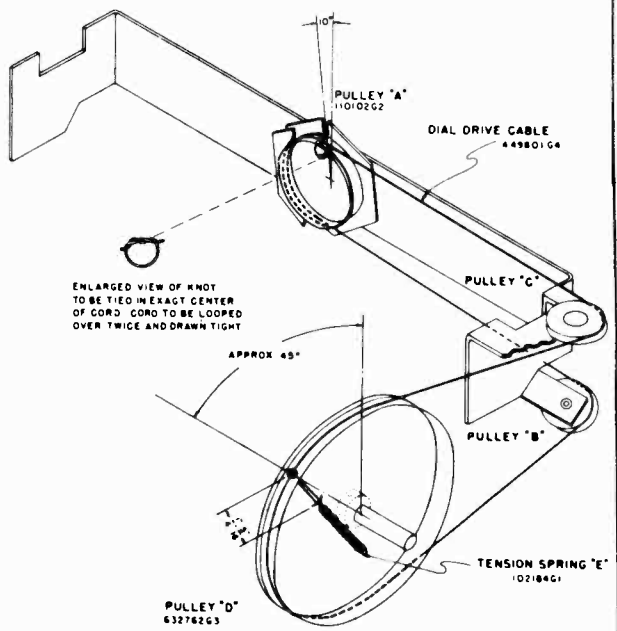


FIGURE 1

To correct this condition, first remove the glass dial and loosen the pointer screw. Then while holding pulley "A" so that its slot is approximately ten degrees to the left of vertical (when viewed from the rear) adjust the pointer until it is resting against the stop at the high frequency end of its travel. Then tighten the pointer set screw securely and replace the glass dial.

Completely unmesh the condenser gang and check the location of the hole or slot in pulley "D". If this hole is not approximately 45 degrees back from vertical as shown on Figure 1, loosen the two No. 6 Allen set screws in the hub of pulley "D" and slip the pulley on its shaft (while holding the condenser gang unmeshed) until the specified adjustment is obtained; then tighten one of the set screws securely. It will be shown later that this is a temporary setting. Next, tie a double knot in the exact center of a 25-inch length of dial cable and fold the cable back on itself so that the knot is at one end. The correct method for tying this knot is shown as an inset on Figure 1. Grasp the cable near the knotted end and slide it into the pulley slot so that the knot is against

the inside rim of the pulley as shown in the sketch. The piece of cable nearest the dial frame should be wound in the direction shown for one-half turn; then over the lower pulley "B", around the bottom of the large pulley "D" and into the hole. Pull the cable taut and wrap the end around the small hook on pulley "D" temporarily.

The remaining piece of cable should be wound around pulley "A" in the direction shown, for one complete turn, over the upper pulley "C", and over the top of pulley "D". Thread the end through the small hole in pulley "D" and pull both ends of the cable taut. With one end of tension spring "E" fastened to the hook on pulley "D" lace the two free ends of the cable through the opposite end of the spring and tie a knot at a point that will allow 1/4" to 5/16" of cable between the spring and the inside rim of pulley "D". Be sure to tie the knot around one coil of the spring in the manner shown.

Now with the condenser gang completely meshed, check the position of the dial pointer. If it is not in line with the last calibration mark at the low frequency end of the dial, loosen the set screw in pulley "D" and turn it until the pointer is in the specified position. Be sure that the condenser gang does not move during this adjustment. Then tighten the two screws in pulley "D" securely completing the operation.

CONDENSER GANG DRIVE ADJUSTMENTS

Whenever any of the mechanical parts in the condenser gang drive assembly require replacement due to rough handling or for any other reason, it is extremely important that clearances and adjustments shown on Figures 2 and 3 are correct; otherwise, the tuning mechanism will be sluggish or it may slip during operation.

In reassembling the mechanism after any part was replaced, follow the procedure outlined below:

1. Assemble the Tuning Shaft, Drive Collar, Compression Spring and Flywheel in the order shown on Figure 3. The distance between the front of the Drive Collar and the front of the Tuning Shaft must be 1 1/8 inches as specified on Figure 2. Install the Flywheel on the rear of the Tuning Shaft and slide it forward until it nearly touches the edge of the Drive Wheel; then tighten one of the set screws in the Flywheel hub. Insert a .010" gauge between the Flywheel and the Pin, and while holding the gauge in this position, loosen the set screw in the Flywheel hub that was previously tightened. The Compression Spring should force the Flywheel back against the gauge—when this occurs, tighten both set screws in the Flywheel hub.

2. Adjust the Muting Switch contact clearance by loosening the two screws in the Contact Bracket and

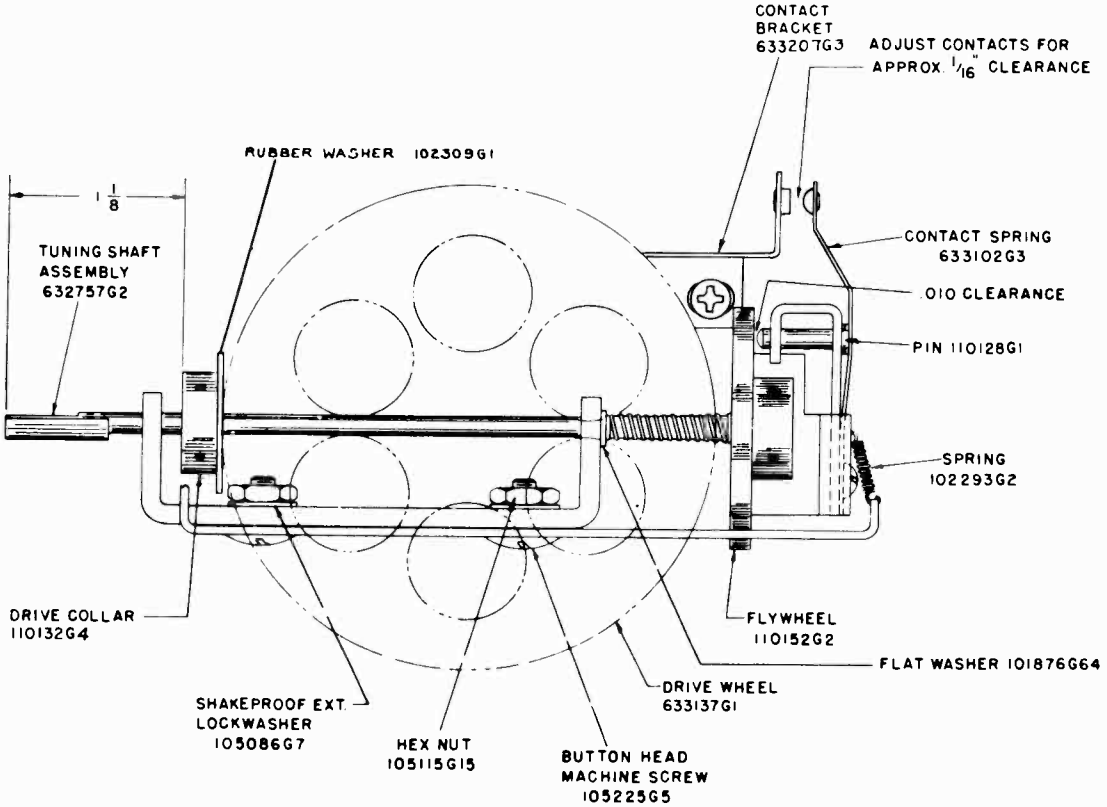


FIGURE 2

sliding the bracket in the required direction until a 1/16" clearance is obtained. If this adjustment cannot be obtained in the manner prescribed, bend the Contact Bracket until proper clearance is realized.

3. The Drive Wheel is properly located on its shaft when its edge nearest the hub is in line with the outside edge of the Drive Collar as shown on Figure 3. Two Allen set screws in the Drive Wheel hub provide a means of adjusting the position of this wheel.

4. When the adjustment outlined in paragraph 2 is correct, the proper contact clearance will automatically be obtained when the Muting Switch is to be "unmuted" while the push buttons are being set. While pressure is applied to any one of the push buttons while they are being set up, a pressure applied simultaneously to the Tuning Control knob will cause the Muting Switch contacts to open. Detailed instructions on setting up these push buttons are shown elsewhere in this bulletin.

5. If the push button shafts at both ends do not engage the Treadle Bar as shown on Figure 3, the three screws in the Treadle Bar must be loosened and the Treadle Bar should be moved until the required condition is obtained.

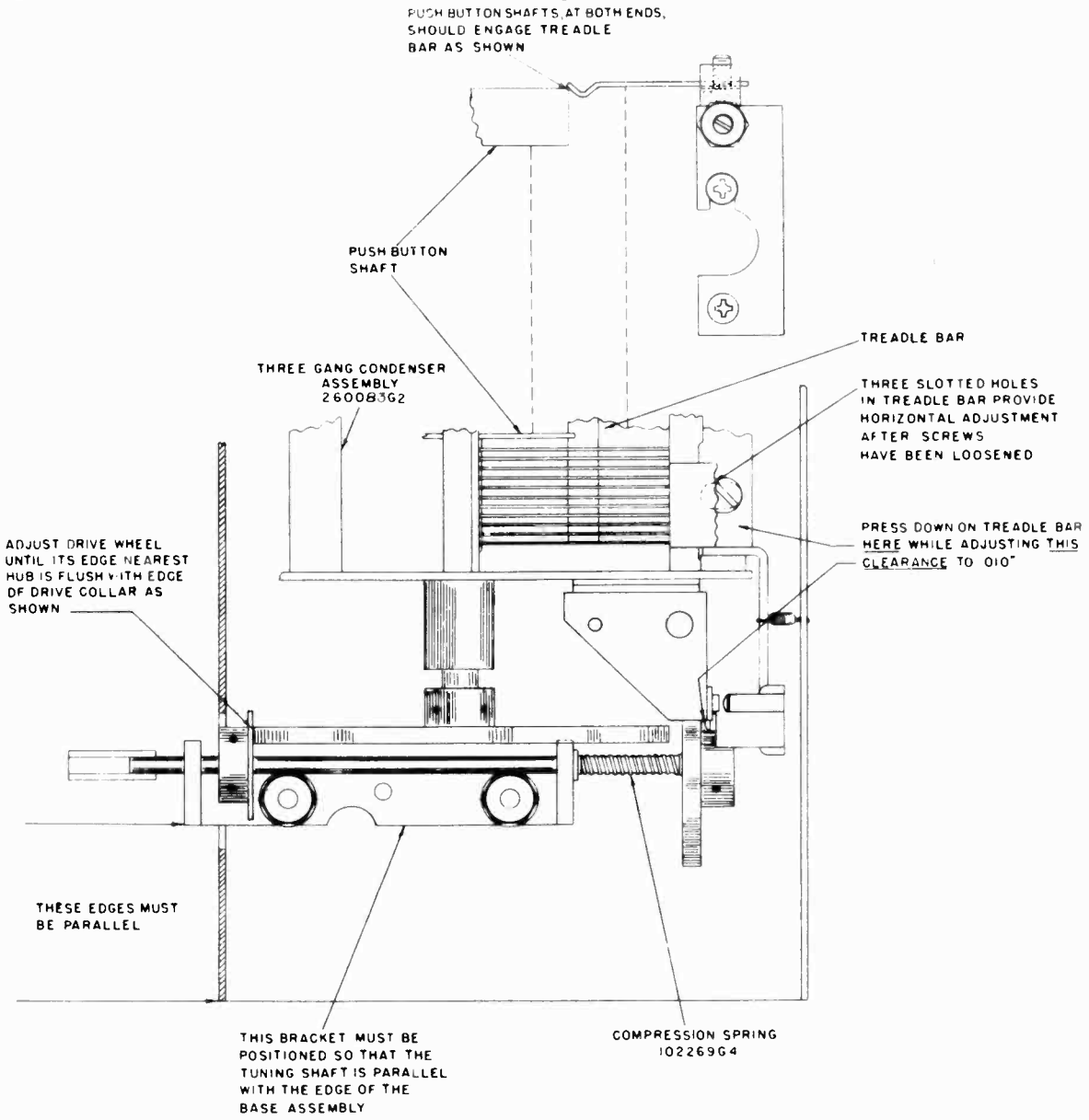
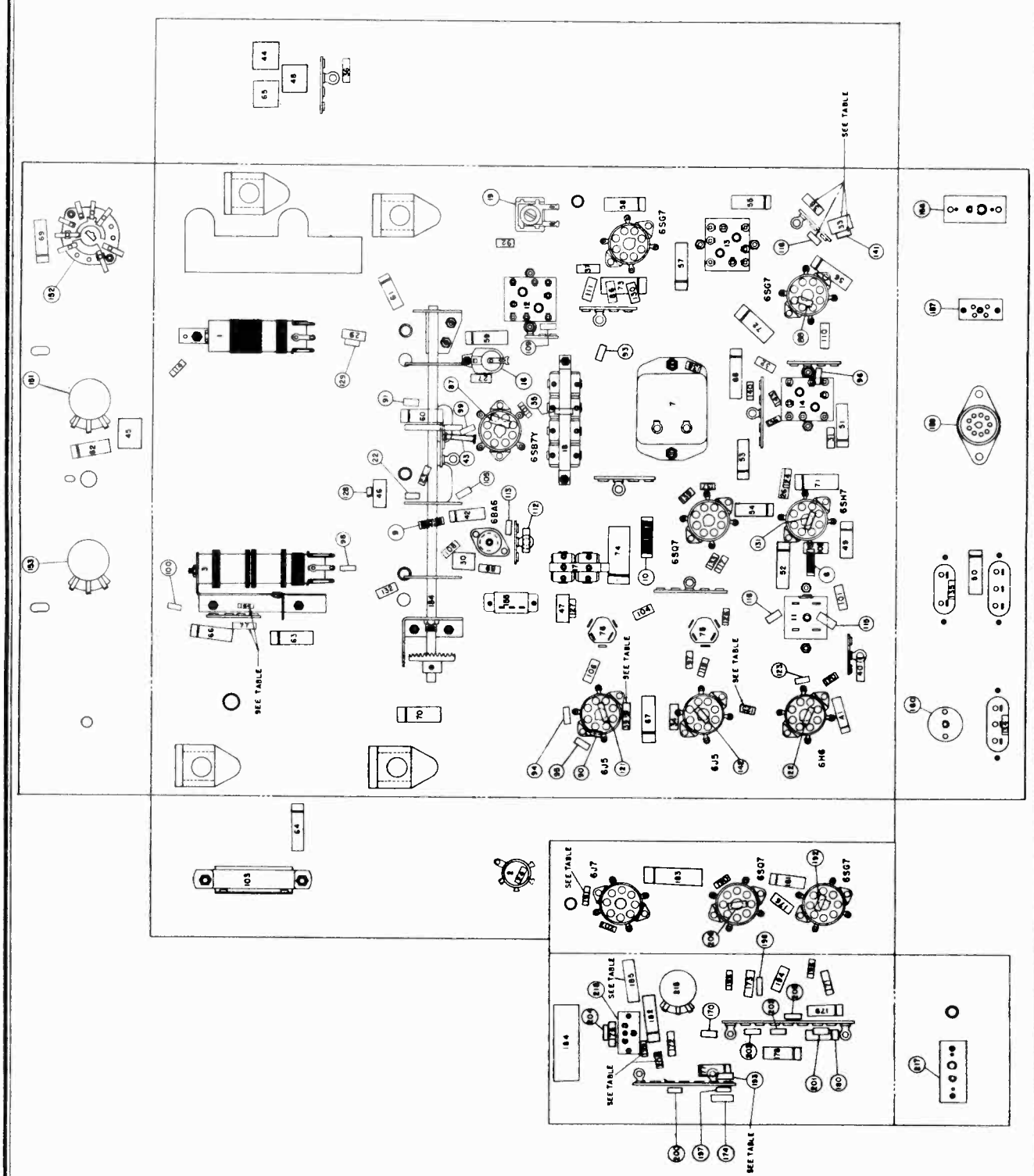
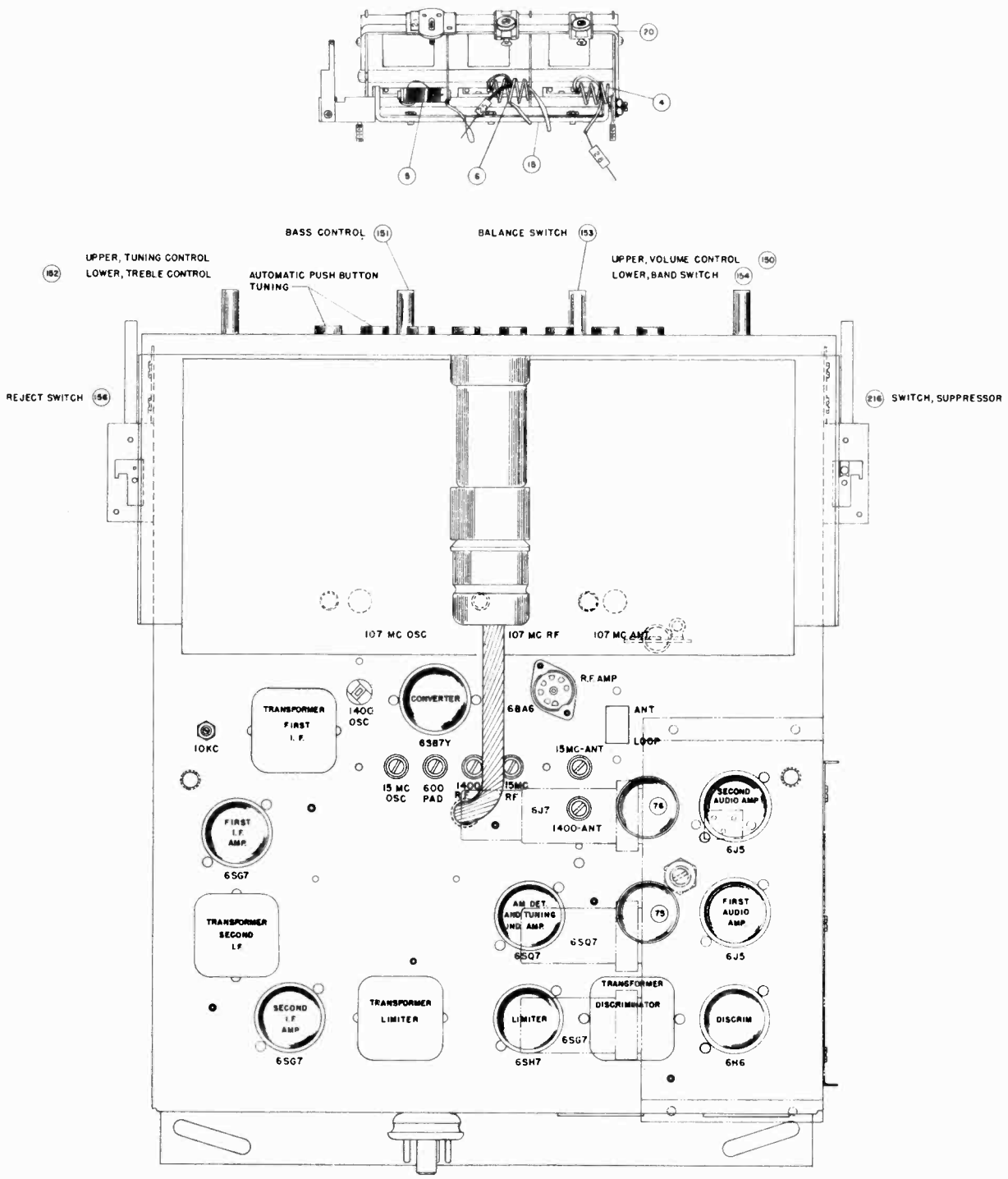


FIGURE 3

MODEL CR-213





ITEM NO	ELECTRICAL VALUES CR213A	CR213B
33	330 MMF	OMIT
38	510 MMF	OMIT
39	510 MMF	OMIT
77	OMIT	1500 MMF
116	82K	OMIT
125	220Ω	470K
141	33 MEG	OMIT
144	OMIT	33K

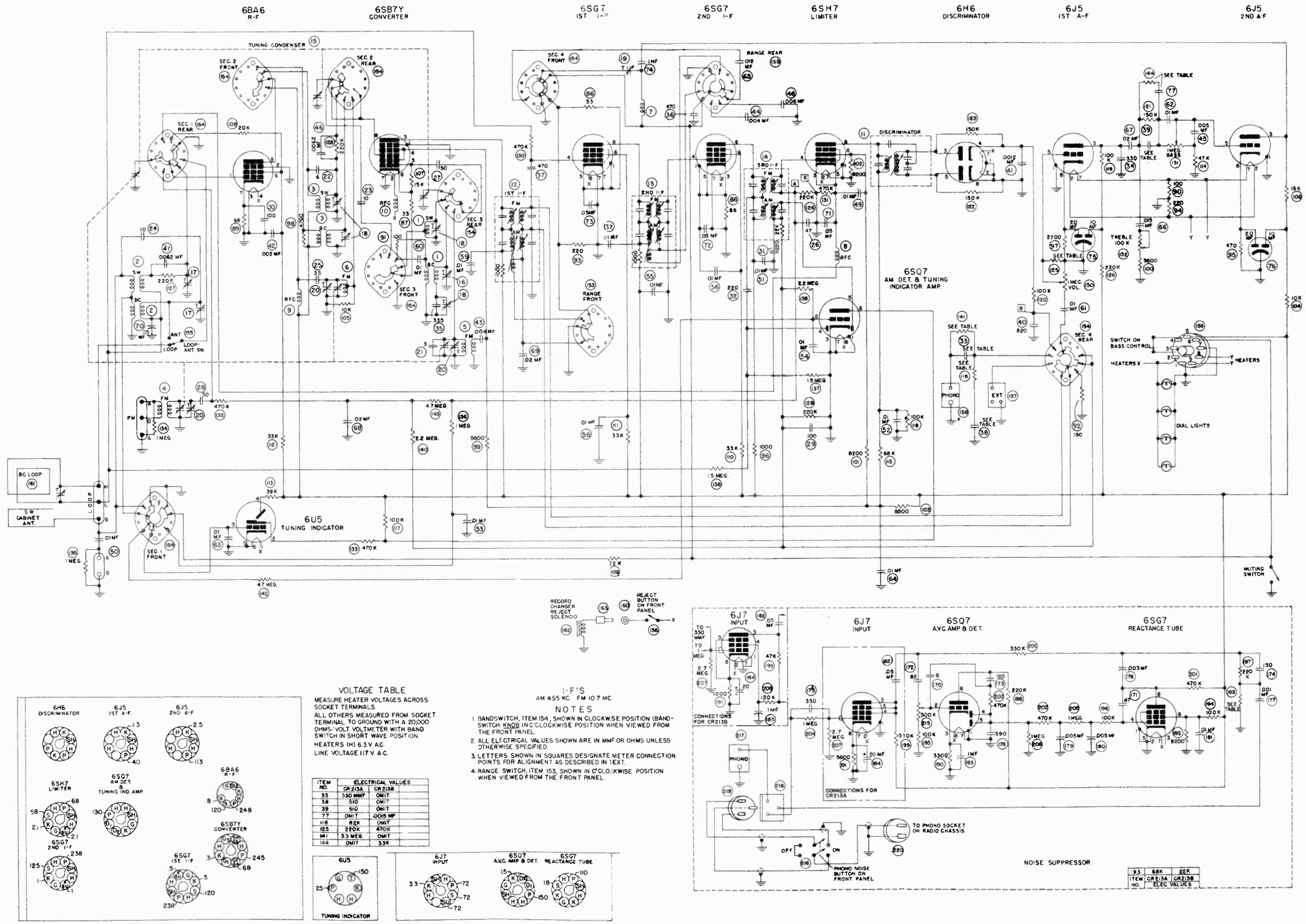
ITEM NO	ELECTRICAL VALUES CR213A	CR213B
190	OMIT	1 MFD
191	5600	1000
193	68K	22K
199	330K	47K
208	OMIT	120K

FIGURE 4

REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
1	Coil Assembly, Oscillator (AM)	360298G1
2	Coil Assembly, Antenna (AM)	360299G1
3	Coil Assembly, R.F. (AM)	360300G1
4	Coil Assembly, Antenna (FM)	360296G3
5	Coil Assembly, Oscillator (FM)	360295G1
6	Coil Assembly, R.F. (FM)	360297G4
7	Coil Assembly, 10 K.C.	360244G1
8	Choke Coil	360284G1
9	Choke Coil	360284G1
10	Choke Coil, Filament	360264G1
11	Transformer (Discriminator)	360305G1
12	Transformer, I.F.	360285G1
13	Transformer, I.F.	360285G1
14	Transformer, Limiter	360286G1
15	Capacitor, Variable, Three Gang Tuning	260075G1
16	Capacitor, Variable, Oscillator Trimmer (Broadcast)	260067G4
17	Capacitor, Variable, 2 Trimmer	260080G1
18	Capacitor, Variable, 4 Trimmer and Oscillator Padder	260082G1
19	Capacitor, Variable, 10 K.C. Trimmer	259610G2
20	Capacitor, Trimmer Assembly	260084G1
21	Capacitor, Ceramic, 3 mmf.	250088G38
22	Capacitor, Ceramic & Composition, 6 mmf.	250164G2
23	Capacitor, Ceramic & Composition, 10 mmf.	250164G3
24	Capacitor, Ceramic & Composition, 10 mmf.	250164G3
25	Capacitor, Ceramic, 35 mmf.	250088G40
26	Capacitor, Mica, 47 mmf.	250159G96
27	Capacitor, Ceramic, 50 mmf.	250088G39
28	Capacitor, Ceramic, 50 mmf.	250088G39
29	Capacitor, Mica, 100 mmf.	250159G98
30	Capacitor, Mica, 100 mmf.	250159G98
31	Capacitor, Mica, 220 mmf.	250159G100
32	Capacitor, Mica, 220 mmf.	250159G100
33	Capacitor, Mica, 330 mmf., ± 10%, (Used on 213A Only)	250159G88
34	Capacitor, Mica, 330 mmf.	250159G101
35	Capacitor, Silver Mica, 335 mmf., ± 1%	250085G38
36	Capacitor, Mica, 470 mmf.	250159G102
37	Capacitor, Mica, 470 mmf.	250159G102
38	Capacitor, Mica, 510 mmf., ± 5%, (Used on 213A Only)	250159G64
39	Capacitor, Mica, 510 mmf., ± 5%, (Used on 213A Only)	250159G64
40	Capacitor, Mica, 820 mmf., ± 10%	250159G132
41	Capacitor, Paper, .0012 mfd., ± 10%, 600 V.	250169G12
42	Capacitor, Paper, .002 mfd., 600 V.	250152G44
43	Capacitor, Ceramic, .004 mfd.	250088G34
44	Capacitor, Molded Paper, .004 mfd., 600 V.	250129G7
45	Capacitor, Molded Paper, .005 mfd., 400 V.	250129G10
46	Capacitor, Mica, .0062 mfd., ± 5%	250161G27
47	Capacitor, Mica, .0062 mfd., ± 5%	250161G27
48	Capacitor, Molded Paper, .008 mfd., 400 V.	250129G11
49	Capacitor, Paper, .01 mfd., 400 V.	250152G27
50	Capacitor, Paper, .01 mfd., 400 V.	250152G27
51	Capacitor, Paper, .01 mfd., 400 V.	250152G27
52	Capacitor, Paper, .01 mfd., 400 V.	250152G27
53	Capacitor, Paper, .01 mfd., 400 V.	250152G27
54	Capacitor, Paper, .01 mfd., 400 V.	250152G27
55	Capacitor, Paper, .01 mfd., 400 V.	250152G27
56	Capacitor, Paper, .01 mfd., 400 V.	250152G27
57	Capacitor, Paper, .01 mfd., 400 V.	250152G27
58	Capacitor, Paper, .01 mfd., 400 V.	250152G27
59	Capacitor, Paper, .01 mfd., 400 V.	250152G27
60	Capacitor, Paper, .01 mfd., 400 V.	250152G27
61	Capacitor, Paper, .01 mfd., 400 V.	250152G27
62	Capacitor, Paper, .01 mfd., 400 V.	250152G27
63	Capacitor, Paper, .01 mfd., 400 V.	250152G27
64	Capacitor, Paper, .01 mfd., 400 V.	250152G27
65	Capacitor, Molded Paper, .012 mfd., 200 V.	250129G13
66	Capacitor, Paper, .015 mfd., ± 10%, 200 V.	250169G5
67	Capacitor, Paper, .02 mfd., 400 V.	250152G26
68	Capacitor, Paper, .02 mfd., 400 V.	250152G26
69	Capacitor, Paper, .02 mfd., 400 V.	250152G26
70	Capacitor, Paper, .05 mfd., 200 V.	250152G15
71	Capacitor, Paper, .05 mfd., 200 V.	250152G15
72	Capacitor, Paper, .05 mfd., 200 V.	250152G15
73	Capacitor, Paper, .05 mfd., 200 V.	250152G15
74	Capacitor, Paper, .1 mfd., 400 V.	250152G22
75	Capacitor, Electrolytic, 10 mfd., 450 V. 20 mfd., 25 V.	270023G6
76	Capacitor, Electrolytic, 10 mfd., 450 V. 20 mfd., 25 V.	270023G6
77	Capacitor, Mica, mmf., ± 10%, 500 V., (Used on 213B Only)	250160G66
86	Resistor, Composition, 33 Ohms, ½ W.	230084G4
87	Resistor, Composition, 33 Ohms, ½ W.	230084G4
88	Resistor, Composition, 68 Ohms, ½ W.	230084G6
89	Resistor, Composition, 68 Ohms, ½ W.	230084G6
90	Resistor, Composition, 100 Ohms, ½ W., ± 10%	230084G50
91	Resistor, Composition, 100 Ohms, ½ W.	230084G7
92	Resistor, Composition, 150 Ohms, ½ W.	230084G8
93	Resistor, Composition, 220 Ohms, ½ W.	230084G9
94	Resistor, Composition, 220 Ohms, ½ W., ± 10%	230084G54
95	Resistor, Composition, 470 Ohms, ½ W.	230084G11
96	Resistor, Composition, 1000 Ohms, ½ W.	230084G13
97	Resistor, Composition, 2200 Ohms, ½ W.	230084G15
98	Resistor, Composition, 4700 Ohms, ½ W.	230084G17
99	Resistor, Composition, 5600 Ohms, ½ W., ± 10%	230084G71
100	Resistor, Composition, 5600 Ohms, ½ W., ± 10%	230084G71
101	Resistor, Composition, 8200 Ohms, 1 W., ± 10%	230085G73
102	Resistor, Composition, 8200 Ohms, 1 W., ± 10%	230085G73
103	Resistor, Strip, 8500 Ohms	240035G5
104	Resistor, Composition, 10,000 Ohms, 1 W.	230085G19
105	Resistor, Composition, 10,000 Ohms, ½ W.	230084G19
106	Resistor, Composition, 15,000 Ohms, 1 W.	230085G20
107	Resistor, Composition, 15,000 Ohms, ½ W.	230084G20
108	Resistor, Composition, 20,000 Ohms, 1 W., ± 5%	230085G190
109	Resistor, Composition, 22,000 Ohms, ½ W.	230084G21
110	Resistor, Composition, 33,000 Ohms, 1 W.	230085G22
111	Resistor, Composition, 33,000 Ohms, 1 W.	230085G22
112	Resistor, Composition, 33,000 Ohms, 2 W., ± 10%	230086G80
113	Resistor, Composition, 39,000 Ohms, ½ W., ± 10%	230084G81
114	Resistor, Composition, 47,000 Ohms, ½ W.	230084G23
115	Resistor, Composition, 68,000 Ohms, ½ W., ± 10%	230084G84
116	Resistor, Composition, 82,000 Ohms, ½ W., ± 10%, (Used on 213A Only)	230084G85
117	Resistor, Composition, 100,000 Ohms, ½ W.	230084G25
118	Resistor, Composition, 100,000 Ohms, ½ W.	230084G25
119	Resistor, Composition, 100,000 Ohms, ½ W.	230084G25
120	Resistor, Composition, 100,000 Ohms, ½ W., ± 10%	230084G86
121	Resistor, Composition, 150,000 Ohms, ½ W.	230084G26
122	Resistor, Composition, 150,000 Ohms, ½ W., ± 10%	230084G88
123	Resistor, Composition, 150,000 Ohms, ½ W., ± 10%	230084G88
124	Resistor, Composition, 220,000 Ohms, ½ W.	230084G27
125	Resistor, Composition, 220,000 Ohms, ½ W., (Used on 213A Only)	230084G27
	Resistor, Composition, 470,000 Ohms, ½ W., ± 10%, (Used on 213B Only)	230084G94
126	Resistor, Composition, 220,000 Ohms, ½ W.	230084G27
127	Resistor, Composition, 220,000 Ohms, ½ W.	230084G27
128	Resistor, Composition, 220,000 Ohms, ½ W.	230084G27
129	Resistor, Composition, 220,000 Ohms, ½ W.	230084G27
130	Resistor, Composition, 470,000 Ohms, ½ W.	230084G29
131	Resistor, Composition, 470,000 Ohms, ½ W.	230084G29
132	Resistor, Composition, 470,000 Ohms, ½ W.	230084G29
133	Resistor, Composition, 470,000 Ohms, ½ W.	230084G29
134	Resistor, Composition, 1 Megohm, ½ W.	230084G31
135	Resistor, Composition, 1 Megohm, ½ W.	230084G31
136	Resistor, Composition, 1 Megohm, ½ W.	230084G31
137	Resistor, Composition, 1.5 Megohm, ½ W.	230084G32
138	Resistor, Composition, 1.5 Megohm, ½ W.	230084G32
139	Resistor, Composition, 2.2 Megohm, ½ W.	230084G33
140	Resistor, Composition, 2.2 Megohm, ½ W.	230084G33
141	Resistor, Composition, 3.3 Megohm, ½ W., ± 10%, (Used on 213A Only)	230084G104
142	Resistor, Composition, 4.7 Megohm, ½ W.	230084G35
143	Resistor, Composition, 4.7 Megohm, ½ W.	230084G35
144	Resistor, Composition, 33,000 Ohms, ½ W., ± 10%, (Used on 213B Only)	230084G80
150	Control, Volume, 1 Megohm	220044G24
151	Control, Bass, 1 Megohm, with Switch	220073G6
152	Control, Treble	160178G1
153	Switch, Balance	220044G26
154	Switch, Rotary Band Switch	160179G1
155	Switch, Slide SPDT	160176G1
156	Switch, Reject	160188G1
157	Socket, External Input	180060G1
158	Socket, Phono.	189741G1
159	Socket, Amplifier	180427G2
160	Socket, Solenoid	182776G1
161	Antenna Loop Assembly *The part number of the loop antenna assembly changes with different Cabinets. It is therefore important that you specify the STYLE NUMBER of the instrument when ordering a replacement loop antenna assembly.	
162	Solenoid	360313G1
163	Plug, Solenoid	189147G1
	Dial Glass Assembly	150303G1
	Push Button Assembly for Gang	260093G1

NOISE SUPPRESSOR—AMP 119A & B

170	Capacitor, Ceramic & Composition, 6 mmf., ± 1 mmf., 500 V.	250164G2
171	Capacitor, Mica, 47 mmf., 500 V.	250159G96
172	Capacitor, Mica, 82 mmf., ± 10%, 500 V.	250159G81
173	Capacitor, Mica, 120 mmf., ± 10%, 500 V.	250159G83
174	Capacitor, Mica, 150 mmf., ± 10%, 500 V.	250159G84
175	Capacitor, Mica, 330 mmf., 500 V.	250159G101
176	Capacitor, Ceramic, 590 mmf.	250088G41
177	Capacitor, Paper, .001 mfd., ± 10%, 600 V.	250169G11
178	Capacitor, Paper, .003 mfd., ± 10%, 600 V.	250169G6
179	Capacitor, Paper, .005 mfd., 400 V.	250152G30
180	Capacitor, Paper, .005 mfd., 400 V.	250152G30
181	Capacitor, Paper, .01 mfd., 200 V.	250152G18
182	Capacitor, Paper, .05 mfd., 200 V.	250152G15
183	Capacitor, Paper, .1 mfd., 200 V.	250152G13
184	Capacitor, Electrolytic, 20 mfd., 25 V.	270027G2
185	Capacitor, Paper, .1 mfd., 400 V., (Used on Amp. 119B Only)	250152G22
190	Resistor, Composition, 3300 Ohms, ½ W.	230084G16
191	Resistor, Composition, 5600 Ohms, ½ W., ± 10%, (Used on 119A Only)	230084G71
	Resistor, Composition, 1000 Ohms, ½ W., (Used on 119B Only)	230084G13
192	Resistor, Composition, 8200 Ohms, ½ W., ± 10%	230084G73
193	Resistor, Composition, 68,000 Ohms, ½ W., ± 10%, (Used on 119A Only)	230084G84
	Resistor, Composition, 22,000 Ohms, ½ W., ± 10%, (Used on 119B Only)	230084G78
194	Resistor, Composition, 100,000 Ohms, 1 W., ± 10%	230085G86
195	Resistor, Composition, 100,000 Ohms, ½ W.	230084G25
196	Resistor, Composition, 100,000 Ohms, ½ W., ± 10%	230084G86
197	Resistor, Composition, 220,000 Ohms, ½ W., ± 10%	230084G90
198	Resistor, Composition, 220,000 Ohms, ½ W.	230084G27
199	Resistor, Composition, 330,000 Ohms, ½ W., (Used on 119A Only)	230084G28
	Resistor, Composition, 47,000 Ohms, ½ W., ± 10%, (Used on 119B Only)	230084G82
200	Resistor, Composition, 330,000 Ohms, ½ W.	230084G28
201	Resistor, Composition, 470,000 Ohms, ½ W.	230084G29
202	Resistor, Composition, 470,000 Ohms, ½ W.	230084G29
203	Resistor, Composition, 470,000 Ohms, ½ W.	230084G29
204	Resistor, Composition, 1 Megohm, ½ W.	230084G31
205	Resistor, Composition, 1 Megohm, ½ W.	230084G31
206	Resistor, Composition, 1 Megohm, ½ W.	230084G31
207	Resistor, Composition, 2.7 Megohm, ½ W., ± 10%	230084G103
208	Resistor, Composition, 120,000 Ohms, ½ W., ± 10%, (Used on 119B Only)	230084G87
215	Potentiometer, Control Channel Gain	220072G11
216	Switch	160187G1
217	Socket, Phono Input	189741G1
218	Socket, Switch	180139G4
219	Plug, Switch	180311G9
220	Plug, Phono	180311G1



VOLTAGE TABLE

MEASURE HEATER VOLTAGES ACROSS SOCKET TERMINALS.

ALL OTHERS MEASURED FROM SOCKET TERMINAL TO GROUND WITH A 20,000 OHMS/VOLT VOLTMETER WITH BAND SWITCH IN SHORT WAVE POSITION.

HEATERS (H) 6.3 V. A.C.

LINE VOLTAGE 117 V. A.C.

ITEM NO.	ELECTRICAL VALUES	
	CR 213A	CR 213B
33	330 MMF	OMIT
38	510	OMIT
39	510	OMIT
77	OMIT	.0015 MF
116	82K	OMIT
125	220K	470K
M1	3.3 MEG.	OMIT
144	OMIT	33K

I-F'S

AM 455 KC FM 10.7 MC

NOTES

1. BANDSWITCH, ITEM 154, SHOWN IN CLOCKWISE POSITION (BANDSWITCH KNOB IN C'CLOCKWISE POSITION WHEN VIEWED FROM THE FRONT PANEL.
2. ALL ELECTRICAL VALUES SHOWN ARE IN MMF OR OHMS UNLESS OTHERWISE SPECIFIED.
3. LETTERS SHOWN IN SQUARES DESIGNATE METER CONNECTION POINTS FOR ALIGNMENT AS DESCRIBED IN TEXT.
4. RANGE SWITCH, ITEM 153, SHOWN IN C'CLOCKWISE POSITION WHEN VIEWED FROM THE FRONT PANEL.

FIGURE 5

MODEL CR-226

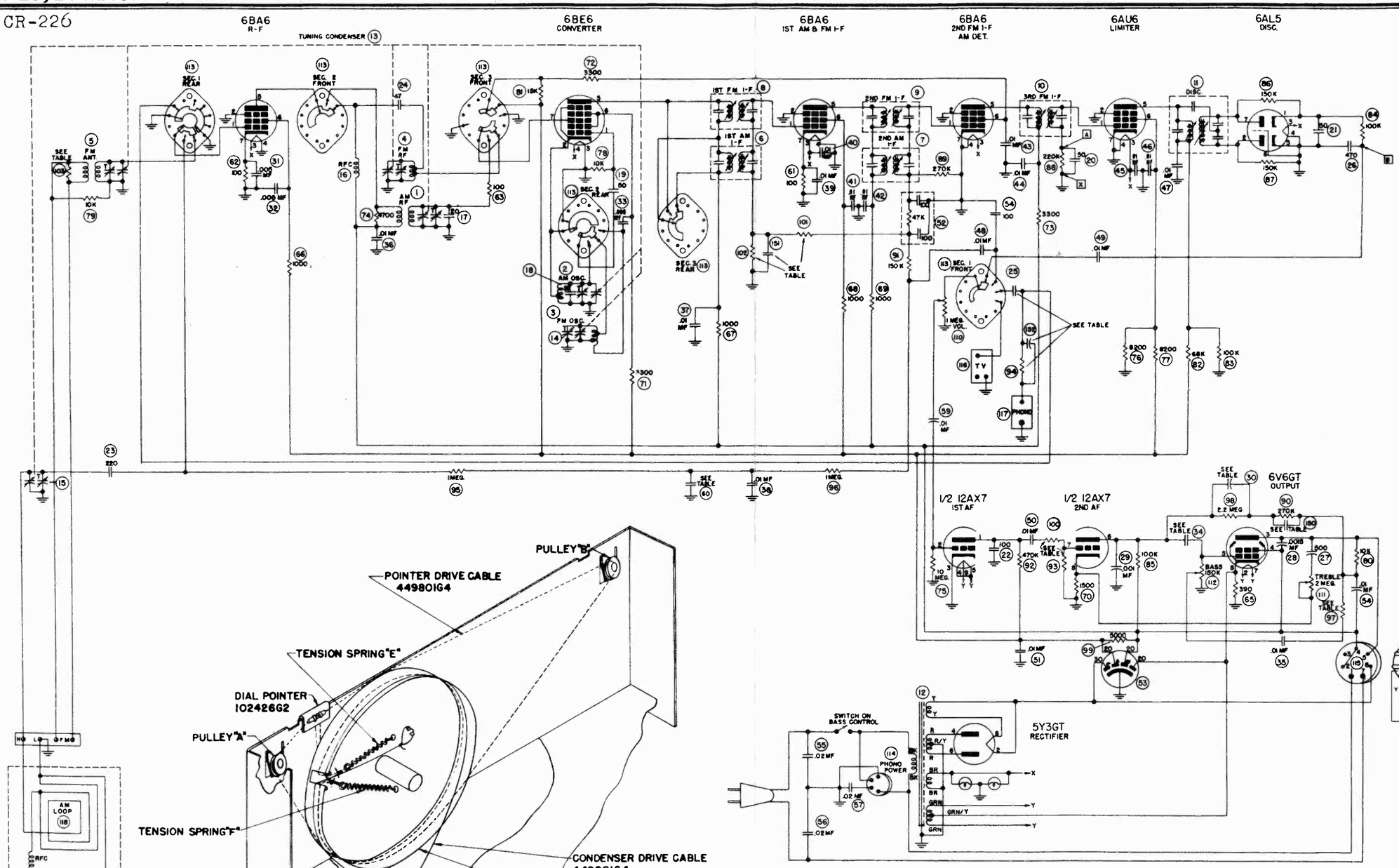


FIGURE 1

FIGURE 2

I-F'S

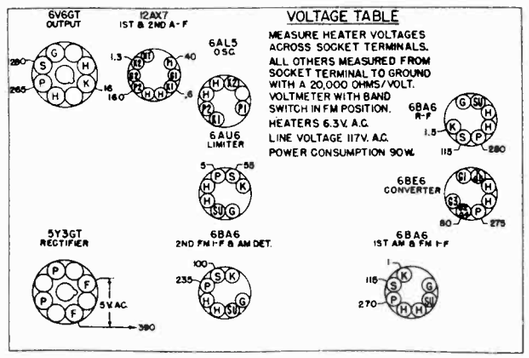
FM 10.7 MC AM 455 KC

NOTES

BAND SWITCH SHOWN IN C'CLOCKWISE (FM) POSITION WHEN VIEWED FROM THE FRONT PANEL.

ALL ELECTRICAL VALUES SHOWN ARE IN MMF OR OHMS UNLESS OTHERWISE SPECIFIED.

LETTERS SHOWN IN SQUARES DESIGNATE METER CONNECTION POINTS FOR ALIGNMENT DESCRIBED IN TEXT.



SPECIFICATIONS

MODEL CR-226

2nd I-F (FM), Detector and AVC (AM)	6BA6
Limiter	6AU6
Discriminator	6AL5
First and Second Audio	12AX7
Power output	6V6GT
Rectifier	5Y3GT
Dial Lamps	Mazda No. 44
Speaker:	
Field coil resistance	1000 ohms
Voice coil impedance (400 cycles)	3.0 ohms
Output transformer	6500/3 ohms
Power supply	117 volts 50/60 cycles AC
Power consumption	85 watts
Power output	6 watts
Intermediate frequency	455 kc./10.7 mc.
Tuning frequency range:	
Broadcast Band	540-1620 kc.
FM Band	88 108 mc.
Tubes:	
R-F Amplifier	6BA6
Converter	6BE6
1st I-F Amplifier (AM-FM)	6BA6

METHOD FOR REMOVING CHASSIS FROM CABINET

Model CR-226 radio chassis is designed for easy removal from the cabinet in which it is installed. As the radio panel is not fastened to the chassis, the control knobs must be removed when the chassis is taken out of the cabinet for service.

To remove the chassis, first remove the loop leads from their terminals and all plugs from the receptacles on the rear of the chassis. Then remove the four screws securing the chassis and lift it from the cabinet. To replace chassis in cabinet, line up mounting holes and replace mounting screws. Replace all plugs in their receptacles and the loop leads on their correct terminals. The antenna terminal board for the loop antenna connections is designated L-H. The two terminals on the loop are designated L and H; the leads connected to these terminals should be wired to the corresponding terminals (L and H) on the chassis.

ALIGNMENT PROCEDURE

Alignment of this receiver requires the use of an accurately calibrated RF signal generator, range 455 kc. to 107 mc., an output meter, and a vacuum tube voltmeter of greater than 10 megohm input impedance. All trimmer condensers can be identified by stampings on the chassis and gang condenser cover and are shown on the chassis layout diagram. The pointer on the radio dial should line up with the first vertical mark on the low frequency end of the dial glass. If the pointer does not line up, loosen the pointer on the dial string and move it to correct position. Re-tighten and re-cement the pointer to the string. Be sure the gang is fully meshed for this pointer alignment. Align AM first. The oscillator frequency is higher than the carrier on the broadcast band, and lower than the carrier on FM.

AM ALIGNMENT

I-F ALIGNMENT

1. Set volume, treble, and bass controls to maximum. Set Band Switch to Broadcast position, and dial pointer to 1000 kc.
2. Tune the signal generator to EXACTLY 455 kc.
3. Connect output of modulated signal generator to the signal grid of the 6BE6 (pin 7) through a .01 mfd. capacitor and signal generator ground to radio chassis.
4. AM and FM i-f transformers on this model are separate and can be identified on the chassis layout diagram Figure 3.
5. Connect output meter across voice coil of speaker and adjust the i-f transformers for peak output as indicated on the output meter.

ALTERNATE VISUAL ALIGNMENT OF I-F STAGES

1. Connect 455 kc. sweep generator having approximately 20 kc. sweep to signal grid of 6BE6 (pin 7) through a .01 mfd. capacitor. Connect an oscilloscope through a 1 megohm isolating resistor across the 150,000 ohm diode load resistor. Align for best possible peak and symmetry.

R-F ALIGNMENT

1. Remove the signal generator lead from the 6BE6 grid and connect it across H and L on terminal strip on the rear of the chassis. The high side of the signal generator should be connected to H and the signal generator ground to L.

2. Check the tuning dial pointer adjustment. When the plates of the tuning condenser are completely meshed, the dial pointer must be in line with the last calibration mark at the low frequency end of the dial. If it is not, slide the pointer on its string to the correct position. Be sure to crimp the lugs (on the rear of the pointer) tightly around the string to hold the pointer in adjustment.

3. Set the signal generator and the radio receiver to 1400 kc., adjust the 1400 kc. oscillator trimmer and the 1400 kc. r-f trimmer for maximum output.

4. Set the signal generator and radio receiver to 600 kc. Adjust the oscillator and r-f coil slugs for maximum output. If considerable adjustment was necessary re-check the 1400 kc. trimmer settings.

5. Replace chassis in cabinet and connect loop antenna leads to proper terminals on the rear of the chassis.

6. Form three turns of wire into a loop, connect this loop to the signal generator and loosely couple it to the receiver loop antenna.

7. With the signal generator and dial at 1400 kc., adjust the loop antenna trimmer for maximum output.

FM ALIGNMENT

DISCRIMINATOR ALIGNMENT

1. Tune signal generator to EXACTLY 10.775 mc. and connect to pin 1 of the 6AU6 Limiter tube socket through a .01 mfd. capacitor.

2. Connect a DC vacuum tube voltmeter between point "B" on schematic diagram, and ground (across .00047 mfd. capacitor—Pin 1 on 6AL5 to ground).

3. Peak both discriminator slugs at 10.775 mc.

4. Retune signal generator to exactly 10.7 mc. and adjust bottom slug for zero volts.

5. The DC voltage at 10.625 mc. should be within 10% of the voltage at 10.775 mc. and of opposite polarity.

Note: If the signal generator is not capable of sufficient output to produce a readable DC voltage, the amplification of the last i-f stage can be used to increase the signal input to the limiter for discriminator alignment. To accomplish this, align the last i-f stage as indicated in "IF Alignment". Then align discriminator as above leaving the signal generator connected to the grid of the 6BA6 2nd i-f tube.

I-F ALIGNMENT

1. Connect high side of signal generator, through a .01 mfd. capacitor and a 1000 ohm resistor in series, to pin 1 of the 6BA6 2nd i-f tube. Connect low side of generator to chassis.

2. Close gang condenser and connect vacuum tube voltmeter across 220,000 ohm limiter grid resistor; (Point "A" on schematic to ground). Adjust signal generator output until a reading of approximately 3 volts is obtained. In order to reduce regeneration caused by the vacuum tube voltmeter leads, a 1-megohm isolating resistor, connected with as short leads as possible to point "A" should be used in series with the vacuum tube voltmeter. Align the 3rd i-f transformer for best peak as indicated on voltmeter.

3. Repeat above for each succeeding transformer by connecting signal generator to signal grid (pin 1) of first i-f tube 6BA6 then to the signal grid (pin 7) of 6BE6 converter. The i-f stages should be aligned in this order.

WARNING—After each i-f stage has been aligned, do not repeak with the signal into the grid of the 6BE6.

ALTERNATE VISUAL ALIGNMENT OF I-F STAGES

1. Replace signal generator with sweep generator having approximately 300 kc. sweep and tune generator to 10.7 mc. Connect oscilloscope across 220,000 ohm limiter grid resistor through a 1-megohm isolating resistor. The order of alignment is the same as when using a vacuum tube voltmeter. Each i-f transformer should be individually aligned for best peak and symmetry.

R-F ALIGNMENT

1. Connect vacuum tube voltmeter across limiter grid resistor as in FM I-F alignment.

2. Ground one side of the FM Antenna by placing a wire jumper from one FM connection on the antenna terminal strip to the ground connection.

3. Connect unmodulated signal generator through a 300 ohm resistor to ungrounded antenna post and chassis, and tune signal generator to 107 mc.

4. Set radio dial to 107 mc. and tune oscillator trimmer to peak output on vacuum tube voltmeter. Adjust signal generator output until a reading of approximately 3 volts is obtained.

5. Tune 107 mc. r-f and antenna trimmers for maximum indication on voltmeter—it may be necessary to rock the dial while adjusting the r-f trimmer.

SPECIAL SERVICE INFORMATION

The following information is provided for the service man who has a vacuum tube voltmeter or a similar measuring instrument available.

STAGE GAINS*

Antenna Post to R-F Grid at:
- 600 kc. 5.00
- 98 mc. 1.15

R-F Grid to Converter Grid at:
- 600 kc. 18.5
- 98 mc. 9.0

R-F on Converter Grid to I-F on I-F Grid at:
- 600 kc. 8.3
- 98 mc. 6.0

I-F on Converter Grid to 1st I-F Grid at:
- 455 kc. (gang closed) 11.5

1st I-F Grid to 2nd I-F Grid** at:
- 455 kc. 64
- 10.7 mc. 30

2nd I-F Grid to Limiter Grid at:
- 10.7 mc. 30

OSCILLATOR OUTPUT VOLTAGE

The DC voltage developed across the Oscillator Grid Resistor at:
- 600 kc. ..... 4.5V.
- 98 mc. ..... 3.5V.

or 0.45 ma. through 10,000 ohm Oscillator Grid Resistor at 600 kc. and 0.35 ma. at 98 mc.

AUDIO GAIN

Voltage required across the Volume Control to produce 0.1 watt speaker output*** at 400 cycles is .01 volt with Input Selector Switch in Broadcast Setting.

*Variations of ± 20% are permissible. Broadcast readings made with sufficient input signal to provide 0.5 watt speaker output. 0.5 watt speaker output at 400 cycles is equivalent to a reading of 1.25V. as measured by a high resistance AC voltmeter across the voice coil of the speaker.

**Detector Plate on AM.

***0.1 watt speaker output at 400 cycles is equivalent to a reading of 0.55 volts as measured by a high resistance AC voltmeter across the voice coil of speaker.

DIAL CORD REPLACEMENT

CONDENSER DRIVE CABLE REPLACEMELT

Remove dial assembly after taking out two screws on each side of chassis. In a length of dial cable, form a small loop and tie a knot in the manner shown on Figure 1. Tie spring to opposite end of cable making length excluding spring 19½ inches. Hook loop over the metal hook in pulley "D" and lace the cable through the pulley slot and around the pulley in a counterclockwise direction when viewed from the rear of the dial assembly keeping the cable to the rear of the pulley groove. Lace the cable around the smaller diameter portion of the tuning control shaft wrapping 2½ turns *from front to back;* then around the opposite side of pulley "D" into the pulley through the slot. Hook the end of tension spring "F" in the hole provided in pulley "D", completing this operation.

Two separate drive cables are used in the CR-226 dial assembly. One cable is used to transmit the motion from the tuning knob to the large pulley that is coupled to the condenser gang; the other cable actuates the dial pointer whenever the large pulley on the condenser gang is rotated. Separate instructions for replacing either of these cables is given in the following paragraphs.

DIAL POINTER DRIVE CABLE REPLACEMENT

Remove dial assembly after taking out two screws on each side of chassis. Slip a one-half inch length of sleeving over a 42-inch length of dial cable. Tie the two ends to the loop end of the cable spring "E" securely so that the cable doubled measures 19⅝ inches end to end excluding spring.

Place spring hook in top hole and draw cable through slot of pulley "D" Loop one end of cable around pulley "D" in a clockwise direction in front of condenser drive cable (viewing dial assembly from front) then loop the remaining end around pulley in a counterclockwise direction. Secure both ends of cable to chassis at edge of pulley slot with scotch tape, keeping piece of sleeving on remaining loop of cable.

Replace dial assembly and loop cable over pulley "A". While holding cable taut remove scotch tape and loop cable over pulley "B" as shown in Figure 1.

Turn the tuning control shaft until the condenser gang is completely meshed and slide the dial pointer on its track until it is in line with the last calibration mark at the low frequency end of the dial. The short piece of sleeving installed prior to the stringing operation should be slid to the rear of the dial pointer and the crimping lug on the pointer pressed over the sleeving. After checking to make certain that the condenser gang is completely meshed and the dial pointer is in the position specified previously, apply a few drops of cement to each end of the sleeving to which the dial pointer is fastened. This completes the operation.

MODEL CR-226

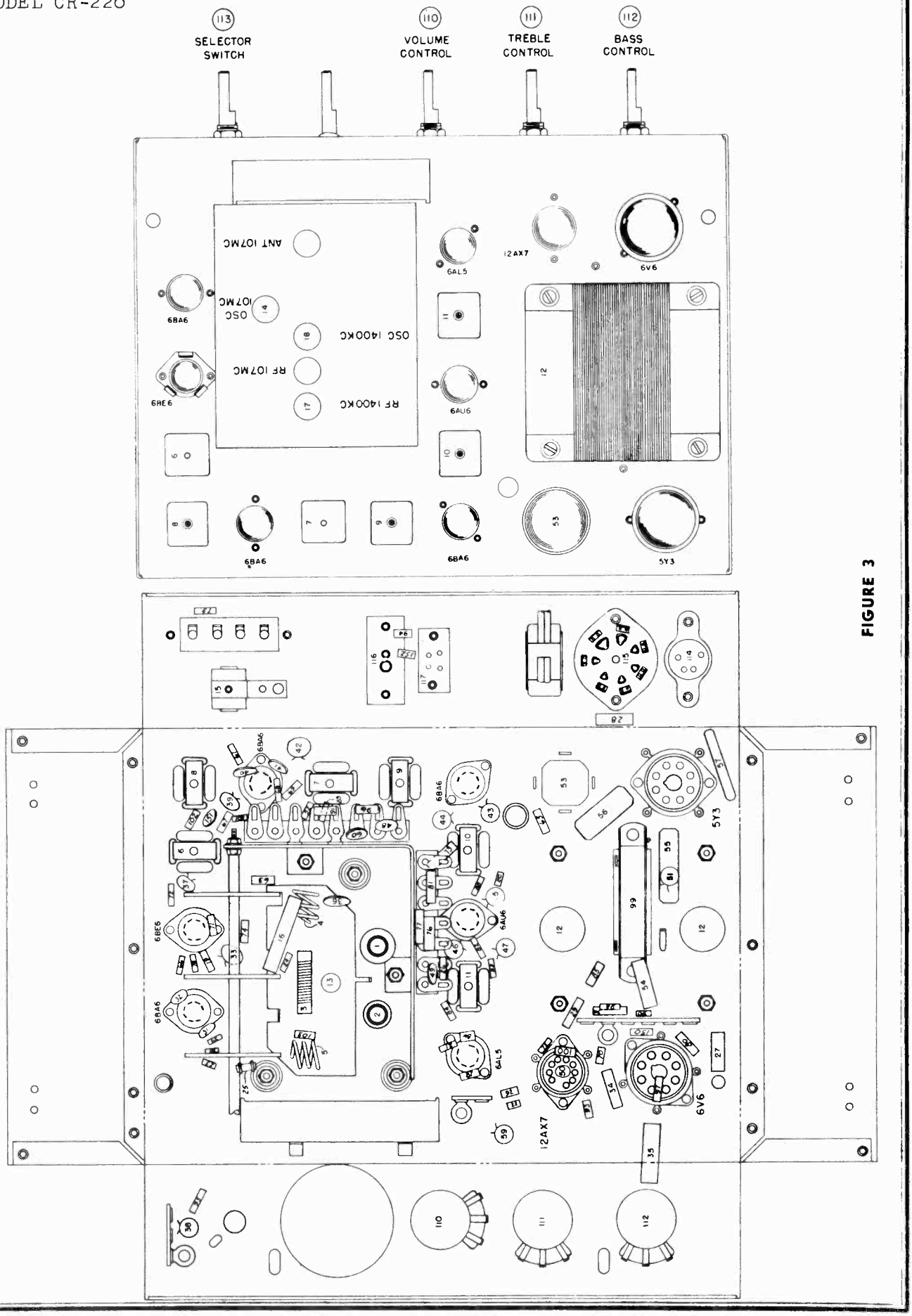


FIGURE 3

PARTS LIST

REFERENCE NO.		MAGNAVOX PART NO.
1	Coil assembly, r-f (AM)	360405G1
2	Coil assembly, oscillator (AM)	360407G1
3	Coil assembly, oscillator (FM)	360323G1
4	Coil assembly, r-f (FM)	360322G2
5	Coil assembly, antenna (FM)	360321G2
6	Transformer, first i-f (AM)	360406G1
7	Transformer, second i-f (AM)	360406G1
8	Transformer, first i-f (FM)	360374G1
9	Transformer, second i-f (FM)	360374G1
10	Transformer, third i-f (FM)	360374G1
11	Transformer, discriminator	360375G1
12	Transformer, power	300056G1
13	Capacitor, gang tuning	260107G1
14	Capacitor, trimmer	260067G6
15	Capacitor, trimmer	250046G2
16	Choke, insulated r-f	360372G2
17	Capacitor, ceramic, 10 mmf.	250088G8
18	Capacitor, ceramic, 10 mmf.	250088G8
19	Capacitor, ceramic, 50 mmf. ±10%	250176G9
20	Capacitor, ceramic, 50 mmf. ±10%	250176G9
21	Capacitor, ceramic, 50 mmf. ±10%	250176G9
22	Capacitor, ceramic, 100 mmf.	250176G6
23	Capacitor, ceramic, 220 mmf.	250176G10
24	Capacitor, ceramic, 47 mmf.	250159G96
25	Capacitor, ceramic, 470 mmf.	250176G11
26	Capacitor, ceramic, 470 mmf.	250176G11
27	Capacitor, paper, .0005 mfd. 1000 V.	250185G8
28	Capacitor, paper, .0015 mfd. 600 V.	250201G2
29	Capacitor, paper, .001 mfd. 600 V.	250201G1
30	Capacitor, paper, .0022 mfd. 600 V. (CR 226A only)	250201G3
	Capacitor, paper, .0033 mfd. 600 V. (CR 226B only)	250201G4
31	Capacitor, ceramic, .005 mfd.	250175G1
32	Capacitor, ceramic, .005 mfd.	250175G1
33	Capacitor, ceramic, .005 mfd.	250175G1
34	Capacitor, paper, .0047 mfd. 600 V. (CR 226A only)	250201G5
	Capacitor, paper, .01 mfd. 600 V. (CR 226B only)	250201G7
35	Capacitor, paper, .01 mfd. 600 V.	250201G7
36	Capacitor, ceramic, .01 mfd.	250175G2
37	Capacitor, ceramic, .01 mfd.	250175G2
38	Capacitor, ceramic, .01 mfd.	250175G2
39	Capacitor, ceramic, .01 mfd.	250175G2
40	Capacitor, ceramic, .01 mfd.	250175G2
41	Capacitor, ceramic, .01 mfd.	250175G2
42	Capacitor, ceramic, .01 mfd.	250175G2
43	Capacitor, ceramic, .01 mfd.	250175G2
44	Capacitor, ceramic, .01 mfd.	250175G2
45	Capacitor, ceramic, .01 mfd.	250175G2
46	Capacitor, ceramic, .01 mfd.	250175G2
47	Capacitor, ceramic, .01 mfd.	250175G2
48	Capacitor, ceramic, .01 mfd.	250175G2
49	Capacitor, ceramic, .01 mfd.	250175G2
50	Capacitor, ceramic, .01 mfd.	250175G2
51	Capacitor, ceramic, .01 mfd.	250175G2
52	Capacitor, resistor, filter	250170G1
53	Capacitor, electrolytic, 30 mfd. 475V.	270021G7
	— 20 mfd. 475V. 20 mfd. 350V. 20 mfd. 25 V.	
54	Capacitor, paper, .01 mfd. 600 V.	250201G7
55	Capacitor, molded paper, .02 mfd. 600 V.	250129G3
56	Capacitor, molded paper, .02 mfd. 600 V.	250129G3
57	Capacitor, molded paper, .02 mfd. 600 V.	250201G3
58	Capacitor, ceramic, 100 mmf.	250176G6
59	Capacitor, ceramic, .01 mfd.	250175G2
60	Capacitor, ceramic, .01 mfd. (CR 226B only)	250175G2
150	Capacitor, ceramic, 100 mmf. (CR 226B only)	250159G82
151	Capacitor, ceramic, .01 mfd. (CR 226B only)	250175G2
152	Capacitor, ceramic, 10 mmf. (CR 226B only)	250088G8
61	Resistor, carbon, 100 ohms, ½W.	230104G50
62	Resistor, carbon, 100 ohms, ½ W.	230104G50
63	Resistor, carbon, 100 ohms, ½ W.	230104G50
65	Resistor, carbon, 390 ohms, ±10%, 1 W.	230105G57
66	Resistor, carbon, 1000 ohms, ½ W.	230104G62
67	Resistor, carbon, 1000 ohms, ½ W.	230104G62
68	Resistor, carbon, 1000 ohms, ½ W.	230104G62
69	Resistor, carbon, 1000 ohms, ½ W.	230104G62
70	Resistor, carbon, 1500 ohms, ½ W.	230104G64
71	Resistor, carbon, 3300 ohms, ½ W.	230104G68
72	Resistor, carbon, 3300 ohms, ½ W.	230104G68
73	Resistor, carbon, 3300 ohms, 1 W.	230105G68
74	Resistor, carbon, 4700 ohms, ±10%, ½ W.	230104G70
75	Resistor, carbon, 10 megohms, ½ W.	230104G110
76	Resistor, carbon, 8200 ohms, ±10%, 1 W.	230105G73
77	Resistor, carbon, 8200 ohms, ±10%, 1 W.	230105G73
78	Resistor, carbon, 10,000 ohms, ±10%, ½ W.	230104G74
79	Resistor, carbon, 10,000 ohms, ±10%, ½ W.	230104G74
80	Resistor, carbon, 10,000 ohms, 1 W.	230105G74
81	Resistor, carbon, 15,000 ohms, 1 W.	230105G76
82	Resistor, carbon, 68,000 ohms, ±10%, ½ W.	230104G84
83	Resistor, carbon, 100,000 ohms, ½ W.	230104G86
84	Resistor, carbon, 100,000 ohms, ½ W.	230104G86
85	Resistor, carbon, 100,000 ohms, 1 W.	230105G86
86	Resistor, carbon, 150,000 ohms, ±10%, ½ W.	230104G88
87	Resistor, carbon, 150,000 ohms, ±10%, ½ W.	230104G88
88	Resistor, carbon, 220,000 ohms, ½ W.	230104G90
89	Resistor, carbon, 270,000 ohms, ±10%, ½ W.	230104G91
90	Resistor, carbon, 270,000 ohms, ±10%, ½ W.	230104G91
91	Resistor, carbon, 150,000 ohms, ±10%, ½ W.	230104G88
92	Resistor, carbon, 470,000 ohms, 1 W.	230105G94
93	Resistor, carbon, 270,000 ohms, ½ W. (CR 226A only)	230104G91
	Resistor, carbon, 330,000 ohms, ½ W. (CR 226B only)	230104G92
94	Resistor, carbon, 820,000 ohms, ±10%, ½ W.	230104G97
95	Resistor, carbon, 1 megohm, ½ W.	230104G98
96	Resistor, carbon, 1 megohm, ½ W.	230104G98
97	Resistor, carbon, 1 megohm, ½ W. (CR 226A only)	230104G98
	Resistor, carbon, 470,000 ohms, ½ W. (CR 226B only)	230104G94
98	Resistor, carbon, 2.2 megohm, ½ W.	230104G102
99	Resistor, wire wound, 5000 ohms, 11 W.	240035G4
100	Resistor, carbon, 220,000 ohms, ½ W. (CR 226A only)	230104G90
	Resistor, carbon, 180,000 ohms, ½ W. (CR 226B only)	230104G89
101	Resistor, carbon, 4.7 megohm, ½ W. (CR 226B only)	230104G106
102	Resistor, carbon, 220,000 ohms, ½ W. (CR 226B only)	230104G90
103	Resistor, carbon, 330,000 ohms, ½ W. (CR 226B only)	230104G56
110	Control, volume	220072G15
111	Control, treble	220072G19
112	Control, bass, with switch	220073G16
113	Switch, selector	160207G1
114	Socket, phono motor	180501G5
	Plug, phono motor	180053G1
115	Socket, speaker	180504G16
	Plug, speaker	180503G4
116	Socket, television	180060G1
	Plug, television	180311G2
117	Socket, phono	189741G1
	Plug, phono	180311G1
118	Loop antenna	360336G2
	Dial pointer	102426G2
	Dial glass	150330G1
	Panel escutcheon	
	Maroon	150318G7
	Beige	150318G8
	Decal for above	150375G1
	Knob, band switch, bass on off	
	Maroon	143727G3
	Beige	143727G2
	Knob, tuning	
	Maroon	140025G4
	Beige	140025G2
	Knob, treble, volume	
	Maroon	140025G5
	Beige	140025G3

*The part number of the loop antenna assembly changes with different cabinets. It is therefore important that you specify the Style Number of the instrument when ordering a replacement loop antenna assembly.

MODEL CR-227

SPECIFICATIONS

Intermediate frequency	455 kc./10.7 mc.
Tuning frequency range:	
Broadcast Band	540—1620 kc.
Short Wave Band	5.9—17.3 mc.
FM Band	88—108 mc.
Tubes:	
R-F Amplifier	6BA6
Converter	6SB7Y
1st I-F Amplifier (AM-FM)	6SG7
2nd I-F Amplifier (AM-FM)	6SG7
Limiter	6SH7
Discriminator	6H6
Detector and AVC (AM) and Tuning Indicator Amplifier	6SQ7
First Audio	6J5
Second Audio	6J5
Tuning Indicator	6U5
Dial Lamps	Mazda No. 44

GENERAL

Model CR-227 radio chassis is an AM-FM tuner that must be used in conjunction with a power amplifier such as the AMP-116 for speaker operation. Heater and plate voltages for the CR-227 radio chassis are supplied from the amplifier chassis; it is therefore essential that the radio and amplifier chassis be interconnected during alignment or for other electrical service operations.

METHOD FOR REMOVING CHASSIS FROM CABINET

Model CR-227 radio chassis is designed for easy removal from the cabinet in which it is installed. As the radio panel is permanently fastened to the chassis, the control knobs need not be removed when the chassis is taken out of the cabinet for service.

To remove the chassis, first remove the antenna leads from their terminals and all plugs from the receptacles on the rear of the chassis. Then remove the two Phillips-head screws from the angular slots in the flange at the rear of the chassis. Lift the rear of the chassis about one inch and pull it straight back. Never remove the chassis tray from the cabinet it has been properly positioned to bring the radio panel in place when the chassis is replaced. In replacing the chassis, slide it so that the small hooks near the front ride inside the flanges on the sides of the chassis tray. Push the chassis forward as far as it will go and the hook should then engage the slots in the chassis tray. Replace the two Phillips-head screws and nuts and tighten securely. Replace all plugs in their receptacles and the antenna leads on their correct terminals. The antenna terminal board for the loop antenna connections is designated L-H. The two terminals on the loop are designated L and H; the leads connected to these terminals should be wired to the corresponding terminals (L and H) on the chassis.

ALIGNMENT PROCEDURE

Alignment of this receiver requires the use of an accurately calibrated RF signal generator, range 455 kc. to 107 mc., an output meter, and a vacuum tube voltmeter of approximately 10 megohm input impedance. All trimmer condensers can be identified by stampings on the chassis and gang condenser cover and are shown on the chassis layout diagram. The pointer on the radio dial should line up with the first horizontal mark on the low frequency end of the dial glass. If the pointer does not line up, loosen the screws on the pointer drive pulley at the end of the tuning gang and adjust the pointer setting; tighten the screws after this adjustment. Be sure the gang is fully meshed for this pointer alignment.

AM ALIGNMENT

I-F ALIGNMENT

1. Set range control to position No. 1. Set volume, treble and bass controls to maximum, the Band Switch to Broadcast position, and dial pointer to 1000 kc.

2. Tune the signal generator to EXACTLY 455 kc.

3. Connect output of modulated signal generator to the signal grid of the 6SB7Y (pin 8) through a .01 mfd. capacitor and signal generator ground to radio chassis.

4. All i-f transformers on this chassis are slug-tuned. Both slug adjustments for 455 kc. are located on top of the transformers; the 10.7 mc. adjustments are accessible on the bottom.

5. Connect output meter across voice coil of 15-inch speaker and peak in order the third, second and first i-f transformers.

6. Use only enough signal input to give a readable indication on voltmeter so that the AVC will not operate and give false readings.

ALTERNATE VISUAL ALIGNMENT OF I-F STAGES

1. Connect 455 kc. sweep generator having approximately 40 kc. sweep to signal grid of 6SB7Y (pin 8) through a .01 mfd. capacitor. Connect an oscilloscope through a 1 megohm isolating resistor across the 220,000 ohm diode load resistor. Align for best possible peak with range switch in position No. 1, and symmetry in position No. 4.

BROADCAST BAND R-F ALIGNMENT

1. Connect signal generator through .00025 mfd. capacitor to antenna and ground terminals on antenna terminal strip on rear of chassis. Be sure "Ant-loop" switch on top of the chassis is in the ANT. position. Connect output meter as for AM i-f alignment.

2. Tune signal generator to 1400 kc.

3. Set dial to 1400 kc. and adjust oscillator, r-f and antenna trimmers for maximum indication on meter.

4. Set signal generator to 600 kc. and tune radio to signal. Adjust the 600 kc. padder to maximum output while simultaneously rocking the gang.

5. 1400 kc. calibration should then be checked and re-adjusted if necessary with the 1400 kc. oscillator trimmer.

SHORT WAVE BAND R-F ALIGNMENT

1. Set the Band Switch to Short Wave and replace the .00025 mfd. capacitor in series with the signal generator lead to the antenna terminal, with a 400-ohm resistor.

2. Set the signal generator and the receiver to 15 mc. and adjust the oscillator, r-f and antenna trimmers for maximum indication on the meter. While adjusting the 15 mc. oscillator trimmer, two peaks may be observed; only one is the correct peak for 15 mc. alignment. To obtain the correct peak, screw trimmer in to maximum capacitance, then decrease until the first peak is observed. This is the correct one.

Another method for checking for the correct peak is to tune the receiver to 15.91 mc. with signal generator at 15 mc. and with the output increased. If the 15 mc. oscillator trimmer is properly adjusted, the signal will be received at 15.91 mc.—if incorrectly aligned, the signal will be received at 14.09 mc.

FM ALIGNMENT

DISCRIMINATOR ALIGNMENT

1. Tune signal generator to EXACTLY 10.775 mc. and connect to pin 4 of the 6SH7 limiter tube socket through a .01 mfd. capacitor.

2. Connect a DC vacuum tube voltmeter from Pin 4 on 6H6 tube socket to ground through a 1 megohm isolating resistor.

3. Peak both discriminator slugs at 10.775 mc.

4. Retune signal generator to exactly 10.7 mc. and adjust bottom slug for zero volts.

5. The DC voltage at 10.625 mc. should be within 10% of the voltage at 10.775 mc. and of opposite polarity.

Note: If the signal generator is not capable of sufficient output to produce a readable DC voltage, the amplification of the last i-f stage can be used to increase the signal input to the limiter for discriminator alignment. To accomplish this, align the last i-f stage as indicated in "IF Alignment". Then align discriminator as above leaving the signal generator connected to the grid of the 6SG7 2nd i-f tube.

I-F ALIGNMENT

1. Connect high side of signal generator, through a .01 mfd. capacitor and a 1000 ohm resistor in series, to pin 4 of the 6SG7 2nd i-f tube. Connect low side of generator to chassis.

2. Close gang condenser and connect vacuum tube voltmeter across 220,000 ohm limiter grid resistor; (Points "A" to "X" on schematic). Adjust signal generator output until a reading of at least 3 volts is obtained. In order to reduce regeneration caused by the vacuum tube voltmeter leads, a 1-megohm isolating resistor, connected with as short leads as possible to point "A" should be used in series with the vacuum tube voltmeter. Align the 3rd i-f transformer for best peak as indicated on voltmeter.

3. Repeat above for the 2nd and 1st transformer by connecting signal generator to signal grid of first i-f tube 6SG7 then to the signal grid of 6SB7Y converter. The i-f stages should be aligned in this order.

WARNING— After each i-f stage has been individually aligned, do not repeak with the signal into the grid of the 6SB7Y.

ALTERNATE VISUAL ALIGNMENT OF I-F STAGES

1. Replace signal generator with sweep generator having approximately 300 kc. sweep and tune generator to 10.7 mc. Connect oscilloscope across 220,000 ohm limiter grid resistor through a 1-megohm isolating resistor. The order of alignment is the same as when using a vacuum tube voltmeter. Each i-f transformer should be individually aligned for best peak and symmetry.

R-F ALIGNMENT

1. Connect vacuum tube voltmeter across limiter grid resistor as in FM I-F alignment. Adjust signal generator output until a reading of at least 3 volts is obtained.

2. Ground one side of the FM Antenna by placing a wire jumper from one FM connection on the antenna terminal strip to the ground connection.

3. Connect unmodulated signal generator through a 300 ohm resistor to ungrounded antenna post and chassis, and tune signal generator to 107 mc.

4. Set radio dial to 107 mc. and tune oscillator trimmer to peak output on vacuum tube voltmeter.

5. Tune 107 mc. r-f and antenna trimmers for maximum indication on voltmeter—it may be necessary to rock the gang while adjusting the r-f trimmer.

SPECIAL SERVICE INFORMATION

The following information is provided for the service man who has a vacuum tube voltmeter or a similar measuring instrument available.

STAGE GAINS*

Antenna Post to R-F Grid at:

600 kc.	5.8
6.5 mc.	2.9
98 mc.	1.0

R-F Grid to Converter Grid at:

600 kc.	11.6
6.5 mc.	9.5
98 mc.	6.8

R-F on Converter Grid to 455 kc. or I-F Grid at:

600 kc.	1.7
6.5 mc.	2.4
98 mc.	6.8

I-F on Converter Grid to 1st I-F Grid at:

455 kc. (dial pointer at 600 kc.)	2.6

1st I-F Grid to 2nd I-F Grid at:

455 kc.	20.5
10.7 mc.	37

2nd I-F Grid to Limiter Grid at:

10.7 mc.	34.5

AUDIO GAIN

Voltage required across the Volume Control to produce 0.1 watt speaker output** at 400 cycles is:

.013 volt with Amplifier AMP-116A

with Band Switch in BDCST setting.

OSCILLATOR OUTPUT VOLTAGE

The DC voltage developed across the Oscillator Grid Resistor (105) at:

600 kc.	4.5V.
6.5 mc.	4.6V.
98 mc.	5.4V.

or 0.3 ma. through 15,000 ohm Oscillator Grid Resistor at 600 kc., 0.31 ma. at 6.5 mc. and 0.36 ma. at 98 mc.

*Variations of ± 20% are permissible. All AM readings made with sufficient input signal to provide 0.5 watt speaker output. 0.5 watt speaker output at 400 cycles is equivalent to a reading of 2.75V. as measured by a high resistance AC voltmeter across the voice coil of the 15-inch speaker.

**0.1 watt speaker output at 400 cycles is equivalent to a reading of 1.22 volts as measured by a high resistance AC voltmeter across the voice coil of 15-inch speaker.

10 KC. FILTER ADJUSTMENT

This chassis incorporates a 10 kc. filter circuit to eliminate the beat note heard as a whistle between stations on the broadcast band. If the trimmer is out of adjustment the following procedure should be observed:

1. Adjust the range control switch to the No. 3 setting.

2. Connect the output of an audio oscillator to the phonograph pickup socket. Adjust the oscillator to exactly 10,000 cycles.

3. Set the band selector to PHONO and adjust the 10 kc. trimmer for minimum output.

4. If an audio oscillator is not available for making this adjustment set the band selector to BDCST, set the range control to position 4, connect the antenna to the receiver and set the gang condenser to a point between two stations on adjacent channels having approximately the same power. If the 10 kc. trimmer is out of adjustment, a whistle will be heard. Adjust the trimmer until the whistle is eliminated.

DIAL CORD REPLACEMENT

Rotate the brass pulley designated "A" in Figure 1 until the dial pointer strikes the stop at the high frequency end of the dial calibration. In this condition the slot in pulley "A" should be approximately ten degrees to the left of being vertical see Figure 1. If the slot in the pulley is in some other position under the above mentioned conditions, the pointer set screw is probably loose and has allowed the pointer to slip.

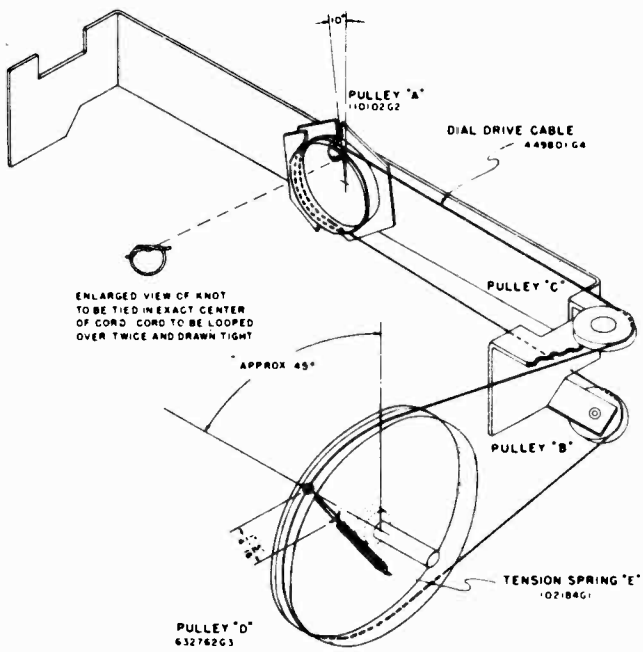


FIGURE 1

To correct this condition, first remove the glass dial and loosen the pointer screw. Then while holding pulley "A" so that its slot is approximately ten degrees to the left of vertical (when viewed from the rear) adjust the pointer until it is resting against the stop at the high frequency end of its travel. Then tighten the pointer set screw securely and replace the glass dial.

Completely unmesh the condenser gang and check the location of the hole or slot in pulley "D." If this hole is not approximately 45 degrees back from vertical as shown on Figure 1, loosen the two No. 6 Allen set screws in the hub of pulley "D" and slip the pulley on its shaft (while holding the condenser gang unmeshed) until the specified adjustment is obtained; then tighten one of the set screws securely. It will be shown later that this is a temporary setting. Next, tie a double knot in the exact center of a 25-inch length of dial cable and fold the cable back on itself so that the knot is at one end. The correct method for tying this knot is shown as an inset on Figure 1. Grasp the cable near the knotted end and slide it into the pulley slot so that the knot is against the inside rim of the pulley as shown in the sketch. The piece of cable nearest the dial frame should be wound in the direction shown for one-half turn; then over the lower pulley "B," around the bottom of the large pulley "D" and into the hole. Pull the cable taut and wrap the end around the small hook on pulley "D" temporarily.

The remaining piece of cable should be wound around pulley "A" in the direction shown, for one complete turn, over the upper pulley "C," and over the top of pulley "D." Thread the end through the small hole in pulley "D" and pull both ends of the cable taut. With one end of tension spring "E" fastened to the hook on pulley "D" lace the two free ends of the cable through the opposite end of the spring and tie a knot at a point that will allow 1/4" to 5/16" of cable between the spring and the inside rim of pulley "D." Be sure to tie the knot around one coil of the spring in the manner shown.

Now with the condenser gang completely meshed, check the position of the dial pointer. If it is not in line with the last calibration mark at the low frequency end of the dial, loosen the set screw in pulley "D" and turn it until the pointer is in the specified position. Be sure that the condenser gang does not move during this adjustment. Then tighten the two screws in pulley "D" securely completing the operation.

MODEL CR-227

CONDENSER GANG DRIVE ADJUSTMENTS

Whenever any of the mechanical parts in the condenser gang drive assembly require replacement due to rough handling or for any other reason, it is extremely important that clearances and adjustments shown on Figures 2 and 3 are correct; otherwise, the tuning mechanism will be sluggish or it may slip during operation.

In reassembling the mechanism after any part was replaced, follow the procedure outlined below:

1. Assemble the Tuning Shaft, Drive Collar, Bracket, Tension Spring, Washer, and Flywheel in the order shown on Figure 3. The distance between the front of the Drive Collar and the front of the Tuning Shaft must be $1\frac{1}{8}$ inches as specified on Figure 2. Install

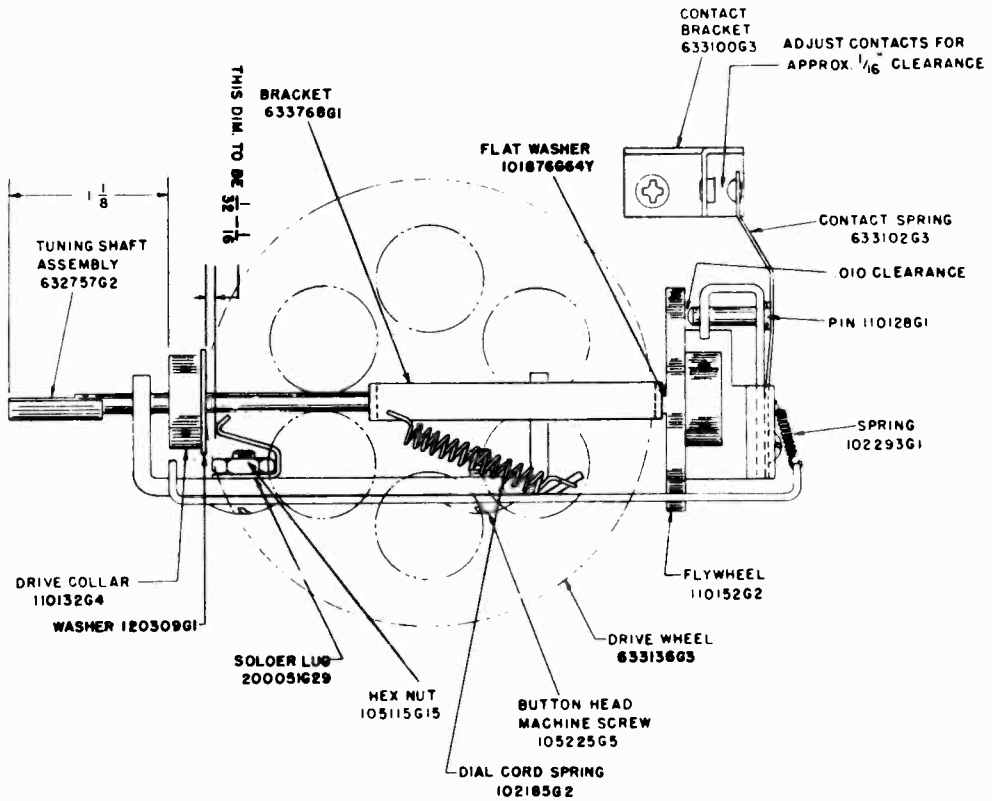


FIGURE 2

the Flywheel on the rear of the Tuning Shaft and slide it forward until it nearly touches the edge of the Drive Wheel; then tighten one of the set screws in the Flywheel hub. Insert a .010" gauge between the Flywheel and the Pin, and while holding the gauge in this position, loosen the set screw in the Flywheel hub that was previously tightened. The Tension Spring should force the Flywheel back against the gauge—when this occurs, tighten both set screws in the Flywheel hub.

2. Adjust the Muting Switch contact clearance by loosening the two screws in the Contact Bracket and sliding the bracket in the required direction until a 1/16" clearance is obtained. If this adjustment cannot be obtained in the manner prescribed, bend the Contact Bracket until proper clearance is realized.

3. The Drive Wheel is properly located on its shaft when its edge nearest the hub is in line with the outside edge of the Drive Collar as shown on Fig-

ure 3. Two Allen set screws in the Drive Wheel hub provide a means of adjusting the position of this wheel.

4. When the adjustment outlined in paragraph 2 is correct, the proper contact clearance will automatically be obtained when the Muting Switch is to be "unmuted" while the push buttons are being set. While pressure is applied to any one of the push buttons while they are being set up, a pressure applied simultaneously to the Tuning Control knob will cause the Muting Switch contacts to open. Detailed instructions on setting up these push buttons are shown elsewhere in this bulletin.

5. If the push button shafts at both ends do not engage the Treadle Bar as shown on Figure 3, the three screws in the Treadle Bar must be loosened and the Treadle Bar should be moved until the required condition is obtained.

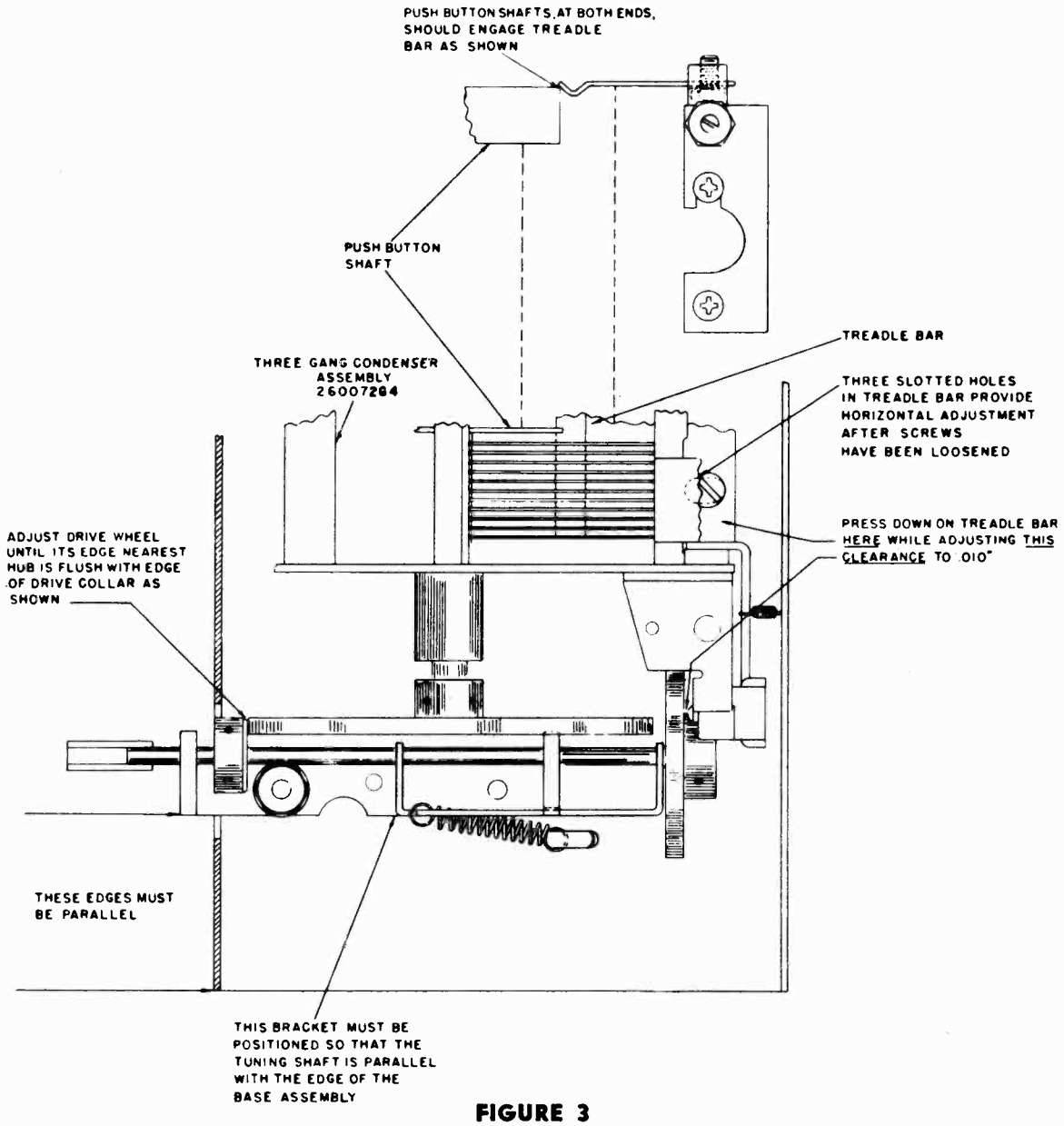


FIGURE 3

MODEL CR-227

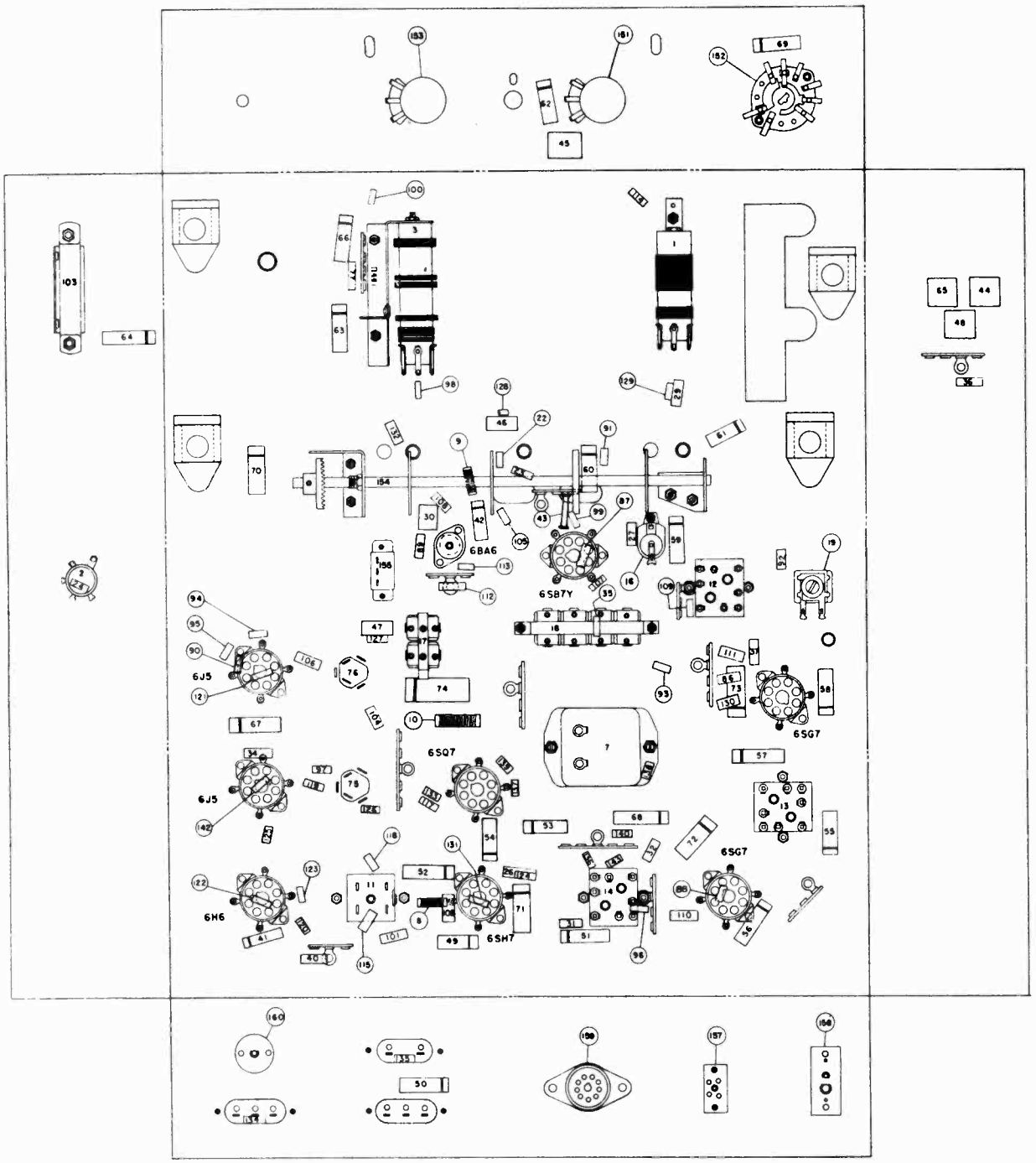
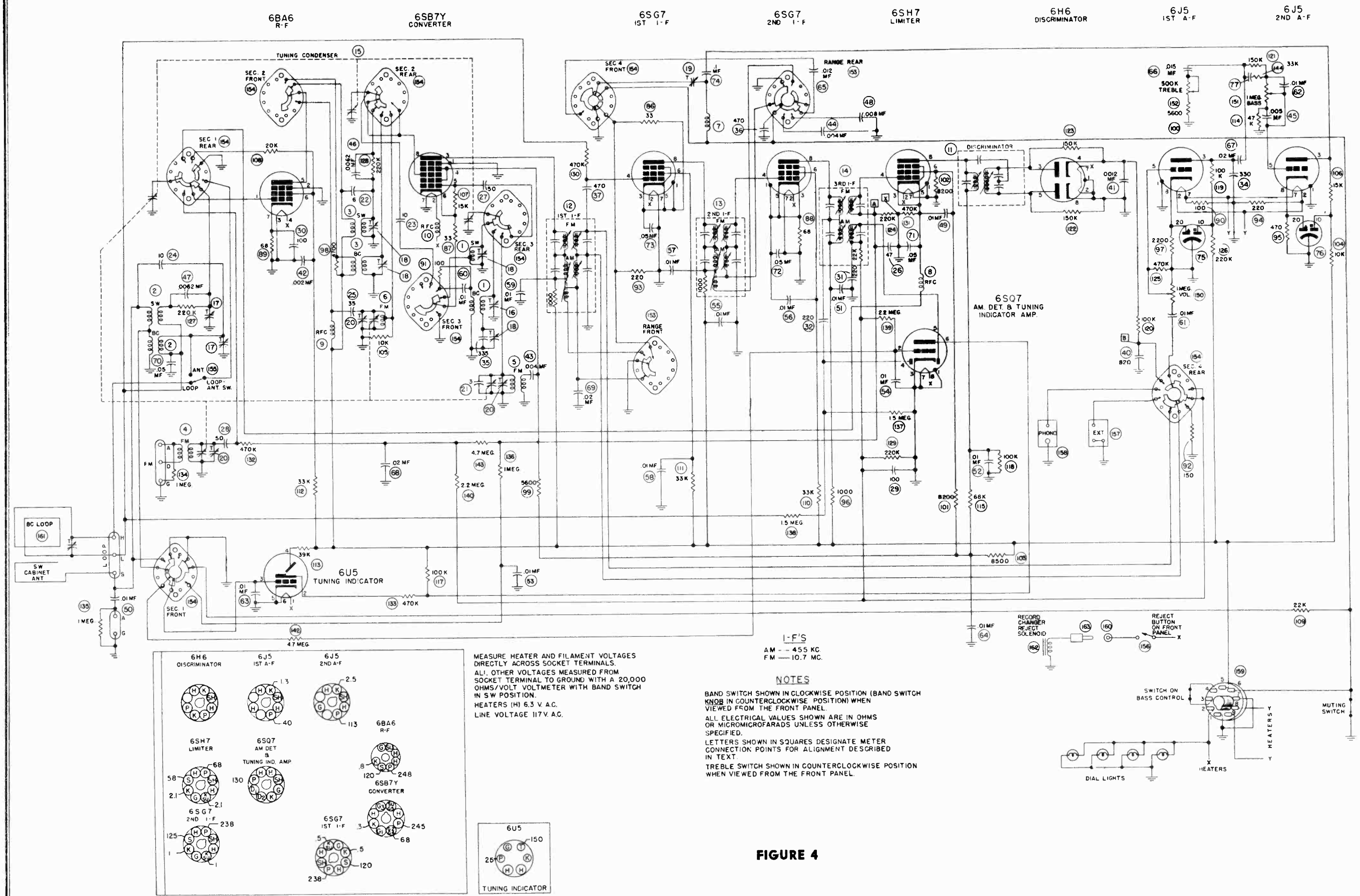


FIGURE 5



MEASURE HEATER AND FILAMENT VOLTAGES DIRECTLY ACROSS SOCKET TERMINALS.

ALL OTHER VOLTAGES MEASURED FROM SOCKET TERMINAL TO GROUND WITH A 20,000 OHMS/VOLT VOLTMETER WITH BAND SWITCH IN SW POSITION.

HEATERS (H) 6.3 V. A.C.

LINE VOLTAGE 117 V. A.C.

I-F'S

AM - - 455 KC.
FM — 10.7 MC.

NOTES

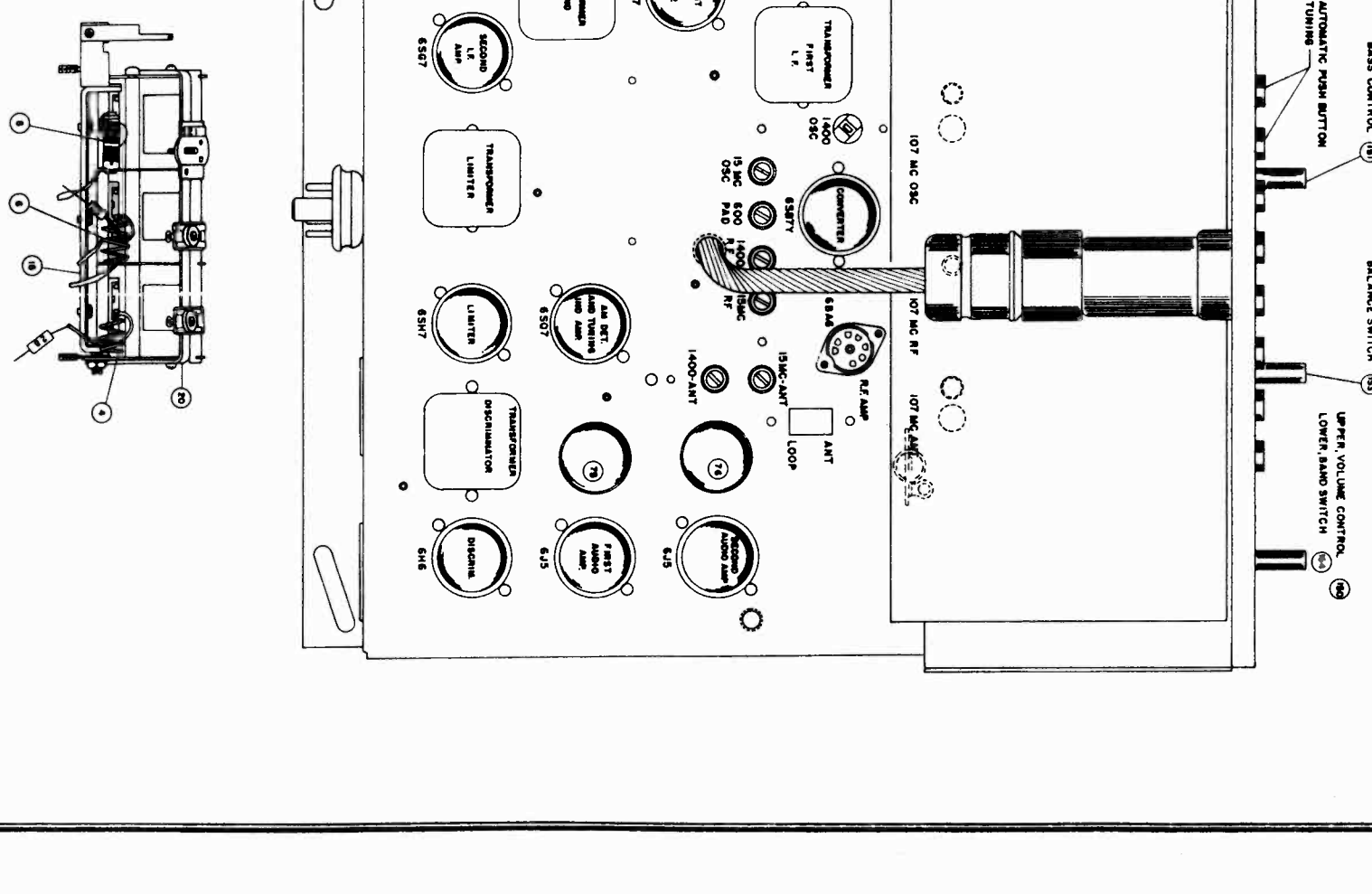
BAND SWITCH SHOWN IN CLOCKWISE POSITION (BAND SWITCH KNOB IN COUNTERCLOCKWISE POSITION) WHEN VIEWED FROM THE FRONT PANEL.

ALL ELECTRICAL VALUES SHOWN ARE IN OHMS OR MICROMICROFARADS UNLESS OTHERWISE SPECIFIED.

LETTERS SHOWN IN SQUARES DESIGNATE METER CONNECTION POINTS FOR ALIGNMENT DESCRIBED IN TEXT.

TREBLE SWITCH SHOWN IN COUNTERCLOCKWISE POSITION WHEN VIEWED FROM THE FRONT PANEL.

FIGURE 4



REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
1	Coil Assembly, oscillator, AM	360298-1
2	Coil Assembly, antenna, AM	360299-1
3	Coil Assembly, r-f, AM	360300-1
4	Coil Assembly, antenna, FM	360296-3
5	Coil Assembly, oscillator, FM	360295-1
6	Coil Assembly, r-f, FM	360297-3
7	Coil Assembly, 10 kc.	360244-1
8	Choke Coil	360284-1
9	Choke Coil	360284-1
10	Choke Coil, filament	360264-1
11	Transformer, discriminator	360305-1
12	Transformer, i-f	360285-1
13	Transformer, i-f	360285-1
14	Transformer, limiter	360286-1
15	Capacitor, variable, three gang tuning	260075-1
16	Capacitor, variable, oscillator trimmer (broadcast)	260067-4
17	Capacitor, variable, 2 trimmer	260080-1
18	Capacitor, variable, 4 trimmer and oscillator padder	260082-1
19	Capacitor, variable, 10 kc., trimmer	259610-2
20	Capacitor, trimmer assembly	260084-1
21	Capacitor, ceramic, 3 mmf.	250088-38
22	Capacitor, ceramic & composition, 6 mmf.	250164-2
23	Capacitor, ceramic & composition, 10 mmf.	250164-3
24	Capacitor, ceramic & composition, 10 mmf.	250164-3
25	Capacitor, ceramic, 35 mmf.	250088-40
26	Capacitor, mica, 47 mmf.	250159-96
27	Capacitor, ceramic, 50 mmf.	250088-39
28	Capacitor, ceramic, 50 mmf.	250088-39
29	Capacitor, mica, 100 mmf.	250159-98
30	Capacitor, mica, 100 mmf.	250159-98
31	Capacitor, mica, 220 mmf.	250159-100
32	Capacitor, mica, 220 mmf.	250159-100
34	Capacitor, mica, 330 mmf.	250159-101
35	Capacitor, silver mica, 335 mmf., ±1%	250085-38
36	Capacitor, mica, 470 mmf.	250159-102
37	Capacitor, mica, 470 mmf.	250159-102
40	Capacitor, mica, 820 mmf., ±10%	250159-132
41	Capacitor, paper, .0012 mfd., ±10%, 600 V.	250169-12
42	Capacitor, paper, .002 mfd., 600 V.	250152-44
43	Capacitor, ceramic, .004 mfd.	250088-34
44	Capacitor, molded paper, .004 mfd., 600 V.	250129-7
45	Capacitor, molded paper, .005 mfd., 400 V.	250129-10
46	Capacitor, mica, .0062 mfd., ±5%	250161-27
47	Capacitor, mica, .0062 mfd., ±5%	250161-27
48	Capacitor, molded paper, .008 mfd., 400 V.	250129-11
49	Capacitor, paper, .01 mfd., 600 V.	250152-38
50	Capacitor, paper, .01 mfd., 600 V.	250152-38
51	Capacitor, paper, .01 mfd., 600 V.	250152-38
52	Capacitor, paper, .01 mfd., 600 V.	250152-38
53	Capacitor, paper, .01 mfd., 600 V.	250152-38
54	Capacitor, paper, .01 mfd., 600 V.	250152-38
55	Capacitor, paper, .01 mfd., 600 V.	250152-38
56	Capacitor, paper, .01 mfd., 600 V.	250152-38
57	Capacitor, paper, .01 mfd., 600 V.	250152-38
58	Capacitor, paper, .01 mfd., 600 V.	250152-38
59	Capacitor, paper, .01 mfd., 600 V.	250152-38
60	Capacitor, paper, .01 mfd., 600 V.	250152-38
61	Capacitor, paper, .01 mfd., 600 V.	250152-38
62	Capacitor, paper, .01 mfd., 600 V.	250152-38
63	Capacitor, paper, .01 mfd., 600 V.	250152-38
64	Capacitor, paper, .01 mfd., 600 V.	250152-38
65	Capacitor, molded paper, .012 mfd., 200 V.	250129-13
66	Capacitor, paper, .015 mfd., ±10%, 200 V.	250169-5
67	Capacitor, paper, .02 mfd., 600 V.	250152-37
68	Capacitor, paper, .02 mfd., 600 V.	250152-37
69	Capacitor, paper, .02 mfd., 600 V.	250152-37
70	Capacitor, paper, .05 mfd., 200 V.	250152-15
71	Capacitor, paper, .05 mfd., 200 V.	250152-15
72	Capacitor, paper, .05 mfd., 200 V.	250152-15
73	Capacitor, paper, .05 mfd., 200 V.	250152-15
74	Capacitor, paper, .1 mfd., 600 V.	250152-33
75	Capacitor, electrolytic, 10 mfd., 450 V.—20 mfd., 25 V.	270023-6
76	Capacitor, electrolytic, 10 mfd , 450 V.—20 mfd., 25 V.	270023-6
77	Capacitor, mica, 1500 mmf., ±10%, 500 V.	250160-66
86	Resistor, composition, 33 ohms, ½ W.	230084-4
87	Resistor, composition, 33 ohms, ½ W.	230084-4
88	Resistor, composition, 68 ohms, ½ W.	230084-6
89	Resistor, composition, 68 ohms, ½ W.	230084-6
90	Resistor, composition, 100 ohms, ±10%, ½ W.	230084-50
91	Resistor, composition, 100 ohms, ½ W.	230084-7
92	Resistor, composition, 150 ohms, ½ W.	230084-8
93	Resistor, composition, 220 ohms, ½ W.	230084-9
94	Resistor, composition, 220 ohms, ±10%, ½ W.	230084-54
95	Resistor, composition, 470 ohms, ½ W.	230084-11
96	Resistor, composition, 1000 ohms, ½ W.	230084-13
97	Resistor, composition, 2200 ohms, ½ W.	230084-15
98	Resistor, composition, 4700 ohms, ½ W.	230084-17
99	Resistor, composition, 5600 ohms, ±10%, ½ W.	230084-71
100	Resistor, composition, 5600 ohms, ±10%, ½ W.	230084-71
101	Resistor, composition, 8200 ohms, ±10%, 1 W.	230085-73
102	Resistor, composition, 8200 ohms, ±10%, 1 W.	230085-73
103	Resistor, strip, 8500 ohms	240035-5
104	Resistor, composition, 10,000 ohms, 1 W.	230085-19
105	Resistor, composition, 10,000 ohms, ½ W.	230084-19
106	Resistor, composition, 15,000 ohms, 1 W.	230085-20
107	Resistor, composition, 15,000 ohms, ½ W.	230084-20
108	Resistor, composition, 20,000 ohms, ±5%, 1 W.	230085-190
109	Resistor, composition, 22,000 ohms, ½ W.	230084-21
110	Resistor, composition, 33,000 ohms, 1 W.	230085-22
111	Resistor, composition, 33,000 ohms, 1 W.	230085-22
112	Resistor, composition, 33,000 ohms, ±10%, 2 W.	230086-80
113	Resistor, composition, 39,000 ohms, ±10%, ½ W.	230086-81
114	Resistor, composition, 47,000 ohms, ½ W.	230084-23
115	Resistor, composition, 68,000 ohms, ±10%, ½ W.	230084-84
117	Resistor, composition, 100,000 ohms, ½ W.	230084-25
118	Resistor, composition, 100,000 ohms, ½ W.	230084-25
119	Resistor, composition, 100,000 ohms, ½ W.	230084-25
120	Resistor, composition, 100,000 ohms, ±10%, ½ W.	230084-86
121	Resistor, composition, 150,000 ohms, ½ W.	230084-26
122	Resistor, composition, 150,000 ohms, ±10%, ½ W.	230084-88
123	Resistor, composition, 150,000 ohms, ±10%, ½ W.	230084-88
124	Resistor, composition, 220,000 ohms, ½ W.	230084-27
125	Resistor, composition, 470,000 ohms, ±10%, ½ W.	230084-94
126	Resistor, composition, 220,000 ohms, ½ W.	230084-27
127	Resistor, composition, 220,000 ohms, ½ W.	230084-27
128	Resistor, composition, 220,000 ohms, ½ W.	230084-27
129	Resistor, composition, 220,000 ohms, ½ W.	230084-27
130	Resistor, composition, 470,000 ohms, ½ W.	230084-29
131	Resistor, composition, 470,000 ohms, ½ W.	230084-29
132	Resistor, composition, 470,000 ohms, ½ W.	230084-29
133	Resistor, composition, 470,000 ohms, ½ W.	230084-29
134	Resistor, composition, 1 megohm, ½ W.	230084-11
135	Resistor, composition, 1 megohm, ½ W.	230084-31
136	Resistor, composition, 1 megohm, ½ W.	230084-31
137	Resistor, composition, 1.5 megohm, ½ W.	230084-32
138	Resistor, composition, 1.5 megohm, ½ W.	230084-32
139	Resistor, composition, 2.2 megohm, ½ W.	230084-33
140	Resistor, composition, 2.2 megohm, ½ W.	230084-33
142	Resistor, composition, 4.7 megohm, ½ W.	230084-35
143	Resistor, composition, 4.7 megohm, ½ W.	230084-35
144	Resistor, composition, 33,000 ohms, ±10%, ½ W.	230084-80
150	Control, volume, 1 megohm	220044-24
151	Control, bass, 1 megohm, with switch	220073-6 220045-7
152	Control, treble	160178-1
153	Switch, range	220044-26 220072-12
154	Switch, rotary band switch	160179-1
155	Switch, slide SPDT	160176-1
156	Switch, reject	160188-1
157	Socket, external input	180060-1
158	Socket, phono	189741-1
159	Socket, amplifier	180427-2
160	Socket, solenoid	182776-1
161	Antenna Loop Assembly *The part number of the loop antenna assembly changes with different Cabinets. It is therefore important that you specify the STYLE NUMBER of the instrument when ordering a replacement loop antenna assembly.	
162	Solenoid	360313-1
163	Plug, solenoid	189147-1
	Dial Glass Assembly	150303-1
	Push Button Assembly for Gang	260093-1

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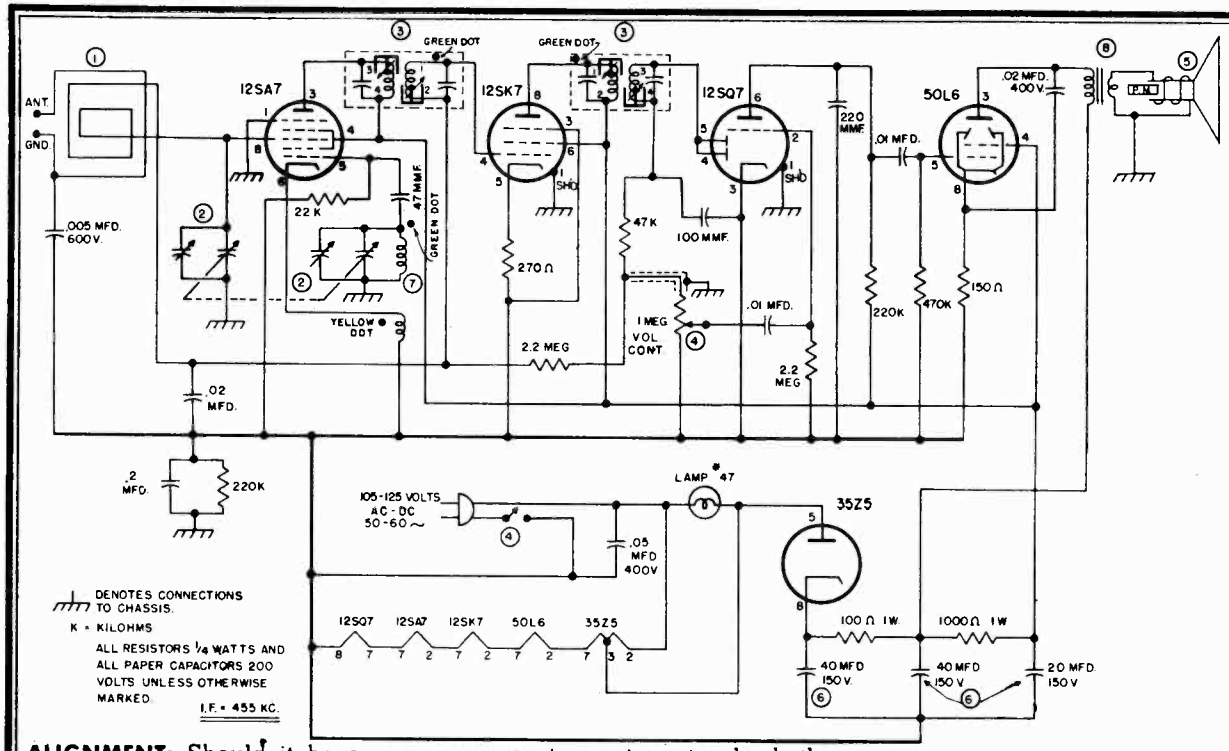
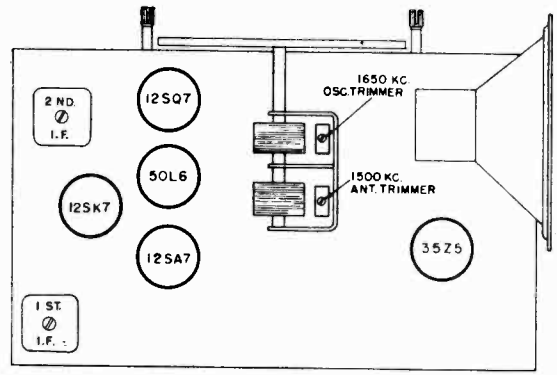




TRIMMER AND TUBE LOCATION DIAGRAM

PART NO		DESCRIPTION
(1)	1.525	LOOP ASSEMBLY
(2)	2.223	2GANG VARIABLE CONDENSER
(3)	1.445-5	I.F. TRANSFORMER
(4)	8.201-8	VOLUME CONTROL & SWITCH
(5)	30.329	P.M. 4" SPEAKER
(6)	5.415-4	ELECTROLYTIC CAP. 40-40-20 MFD.
(7)	1.526	OSCILLATOR COIL
(8)	9.249-1	OUTPUT TRANSFORMER

ALIGNMENT: Should it become necessary at any time to check the alignment of this receiver, proceed as follows:

(1) Set the Signal Generator to 455 KC and connect to the stator lug on the rear section of the Variable Capacitor. Connect the Signal Generator Ground lead to the chassis. Connect a suitable output meter across the Speaker Voice Coil Connections. Turn the Volume Control to the maximum position. Turn the Variable Capacitor to the extreme clockwise position.

(2) Adjust the trimmers located at the top of the first and second I. F. Transformers or the iron cores located at the top and bottom of each I. F. for maximum output as indicated on the Output Meter.

(3) Loosely couple the Signal Generator lead to the Loop and set to 1650 KC.

(4) With Variable Capacitor set at the extreme clockwise position, tune in the 1650 KC signal by means of the Oscillator Trimmer on the Variable Capacitor (front section).

(5) Set the Signal Generator to 1500 KC and turn the Tuning Control so that this frequency is indicated on the dial. Adjust the Antenna Trimmer on the Variable Capacitor (rear section) for maximum output. No other adjustments are necessary.

LINE VOLTAGE: This receiver is designed for operation on 105-125 Volts, 50-60 Cycles, either Alternating or Direct Current (AC-DC).

POWER CONSUMPTION: 30 Watts.

TUNING RANGE: Broadcast: 540 to 1650 Kilocycles (180 to 555 meters).

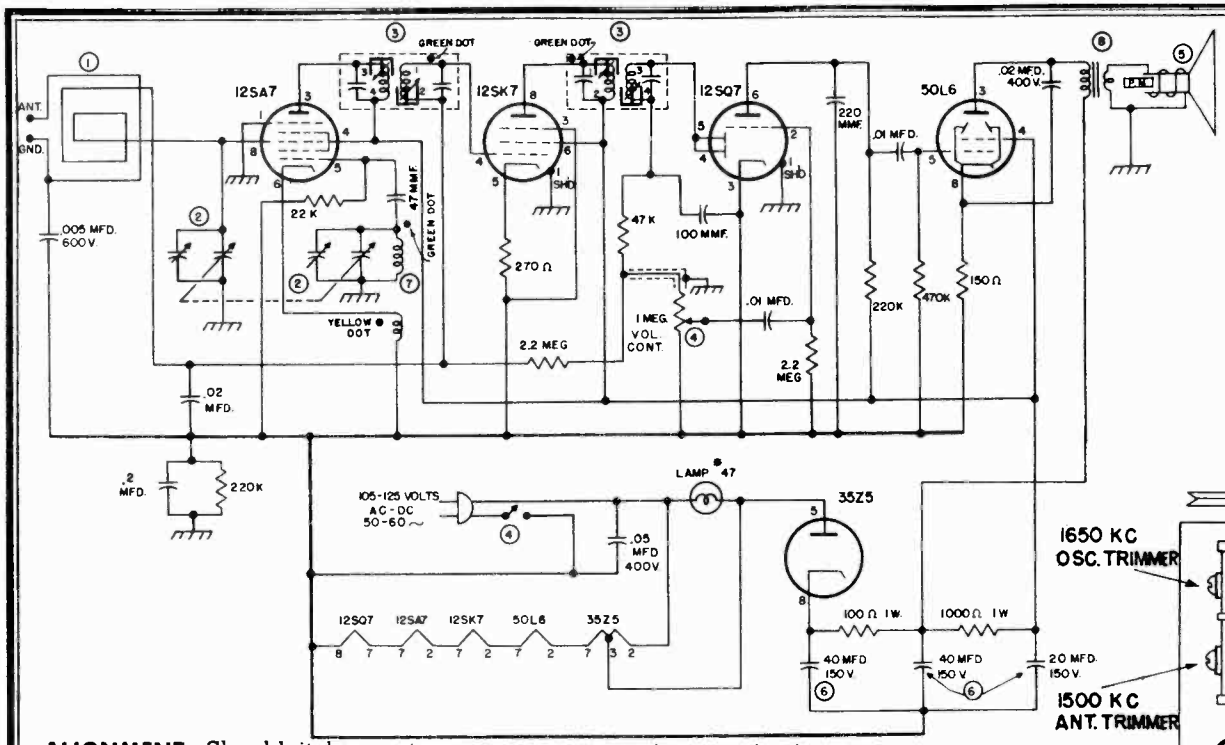
DIAL: The Dial Scale is calibrated in Kilocycles times 10 to correspond with newspaper or periodical listings.

TUBES: The tubes used, and their functions, are as follows:

12SA7 Converter — 12SQ7 Detector, Avc and Audio Amp.

12SK7 I.F. Amplifier — 50L6 Beam Power Amplifier

35Z5 Rectifier

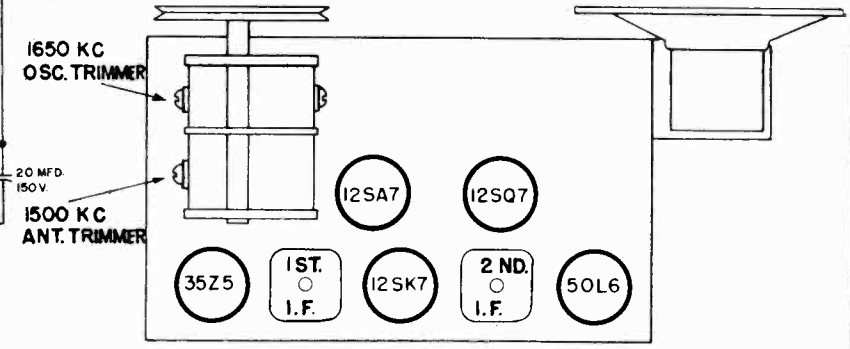


PART NO	DESCRIPTION
(1)	1.527 LOOP ASSEMBLY
(2)	2.224 2GANG VARIABLE CONDENSER
(3)	1.445-5 I.F. TRANSFORMER
(4)	8.201-8 VOLUME CONTROL & SWITCH

PART NO.	DESCRIPTION
(5)	30.329 P.M. 4" SPEAKER
(6)	5.415-4 ELECTROLYTIC CAP. 40-40-20 MFD.
(7)	1.526 OSCILLATOR COIL
(8)	9.249-2 OUTPUT TRANSFORMER

⏚ DENOTES CONNECTIONS TO CHASSIS.
K = KILOHMS
ALL RESISTORS 1/4 WATTS AND ALL PAPER CAPACITORS 200 VOLTS UNLESS OTHERWISE MARKED.

I.F. = 455 KC.



TRIMMER AND TUBE LOCATION DIAGRAM

ALIGNMENT: Should it become necessary at any time to check the alignment of this receiver, proceed as follows:

(1) Set the Signal Generator to 455 KC and connect to the stator lug on the rear section of the Variable Capacitor. Connect the Signal Generator Ground lead to the chassis. Connect a suitable output meter across the Speaker Voice Coil Connections. Turn the Volume Control to the maximum position. Turn the Variable Capacitor to the extreme clockwise position.

(2) Adjust the trimmers located at the top of the first and second I. F. Transformers or the iron cores located at the top and bottom of each I. F. for maximum output as indicated on the Output Meter.

(3) Loosely couple the Signal Generator lead to the Loop and set to 1650 KC.

(4) With Variable Capacitor set at the extreme clockwise position, tune in the 1650 KC signal by means of the Oscillator Trimmer on the Variable Capacitor (front section).

(5) Set the Signal Generator to 1500 KC and turn the Tuning Control so that this frequency is indicated on the dial. Adjust the Antenna Trimmer on the Variable Capacitor (rear section) for maximum output. No other adjustments are necessary.

LINE VOLTAGE: This receiver is designed for operation on 105-125 Volts, 50-60 Cycles, either Alternating or Direct Current (AC-DC).

POWER CONSUMPTION: 30 Watts.

TUNING RANGE: Broadcast: 540 to 1650 Kilocycles (180 to 555 meters).

DIAL: The Dial Scale is calibrated in Kilocycles times 10 to correspond with newspaper or periodical listings.

TUBES: The tubes used, and their functions, are as follows:

12SA7 Converter — 12SQ7 Detector, Avc and Audio Amp.

12SK7 I.F. Amplifier — 50L6 Beam Power Amplifier

35Z5 Rectifier

MEISSNER T.R.F. BANDPASS TUNER
MODEL 4E

The Meissner Model 4E T.R.F. Bandpass Tuner is designed for superior high fidelity broadcast reception. It is specifically designed for custom installation and may be used in connection with a power amplifier and speaker system to fit a wide variety of installations ranging from the simplest home installation consisting of a low power amplifier and a speaker, to the largest high power installations designed to serve large auditoriums and consisting of one or more high power amplifiers and multiple speakers.

The Power Amplifier

The output impedance of the 4E Tuner is 100,000 ohms and should be worked into an amplifier having high impedance input. High impedance amplifiers usually have an input impedance of 500,000 ohms, but some have a lower impedance than this and the 4E may be worked into an impedance as low as 100,000 ohms with no appreciable loss of low frequencies or increase in distortion. An amplifier having provision for phonograph input from a crystal pickup is satisfactory for use with the 4E, but under no conditions should the 4E be worked into a microphone input channel. The relatively high output of the 4E would cause overloading and severe distortion in the microphone input stage and the hum level would be too high to be considered acceptable.

The Cabinet

One thing that should be observed in planning an installation is to use the normal precautions against microphonics. Since the 4E is a T.R.F. circuit and has no local oscillator, its tendency toward mocrophonism will be much less than in a similar superhet unit; but the 6AT6 audio amplifier tube may produce microphonics if subjected to severe vibration. This vibration may be transmitted through the cabinet or through the air from the speaker and the installation layout should be planned to avoid it.

The Record Player (or Changer)

The phonograph system of the 4E chassis is designed for use with crystal type pickups, and any record player or changer having this type pickup may be used. The following notes should be observed:

1. The record player frame must be connected to the tuner chassis in order to prevent hum pickup. In some record players the connecting lead from the phonograph pickup cartridge to the tuner chassis is a shielded lead with the shield connected to the pickup cartridge and to the record player frame. In this case the record player frame is automatically connected to the tuner chassis; but in record players which do not have this connection, a separate connecting lead between the record player frame and tuner may be used.
2. The record player motor may be plugged into the convenient outlet on the rear of the tuner chassis. A power switch must be provided on the record player to turn the motor on and off.
3. The connecting lead from the pickup cartridge must be provided with a miniature phonograph plug. The 4E chassis is shipped with a proper plug in the input jack for use on phono units not so equipped. The outer band or shield is connected to the shell of the plug, and the center wire is soldered in the pin of the plug.

MODEL 4E

In circuits formerly employing a small value of fixed condenser across the output transformer as a permanent minimum tone control, it is desirable to cut this capacity to approximately one-half its former value when the 10-kc filter is added. Pentode amplifiers usually employ such condensers. Triode amplifiers seldom use such oondensers, but if they do, it is well to reduce their value to half.

Alignment Procedure (use 200 uuf. dummy)

1. Using an F.M. Signal Generator and Oscilloscope:
Connect the vertical plates of the oscilloscope to the chassis and top of the volume control. Connect the horizontal plates to the sync terminals of the F.M. signal generator.
Set the dial of the tuner to 1,400 kc and the generator to 1,400 kc. using a sweep frequency of 400 cycles and deviation of about ±50 kc. Set the output of the generator to the least that will give a useful picture, connecting generator to antenna terminal.
Adjust the 4 trimmers at the top of the gang condenser to obtain a pattern of the greatest amplitude, reducing generator input as alignment proceeds, and at the same time adjusting the trimmers to give a double-humped pattern with humps of equal magnitude and with the center of the pattern centered on the scope.

2. Using an A.M. Signal Generator:
Connect the signal generator as usual, with an output meter as indicator connected to top of volume control or audio cable.
Set generator at 1,385 kc and tuner to 1,400 kc. Loosen the 4 trimmers on top of the gang and slowly tighten one at a time to obtain a maximum output reading. Keep each trimmer on the loose side of resonance until all trimmers are nearly peaked; then carefully peak each trimmer. Check alignment by slowly tuning generator to about 1,415 kc, during which the output meter should show a slight drop and then arise again. This alignment centers the response at 1,400 kc so that the dial calibration will be accurate. If the generator had been set at 1,400 kc initially, the center of the tuner's response would be below 1,400 kc on the tuner dial.

Resistance and Voltage Chart

Resistance between pin and chassis

Tube	Pin Number						
	1	2	3	4	5	6	7
6BA6 1st RF	2.1 meg.	0	*0-25	*0-25	**5 meg.	**5 meg.	470
6BA6 2nd RF	470K	0	*0-25	*0-25	**5 meg.	**5 meg.	470
6AT6 Detector	10 meg.	0	*0-25	*0-25	940K	147K	**5 meg.
6X4 Rectifier	240 Tie Point		*0-25	*0-25	Tie Point	240	**5 meg.

*Reading subject to position of hum balance control.
**Reading subject to variation depending upon the filter condensers.
CAUTION: Discharge filter condensers before making measurements.

Voltage between pin and chassis.

No signal condition.
Measurements to ground with 20,000 ohm/volt meter, 1,000 ohm/volt on AC

Tube	Pin Number						
	1	2	3	4	5	6	7
6BA6 1st RF	Sl.Neg.	0	*	*	200	132	3.5
6BA6 2nd RF	Sl.Neg.	0	*	*	200	132	3.9
6AT6 Detector	Sl.Neg.	0	*	*	Sl.Neg.	Sl.Neg.	85
6X4 Rectifier	185 VAC Tie Point		*	*	Tie Point	185 VAC	237

*Reading will range from 0 to 6.3 volts AC depending on setting of hum control.

Service Data

General

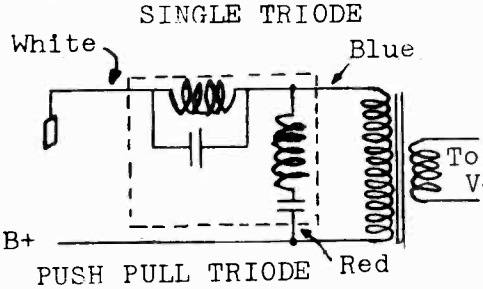
Power Supply 110-120 V 50-60 cycles.
Power Consumption 25 watts.
Undistorted Output 2 to 15 volts.
Replacement Part Numbers - as shown on circuit diagram
Circuit T.R.F. Bandpass.
Audio Frequency Response - flat ±2 db. 40 to 15,000 cycles.
Hum Output .002 volts.
Tubes: 6BA6 R.F. Amplifier 6AT6 Detector - Audio Amplifier
6BA6 R.F. Amplifier 6X4 Rectifier

10-kc Filter

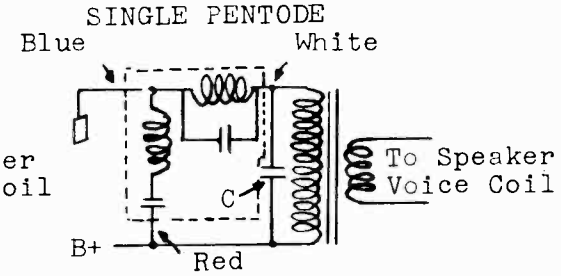
In the case where two strong broadcast signals are received on adjacent channels, a 10-kc beat note is formed by the two broadcast signals heterodyning together and when this happens a broad band, high fidelity receiver or tuner will pass this 10-kc beat note and produce an annoying high pitched whistle in the speaker.
The Meissner 10-kilocycle filter is designed to eliminate the 10-kc whistle between stations being received on high-fidelity radio installations. This filter has several points of superiority listed below:

1. It is placed in the output stage where it will not pick up hum voltages from filter chokes and power transformers, a common fault of high-impedance filter sections connected one or more stages ahead of the output tube.
2. It employs two filter circuits instead of the single circuit usually used, producing far greater attenuation of the 10-kc note than a single-section filter can produce.
3. It requires no tuning, being manufactured of close-tolerance circuit elements of fixed values.
4. Requires a minimum of space for the attenuation produced, both filter circuits being placed in the same can but shielded from each other.
5. Can be utilized efficiently in either pentode or triode circuits.
6. Works well with a single tube, or two identical filters usable for a push-pull stage.
7. Current-carrying capacity of 75 ma. permits it to be used in any receiver and in all but the very high power Public Address systems.

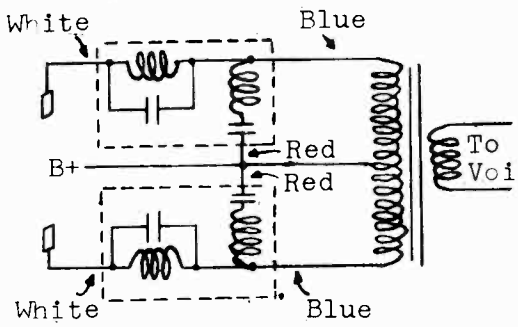
SINGLE TRIODE



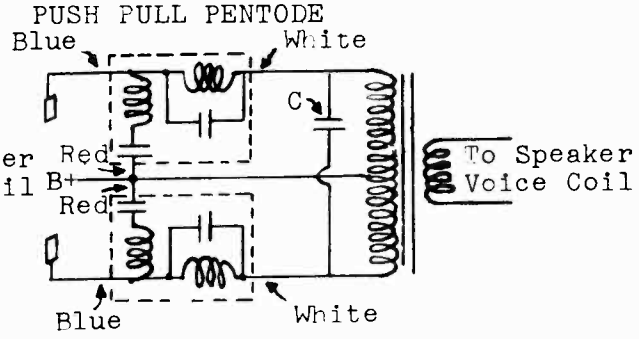
SINGLE PENTODE



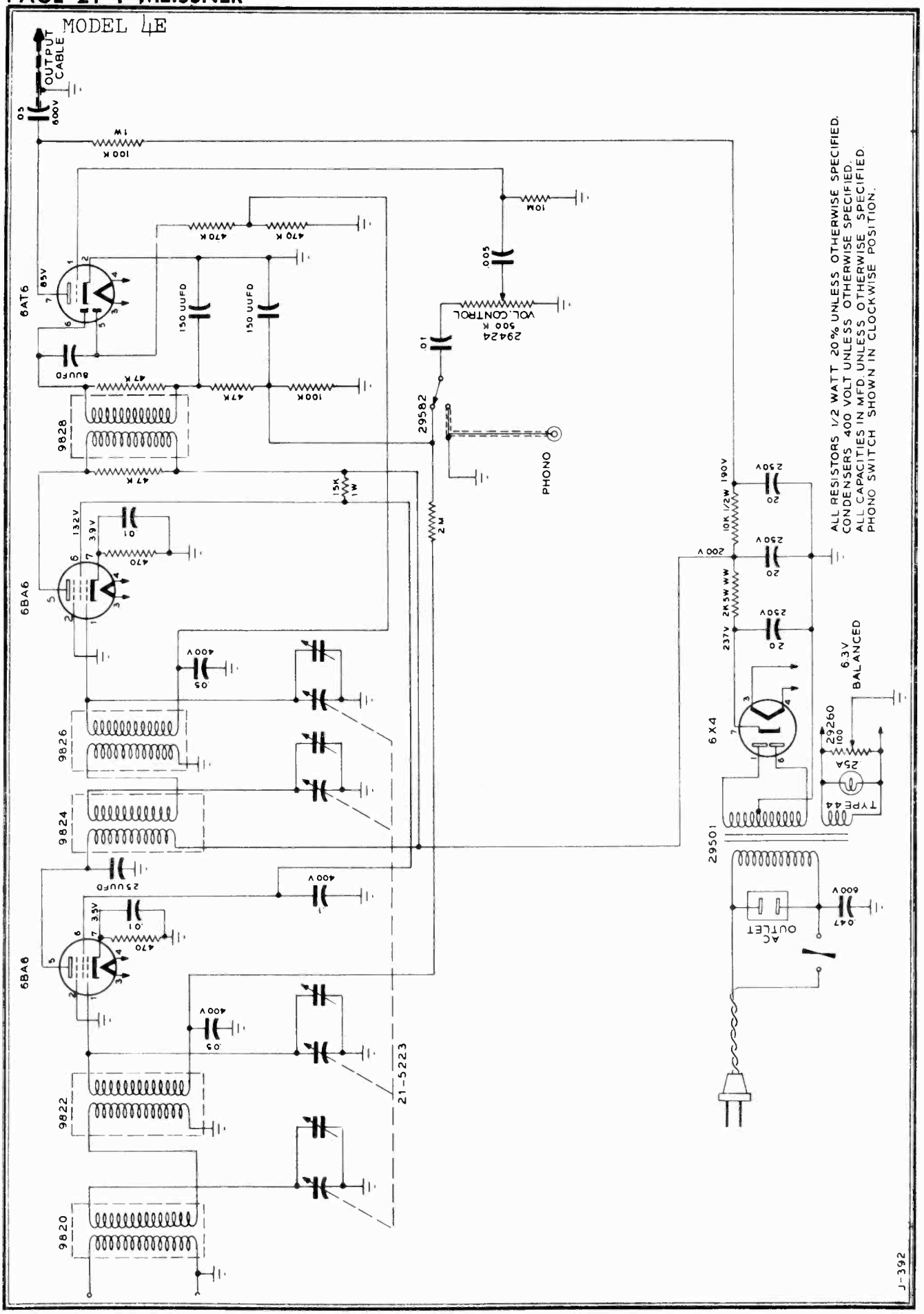
PUSH PULL TRIODE



PUSH PULL PENTODE



NOTE: C = approx. 1/2 original fixed tone control capacity.



Service Data

General:

Power Supply	110-120 V 50-60 cycles
Power Consumption	65 watts
Power Output	4 watts
AM I.F.	455 kc.
FM I.F.	10.7 mc.

Replacement part numbers - as shown on schematic diagram.

AM Alignment

I.F. 455 kc.
Align Ant. and Osc. Trimmers at 1400 kc.

FM Alignment

Alignment may be carried out with an unmodulated R.F. signal generator covering 10.7 mc. and 88 to 108 mc. and a high impedance DC voltmeter having a low range of 1 to 5 volts DC.

Connect the positive lead of the DC voltmeter to pin #1 of the 6AL5 detector tube, and the negative lead to pin #2 of the 6AL5. Apply an unmodulated 10.7 mc. signal to the grid of the second 6BA6 I.F. amplifier tube, through an .05 mfd. coupling condenser. Tune the bottom adjustment screw of the detector coil for maximum indication on the DC voltmeter. This completes this part of the adjustment.

Next, locate the 220 ohm resistor which is connected to the center lug of three lugs of the detector coil (on the side next to the 6AL5 socket). Connect the negative lead of the DC voltmeter to the junction of this 220 ohm resistor and the two 100 mmf. condensers on the tie lug near 6AL5. Connect positive lead of the voltmeter to chassis. With 10.7 mc. signal still applied to the grid of the second 6BA6, tune the top adjustment screw of the detector coil for a point of zero voltage. If more than a half turn adjustment was necessary in either of the preceding steps, then both of the adjustments should be repeated.

Connect negative lead of DC voltmeter to pin #2 of 6AL5.

Without changing the signal generator frequency, connect the 10.7 mc. signal across the FM converter coil (rear FM section of gang). Rotate tuning knob slightly to determine that receiver is not tuned to a harmonic of the generator. Adjust both top and bottom cores of FM I.F. transformers for maximum DC indication on the meter, keeping the signal level from the generator low enough so that this DC voltage does not exceed 5 volts.

R.F. alignment is carried out by setting signal generator to 108 mc. Connect generator to G and A2 antenna terminal through a 300 ohm dummy and adjust converter trimmer for maximum DC indication. Tune generator to 88 mc. and adjust converter coil by squeezing or spreading turns for maximum DC indication. There is some pulling between oscillator and converter, so the tuning control should be rocked slightly as these adjustments are made. The oscillator trimmer and coil should not be adjusted unless the receiver is noticeable off calibration.

MODELS 9AJ, 9AJ-1

Voltage Chart 9AJ

Tube	Pin Number 1	2	3	4	5	6	7	8	9 &
6BA6 FM RF	0	0	0	6.3AC	52*	94*	1*		
12AT7 FM Conv. Osc.	105*	Sl.Neg.	0	6.3AC	6.3AC	106*	0	1.4*	0
6BE6 AM Conv. Osc.	-6.8	0	0	6.3AC	95	95	Sl.Neg.		
6BA6 IF	Sl.Neg.	0	0	6.3AC	105	105	1		
6BA6 FM Driver	0	0	0	6.3AC	102	102	1		
6AL5 Ratio Det.	Sl.Pos.	Sl.Neg.	0	6.3AC	Sl.Pos.	0	Sl.Pos.		
6AT6 Det. AF	-0.3	0	0	6.3AC	Sl.Neg.	Sl.Neg.	57		
6V6 Power Amp.	0	0	245	258	0	57	6.3AC	13.5	
5Y3 Rectifier	0	272	117AC	265AC	0	265AC	0	272	

DC voltages with 20,000 ohm/volt meter, 117V AC line, switch in AM pos. except * in FM.
AC voltages with 1,000 ohm/volt meter. Voltage from pin to chassis.

RESISTANCE CHART 9AJ

Tube	Pin Number 1	2	3	4	5	6	7	8	9
6BA6 FM RF	0	0	0	0	100K*	100K*	68		
12AT7 FM Conv.Osc.	130K	10K	0	1	1	130K*	0	560	0
6BE6 AM Conv. Osc.	22K	0.5	0	0	150K*	150K*	2.5M		
6BA6 IF	1M	0	0	0	150K*	150K*	68		
6BA6 FM Driver	1	0	0	0	150K*	150K*	68		
6AL5 Ratio Det.	6.8K	6.8K	0	0	∞	∞	∞		
6AT6 Det. AF	10M	0	0	0	1.5M	500K	225K*		
6V6 Power Amp.	0	0	250K*	250K*	500K	225K*	0	330	
5Y3 Rectifier	∞	250K*	∞	80	∞	100	∞	250K*	

*Subject to variation depending on condition of filter condensers. Readings on 6BA6 RF and 12AT7 with switch in FM pos.
K= 1,000
M= 1,000,000

9AJ1 VOLTAGE CHART 117 V Line

Pin Number	1	2	3	4	5	6	7	8	9
6BA6 FM RF	0	0	0	6.3AC	85	85	1		
12AT7 FM osc.-Conv.	98	-.2	0	6.3AC	6.3AC	96	0	1.3	0
Above readings in FM position									
6BE6 AM Conv.	-7	0	0	6.3AC	95	95	0		
6BA6 AM FM IF	0	0	0	6.3AC	102	102	1		
6BA6 FM IF	0	0	0	6.3AC	103	103	1		
6AL5 Ratio Det.	0	0	0	6.3AC	0	0	0		
6AT6 Det. Audio	0	0	0	6.3AC	0	0	56		
6V6 Power Amp.	0	0	255	196	0	56	6.3AC	11	
5Y3 Rectifier	0	272	117AC	280AC	0	280AC	0	272	

DC Readings 20,000 ohms/v meter - voltages from tube pin to chassis.
AC Readings 1000 ohms/volt.

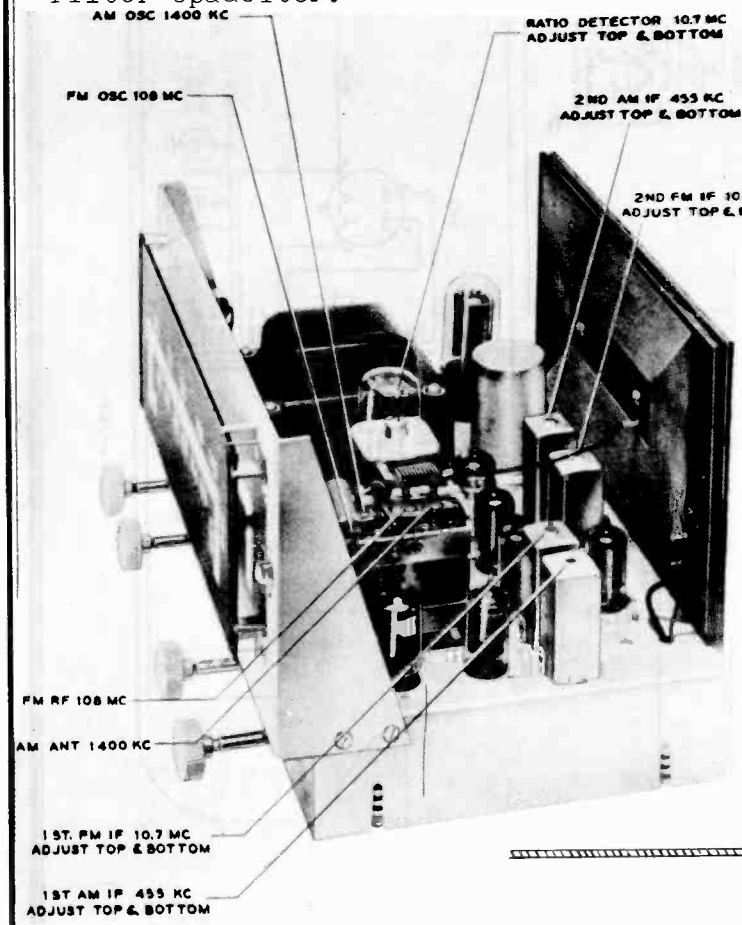
9AJ1 RESISTANCE CHART

MODELS 9AJ, 9AJ-1

Pin Number	1	2	3	4	5	6	7	8	9
6BA6 FM RF	0	0	0	0	280K*	280K*	68		
12AT7 FM Osc.-Conv.	280K*	10K	0	1 ohm	1 ohm	280K*	0	560	0
Above readings in FM position									
6BE6 AM Conv.	22K	.5 ohm	0	0	280K*	280K*	2.5M		
6BA6 AM FM IF	1.6M	0	0	0	280K*	280K*	68		
6BA6 AM IF	1 ohm	0	0	0	280K*	280K*	68		
6AL5 Ratio Det.	6.8K	6.8K	0	0	∞	∞	∞		
6AT6 Det. Audio	10M	0	0	0	1.5M	500K	500K*		
6V6 Power Amp.	0	0	250K*	250K*	500K	500K*	0	330	
5Y3 Rectifier	∞ *	250K*	∞	100	∞	100	∞	250K*	

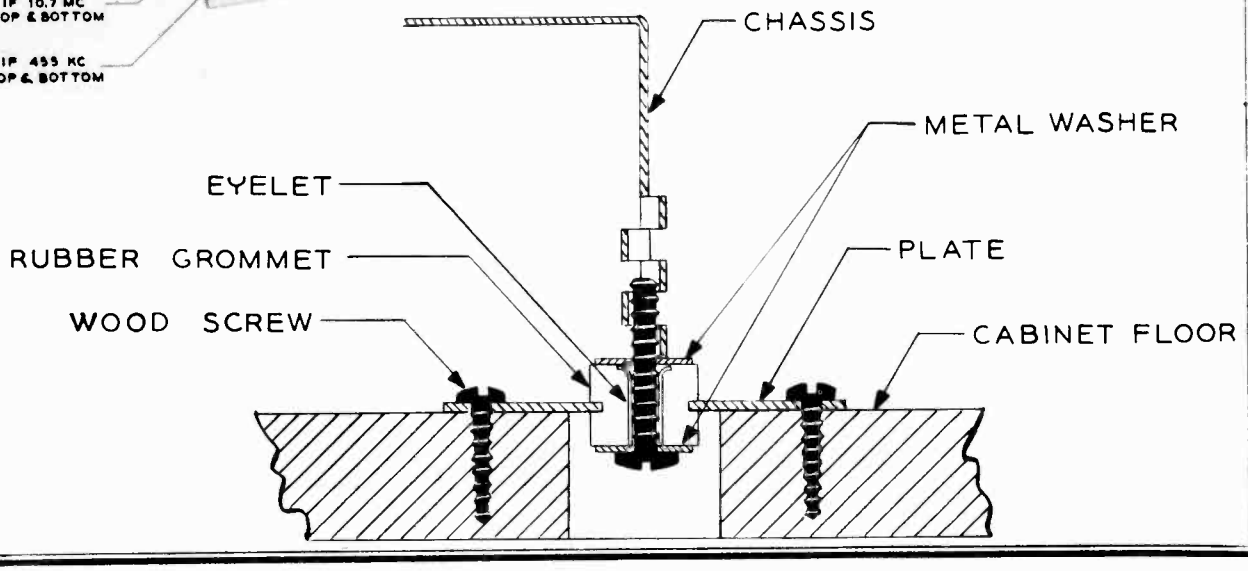
*Resistance reading subject to wide variation depending on condition of filter cpaacitor.

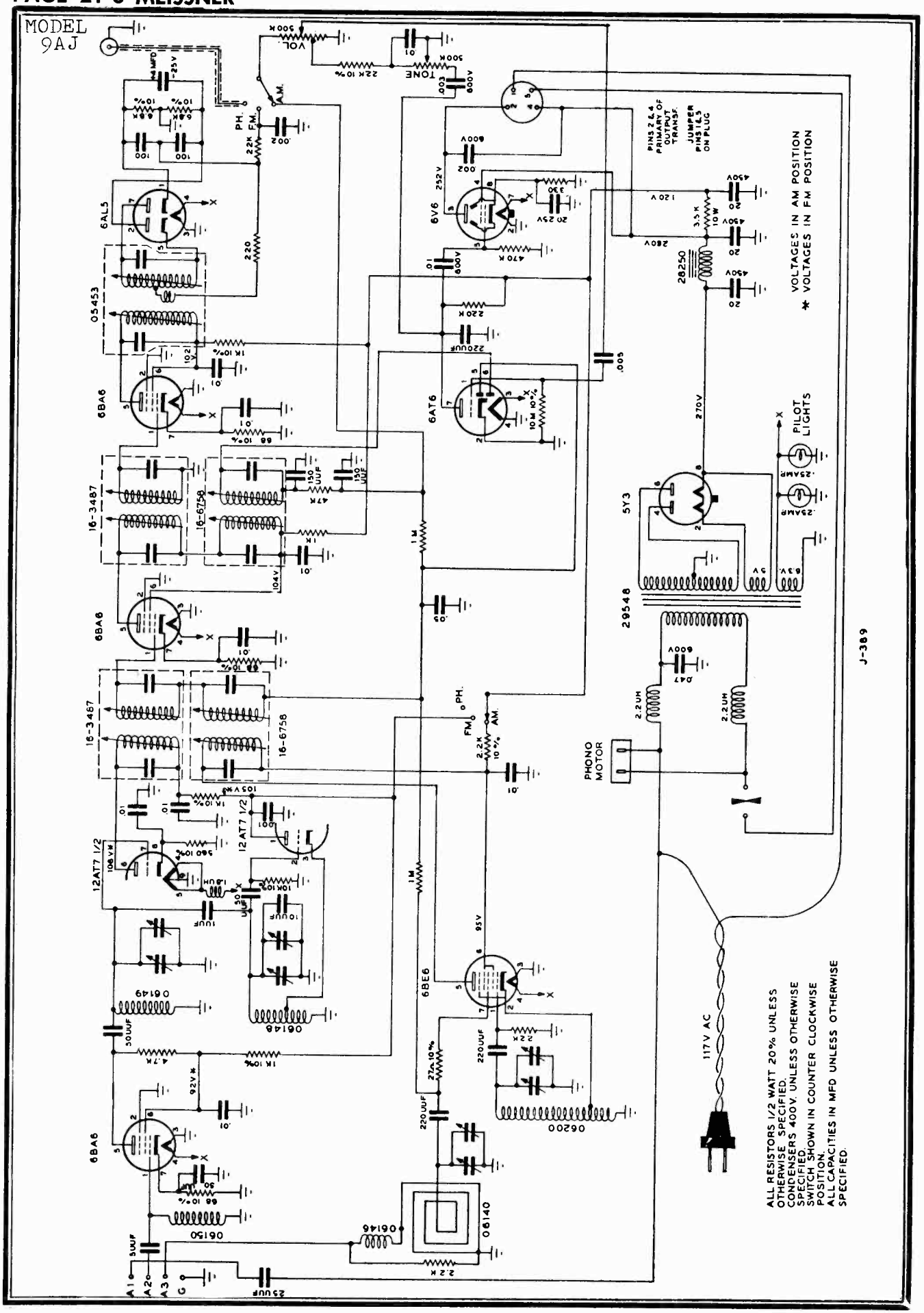
K - 1000
M - 1,000,000

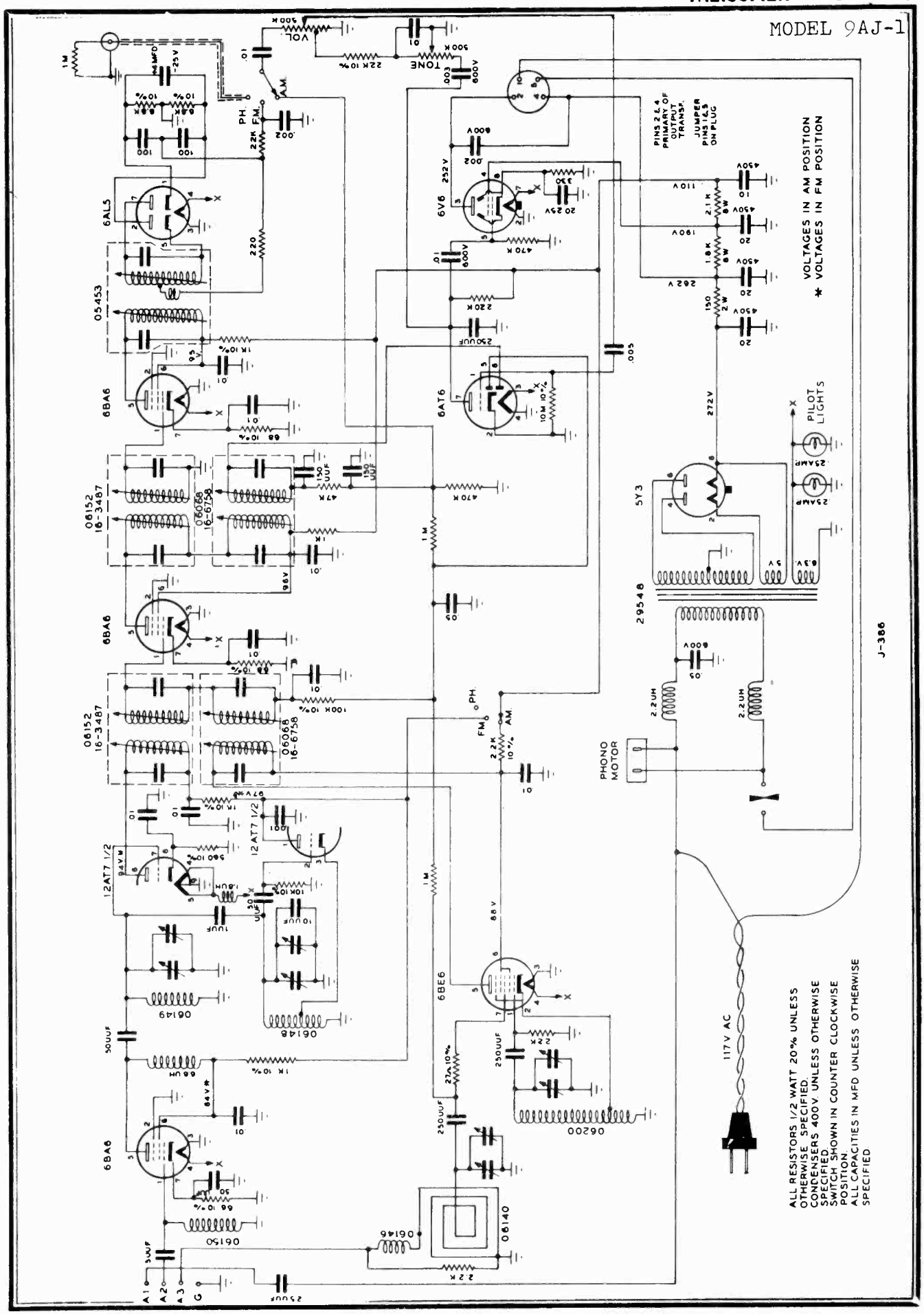


LOCATION OF TUNING ADJUSTMENTS

DETAIL OF RUBBER MOUNTING J-385







MODEL 8BT
Power Amplifier

The output impedance of the 8BT tuner is 220,000 ohms and should be worked into an amplifier having high impedance input. High impedance amplifiers usually heve an input impedance of 500,000 ohms, but some have a lower impedance than this, and the 8BT may be worked into an impedance as low as 250,000 ohms with no appreciable loss of low frequencies or increase in distortion. An amplifier having provision for phonograph input from a crystal pickup is satisfactory for use with the 8BT, but under no conditions should the 8BT be worked into a microphone input channel. The relatively high output of the 8BT would cause overloading and distortion in the microphone input stage and the hum level would be too high to be considered acceptable.

SERVICE DATA

General:

Power Supply	110-120 V 50-60 cycles
Power Consumption	40 watts
Output	1 to 15 volts
AM I.F.	455 kc
FM I.F.	10.7 mc

Replacement part numbers - as shown on schematic diagram.

AM Alignment

I.F. 455 kc.
Align Ant. and Osc. Trimmers at 1400 kc.

FM Alignment

Alignment may be carried out with an unmodulated R.F. signal generator covering 10.7 mc. and 88 to 108 mc. and a high impedance DC voltmeter having a low range of 1 to 5 volts DC.

Connect the positive lead of the DC voltmeter to pin #1 of the 6AL5 detector tube, and the negative lead to pin #2 of the 6AL5. Apply an unmodulated 10.7 mc signal to the grid of the second 6BA6 I.F. amplifier tube, through an .05 mfd. coupling condenser. Tune the bottom adjustment screw of the detector coil for maximum indication on the DC voltmeter. This completes this part of the adjustment.

Next, locate the 220 ohm resistor which is connected to the center lug of the detector coil (on the side next to the 6AL5 socket). Connect the negative lead of the DC voltmeter to the junction of this 220 ohm resistor and the two 100 mmfd. condensers on the tie lug near 6AL5. Connect positive lead of the voltmeter to chassis. With 10.7 mc. signal still applied to the grid of the second 6BA6, tune the top adjustment screw of the detector coil for a point of zero voltage. If more than a half turn adjustment was necessary in either of the preceding steps then both of the adjustments should be repeated.

Connect negative lead of DC voltmeter to pin #2 of 6AL5.

Without changing the signal generator frequency, connect the 10.7 mc. signal across the FM converter coil (rear FM section of gang). Rotate tuning knob slightly to determine that receiver is not tuned to a harmonic of the generator. Adjust both top and bottom cores of FM I.F. transformers for maximum DC indication on the meter, keeping the signal level from the generator low enough so that this DC voltage does not exceed 5 volts.

R.F. alignment is carried out by setting signal generator to 108 mc. Connect generator to G and A2 antenna terminal through a 300 ohm dummy and adjust converter coil by squeezing or spreading turns for maximum DC indication. There is some pulling between oscillator and converter, so the tuning control should be rocked slightly as these adjustments are made. The oscillator trimmer and coil should not be adjusted unless the receiver is noticeably off calibration.

Resistance Chart 8BT

Tube	Pin Number								
	1	2	3	4	5	6	7	8	9
6BA6 FM RF	0	0	0	0	500K*	500K*	68		
12AT7 FM Conv. Osc.	500K*	10K	0	1	1	500K*	0	560	0
6BE6 AM Conv. Osc.	22K	0.5	0	0	500K*	500K*	2.5M		
6BA6 IF	1M	0	0	0	500K*	500K*	68		
6BA6 FM Driver	0.5	0	0	0	500K*	500K*	68		
6AL5 Ratio Det.	6.8K	6.8K	0	0	Inf.	Inf.	Inf.		
6AT6 Det. AF	10M	0	0	0	1.5M	500K*	500K*		
6X5 Rectifier	0	0	250	Inf.	250	Inf.	0	500K*	

* Subject to variation depending on condition of filter condensers. Readings on 6BA6 FM RF and 12AT7 with switch in FM pos.
k = 1000 M = 1,000,000

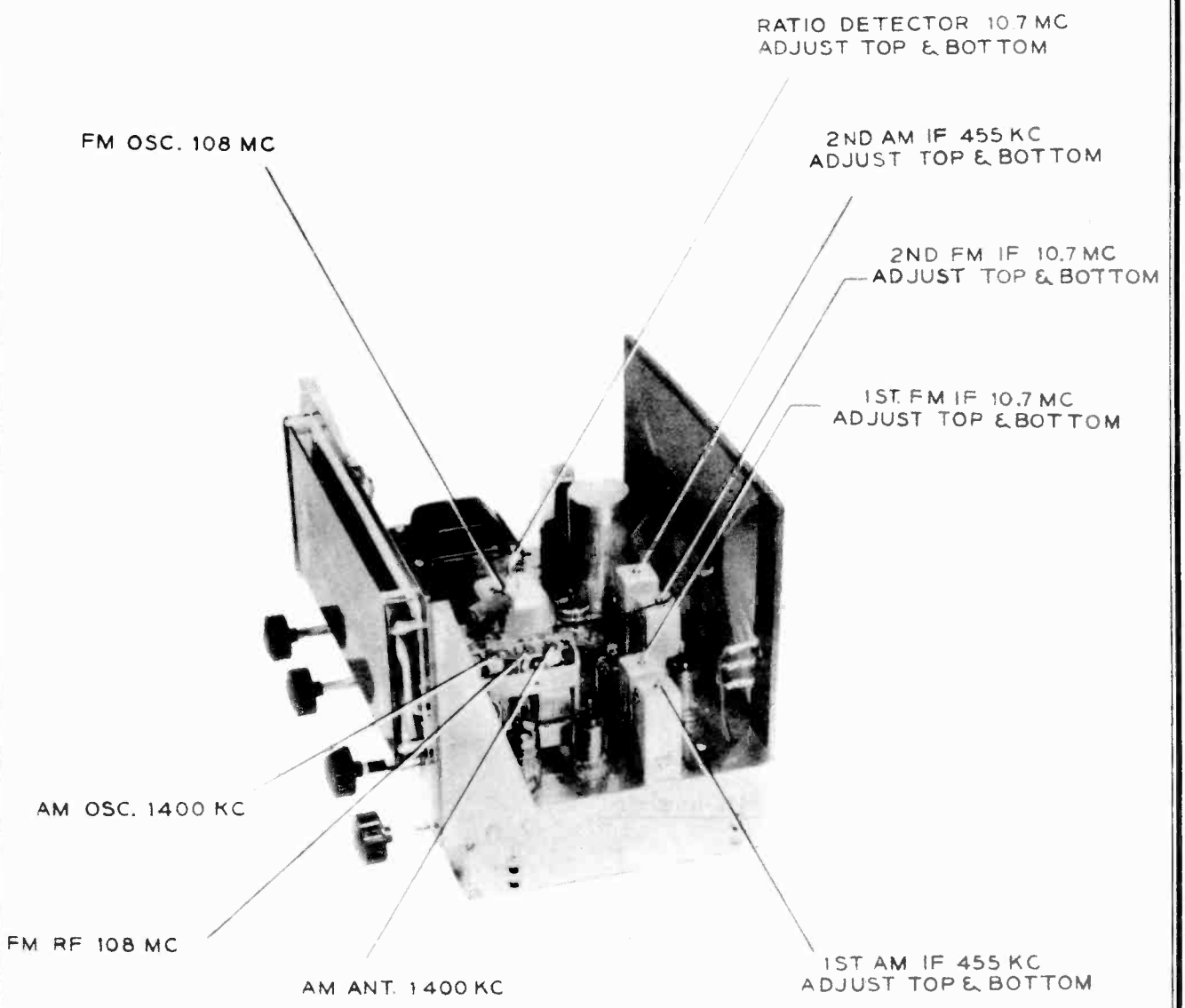
Voltage Chart

Tube	Pin Number								
	1	2	3	4	5	6	7	8	9
6BA6 FM RF	0	0	0	6.3AC	57	97	1		
12AT7 FM Conv. Osc.	106	Sl. Neg.	0	6.3AC	6.3AC	104	0	1.2	0
6BE6 AM Conv. Osc.	-6.8	0	0	6.3AC	96	96	Sl. neg.		
6BA6 IF	Sl.Neg.	0	0	6.3AC	108	108	1		
6BA6 FM Driver	0	0	0	6.3AC	102	102	1		
6AL5 Ratio Det.	Sl.Pos.	Sl.Neg.	0	6.3AC	0	0	Sl.Pos.		
6AT6 Det. AF	-.5	0	0	6.3AC	Sl.Neg.	Sl.Neg.	57		
6X5 Rectifier	0	0	180AC	117AC	180AC	0	6.3AC	200	

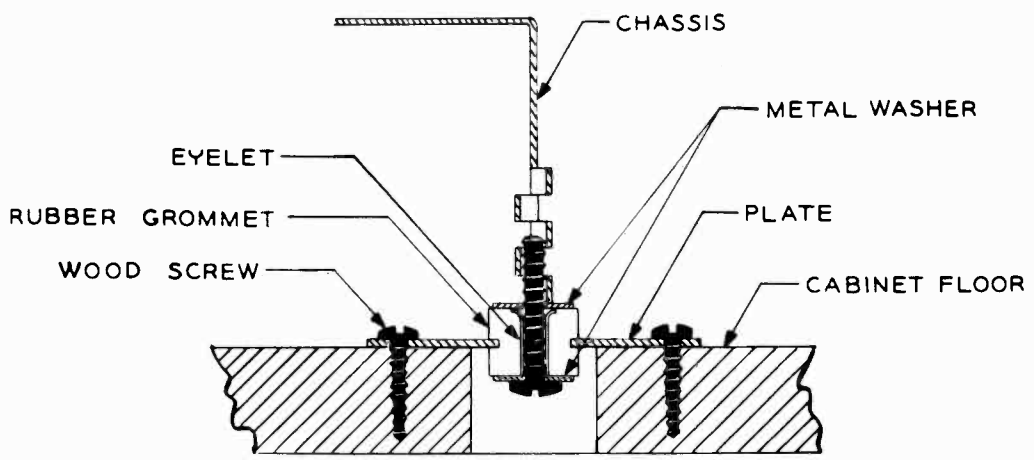
117V AC line, switch in AM position except 6BA6 FM RF and 12AT7.

DC readings with 20,000 ohm/volt meter, AC readings 1000 ohm/volt.

MODEL 8BT

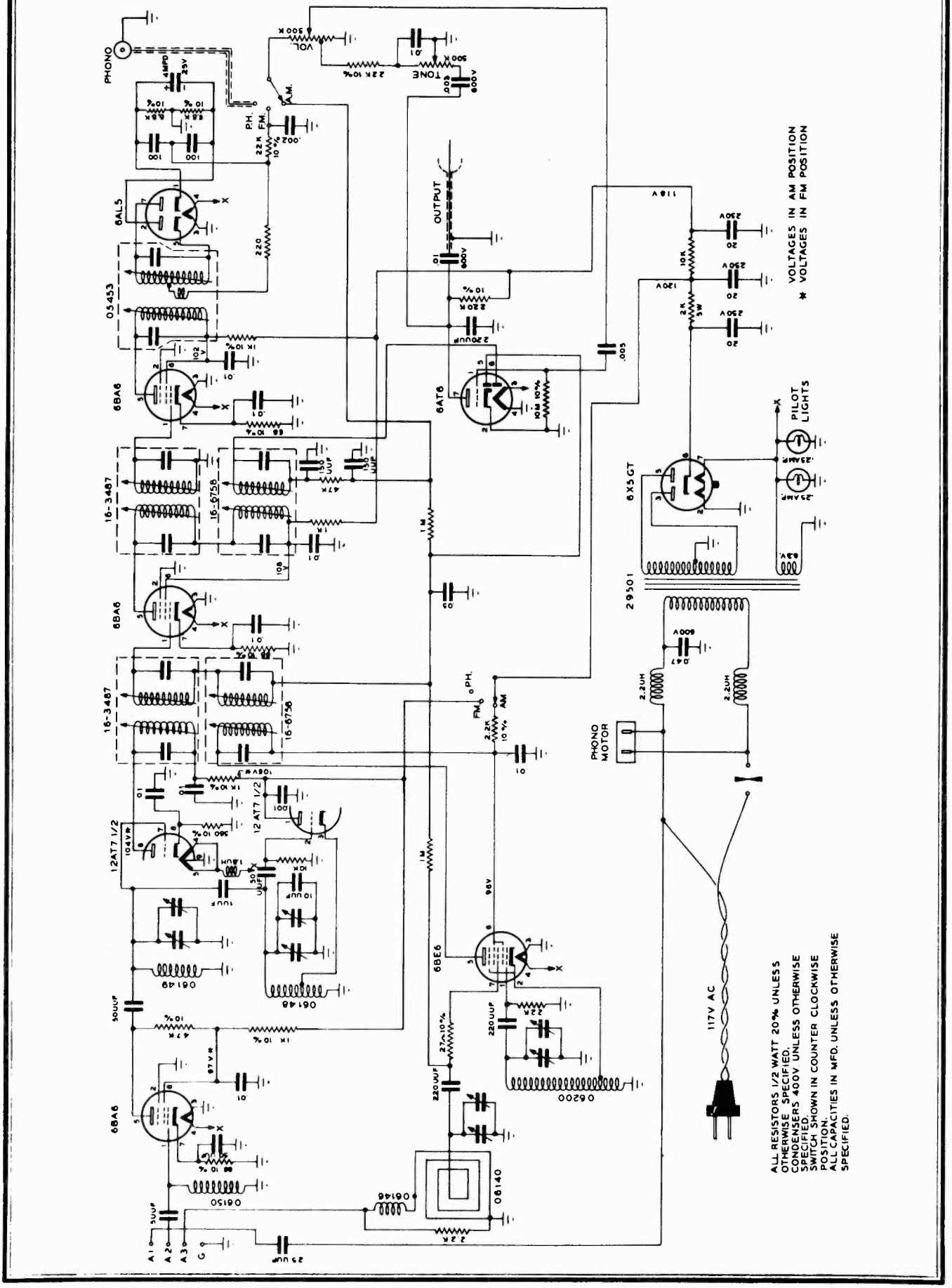


LOCATION OF TUNING ADJUSTMENTS



DETAIL OF RUBBER MOUNTING

MODEL 8BT



MODEL TK16,
Ch. KC-16

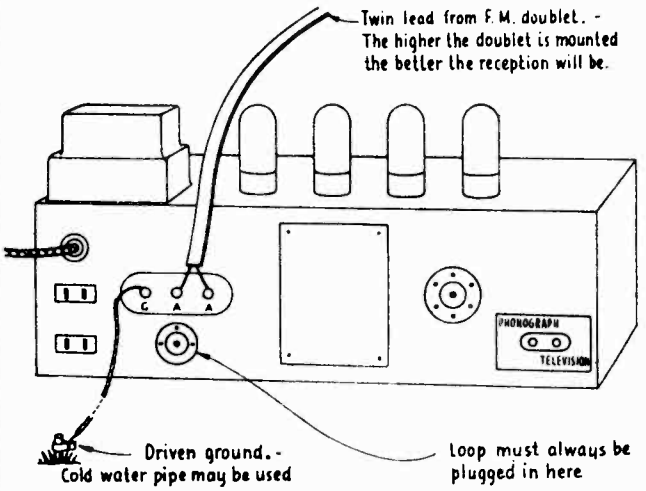
SPECIFICATIONS

Power Requirement: 120 volts, 50 to 60 cycles, 110 watts.
Frequency Coverage:
Band A – 540 to 1600 KC, AM
Band B – 1.6 to 4.7 MC
Band C – 4.7 to 10 MC
Band D – 11 to 22 MC
Band E – 88 to 108 MC, FM
Audio Sensitivity: .02 volts for ½ watt output.
Maximum Undistorted Audio: 10 watts.
AM Sensitivity: 2 to 4 microvolts.
FM Sensitivity: 20 microvolts, quieting signal.
5 microvolts, minimum signal.

Tube Complement:

RF	6BA6	FM Detector	6AL5
Mixer	12AT7	1st AF	6C4
Oscillator	12AT7	2nd AF	6C4
1st IF	6BA6	Phase Inv.	6C4
2nd IF	6BA6	AF output, two	6V6GT
AM Detector	6AL5	Rectifiers, two	5Y3GT
3rd IF, FM	6BA6	Tuning Ind.	6U5

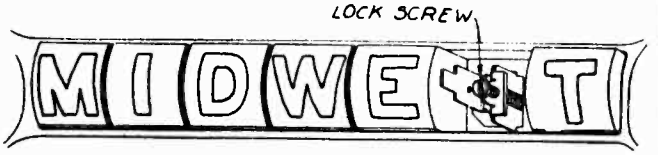
INSTALLATION



PRECAUTIONS. Be sure that the speaker and Magna Tenna Loop are plugged in, also the flexible dipole leads must be connected to screw strip at "A–A". A ground wire may be connected to "G" but it is usually not needed. See that all tubes are seated and light up.

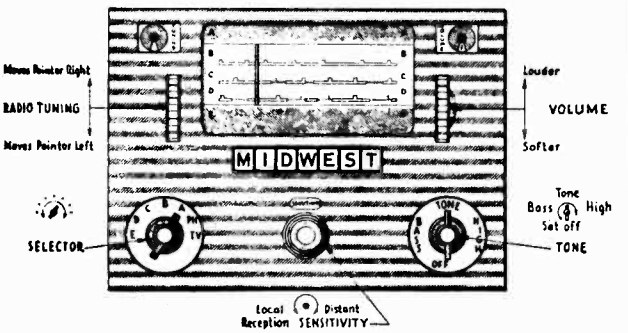
The next step to select the type of entertainment you wish is to turn the **SELECTOR.** The pointer has seven positions: **TV, PH, A, B, C, D** and **E.** The letters represent television adaptor, phonograph, and radio bands A–Standard American Broadcast, BCD–short wave bands and E–FM Broadcast.

The push buttons are for your convenience in selecting stations without the bother of making the exact tuning adjustments necessary for best reception. There are seven buttons and each button may be set for a station at any point on the dial. We do not recommend the use of the push buttons for short wave stations. To set the push buttons this exact procedure should be followed. A screwdriver will be needed.



1. Turn on the receiver and allow ten minutes to warm up.
2. Remove the push button by pulling straight out. A hooked instrument will be of assistance.
3. Loosen the **LOCK SCREW** at least one half turn.
4. Using the screwdriver with the blade in the screw slot, push the mechanism in firmly. Hold in during step 5. The mechanism may bind at first and you must use sufficient force to break it loose so that the push buttom and **TUNING** control wheel are independent, that is, the **TUNING** control does not try to push the button mechanism outward when the pointer is tuned across the dial.
5. Tune the pointer past the desired station, then back to the desired station and make the tuning adjustment as carefully as you know how.
6. Tighten the **LOCK SCREW.**
7. Check the setting of this push button by tuning away from the station manually then push the button down firmly maintaining pressure until the pointer moves to the position it had when the **LOCK SCREW** was tightened. If the station is not tuned in perfectly repeat steps 2 to 6 carefully.

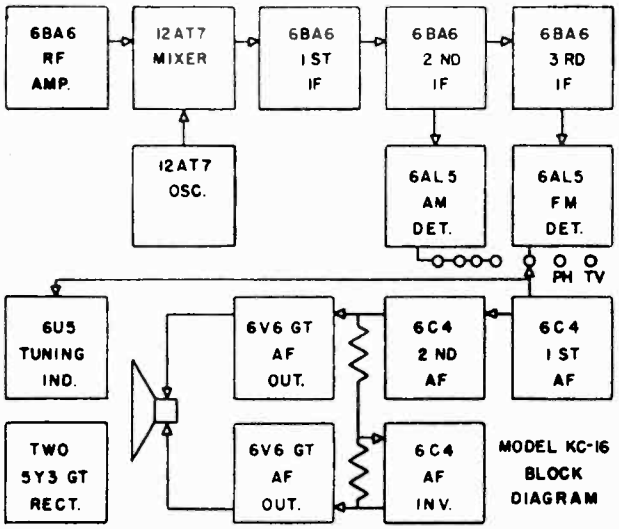
OPERATION



8. Adjust each of the seven buttons, or as many as you need, exactly as outlined above.

Any button can be set for any pointer position, however, you will find it more desirable to select the button nearest the pointer position so that each button may be more easily identified with the station. For example, the "M" button will be set for a station at the left of the dial, the "W" button will be set for a station near the center, etc.

MODEL TK16,
Ch. KC-16



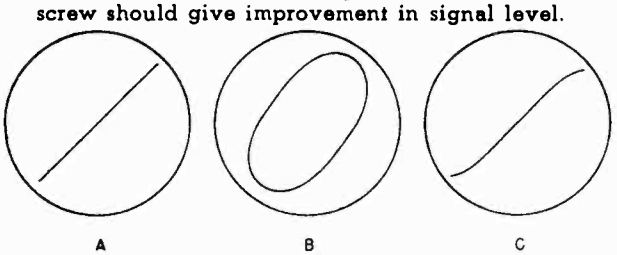
ALIGNMENT

The alignment points are shown on the top and bottom views of the chassis as well as certain part numbers.

AM IF should be aligned at 456 KC. There are three transformers and six adjustments, the transformers are coupled with less than critical coupling and there is only one peak. Couple the generator into the mixer grid and use either AVC or audio for the output meter.

FM IF should be aligned at 10.7 MC. There are four transformers and eight adjustments, the transformers are over-coupled and must be aligned with a scope and sweep generator.

1. Connect generator to 3rd IF grid and vertical input of scope to the audio of the receiver at any point where sufficient signal is available and phasing can be properly adjusted.
2. Adjust the top screw for greatest length of straight line. This is the secondary winding, the bottom screw should give improvement in signal level.



A does not have the hook indicating that the sweep generator has a greater deviation than the detector capability.

B shows improper phasing of the horizontal sweep with the audio output of the receiver.

C is preferred because it shows the limits of deviation and you obtain it simply by adjusting the deviation (sweep width) control on the signal generator. Approximately 150 KC is normal.

3. Connect generator to 2nd IF grid and adjust the 2nd IF slugs for maximum signal **and** band width. This you can be sure of by the amount of hook at the ends of the line on the scope. Repeat this procedure for 1st IF grid and mixer grid. Adjust for greatest signal without appreciable loss of band width.

Alternate Method: The IF response of the 1st, 2nd and 3rd transformer may be observed more directly if you use a crystal detector at the plate of the tube following the transformer and feed the vertical plates of the scope from that point. Feed signal into grid of tube preceding transformer. Use a CW marker at 10.7 to be sure the double peaked response curve straddles the ratio detector response. Observe each stage separately.

Notice: Do not use AM or CM signal to peak the FM transformers. Regeneration may result and bandwidth and noise rejection will be poor, although signal strength will increase.

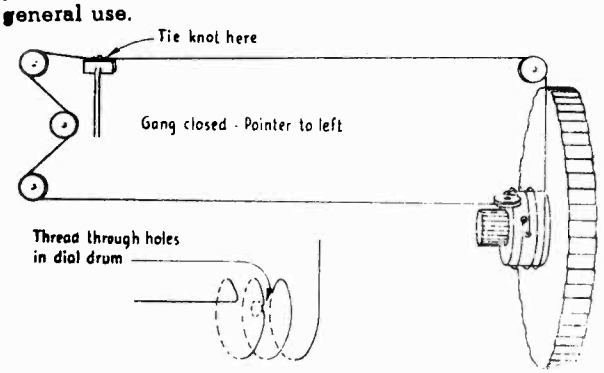
FM RF should be trimmed at 105 MC. There should not be any reason to adjust the low end but if this is necessary it can be done by distorting the FM coils on the tuning gang.

AM RF should be peaked at the high end with the trimmer and at the low end by core adjustment.

Notice: Use as low signal input as possible for readable output indication. Feed signal in from FM RF generator through 150 ohms in each lead to "A-A." Use 400 ohms in lead from AM RF generator and connect to either "A" terminal.

A very convenient design is shown here schematically of a Crystal probe for detection of resonant response for display on the oscillograph and your available materials will decide the physical design, most important feature is the ability to change the load resistor, R.

The value for C is limited by the physical size, any capacity greater than 100 mmfd will be satisfactory, the value of R should be 470 ohms when the probe is used in the IF stages to obtain the response of the grid circuit with 470 ohms in plate in place of the tuned plate circuit whereas a value of 470K ohms is alright for general use.



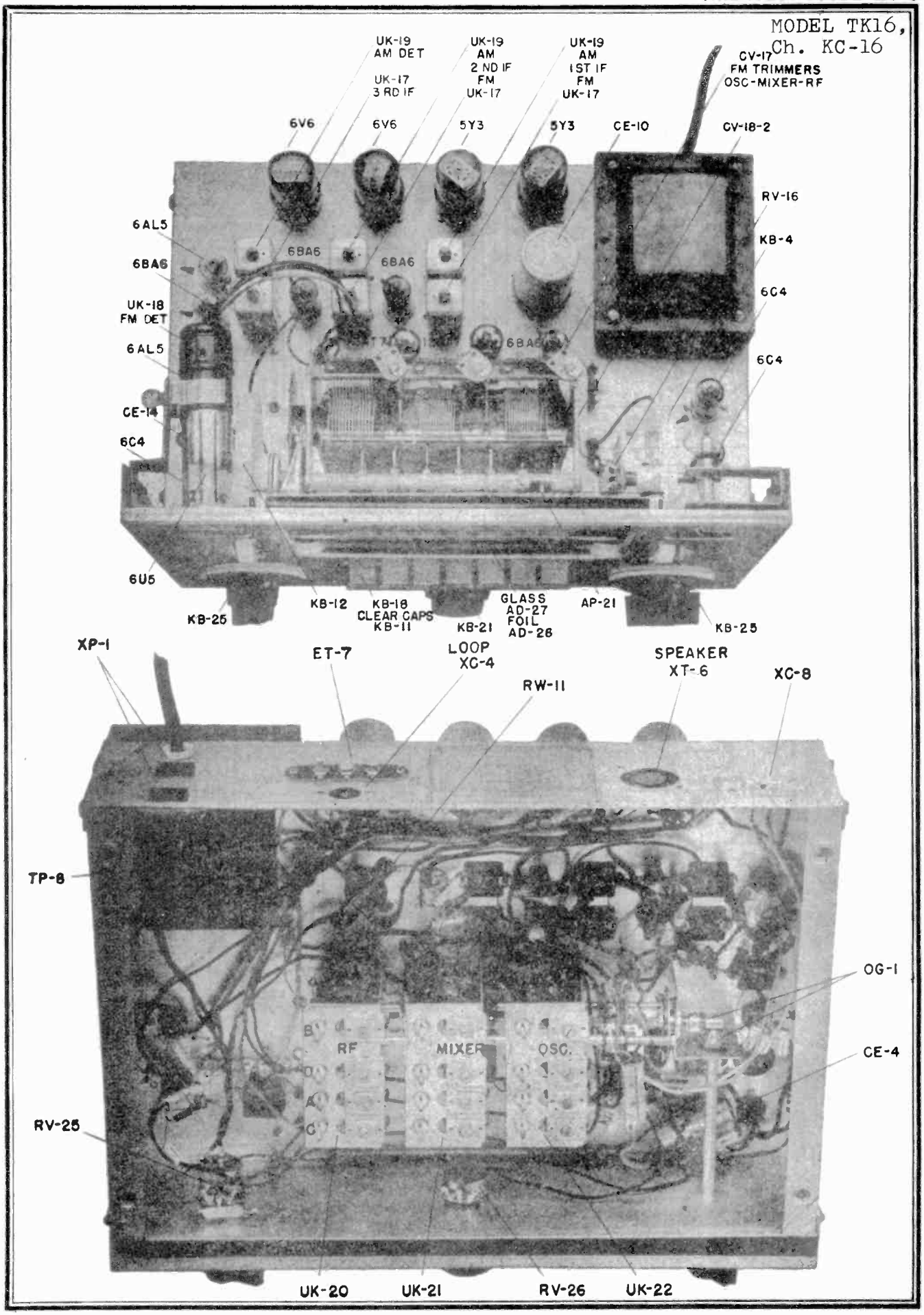
For dial stringing use a light weight dial cord such as Bevin-Wilcox 6-18 Imperial silk cord.

Radio Band	Coil Adj.	Trimmer Adj.
A	560 KC	1500 KC
B	1.6 MC	4.7 MC
C	5 MC	10 MC
D	11.5 MC	22 MC
E	.....	105 MC

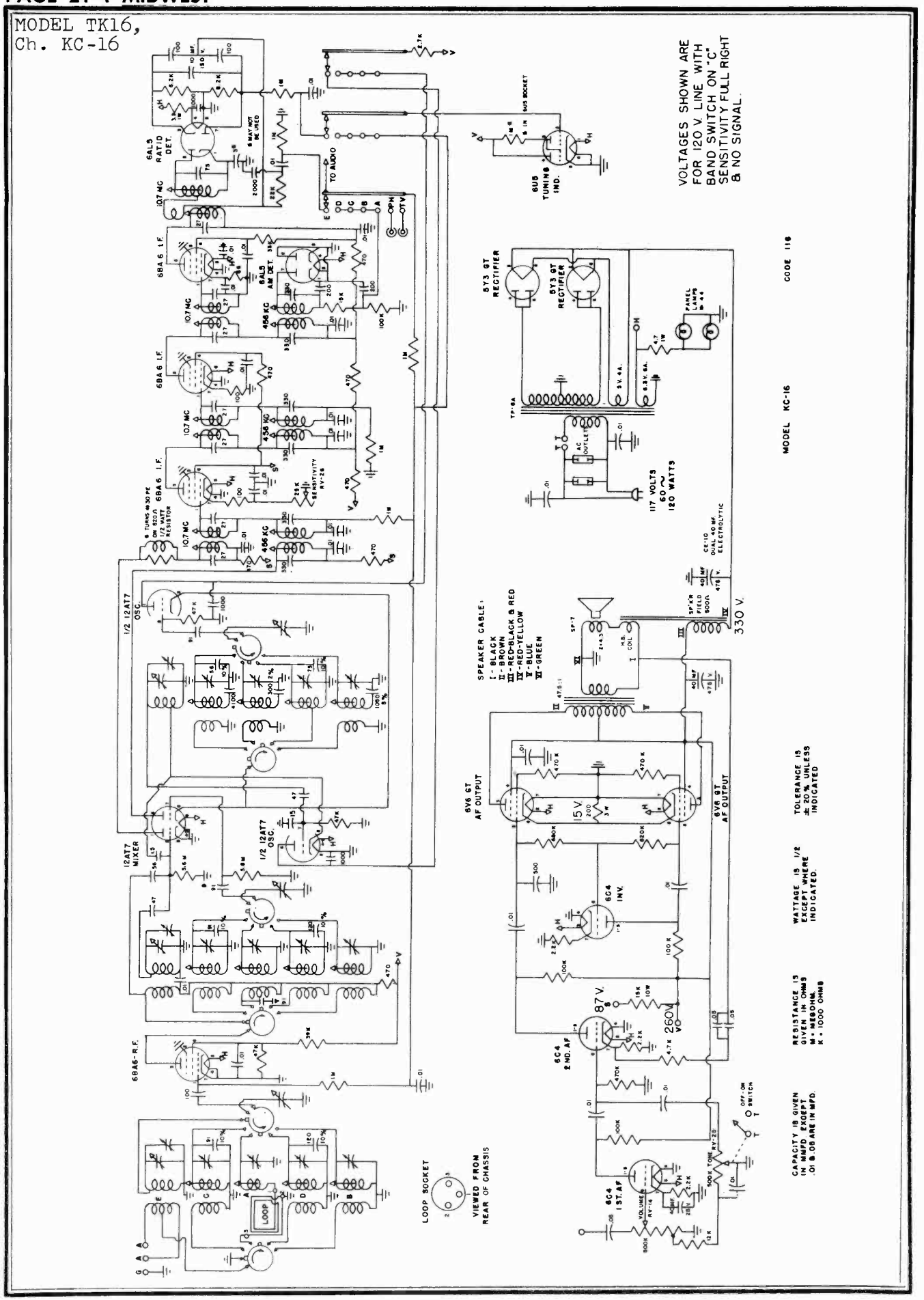
If replacement parts of identical manufacture and rating are not available for service repairs these should be ordered from Midwest Radio & Television Corporation, giving model number and serial number of the chassis and name of the part.

Repair data for the record changer mechanism is available separately, please specify Model.

MODEL TK16,
Ch. KC-16



MODEL TK16,
Ch. KC-16



MODEL TK16,
Ch. KC-16

During Early production the following changes have been made.

1. The ground end of the padder on the "C" band, in the oscillator plate must return to ground lug on the coil plate near the "C" trimmer. This is done to prevent coupling into the "D" band.

2. There should be an additional .01 condenser from the 1st IF grid return to the saddle of the 6V6 socket. This is added to reduce regeneration.

3. There should be an additional .01 condenser from the screen supply end of the 15K dropping resistor to a ground on the saddle of the 5Y3 socket. To reduce regeneration.

4. The .01 ground return of the capristor at the B+ side of the 1st AM IF transformer may retutn to the ground on the saddle of the 5Y3 socket. To reduce regeneration.

5. The blue plate lead on the AM section of the triode mixer must be dressed away from the grid pin of that section. To reduce regeneration.

6. The RF stage may regenerate on FM. The cure is to ground the 6BA6 RF tube suppressor separately, to the front of the socket; solder the wire to the chassis if the socket does not have the saddle below the chassis.

7. Four ceramic B+ decoupling condensers should be replaced by paper condensers of .01 MFD capacity and 600 volts rating. These are in the IF B+ lead string and one in the mixer coil plate.

8. Remove ceramic .01 MFD condensers at the 3rd 6BA6 IF screen, at the 1st 6BA6 IF screen and at the terminal feeding mixer plate voltage to the 1st IF transformers. Replace with .01MFD ceramic disc capacitors.

9. The black wire used to ground the arm of the tone control should be connected directly to the 6C4 socket ground. To reduce hum.

10. To prevent overload on strong local FM Stations the grid return of the 2nd IF grid should be made directly to ground instead of through the .01-1 meg capristor.

11. To prevent regeneration in the "C" band, in addition to revision 4, add a 1000 mmf disc condenser from B+ side of 1st AM, IF transformer to ground on the mounting foot of the adjacent terminal strip.

CONNECTING THE SET

POWER SUPPLY. This receiver is designed to operate on an alternating current supply (AC) ranging from 110 to 120 volts, 60 Cycles only. *Do Not Operate on Direct Current.*

Before connecting the set be sure that your house is wired for the voltage and current for which the set is designed. If in doubt, call your local power company for the necessary information. Connecting the set to a supply outlet furnishing the wrong type of current will result in improper operation or damage.

ANTENNA. This receiver has a built-in "loop" aerial. Its excellent design is such as to increase pick-up from stations having wide variations in signal strength. The efficiency and selectivity of the loop provide outstanding reception without the use of an external aerial.

TUBES. Five tubes (including rectifier) are used. Type numbers and locations are shown in the tube location diagram on the bottom of the cabinet.

GROUND. No ground connection should be used when operating this receiver. The receiver gets its ground connection through the power line and any external connection to the chassis may cause a short circuit and consequent damage.

CAUTION. Do not place receiver on hot objects such as stoves, radiators, etc. Heat will damage the cabinet and the internal components of the receiver.

RADIO OPERATION

AUTO-OFF-ON SWITCH KNOB (Bottom of Clock Face). Turn this knob to the right (clockwise), so that the indicator points to "ON", to turn on the radio. To turn off the radio, turn this knob so that the indicator points straight up to "OFF".

VOLUME CONTROL KNOB (Bottom Knob on Front of Cabinet) This knob controls the volume of the signal received. To reduce the volume, rotate this knob to the left (counter-clockwise). When this knob is rotated to the right it will increase the volume.

STATION SELECTOR KNOB. (Large Knob on Front of Cabinet) Rotate this knob over a narrow range of the dial where the desired station is located, until the station is received with maximum volume and clarity. Then readjust the volume control to the proper level. NEVER use the station selector knob to adjust the volume as this will result in the signal being received with distorted tone quality.

The station selector knob is calibrated in Kilocycles with the last zero of the actual frequency omitted. For instance, the numeral 55 on the knob indicates 550 Kilocycles and 160 indicates 1600 Kilocycles.

OPERATION OF CLOCK

This clock-radio is equipped with a self-starting clock. As soon as the power plug is inserted into the wall outlet, the sweep second hand will begin to operate.

To set the time hands, rotate the knob located at the rear of the receiver so that the hands will rotate in a clockwise rotation. Once the clock is set, it needs no further attention unless you remove the plug or there is a power interruption.

The clock of this clock-radio is equipped to automatically turn on the radio at any time during the course of approximately 10-$\frac{1}{2}$ hours after the controls are properly set. The controls may be properly set by following the instructions itemized below:

1. SET TURN-ON TIME. Pull out and turn the knob at the top of clock face to the left (counter-clockwise) until the selected TURN-ON time is indicated on the small center dial by the small pointer on the opposite end of the hour hand.

   Leave this knob out if you wish the conventional alarm to turn on in addition to the radio. The conventional alarm will sound approximately seven minutes after the radio is turned on.

   If you prefer to have the radio turned on without the conventional alarm, push the knob in after the TURN-ON time is set.

2. SELECT PROGRAM TO BE TURNED ON. Tune in the station that will carry the desired program at the selected time, and adjust the volume to the proper level.

3. SET AUTO-OFF-ON SWITCH KNOB. Turn this knob to the left until the indicator points to "AUTO". This will turn off the radio and set the switch so that it automatically comes on again at the selected time.

To turn the radio on before the "TONE-ALARM" time, turn the AUTO-OFF-ON knob to the "ON" position. It will then be necessary to repeat the steps listed above to again use the alarm feature.

Radio Clock

USE OF "CONVENTIONAL ALARM"

The clock may be set to turn on the conventional buzzer alarm without turning on the radio. To accomplish this set the TURN-ON time as explained under "USE of TONE-ALARM" and leave the knob out from the cabinet. Set "AUTO-OFF-ON" switch knob to the "OFF" position. At the selected time, the buzzer will sound and will continue to sound until you turn it off by pushing knob all the way in.

USE OF TURN-ON FEATURE WITH EXTERNAL APPLIANCES

An electrical outlet is provided at the rear of the receiver to use the TURN-ON feature on any electrical appliance which operates on a 110-120 volt, 60 cycle power supply.

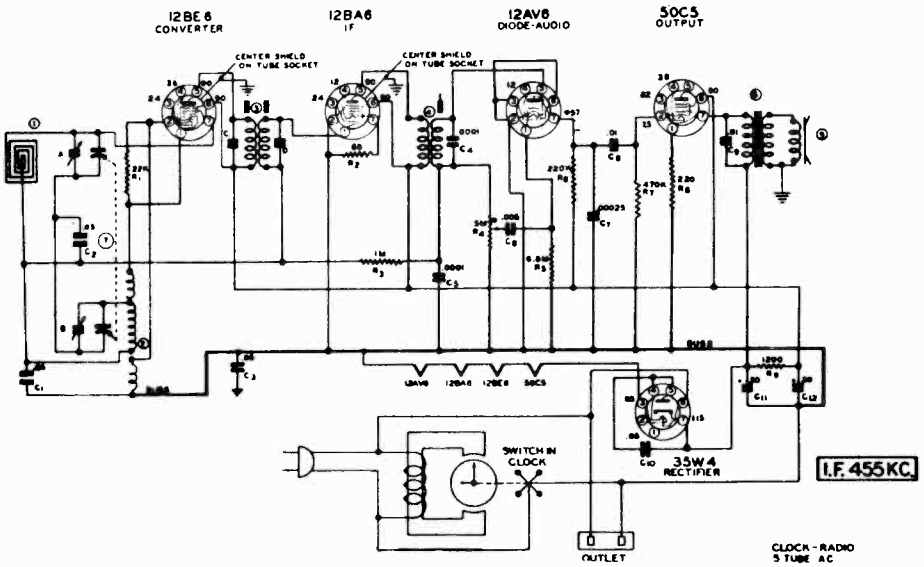
To use this outlet, simply plug in the appliance and set the controls on the clock the same as explained in the paragraph "USE OF TONE-ALARM" This will automatically start the appliance AND the radio at the selected time.

CAUTION: THE RATING OF THE EXTERNAL ELECTRICAL APPLIANCE MUST NOT EXCEED 660 WATTS.

Current is available at this outlet whenever the radio is turned on.

ALIGNMENT

Step No.	Position of Gang	Signal Generator Frequency	Generator Connection	Dummy Antenna	Adjustment	Type of Adjustment
1.	Open	455 KC.	Rear Gang Terminal	.1 Mfd.	I.F. Slugs	Adjust for Maximum Output
2.	Open	1620 KC.	Dummy Antenna	2 Turns of Hookup Wire 6" in Dia. (Place Approx. a Foot from & parallel to loop.)	Front Gang Trimmer	Adjust for Maximum Output
3.	1400 KC	1400 KC.			Rear Gang Trimmer	Adjust for Maximum Output
4.	600 KC	600 KC.				Check Gang Alignment



PARTS LIST

SCHEMATIC LOCATION	PART NUMBER	DESCRIPTION
C1,C2,C3	N-1345	Capacitor-Paper .05 MFD. 200 V
C4	N-7549	Capacitor-Ceramic 100 MMFD 500 V. 10%
C5	N-6015	Capacitor-Ceramic 100 MMFD 500 V. 20%
C6	N-4894	Capacitor-Paper .005 MFD. 600 V.
C7	N-6488	Capacitor-Ceramic 250 MMFD. 500 V. 20%
C8,C9	N-1344	Capacitor-Paper .01 MFD. 400 V.
C10	N-1346	Capacitor-Paper .05 MFD. 400 V.
C11) C12)	N-7889	Capacitor-Electrolytic 50 MFD. 150 V. 30 MFD. 150 V

R1	N-4025	Resistor - 22,000 Ohm - 1/2W. - 20%
R2	N-6485	Resistor - 68 Ohm - 1/2W. - 10%
R3	N-1262	Resistor - 1.0 Megohm - 1/2 W. - 20%
R4	N-7957	Control - On-Off & Volume
R5	N-4028	Resistor - 6.8 Megohm - 1/2 W. - 20%
R6	N-4026	Resistor - 220,000 Ohm - 1/2W. - 20%
R7	N-4027	Resistor - 470,000 Ohm - 1/2W. - 20%
R8	N-4024	Resistor - 220 Ohm - 1/2W. - 10%
R9	N-4900	Resistor - 1,200 Ohm - 1.0W. - 10%
	N-7884	Speaker - 4" P.M. with Output Transformer
	N-7956	Coil - Loop Antenna
	N-7888	Coil - 1st, I.F.
	N-7542	Coil - 2nd, I.E.
	N-7139	Coil - Oscillator

MODELS 05FJB-6775B, 61-6775

INSTALLATION

Due to the compact size of this receiver, many mounting positions are possible. However, the most convenient is directly below the instrument panel as illustrated in figure 1. The following step by step procedure will facilitate the installation of the receiver.

1. With the receiver itself as a model, select the desired position.

2. Using the mounting bracket as a template locate the two front mounting holes and drill a ¼" hole at each point.

3. Locate the position for the rear mounting stud in the bulkhead and drill a ½" hole.

4. With the stud mounted on the receiver and the inside nut and washer in place, insert the stud through the bulkhead hole and attach the front end of the receiver to the instrument panel with the two 8-32 machine screws contained in kit of mounting hardware.

5. Open the engine compartment and remove the paint on the bulkhead around the stud. Assemble the washer and nut on this side and adjust both this nut and the inside nut for perfect alignment of the receiver and for good contact with the brightened surface of the bulkhead.

Caution: Do not screw stud in case beyond point necessary to insure support, otherwise, it may penetrate rear wall of case and cause damage to the instrument.

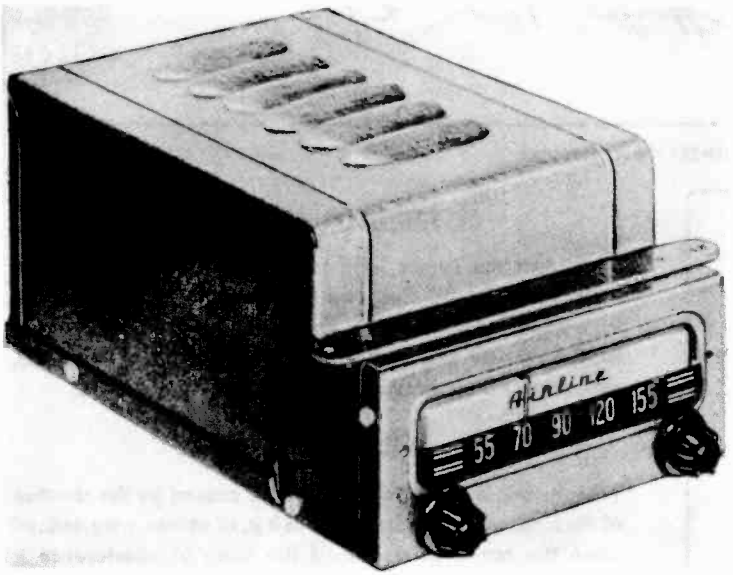
6. Attach the terminal of the "A" battery cable to one of the posts on the ammeter, preferably on the battery side. This may be ascertained by switching the receiver on. If no deflection of the ammeter occurs, the receiver is properly connected.

7. Insert plug on the end of the antenna lead into socket connector located on the left side of the radio.

ACCESSORIES FURNISHED FOR INSTALLATION

MOUNTING PARTS KIT

1 mounting stud	2 8-32 machine screws
2 ⅜-16 hex nuts	2 8-32 hex nuts
2 ⅜" I.D. washers	2 No. 8 washers
	2 No. 8 lock washers



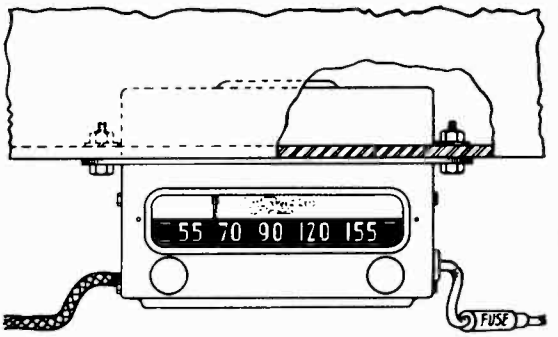
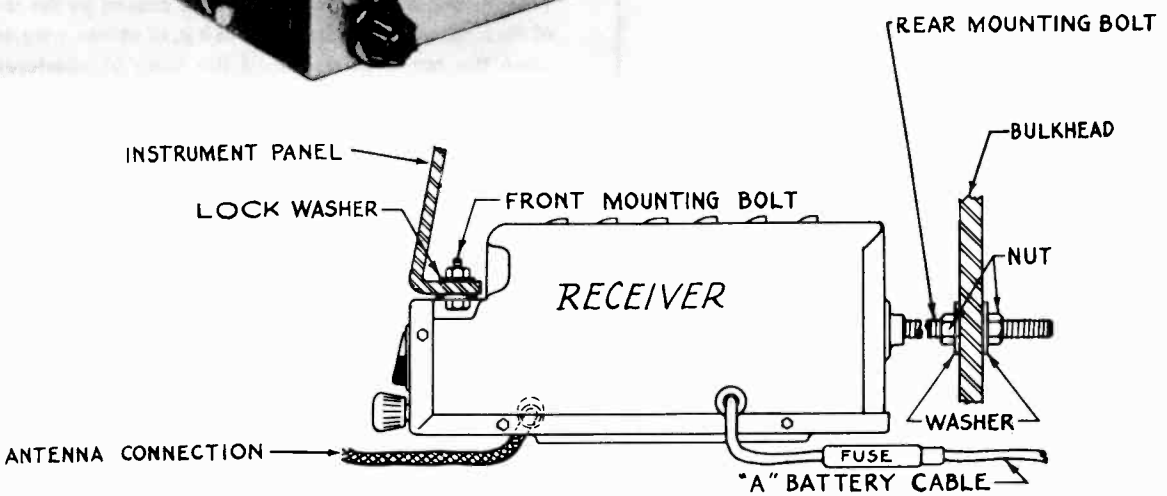


FIG. 1 RECEIVER MOUNTING DIAGRAM



MODELS 05FJB-6775B,
61-6775

MOTOR NOISE ELIMINATION

SUPPRESSION KIT

A suppression kit is shipped with this receiver. It contains the following parts:

1 Generator Condenser. 1 Distributor Suppressor.

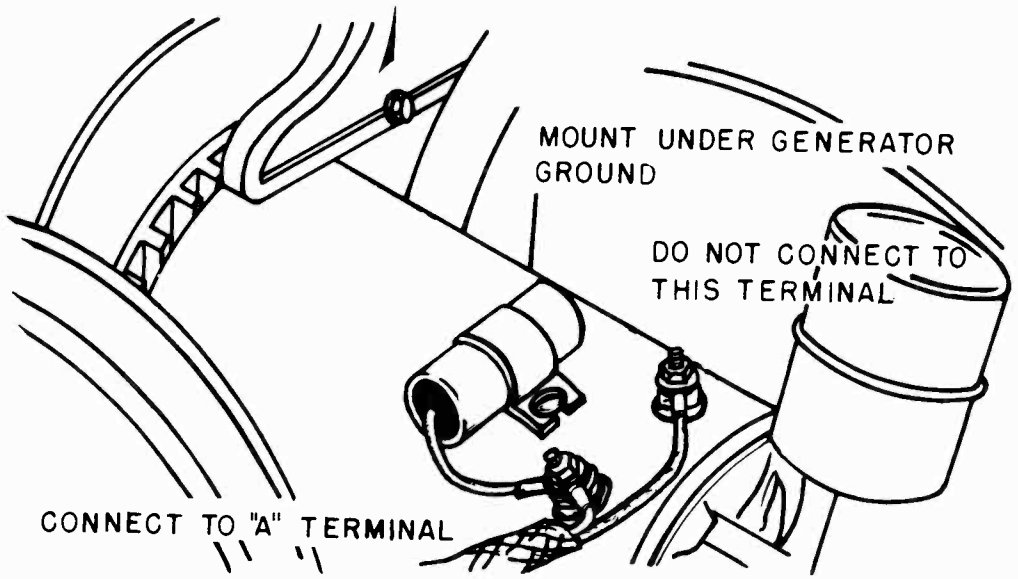


FIG. 2 GENERATOR CONDENSER

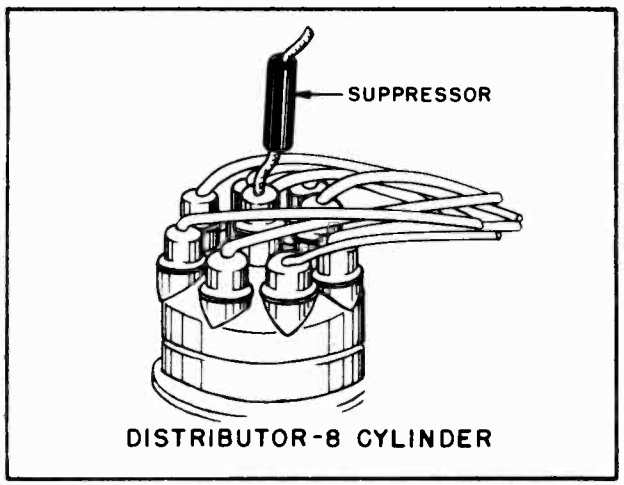


FIG. 3 DISTRIBUTOR SUPPRESSOR

GENERATOR CONDENSER

The generator condenser (Installed as shown in Figure 2) and distributor suppressor will normally eliminate all objectionable motor noise. If the motor noise persists, a .5 MFD by-pass condenser may be connected to either side of the ammeter with the ground lug fastened to a good ground nearby.

DISTRIBUTOR SUPPRESSOR

Disconnect the center lead in the distributor head of the motor (see Fig. 3). Cut lead approximately 2 inches back from metal tip end. Screw suppressor into cut end of long lead. Screw cut end of short lead into suppressor. Plug lead, with attached suppressor, back into distributor head.

WHEEL STATIC

Wheel static is a form of interference caused by the rotation of the front wheels of the car, and it is, of course, only noticed when the car is in motion. If this form of interference is present, it can be eliminated by installing wheel static collector springs between the inner hub cap and the spindle shaft.

ELECTRICAL ACCESSORIES

In some cases, it may be found that car accessories such as electric heaters, lighters, automatic relays or gauges, may cause interference while in operation. Proper procedure in such cases is to connect a .5 MFD by-pass condenser from ground to the suspected accessory until the source of interference is found. The condenser then should be permanently mounted in this location.

MODELS 05FJB-6775B,
61-6775

SERVICE DATA

ELECTRICAL SPECIFICATIONS

Power Supply .....6.3 Volts DC.
Current .....5.5 Amp. Average
Frequency Range .....538-1600 KC.
Speaker .....5" PM 3.2 Ohm V. C.
Power Output .....1.5 watts, undistorted
2 watts, maximum

This receiver contains the following:

1 — 6BE6 — Converter
1 — 6BA6 — I. F. Amplifier
1 — 6AT6 — Detector — AVC — 1st Audio
1 — 6AS5 — Power Output
1 — 6X4 — Rectifier

SERVICE NOTES

Voltage taken from the different points of the circuit to the chassis are measured with volume control in maximum position, all tubes in their sockets, no signal applied, and with a volt meter having a resistance of 20,000 Ohms per volt. These voltages are clearly shown on the voltage chart.

All voltages should be measured with an input voltage of 6.3 volts DC.

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

ALIGNING INSTRUCTION

Never attempt any adjustments on this receiver unless it becomes necessary to replace a coil or transformer, or the adjustments have been tampered with in the field. Always make certain that other circuit components, such as tubes, condensers, resistors, etc., are normal before proceeding with realignment.

If realignment is necessary follow the instructions given under the heading "Alignment Procedure." After realignment has been completed repeat the procedure as final check.

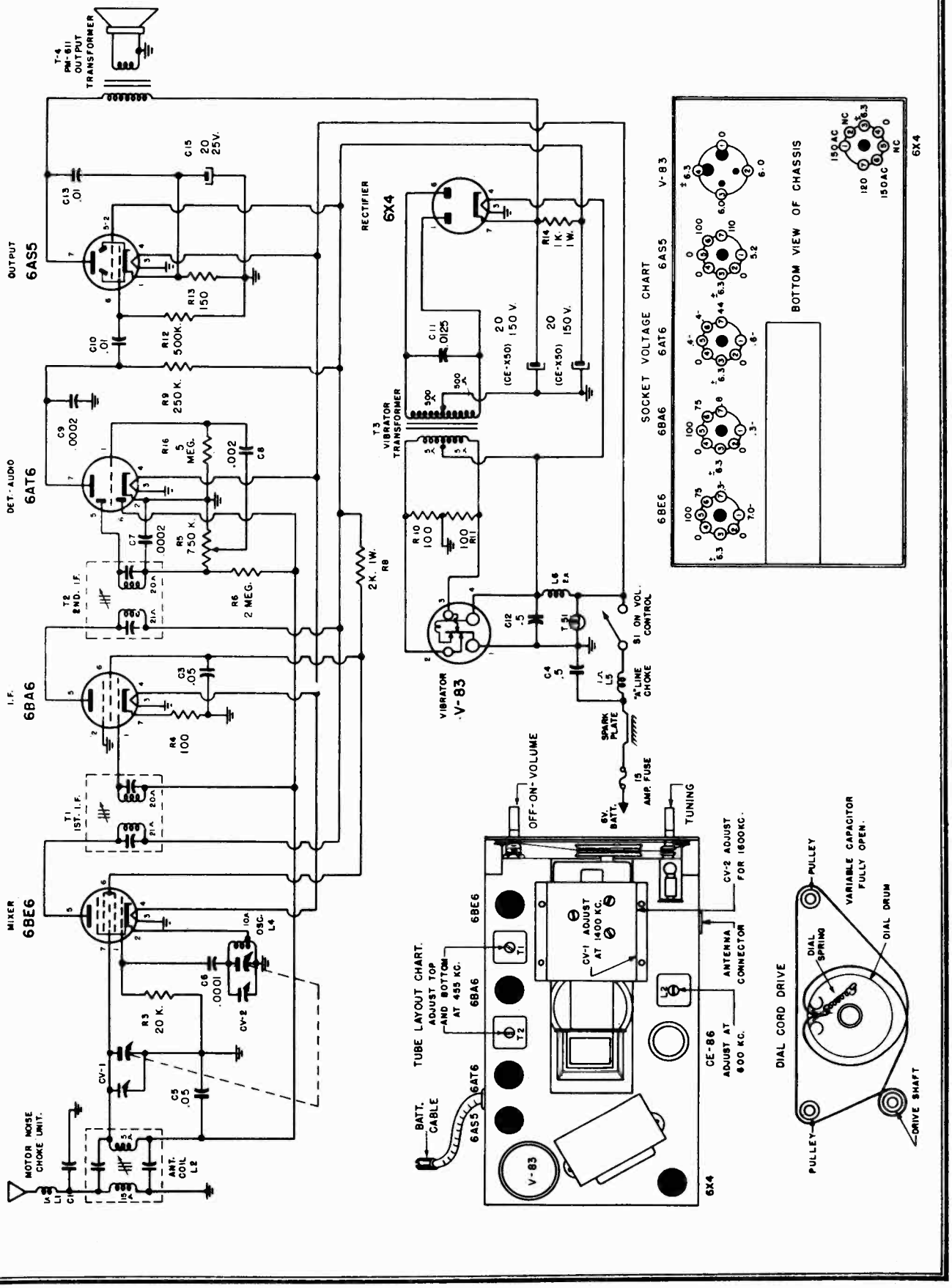
ALIGNMENT PROCEDURE

Volume control — Maximum, all adjustments.
No signal applied to antenna.
Power input — 6.3 volts.
Connect dummy antenna in series with output lead of signal generator.
Connect ground lead of signal generator to chassis.
Repeat alignment procedure as a final check.

The following equipment is necessary for proper alignment:
Signal generator that will provide the test frequencies as listed, modulated 400 cycles, 30%.
Non-metallic screwdriver.
Output meter. (1.8 volt for 1 watt output.)
Dummy antennas — .1 MFD., 100 MMFD.
For alignment points refer to Schematic Diagram.

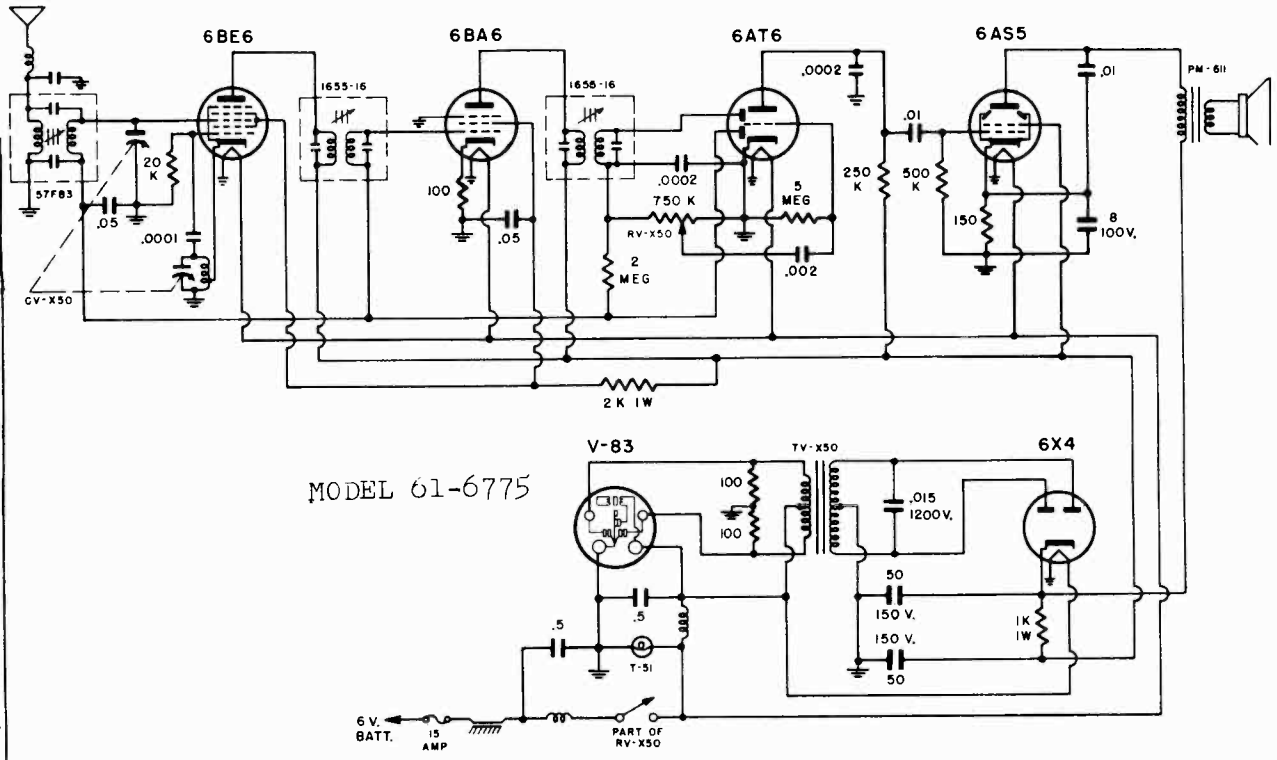
DIAL SETTING	GENERATOR FREQUENCY	DUMMY ANT.	GENERATOR CONNECTION	TRIMMER REFERENCE	TRIMMER ADJUSTMENT	TRIMMER FUNCTION
1) Fully open	455 KC	.1 MFD	6BE6 Grid	T2 Top & bottom	Maximum	Output I.F.
2) Fully open	455 KC	.1 MFD	6BE6 Grid	T1 Top & bottom	Maximum	Input I.F.
3) Fully open	1600 KC	100 MMFD	Ant. lead	CV2	Maximum	Oscillator
4) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV1	Maximum	Antenna
5) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L2	Maximum	Antenna
6) Repeat steps 4 and 5						

MODEL 05FJB-6775B



REPLACEMENT PARTS LIST

SCHEMATIC DIAGRAM REF. NO.	PART NO.	DESCRIPTION
		CONDENSERS
C3, C5	C207	.05 MFD 200 volt condenser
C4, C12	C209	.5 MFD 100 volt condenser
C6	CC200	100 MMFD ceramic condenser
C7, C9	CC201	200 MMFD ceramic condenser
C8	C203	.002 MFD 400 volt condenser
C10, C13	C206	.01 MFD 600 volt condenser
C11	C220	.0125 MFD 1200 volt condenser
C15	CE-X50	20 MFD 150 volt electrolytic condenser 20 MFD 150 volt electrolytic condenser 20 MFD 25 volt electrolytic condenser
		RESISTORS
R3	R306	20K ohm ½ watt 20% resistor
R4, R10, R11	R301	100 ohm ½ watt 20% resistor
R5	RV-X50	Volume control ¾ megohm with switch
R6	R310	2 megohm ½ watt 20% resistor
R8	R326	2K ohm 1 watt 20% resistor
R9	R307	250K ohm ½ watt 20% resistor
R12	R308	500K ohm ½ watt 20% resistor
R13	R327	150 ohm ½ watt 20% resistor
R14	R312	1K ohm 1 watt 20% resistor
		COILS AND TRANSFORMERS
L1-C1	L200	Motor noise elimination Unit
L2	57FB-3	Antenna Coil
L4	L201	R.F. Oscillator coil
L5	L203	Choke "A" line
L6	L202	Choke, vibrator hash



MODEL 61-6775

T1	1655-16	1st IF transformer
T2	1655-16	2nd IF transformer
T3	TV-X50	Vibrator transformer
T4		Output transformer (Part of speaker, not furnished separately)

DIAL PARTS

H201	Grommet, rubber drive
T51	Pilot light
H202	Pilot light socket
H203	Pulley, idler
H204	Spring, Dial drive string tension
H531	String, Dial drive
DP 530	Dial Pan
PS 800	Dial Pointer

DS 540	Drive shaft assembly
S556	Dial scale window
H508	Knob
F555	Felt washers (for knobs)

MISCELLANEOUS

A300	"A" lead assembly
A201	Fuse 15 Amp.
V83	Vibrator
H207	Clip, case anti-rattle
H208	Clip, coil mounting
PM611	Speaker 5" (includes output transformer)
H212	Receptacle, Antenna cable
GC607	Speaker Grill cloth
H601	Case bottom
H602	Case cover

MODELS 05FJB-6775B, 61-6775

MODELS 05FJB-6776B,
61-6776

INSTALLATION

Due to the compact size of this receiver, many mounting positions are possible. However, the most convenient is directly below the instrument panel as illustrated in figure 1. The following step by step procedure will facilitate the installation of the receiver.

1. With the receiver itself as a model, select the desired position.

2. Using the front mounting bracket as a template locate the two front mounting holes and a ¼" hole at each point.

3. Attach front mounting bracket to the receiver by two No. 6 self-tapping screws.

4. Locate the position for the rear mounting stud in the bulkhead and drill a ½" hole.

5. With the stud mounted on the receiver and the inside nut and washer in place, insert the stud through the bulkhead hole and attach the front end of the receiver to the instrument panel with two 8-32 machine screws contained in kit of mounting hardware.

6. Open the engine compartment and remove the paint on the bulkhead around the stud. Assemble the washer and nut on this side and adjust both this nut and the inside nut for perfect alignment of the receiver and for good contact with the brightened surface of the bulkhead.
Caution: Do not screw stud in case beyond point necessary to insure support, otherwise, it may penetrate rear wall of case and cause damage to the instrument.

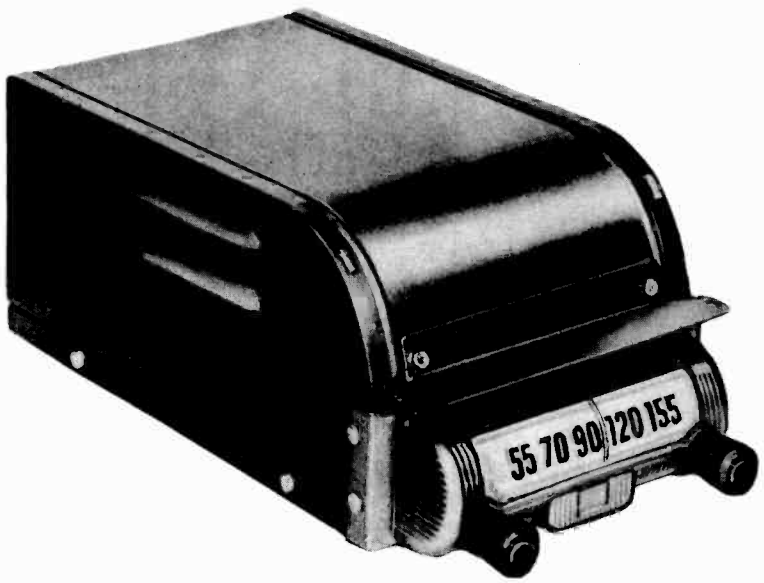
7. Attach the terminal of the "A" battery cable to one of the posts on the ammeter, preferably on the battery side. This may be ascertained by switching the receiver on. If no deflection of the ammeter occurs, the receiver is properly connected.

8. Insert plug on the end of the antenna lead into socket connector located on the left side of the radio.

ACCESSORIES FURNISHED FOR INSTALLATION

MOUNTING PARTS KIT

1 mounting stud
2 ⅜-16 hex nuts
2 ⅜" I.D. washers
2 8-32 machine screws
2 8-32 hex nuts
2 No. 8 washers
2 No. 8 lock washers



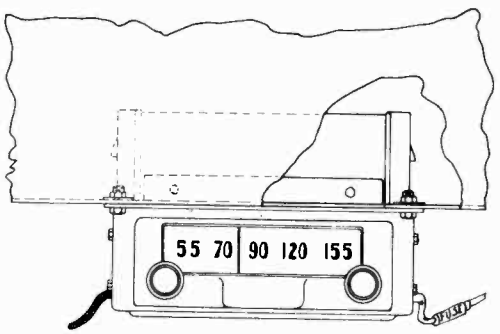
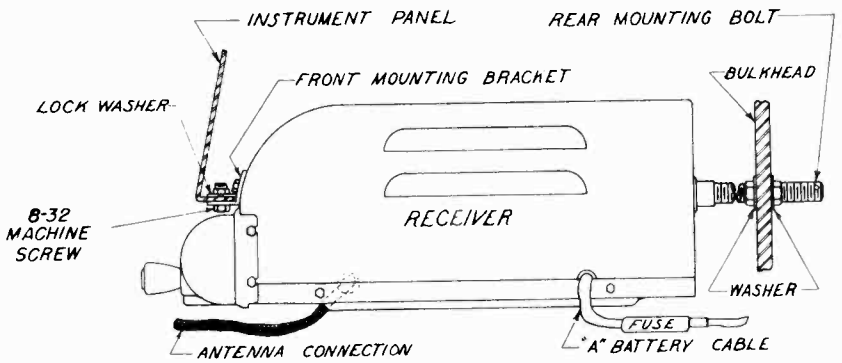


FIG. 1 DETAIL MOUNTING ASSEMBLY



MODELS 05FJB-6776B, 61-6776

MOTOR NOISE ELIMINATION

SUPPRESSION KIT

1 .5 MFD Generator Condenser 1 Distributor Suppressor

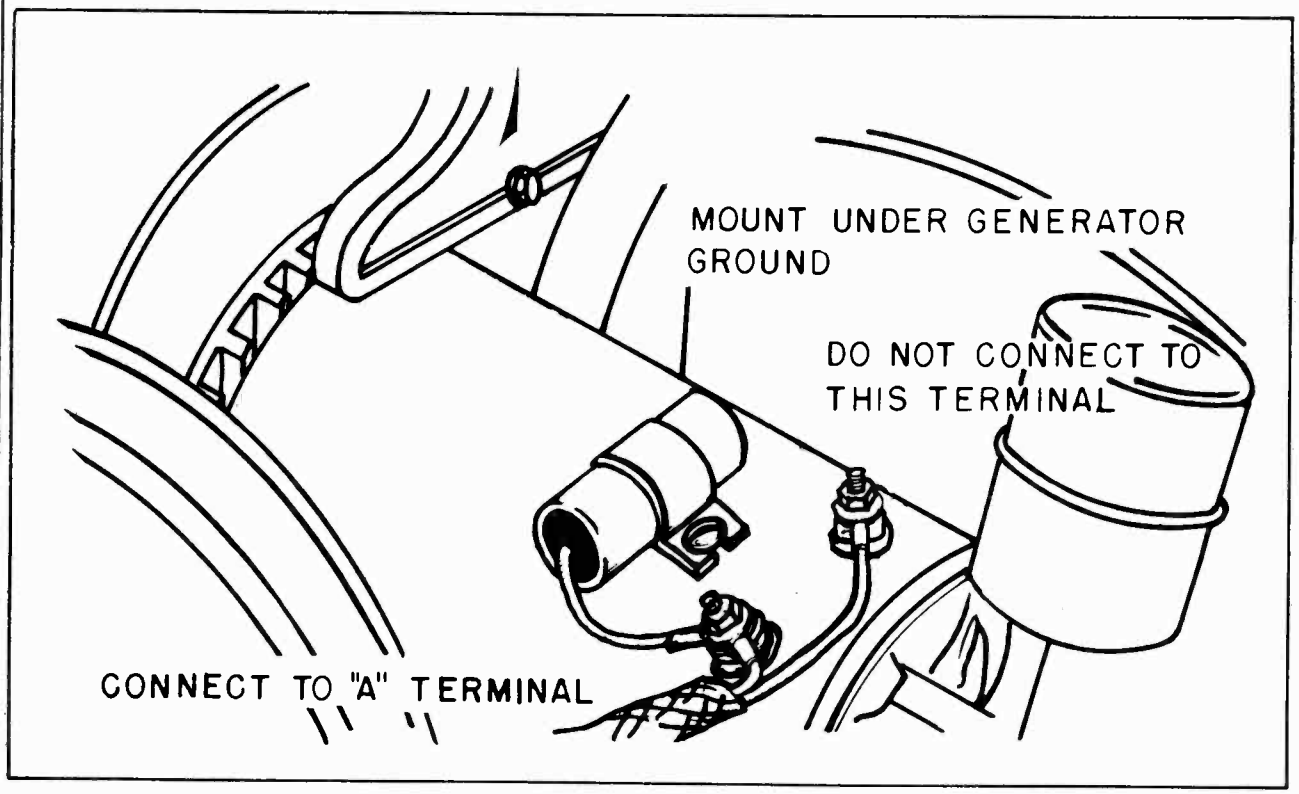


FIG. 2 GENERATOR CONDENSER

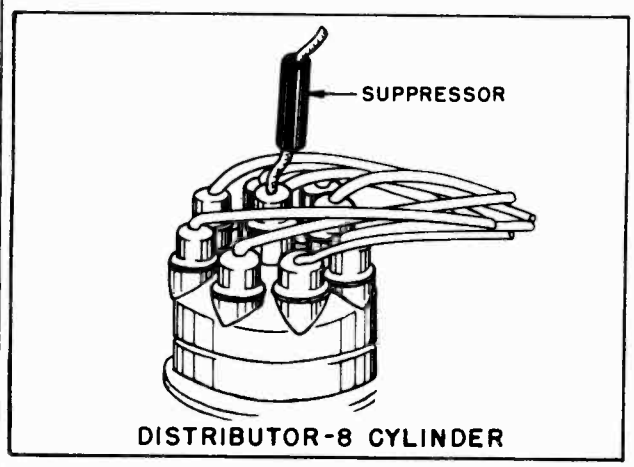


FIG. 3 DISTRIBUTOR SUPPRESSOR

GENERATOR CONDENSER

The generator condenser (Installed as shown in Figure 2) and distributor suppressor will normally eliminate all objectionable motor noise. If the motor noise persists, a .5 MFD by-pass condenser may be connected to either side of the ammeter with the ground lug fastened to a good ground nearby.

DISTRIBUTOR SUPPRESSOR

Disconnect the center lead in the distributor head of the motor (see Fig. 3). Cut lead approximately 2 inches back from metal tip end. Screw suppressor into cut end of long lead. Screw cut end of short lead into suppressor. Plug lead, with attached suppressor, back into distributor head.

WHEEL STATIC

Wheel static is a form of interference caused by the rotation of the front wheels of the car, and it is, of course, only noticed when the car is in motion. If this form of interference is present, it can be eliminated by installing wheel static collector springs between the inner hub cap and the spindle shaft.

ELECTRICAL ACCESSORIES

In some cases, it may be found that car accessories such as electric heaters, lighters, automatic relays or gauges, may cause interference while in operation. Proper procedure in such cases is to connect a .5 MFD by-pass condenser from ground to the suspected accessory until the source of interference is found. The condenser then should be permanently mounted in this location.

MODELS 05FJB-6776B,
61-6776

SERVICE DATA

ELECTRICAL SPECIFICATIONS

Power Supply ..... 6.3 Volts DC
Current ..... 5.5 Amp. average
Frequency Range ..... 538-1600 KC
Speaker ..... 5" PM 3.2. Ohm. V.C.
Power Output ..... 2 watts, undistorted
3 watts, maximum
Sensitivity ..... 2-3 microvolts average for 1 watt output
Selectivity .. 40 KC broad at 1000 times signal, at 1000 KC

This receiver contains the following:

1 — 6BA6 — RF Amplifier
1 — 6BE6 — Converter
1 — 6BA6 — I. F. Amplifier
1 — 6AT6 — Detector — AVC — 1st Audio
1 — 6AQ5 — Power Output
1 — 6X4 — Rectifier

SERVICE NOTES

Voltage taken from the different points of the circuit to the chassis are measured with volume control in maximum position, all tubes in their sockets, no signal applied, and with a volt meter having a resistance of 20,000 Ohms per volt. These voltages are clearly shown on the voltage chart.

All voltages should be measured with an input voltage of 6.3 volts DC.

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

ALIGNING INSTRUCTION

Never attempt any adjustments on this receiver unless it becomes necessary to replace a coil or transformer, or the adjustments have been tampered with in the field. Always make certain that other circuit components, such as tubes, condensers, resistors, etc., are normal before proceeding with realignment.

If realignment is necessary follow the instructions given under the heading "Alignment Procedure." After realignment has been completed repeat the procedure as final check.

ALIGNMENT PROCEDURE

Volume control — Maximum, all adjustments.
No signal applied to antenna.
Power input — 6.3 volts.
Connect dummy antenna in series with output lead of signal generator.
Connect ground lead of signal generator to chassis.
Repeat alignment procedure as a final check.

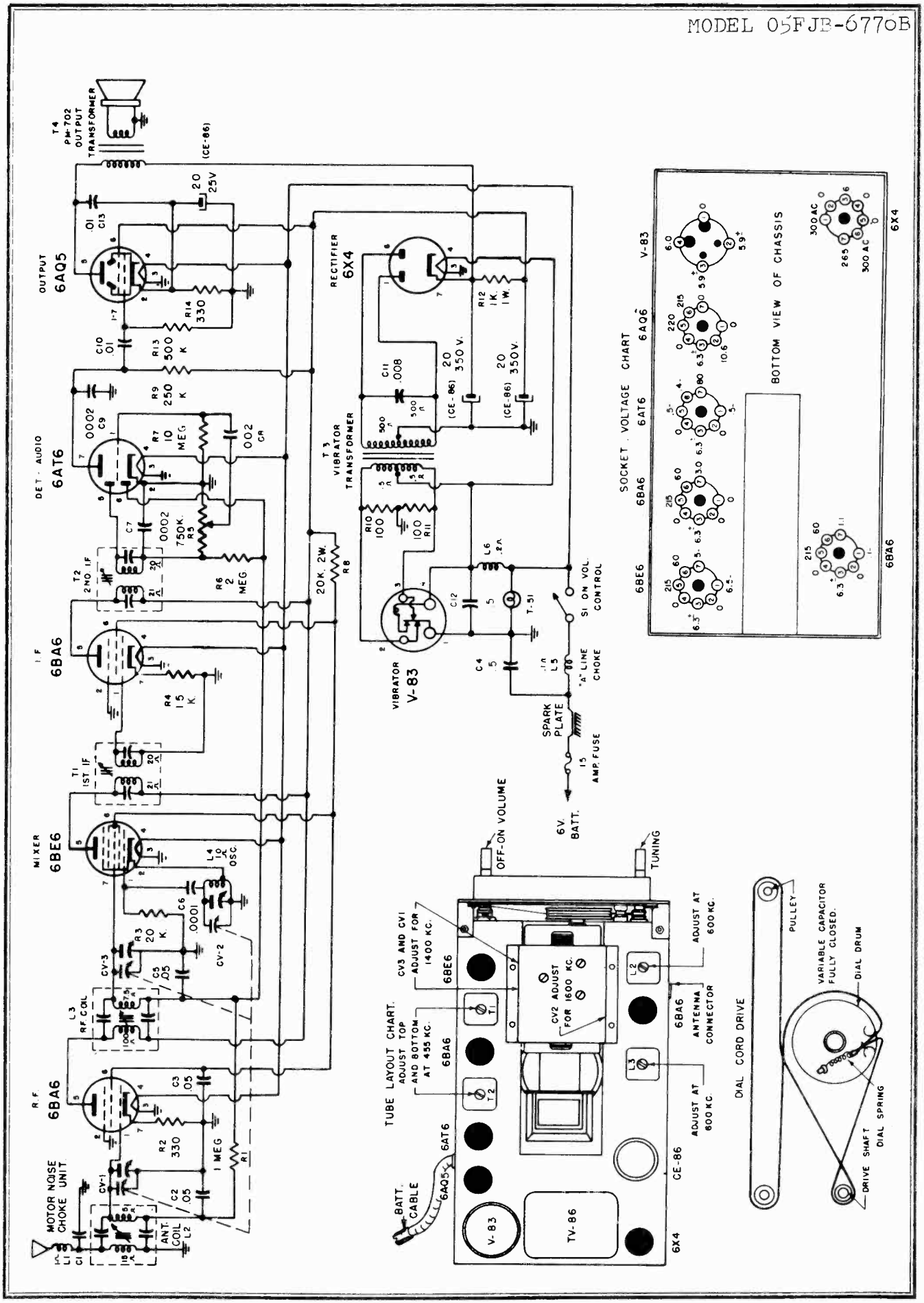
The following equipment is necessary for proper alignment:

Signal generator that will provide the test frequencies as listed, modulated 400 cycles, 30%.
Non-metallic screwdriver.
Output meter. (1.8 volt for 1 watt output.)
Dummy antennas — .1 MFD., 100 MMFD.

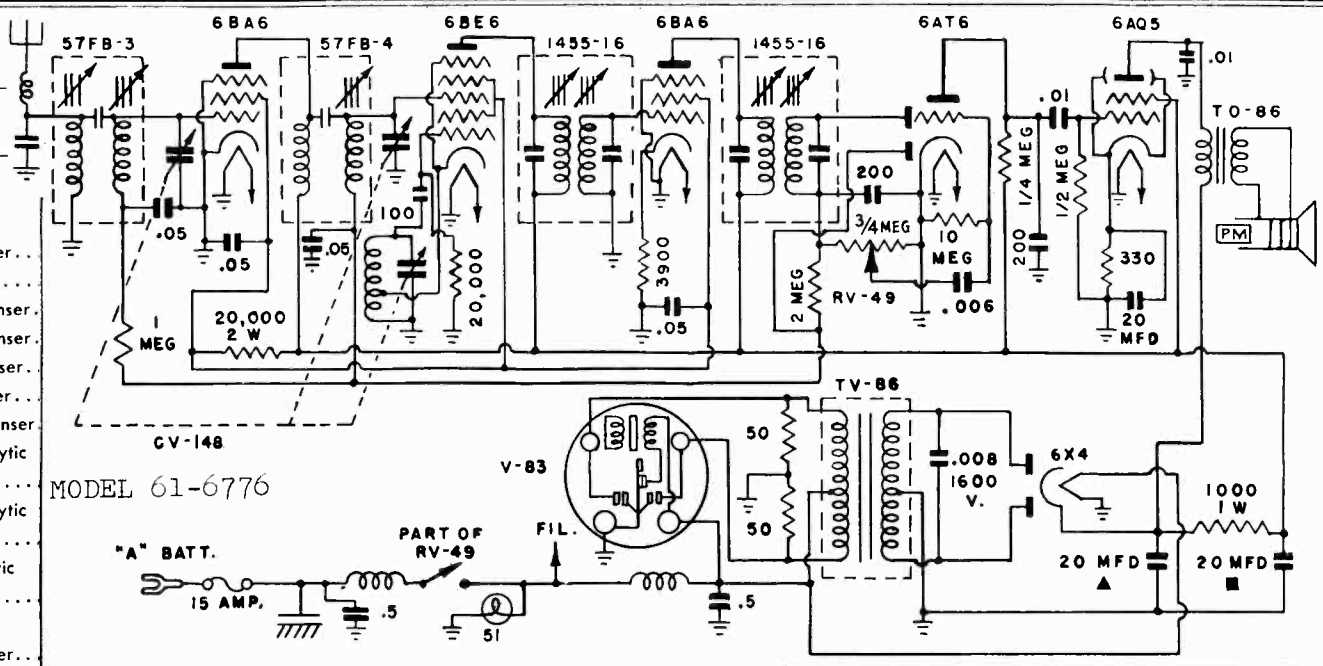
For alignment points refer to Schematic Diagram.

DIAL SETTING	GENERATOR FREQUENCY	DUMMY ANT.	GENERATOR CONNECTION	TRIMMER REFERENCE	TRIMMER ADJUSTMENT	TRIMMER FUNCTION
1) Fully open	455 KC	.1 MFD	6BE6 Grid	T2 Top & bottom	Maximum	Output I.F.
2) Fully open	455 KC	.1 MFD	6BE6 Grid	T1 Top & bottom	Maximum	Input I.F.
3) Fully open	1600 KC	100 MMFD	Ant. lead	CV2	Maximum	Oscillator
4) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV3	Maximum	RF Stage
5) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV1	Maximum	Antenna
6) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L3	Maximum	RF Stage
7) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L2	Maximum	Antenna
8) Repeat steps 4 and 5						

MODEL 05FJB-6770B



REPLACEMENT PARTS LIST



SCHEMATIC DIAGRAM REFERENCE	PART NO.	DESCRIPTION
CONDENSERS		
C2, C3, C5	C207	.05 MFD 200 volt condenser
C4, C12	C209	.5 MFD 100 volt condenser
C6	CC200	100 MMFD ceramic condenser
C7, C9	CC201	200 MMFD ceramic condenser
C8	C203	.002 MFD 400 volt condenser
C10, C13	C206	.01 MFD 600 volt condenser
C11	C205	.008 MFD 1600 volt condenser
CE-86	CE-86	20 MFD 350 volt electrolytic condenser 20 MFD 350 volt electrolytic condenser 20 MFD 25 volt electrolytic condenser
CV1, CV2, CV3	CV-148	3 section variable condenser
RESISTORS		
R1	R-309	1 megohm ½ watt 20% resistor
R2, R14	R-303	330 ohm ½ watt 20% resistor
R3	R-306	20K ohm ½ watt 20% resistor
R4	R-314	1.5K ohm ½ watt 20% resistor
R5	RV-57	Volume control ¾ megohm with switch
R6	R-310	2 megohm ½ watt 20% resistor
R7	R-311	10 megohm ½ watt 20% resistor
R8	R-313	20K ohm 2 watt 20% resistor
R9	R-307	250K ohm ½ watt 20% resistor
R10, R11	R-301	100 ohm ½ watt 20% resistor
R12	R-312	1k ohm 1 watt 20% resistor
COILS AND TRANSFORMERS		
L1-C1	L-200	Motor Noise elimination unit
L2	57FB-3	Antenna Coil
L3	57FB-4	R.F. Coil
L4	L-201	R.F. Oscillator Coil
L5	L-203	Choke "A" Line
L6	L-202	Choke, vibrator hash
T1	1655-16	1st I.F. Transformer
T2	1655-16	2nd I.F. Transformer
T3	TV86 or TV86A	Vibrator Transformer
T4		Output transformer (Part of speaker not furnished separately)

PART NO.	DESCRIPTION
DIAL PARTS	
H201	Grommet, rubber drive
T51	Pilot light
H202	Pilot light socket
H203	Pulley, idler
H204	Spring, Dial drive string tension
H503	String, Dial drive
DP505	Dial Pan

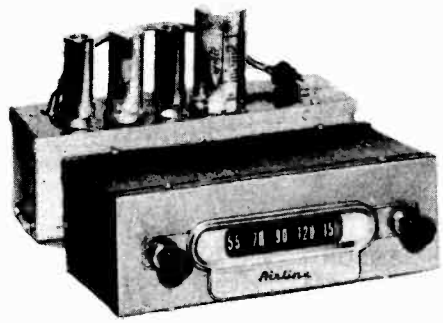
ELECTROLYTIC CONDENSER CE-86
■ 20 MFD 350 VDC
▲ 20 MFD 350 VDC
20 MFD 25 VDC

I.F. 455 KC
RANGE 538 TO 1600 KC

ISSUE 1247

PS 1024	Dial Pointer
DS -500	Drive shaft assembly
	Plastic Dial Scale front
H508	Knob
MISCELLANEOUS	
A300	"A" lead assembly
A201	Fuse 15 Amp.
V-83	Vibrator
H-207	Clip, case anti-rattle
H-208	Clip, coil mounting
H-501	Case bottom
H-502	Case cover
PM-702-A	Speaker 5" (includes output transformer)
H-212	Receptacle, Antenna Cable
GC-507	Speaker Grill Cloth and cardboard baffle

MODELS 05FJB-6777B,
61-6777, Ford, 1949-1950



INSTALLATION

1. Remove two speed nuts securing radio opening cover plate to instrument panel.
2. Remove cover plate.
3. Place speaker and power pack unit over four threaded stud bolts located on the underside of the instrument panel. (Position power pack unit so that power cable is located on the left hand side.) See Fig. 1.
4. Secure power pack into position with four 8-32 nuts and washers supplied in kit of mounting hardware.
5. Remove knobs, cup washers and hex mounting nuts from tuning units. *Do not* remove escutcheon.
6. Place tuning unit behind instrument panel so that mounting bushings and shafts protrude through the front panel.
7. Attach tuning unit with a hex nut on each mounting bushing.
8. Replace cup washers, grommets and knobs over shafts.
9. Secure a supporting bracket (2 supplied in kit of hardware) to each side of the power pack unit by means of two No. 8 self-tapping screws. Use end of supporting bracket with round hole. If more convenient, these brackets may be attached before power pack unit is positioned in place.
10. Swing supporting brackets so that slotted holes are in line with the holes on each side of the tuning unit.
11. Secure to tuning unit with two No. 8 self-tapping screws.
12. Insert power cable plug into socket on rear of tuning unit.
13. Plug antenna cable into tuning unit.
14. Secure power cable under cable clamp and tighten clamp screw.
15. Connect "A" lead to accessory terminal marked RAD. GA, on the ignition switch.

ACCESSORIES FURNISHED FOR INSTALLATION

MOUNTING PARTS KIT

The following mounting hardware parts are shipped attached to the receiver. (See detail assembly drawing Fig. 1).

- 2 7/16-28 hex nuts
- 2 Cup washers
- 2 Grommets
- 2 Knobs
- 1 Cable clamp

An envelope containing additional mounting hardware is supplied with this receiver. It contains the following parts:

- 2 Supporting brackets
- 4 No. 8 self-tapping screws
- 4 8-32 nuts
- 4 No. 8 washers

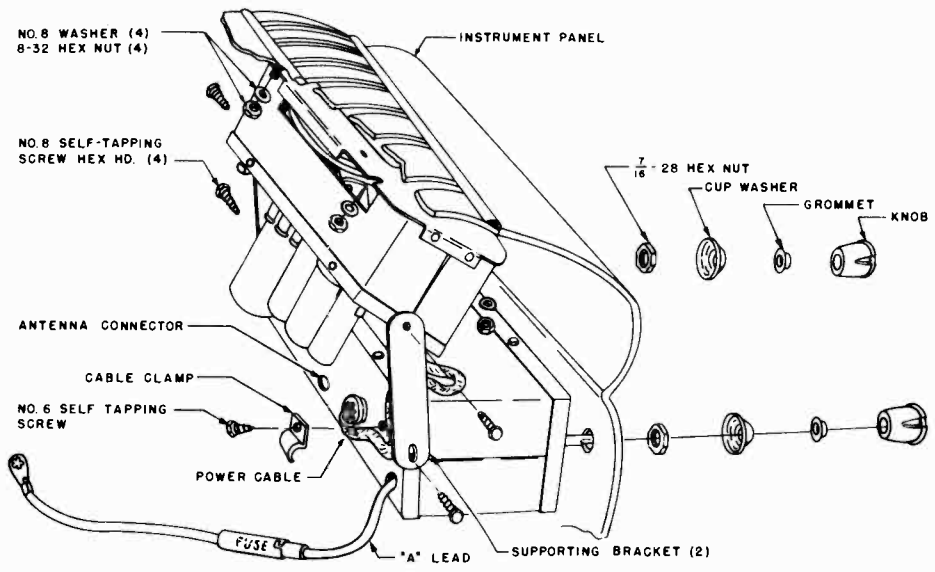
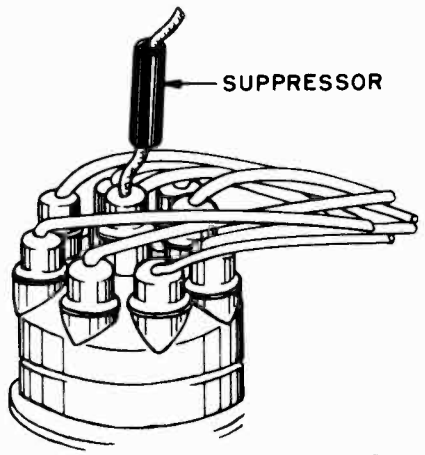


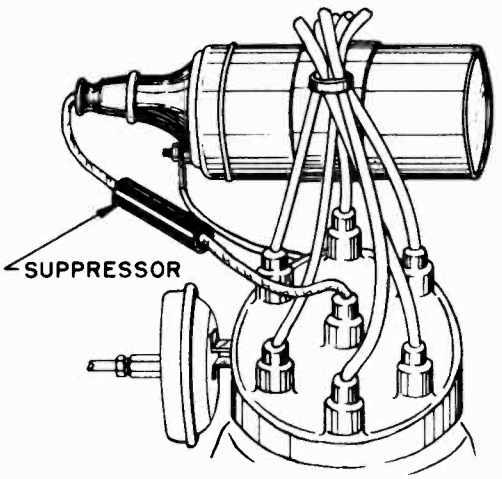
FIG. 1 DETAIL MOUNTING ASSEMBLY

MODELS 05FJB-6777B,
61-6777, Ford, 1949-1950

MOTOR NOISE ELIMINATION



DISTRIBUTOR-8 CYLINDER



DISTRIBUTOR-6 CYLINDER

FIG. 2 DISTRIBUTOR SUPPRESSOR

SUPPRESSION KIT

A suppression kit is shipped with this receiver. It contains the following parts:

1 Generator Condenser

1 Distributor suppressor

DISTRIBUTOR SUPPRESSOR

Disconnect high tension wire that runs from the ignition coil to the center hole of the distributor head. Cut lead one and one-half inches back from metal tip end for 8 cylinder Ford or two and one-half inches back for 6 cylinder Ford. Screw suppressor into cut end of long lead. Screw cut end of short lead into suppressor. Plug lead with attached suppressor, back into distributor head.

GENERATOR CONDENSER

Loosen the top assembly bolt from the rear end plate of the generator. DO NOT REMOVE. Mount .5MFD generator condenser under this bolt. Tighten bolt and connect condenser lead to the armature terminal of the generator.

The generator condenser and distributor suppressor should eliminate all objectionable motor noise in most cases. If the motor noise persists the following steps should be taken. Check operation of radio as each step is made.

WHEEL STATIC

Wheel static is a form of interference caused by the rotation of the front wheels of the car, and it is, of course, only noticed when the car is in motion. If this form of interference is present, it can be eliminated by installing wheel static collector springs between the inner hub cap and the spindle shaft.

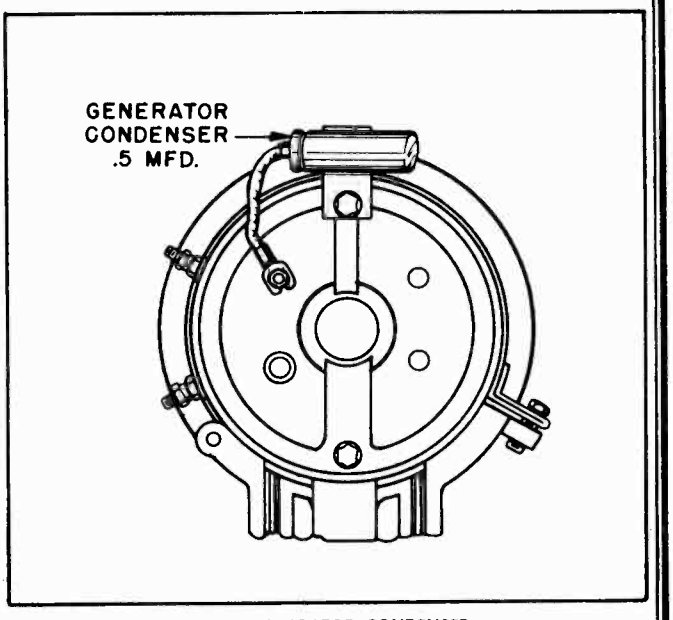


FIG. 3 GENERATOR CONDENSER

AMMETER CONDENSER

A .5 MFD by-pass condenser should be connected to either side of the ammeter with the ground lug fastened to a good ground nearby.

ELECTRICAL ACCESSORIES

In some cases, it may be found that car accessories such as electric heaters, lighters, automatic relays or gauges, may cause interference while in operation. Proper procedure in such cases is to connect a .5 MFD by-pass condenser from ground to the suspected accessory until the source of interference is found. The condenser then should be permanently mounted in this location.

MODELS 05FJB-6777B,
61-6777, Ford, 1949-1950

SERVICE DATA

ELECTRICAL SPECIFICATIONS

Power Supply .....6.3 Volts DC
Current .....5.5 Amp. average
Frequency Range .....538-1600 KC
Speaker .....5¼" PM 3.2 Ohm V.C.
Power Output .....2 watts, undistorted
3 watts, maximum
Sensitivity ..... 2-3 microvolts average for 1 watt output
Selectivity .. 40 KC broad at 1000 times signal, at 1000 KC
This receiver contains the following:
1 — 6BA6 — RF Amplifier
1 — 6BE6 — Converter
1 — 6BA6— I. F. Amplifier
1 — 6AT6 — Detector — AVC — 1st Audio
1 — 6AQ5 — Power Output
1 — 6X4 — Rectifier

SERVICE NOTES

Voltage taken from the different points of the circuit to the chassis are measured with volume control in maximum position, all tubes in their sockets, no signal applied, and with a volt meter having a resistance of 20,000 Ohms per volt. These voltages are clearly shown on the voltage chart.

All voltages should be measured with an input voltage of 6.3 volts DC.

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

ALIGNING INSTRUCTION

Never attempt any adjustments on this receiver unless it becomes necessary to replace a coil or transformer, or the adjustments have been tampered with in the field. Always make certain that other circuit components, such as tubes, condensers, resistors, etc., are normal before proceeding with realignment.

If realignment is necessary follow the instructions given under the heading "Alignment Procedure." After realignment has been completed repeat the procedure as final check.

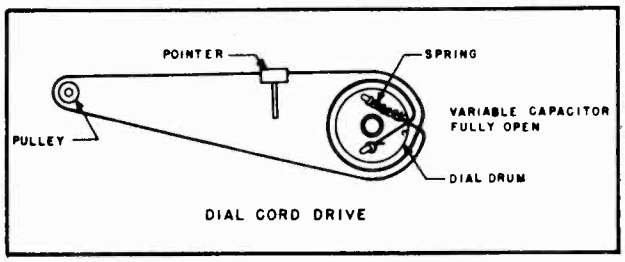


FIG. 4 DIAL CORD DRIVE

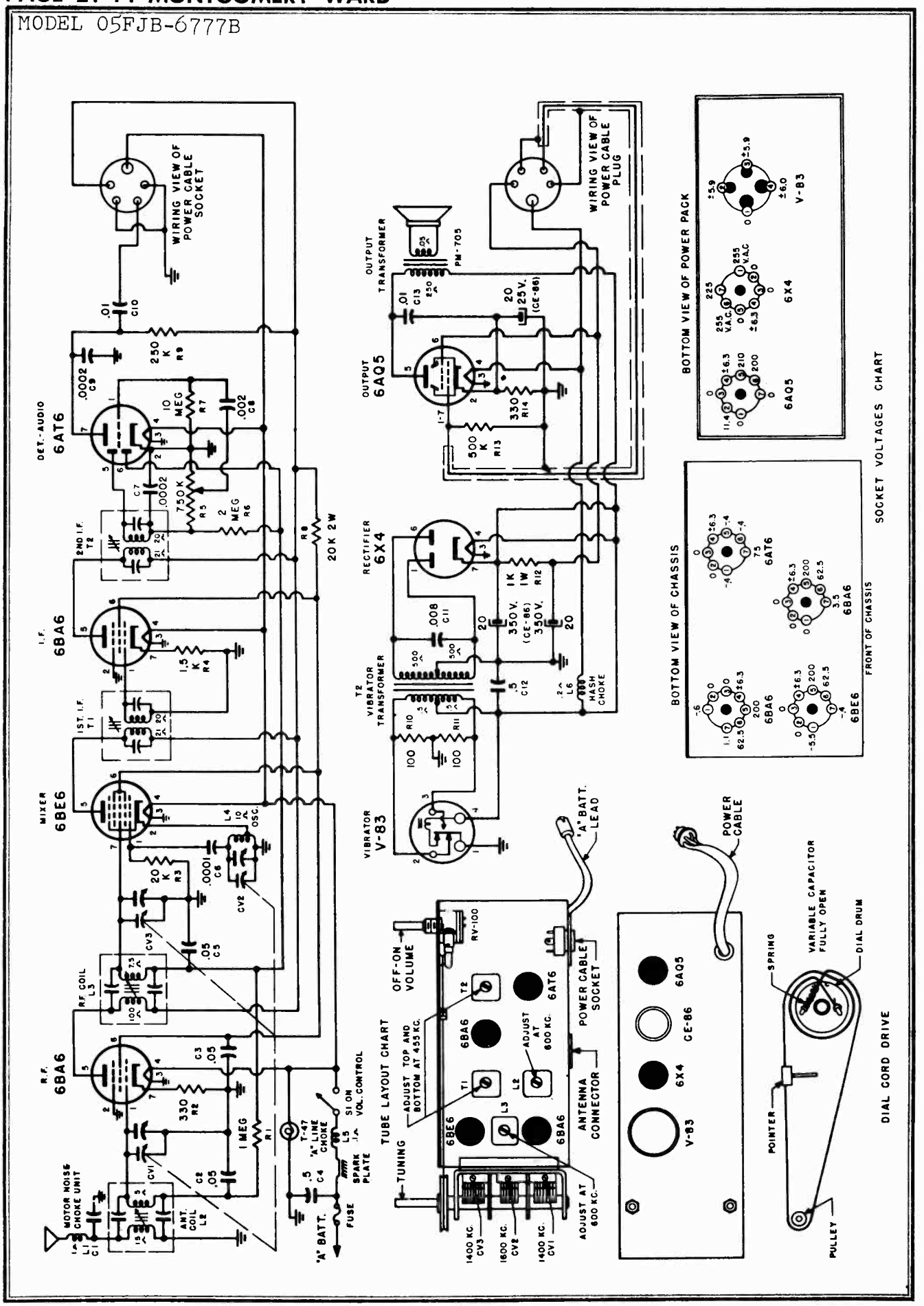
ALIGNMENT PROCEDURE

Volume control — Maximum all adjustments.
No signal applied to antenna.
Power input — 6.3 volts.
Connect dummy antenna in series with output lead of signal generator.
Connect ground lead of signal generator to chassis.
Repeat alignment procedure as a final check.

The following equipment is necessary for proper alignment:
Signal generator that will provide the test frequencies as listed, modulated 400 cycles, 30%.
Non-metallic screwdriver.
Output meter. (1.8 volt for 1 watt output.)
Dummy antennas — .1 MFD., 100 MMFD.
For alignment points refer to Schematic Diagram.

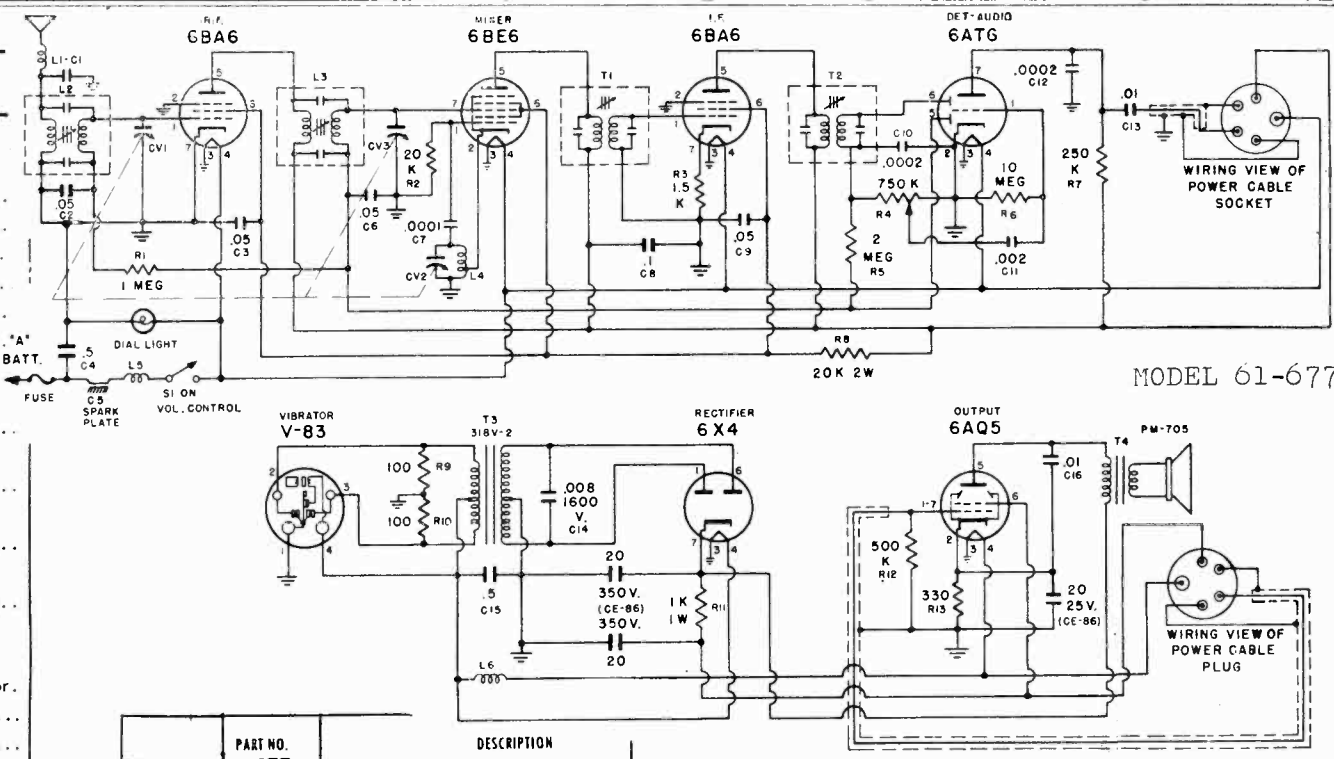
DIAL SETTING	GENERATOR FREQUENCY	DUMMY ANT.	GENERATOR CONNECTION	TRIMMER REFERENCE	TRIMMER ADJUSTMENT	TRIMMER FUNCTION
1) Fully open	455 KC	.1 MFD	6BE6 Grid	T2 Top & bottom	Maximum	Output I.F.
2) Fully open	455 KC	.1 MFD	6BE6 Grid	T1 Top & bottom	Maximum	Input I.F.
3) Fully open	1600 KC	100 MMFD	Ant. lead	CV2	Maximum	Oscillator
4) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV3	Maximum	RF Stage
5) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV1	Maximum	Antenna
6) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L3	Maximum	RF Stage
7) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L2	Maximum	Antenna
8) Repeat steps 4 and 5						

MODEL 05FJB-6777B



REPLACEMENT PARTS LIST

SCHEMATIC DIAGRAM REF. NO.	PART NO.	DESCRIPTION
CONDENSERS		
C2, C3, C5	C207	.05 MFD 200 volt condenser
C4, C12	C209	.5 MFD 100 volt condenser
C6	CC200	100 MMFD ceramic condenser
C7, C9	CC201	200 MMFD ceramic condenser
C8	C203	.002 MFD 400 volt condenser
C10, C13	C206	.01 MFD 400 volt condenser
C11	C205	.008 MFD 1600 volt condenser
CE-86	CE-86	20 MFD 350 volt electrolytic condenser 20 MFD 350 volt electrolytic condenser 20 MFD 25 volt electrolytic condenser
CV1-CV2-CV3	CV-100A	3 section variable
RESISTORS		
R1	R309	1 megohm ½ watt 20% resistor
R2, R14	R303	330 ohm ½ watt 20% resistor
R3	R306	20K ohm ½ watt 20% resistor
R4	R314	1.5K ohm ½ watt 20% resistor
R5	RV-100	Volume control ¾ megohm with switch
R6	R310	2 megohm ½ watt 20% resistor
R7	R311	10 megohm ½ watt 20% resistor
R8	R313	20K ohm 2 watt 20% resistor
R9	R307	250K ohm ½ watt 20% resistor
R10, R11	R301	100 ohm ½ watt 20% resistor
R12	R312	1K ohm 1 watt 20% resistor
R13	R308	500K ohm ½ watt 20% resistor
COILS AND TRANSFORMERS		
L1-C1	L200	Motor noise elimination unit
L2	15053 or 57FB-3	Antenna coil
L3	15054 or 57FB-4	R.F. coil
L4	L201	R. F. oscillator coil
L5	L203	Choke "A" line
L6	L202	Choke, vibrator hash



MODEL 61-6777

	PART NO.	DESCRIPTION
T2	14977 or 1655-16	2nd IF transformer
T1	14977 or 1655-16	1st IF transformer
T3	TV-100 or 318V-2	Vibrator transformer
T4		Output transformer (Part of speaker not furnished separately)

DIAL PARTS

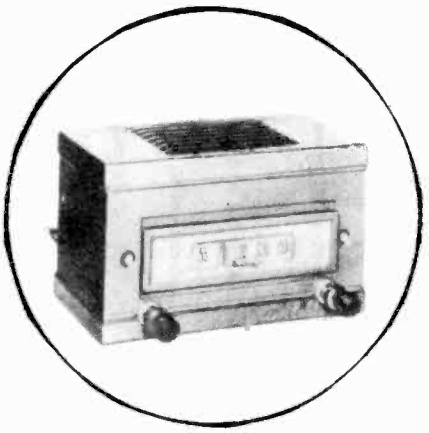
D100	Dial Scale Escutcheon, Plastic
PS100	Dial Pointer
T47	Pilot Light
H114	Pilot Light Socket
H203	Pulley, idler
H204	Spring, Dial drive String Tension
H115	String, dial drive

MISCELLANEOUS

A300	"A" lead assembly
H301	Case, less covers for Power Supply Unit
H100	Case, complete with covers for R.F. tuning unit
H207	Clip, Anti-rattle
H208	Clip, coil mounting
H102	Cover, power supply unit mounting (with speaker louvres)
A201	Fuse 15 Amp.
504PC-300	Power Cable Assembly (complete with plug)
H212	Receptacle, Antenna cable
504-FC	Socket, power cable
PM-705	Speaker, 5¼" PM (includes output transformer)
V-83	Vibrator
H310	Knob
H311	Cup washer
H113	7/16—28 Hex nut
C100	.5 MFD generator condenser
R100	Distributor suppressor

MODELS 05FJB-6777B, 61-6777, Ford, 1949-1950

MODEL 05FJB-6778B,
Dodge, Plymouth,
1949-1950



INSTALLATION

PLYMOUTH P18 SPECIAL DELUXE

1. Remove six screws securing Radio Grille in place and remove Radio Grille.

2. Remove dummy plates covering radio dial and control openings.

3. Remove knobs, cup washers, hex nuts and washers from control shafts and mounting bushings.

4. Secure two mounting brackets to Radio Grille with ⅜ inch long 10-32 self-tapping screws, lockwashers, and cup washers as shown in detail assembly, Fig. 1.

5. Place radio controls cover plate over mounting bushings.

6. Position receiver behind Radio Grille so that mounting bushings and shafts protrude through the grille.

7. Attach receiver by replacing washers and hex nuts on mounting bushings.

8. Replace cup washers and knobs over shafts.

9. Secure receiver to mounting brackets with two No. 8 self-tapping thumb screws.

10. Insert radio with attached grille through front opening on instrument panel.

11. Replace grille mounting screws.

12. Connect battery lead to terminal marked "ACC" on ignition switch.

13. Plug antenna cable into receiver.

DODGE "CORONET"

Install in the same manner as outlined for the P18 DeLuxe Plymouth except do not remove radio grille.

PLYMOUTH P17, P18 4-DOOR DELUXE AND P18 CLUB COUPE DELUXE DODGE "WAYFARER" AND "MEADOWBROOK"

These models are not equipped by the car manufacturers with a radio grille.

The following parts must be obtained from any authorized Plymouth or Dodge dealer before an installation can be made in any of these cars.

Plymouth P17, P18 4-Door DeLuxe, P18 Club Coupe DeLuxe
Radio Grill No. 1299913

Dodge "Meadowbrook" or "Wayfarer"
Radio Grill No. 1301360

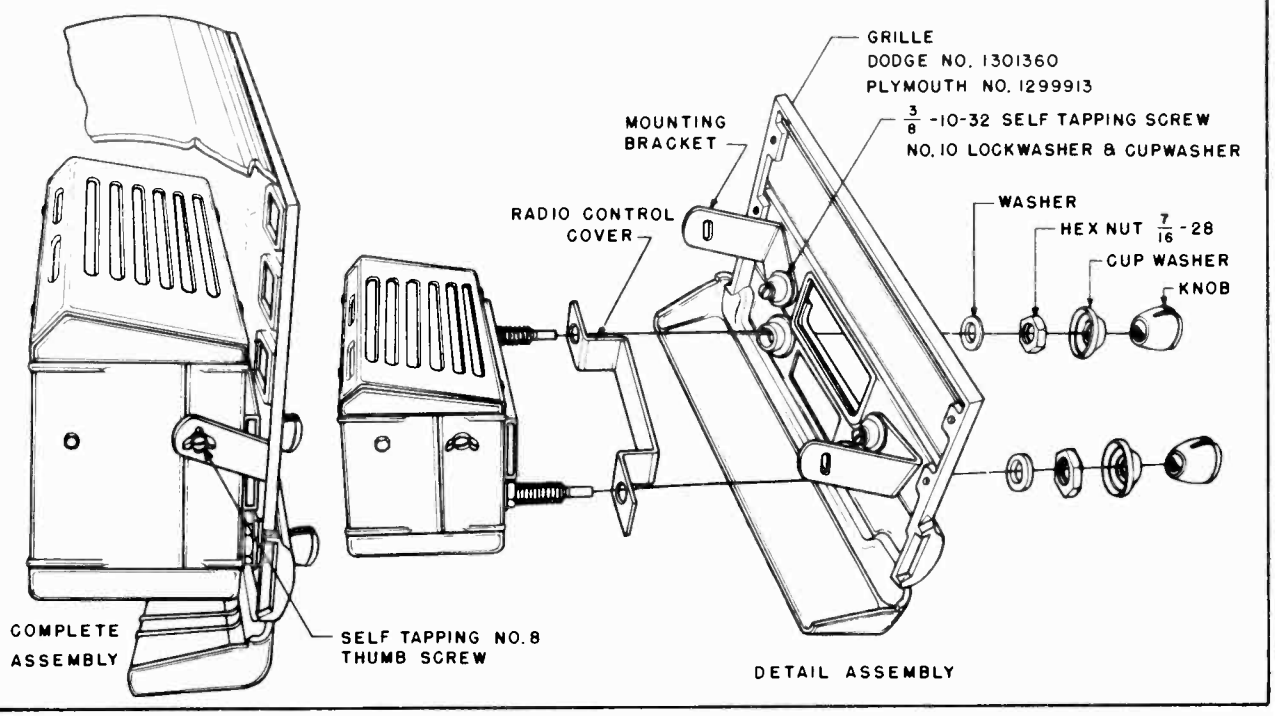


FIG. 1 RECEIVER MOUNTING DIAGRAM

MODELS 05FJB-6778B, 61-6778, Dodge, Plymouth, 1949-1950

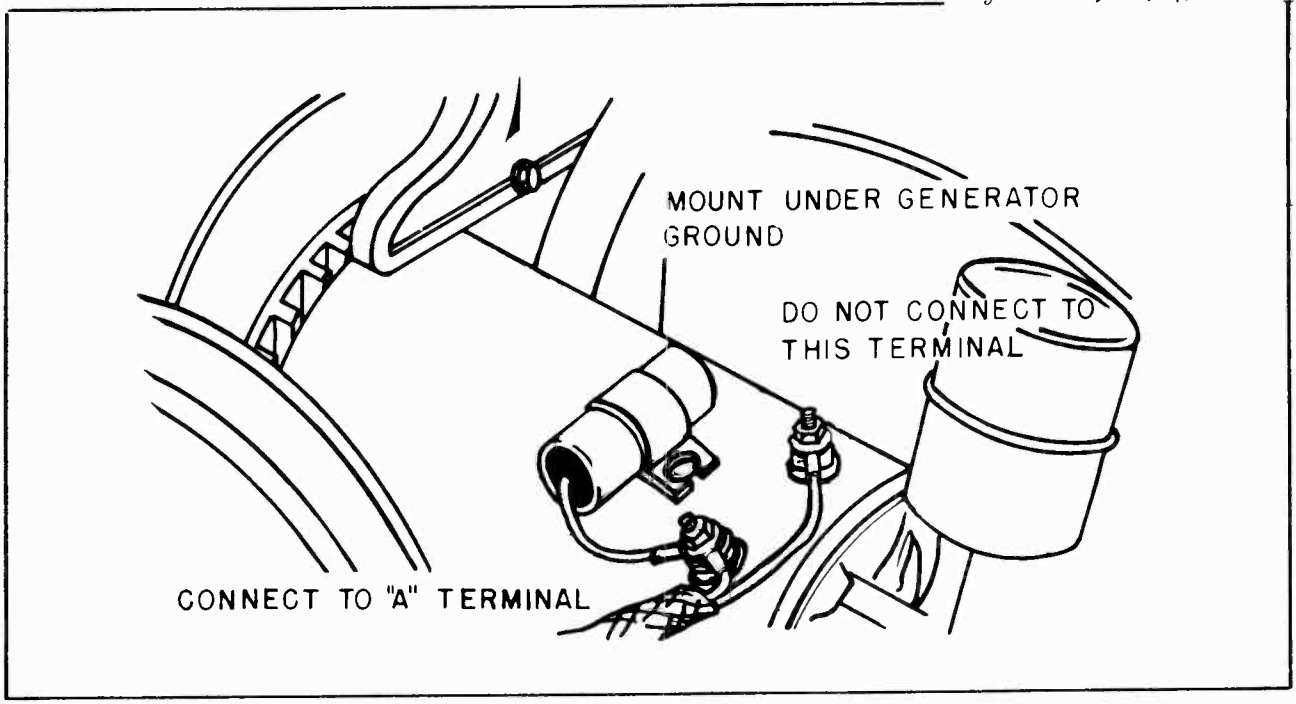


FIG. 2 GENERATOR CONDENSER

ACCESSORIES FURNISHED FOR INSTALLATION

Mounting Parts Kit

The following mounting hardware parts are shipped attached to the receiver. (See detail assembly drawing Fig. 1)

- 2 Washers
- 2 7/16-28 hex nuts
- 2 Cup washers
- 2 Knobs
- 2 Mounting Brackets
- 2 No. 8 self-tapping thumb screws
- 1 Radio control cover

An envelope containing additional mounting hardware is supplied with this receiver. It contains the following parts:

- 2 3/8 10-32 self-tapping screws
- 2 Cup washers
- 2 No. 10 lockwashers

MOTOR NOISE ELIMINATION

SUPPRESSION KIT

A suppression kit is shipped with this receiver. It contains the following parts:

- 1 Distributor Suppressor
- 1 .5 MFD Generator Condenser

DISTRIBUTOR SUPPRESSOR

NOTE: 1950 Dodge and Plymouth automobiles do *not* require distributor suppressors.

1949 DODGE AND PLYMOUTH: Remove metal tip from the distributor center tower lead and screw lead into the suppressor. Plug suppressor with attached lead back into distributor head.

GENERATOR CONDENSER

The generator condenser and distributor suppressor should eliminate all objectionable motor noise in most cases. If the motor noise persists the following steps should be taken. Check operation of radio as each step is made.

WHEEL STATIC

Wheel static is a form of interference caused by the rotation of the front wheels of the car, and it is, of course, only noticed when the car is in motion. If this form of interference is present, it can be eliminated by installing wheel static collector springs between the inner hub cap and the spindle shaft.

AMMETER CONDENSER

A .5 MFD by-pass condenser should be connected to either side of the ammeter with the ground lug fastened to a good ground nearby.

ELECTRICAL ACCESSORIES

In some cases, it may be found that car accessories such as electric heaters, lighters, automatic relays or gauges, may cause interference while in operation. Proper procedure in such cases is to connect a .5 MFD by-pass condenser from ground to the suspected accessory until the source of interference is found. The condenser then should be permanently mounted in this location.

MODELS 05FJB-6778B,
61-6778, Dodge,
Plymouth, 1949-1950

SERVICE DATA

ELECTRICAL SPECIFICATIONS

Power Supply .....6.3 Volts DC
Current .....5.5 Amp. average
Frequency Range .....538-1600 KC
Speaker .....5" PM 3.2 Ohm V.C.
Power Output .....2 watts, undistorted
3 watts, maximum
Sensitivity ..... 2-3 microvolts average for 1 watt output
Selectivity .. 40 KC broad at 1000 times signal, at 1000 KC

This receiver contains the following:

1 — 6BA6 — RF Amplifier
1 — 6BE6 — Converter
1 — 6BA6 — I. F. Amplifier
1 — 6AT6 — Detector — AVC—1st Audio
1 — 6AQ5 — Power Output
1 — 6X4 — Rectifier

SERVICE NOTES

Voltage taken from the different points of the circuit to the chassis are measured with volume control in maximum position, all tubes in their sockets, no signal applied, and with a volt meter having a resistance of 20,000 Ohms per volt. These voltages are clearly shown on the voltage chart.

All voltages should be measured with an input voltage of 6.3 volts DC.

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

ALIGNING INSTRUCTION

Never attempt any adjustments on this receiver unless it becomes necessary to replace a coil or transformer, or the adjustments have been tampered with in the field. Always make certain that other circuit components, such as tubes, condensers, resistors, etc., are normal before proceeding with realignment.

If realignment is necessary follow the instructions given under the heading "Alignment Procedure." After realignment has been completed repeat the procedure as final check.

INSTRUCTIONS FOR SERVICING RECEIVER COMPONENTS

The novel design of this receiver permits servicing all components without removing the chassis from the cose. The top cover (the one with the speaker louvres) can be removed by removing the four (4) screws securing it to the case. This exposes all tube sockets, connectors, resistors and condensers for observation and service.

Removing the bottom cover makes it possible to service tubes, vibrator, and volume control.

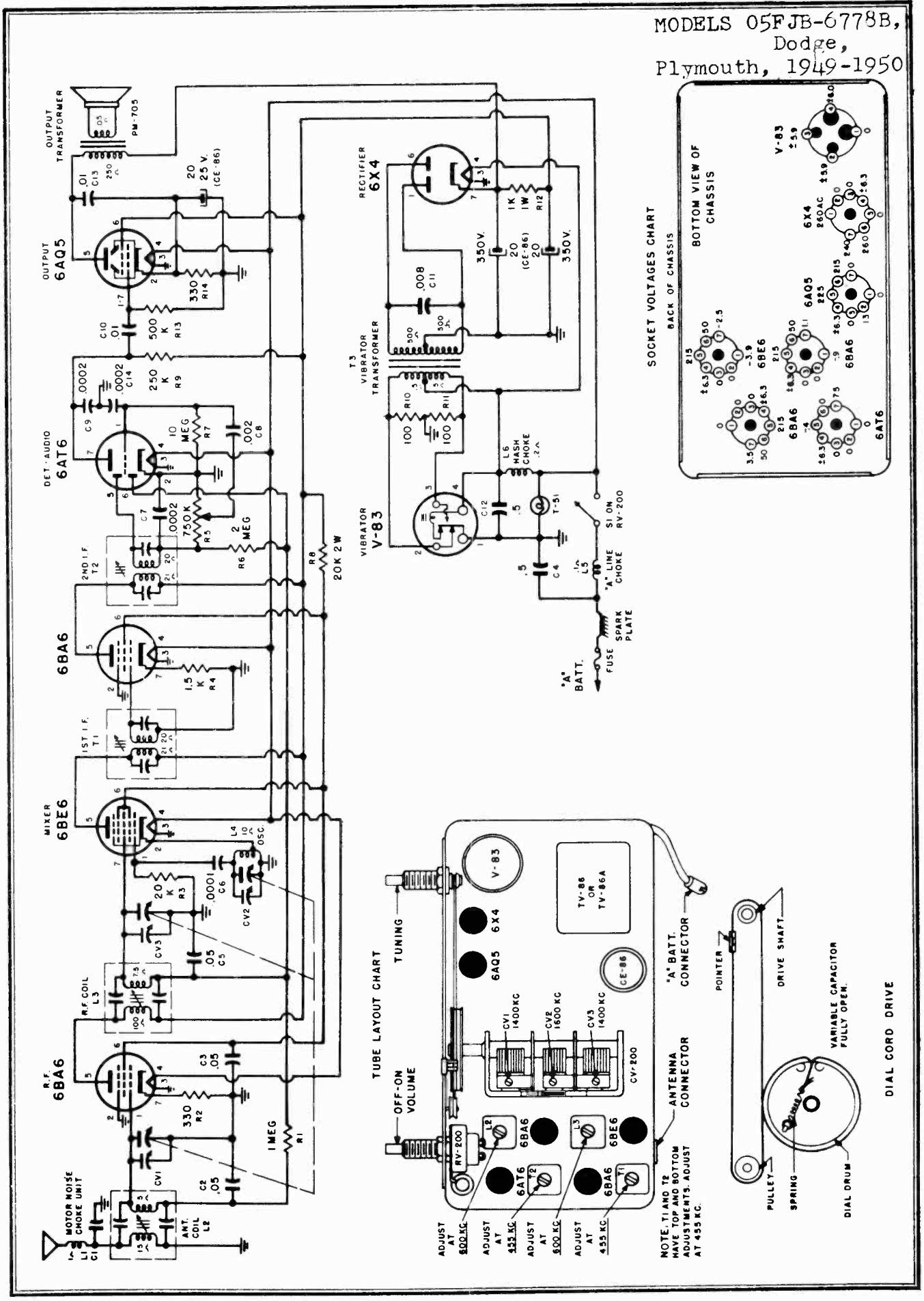
ALIGNMENT PROCEDURE

Volume control — Maximum all adjustments.
No signal applied to antenna.
Power input — 6.3 volts.
Connect dummy antenna in series with output lead of signal generator.
Connect ground lead of signal generator to chassis.
Repeat alignment procedure as a final check.

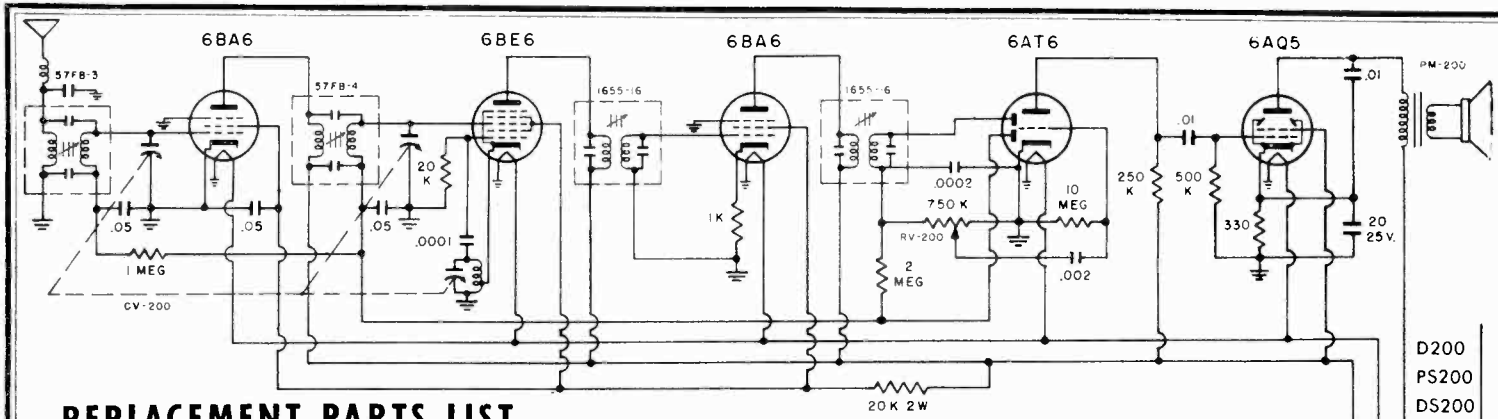
The following equipment is necessary for praper alignment:
Signal generator that will provide the test frequencies as listed, modulated 400 cycles, 30%.
Non-metallic screwdriver.
Output meter. (1.8 volt for 1 watt output.)
Dummy antennas — .1 MFD., 100 MMFD.
For alignment points refer to Schematic Diagram.

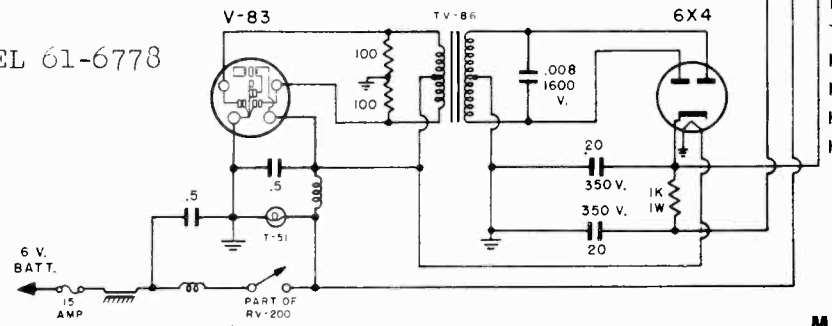
DIAL SETTING	GENERATOR FREQUENCY	DUMMY ANT.	GENERATOR CONNECTION	TRIMMER REFERENCE	TRIMMER ADJUSTMENT	TRIMMER FUNCTION
1) Fully open	455 KC	.1 MFD	6BE6 Grid	T2 Top & bottom	Maximum	Output I.F.
2) Fully open	455 KC	.1 MFD	6BE6 Grid	T1 Top & bottom	Maximum	Input I.F.
3) Fully open	1600 KC	100 MMFD	Ant. lead	CV2	Maximum	Oscillator
4) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV3	Maximum	RF Stage
5) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV1	Maximum	Antenna
6) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L3	Maximum	RF Stage
7) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L2	Maximum	Antenna
8) Repeat steps 4 and 5						

MODELS 05FJB-6778B,
Dodge,
Plymouth, 1949-1950



MODELS 05FJB-6778B, 61-6778, Dodge, Plymouth, 1949-1950





REPLACEMENT PARTS LIST

MODEL 61-6778

SCHEMATIC DIAGRAM REFERENCE	PART NO.	DESCRIPTION
		CONDENSERS
C2,C3,C4	C207	.05 MFD 200 volt condenser
C5	CC200	100 MMFD ceramic condenser
C6, C13, C14	CC201	200 MMFD ceramic condenser
C7	C203	.002 MFD 400 volt condenser
C8, C9	C206	.01 MFD 600 volt condenser
C10, C11	C209	.5 MFD 100 volt condenser
C12	C205	.008 MFD 1600 volt condenser
CE-86	CE-86	20 MFD 350 volt electrolytic condenser 20 MFD 350 volt electrolytic condenser 20 MFD 25 volt electrolytic condenser
CV-200	CV-200	3 section variable tuning condenser
		RESISTORS
R1	R309	1 megohm ½ watt 20% resistor
R2	R306	20K ohm ½ watt 20% resistor
R3	R314	1.5K ohm ½ watt 20% resistor
R4	R310	2 megohm ½ watt 20% resistor
R5	R311	10 megohm ½ watt 20% resistor
R6	R307	250K ohm ½ watt 20% resistor
R7	R308	500K ohm ½ watt 20% resistor
R8, R13	R303	330 ohm ½ watt 20% resistor
R9	R313	20K ohm 2 watt 20% resistor
R10, R11	R301	100 ohm ½ watt 20% resistor
R12	R312	1K ohm 1 watt 20% resistor
RV-200	RV-200	Volume control ¾ megohm with switch
		COILS AND TRANSFORMERS
L1-C1	L200	Motor noise elimination unit
L2	57FB-3	Antenna Coil
L3	57FB-4	RF coil
L4	L201	RF Oscillator coil
L5	L202	Choke, vibrator hash
L6	L203	Choke, "A" line
T1	1655-16	1st IF transformer
T2	1655-16	2nd IF transformer
T3		Output transformer (Part of speaker not furnished separately)
T4	TV-86 or TV-86A	Vibrator transformer

DIAL PARTS

D200	Dial Scale
PS200	Dial Pointer
DS200	Drive shaft assembly
H201	Grommet, rubber drive
T51	Pilot light
H202	Pilot light socket
H203	Pulley, idler
H204	Spring, Dial Drive String Tension
H205	String, Dial Drive

MISCELLANEOUS

A200	"A" lead assembly
H216	Bracket, mounting
H206	Case, (less covers)
H207	Clip, antirattle
H208	Clip, coil mounting
H209	Cover, bottom case
H218	Cover, radio control
H210	Cover, top case (with speaker louvres)
H311	Cup washers, shaft
A201	Fuse, 15 amp
H211	Grommet, rubber, gang mounting
H310	Knob
H217	Nuts, mounting
H212	Receptacle, antenna cable
PM-250	Speaker, 5" PM includes output transformer
V-83 or V-94	Vibrator
H113	7/16—28 Hex nut
C100	.5 MFD Generator condenser
R100	Distributor suppressor

MODELS 05FJB-6779B, 61-6779, Chevrolet, 1949-1950

INSTALLATION

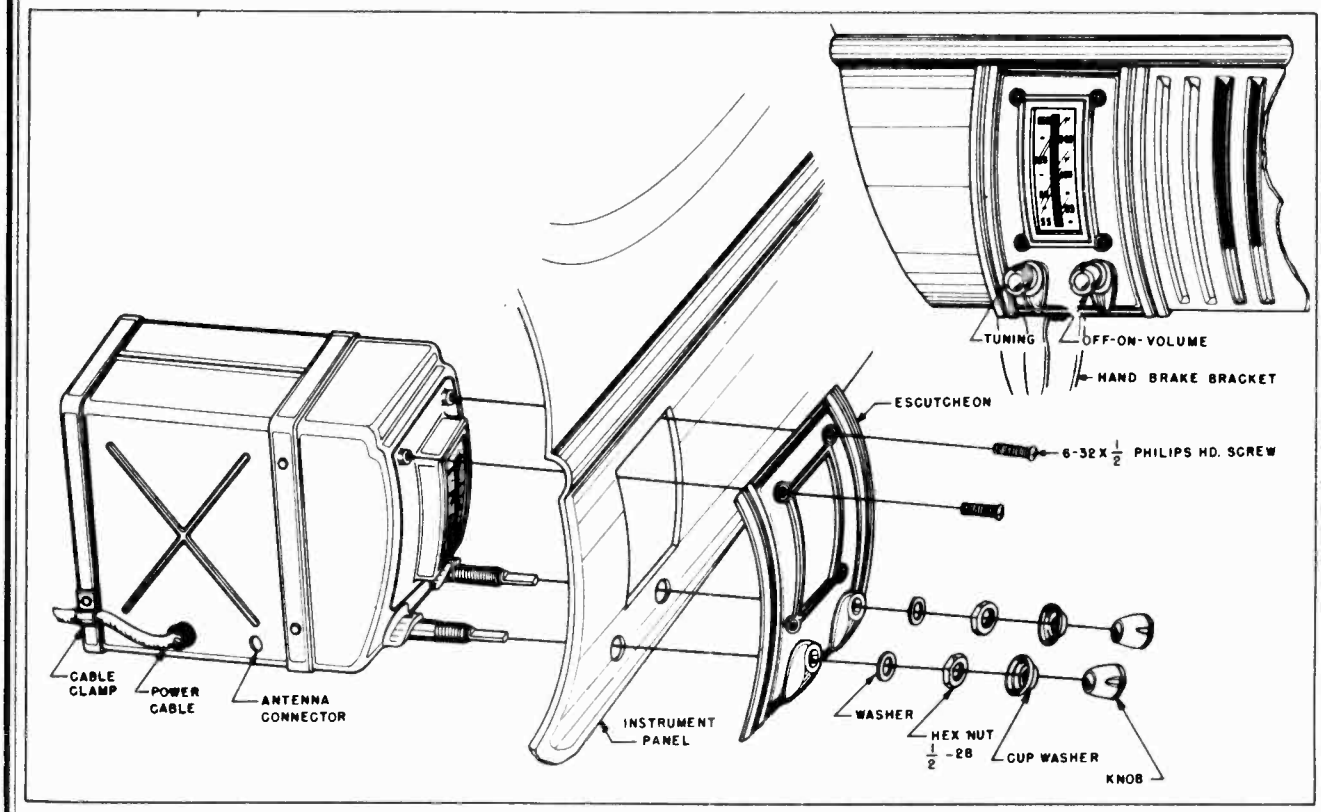


FIG. 1 R.F. TUNING UNIT DETAIL MOUNTING ASSEMBLY

R. F. TUNING UNIT

1. Loosen nuts on the two moulding studs located behind the instrument panel cover plate.

2. Remove sheet metal screw from the lower edge of the instrument panel cover plate and the two screws and washers attaching the hand brake to the instrument panel. Keep these parts.

3. Remove instrument panel cover plate and discard.

4. Tighten nuts on the two moulding studs located behind the instrument panel cover plate.

5. Drop vent controls by removing screws, lockwashers, and flat washers securing these controls to the instrument panel. This will facilitate installation of both receiver units. Save parts removed.

6. Install R.F. Tuning Unit behind instrument panel so that mounting bushings and tuning shafts protrude through the instrument panel.

7. Slide plastic escutcheon over mounting bushings and secure with flat washers, nuts, cup washers, and knobs as shown in Fig. 1.

8. Secure top part of plastic escutcheon to R.F. Tuning Unit with two No. 6-32 x ½" long Philips Head screws.

POWER SUPPLY UNIT

1. Insert a thin blade screwdriver or a flat strip of metal through the Radio Grille and slit fiberboard Radio Grille screen. Reach in back of Radio Grille and remove screen by grasping slit edge. Discard fiberboard screen.

2. Remove 10-32 nuts and washers from the moulding studs behind the Radio Grille.

3. Remove 10-32 nuts, screws, and washers securing the lower tabs of the Radio Grille to the instrument panel.

4. Install Power Supply Unit behind Radio Grille and position into place so that holes in top of unit slide over moulding studs as shown in Fig. 2.

NOTE: It may be more convenient, in car models with air conditioner heaters, to remove the vibrator before installing this unit. The vibrator can be replaced after the power unit is mounted.

5. Replace 10-32 nuts and washers on moulding studs.

6. Replace lower grille tab 10-32 mounting screws, nuts, and washers so that screws secure the lower grille tabs and Power Supply Unit to the instrument panel.

7. Connect cable from Power Supply Unit to R.F. Tuning Unit.

8. Secure Power Supply Cable under clamp on R.F. Tuning Unit.

9. Replace vent controls.

10. Replace screws and washers securing hand brake. Connect battery lead to terminal on Ignition Switch. Plug Antenna cable into receiver.

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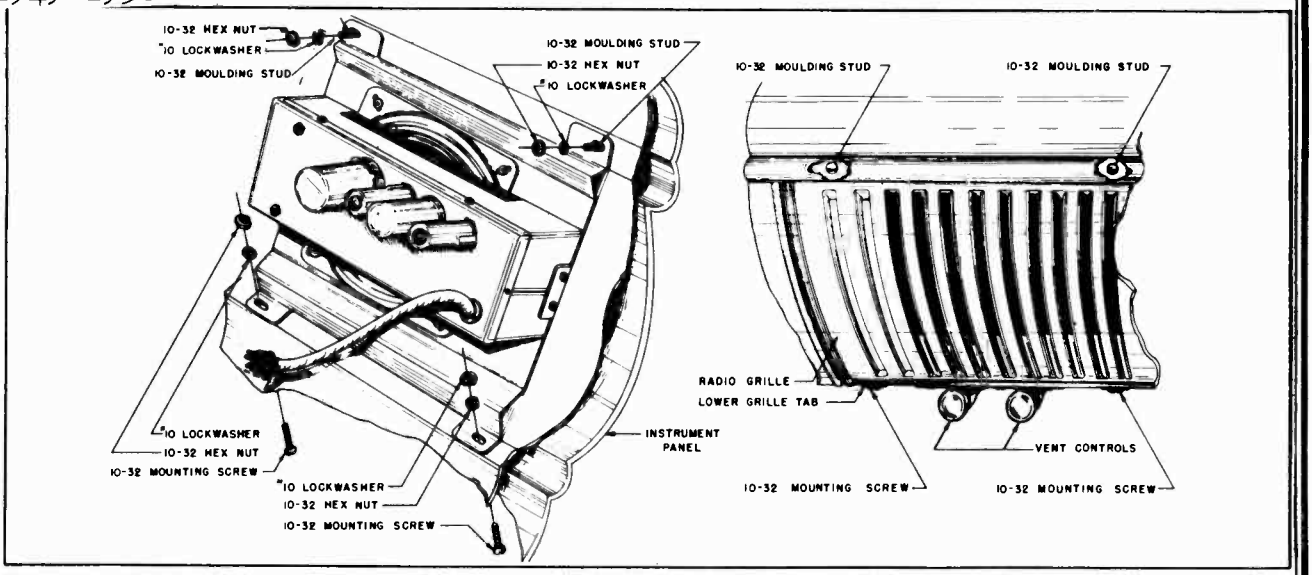
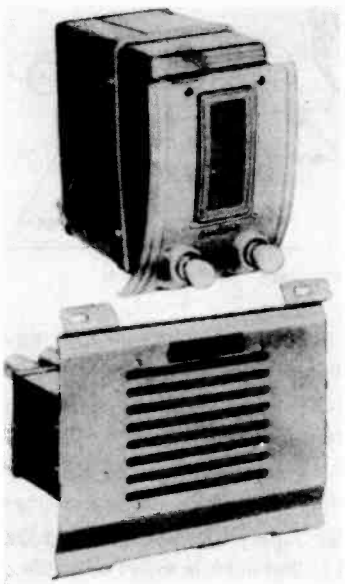


FIG. 2 POWER SUPPLY UNIT DETAIL MOUNTING ASSEMBLY



MOTOR NOISE ELIMINATION

SUPPRESSION KIT

A suppression kit is shipped with this receiver. It contains the following parts:

1 Distributor Suppressor. 1 Generator Condenser.

DISTRIBUTOR SUPPRESSOR

Disconnect the center lead in the distributor head of the motor. Cut lead approximately 2 inches back from metal tip end. Screw suppressor into cut end of long lead. Screw cut end of short lead into suppressor. Plug lead, with attached suppressor, back into distributor head.

GENERATOR CONDENSER

The generator condenser and distributor suppressor will normally eliminate all objectionable motor noise. If the motor noise persists, a .5 MFD by-pass condenser may be connected to either side of the ammeter with the ground lug fastened to a good ground nearby.

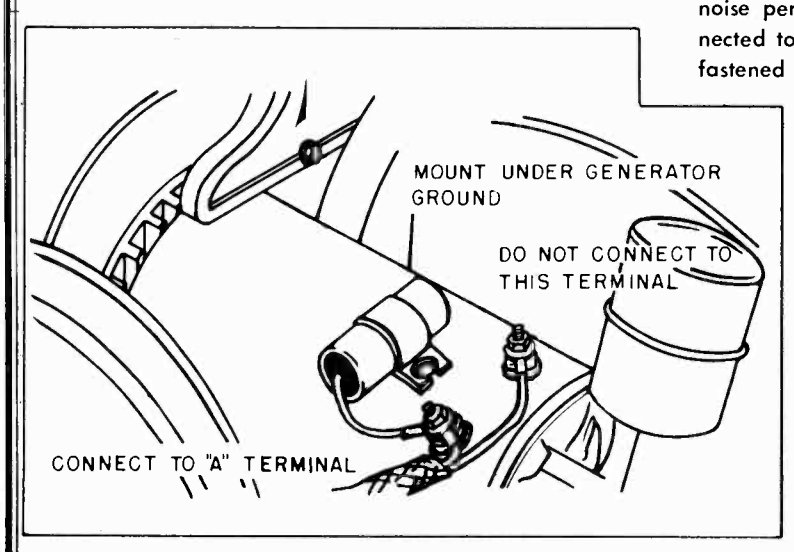


FIG. 3 GENERATOR CONDENSER

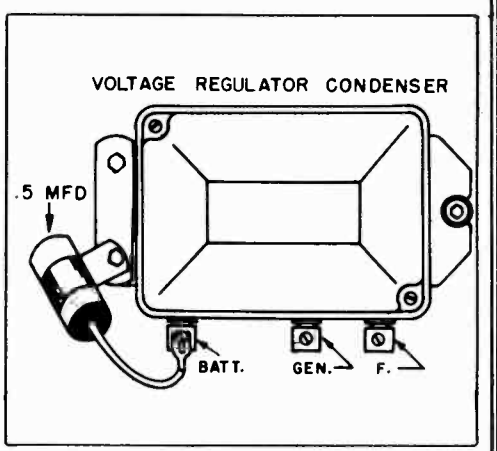


FIG. 4 VOLTAGE REGULATOR CONDENSER

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VOLTAGE REGULATOR

Voltage Regulator contacts may cause interference in some cases. Connect a .5 MFD by-pass condenser from ground to the "BATT" terminal on the voltage regulator to eliminate this source of interference.

WHEEL STATIC

Wheel static is a form of interference caused by the rotation of the front wheels of the car, and it is, of course, only noticed when the car is in motion. If this form of interference is present, it can be eliminated by installing wheel static collector springs between the inner hub cap and the spindle shaft.

ELECTRICAL ACCESSORIES

In some cases, it may be found that car accessories such as electric heaters, lighters, automatic relays or gauges, may cause interference while in operation. Proper procedure in such cases is to connect a .5 MFD by-pass condenser from ground to the suspected accessory until the source of interference is found. The condenser then should be permanently mounted in this location.

SERVICE DATA

ELECTRICAL SPECIFICATIONS

Power Supply ..... 6.3 Volts DC
Current ..... 5.5 Amp. average
Frequency Range ..... 538-1600 KC
Speaker ..... 5¼" PM 3.2 Ohm V.C.
Power Output ..... 2 watts, undistorted 3 watts, maximum
Sensitivity ..... 2-3 microvolts average for 1 watt output
Selectivity ..... 40 KC broad at 1000 times signal, at 1000 KC
This receiver contains the followina:
1 - 6BA6 — RF Amplifier 1 - 6AT6 — Detector — AVC — 1st Audio
1 - 6BE6 — Converter 1 - 6AQ5 — Power Output
1 - 6BA6 — I. F. Amplifier 1 - 6X4 — Rectifier

SERVICE NOTES

Voltage taken from the different points of the circuit to the chassis are measured with volume control in maximum position, all tubes in their sockets, no signal applied, and with a volt meter having a resistance of 20,000 Ohms per volt. These voltages are clearly shown on the voltage chart.

All voltages should be measured with an input voltage of 6.3 volts DC.

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

ALIGNING INSTRUCTION

Never attempt any adjustments on this receiver unless it becomes necessary to replace a coil or transformer, or the adjustments have been tampered with in the field. Always make certain that other circuit components such as tubes, condensers, resistors, etc., are normal before proceeding with realignment.

If realignment is necessary follow the instructions given under the heading "Alignment Procedure." After realignment has been completed repeat the procedure as final check.

ALIGNMENT PROCEDURE

Volume control — Maximum all adjustments.
No signal applied to antenna.
Power input — 6.3 volts.
Connect dummy antenna in series with output lead of signal generator.
Connect ground lead of signal generator to chassis.
Repeat alignment procedure as a final check.

The following equipment is necessary for proper alignment:
Signal generator that will provide the test frequencies as listed, modulated 400 cycles, 30%.
Non-metallic screwdriver.
Output meter. (1.8 volt for 1 watt output.)
Dummy antennas — .1 MFD., 100 MMFD.
For alignment points refer to Schematic Diagram.

DIAL SETTING	GENERATOR FREQUENCY	DUMMY ANT.	GENERATOR CONNECTION	TRIMMER REFERENCE	TRIMMER ADJUSTMENT	TRIMMER FUNCTION
1) Fully open	455 KC	.1 MFD	6BE6 Grid	T2 Top & bottom	Maximum	Output I.F.
2) Fully open	455 KC	.1 MFD	6BE6 Grid	T1 Top & bottom	Maximum	Input I.F.
3) Fully open	1600 KC	100 MMFD	Ant. lead	CV2	Maximum	Oscillator
4) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV3	Maximum	RF Stage
5) Tune in signal from generator	1400 KC	100 MMFD	Ant. lead	CV1	Maximum	Antenna
6) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L3	Maximum	RF Stage
7) Tune in signal from generator	600 KC	100 MMFD	Ant. lead	L2	Maximum	Antenna
8) Repeat steps 4 and 5						

MODEL 05FJB-6779B,
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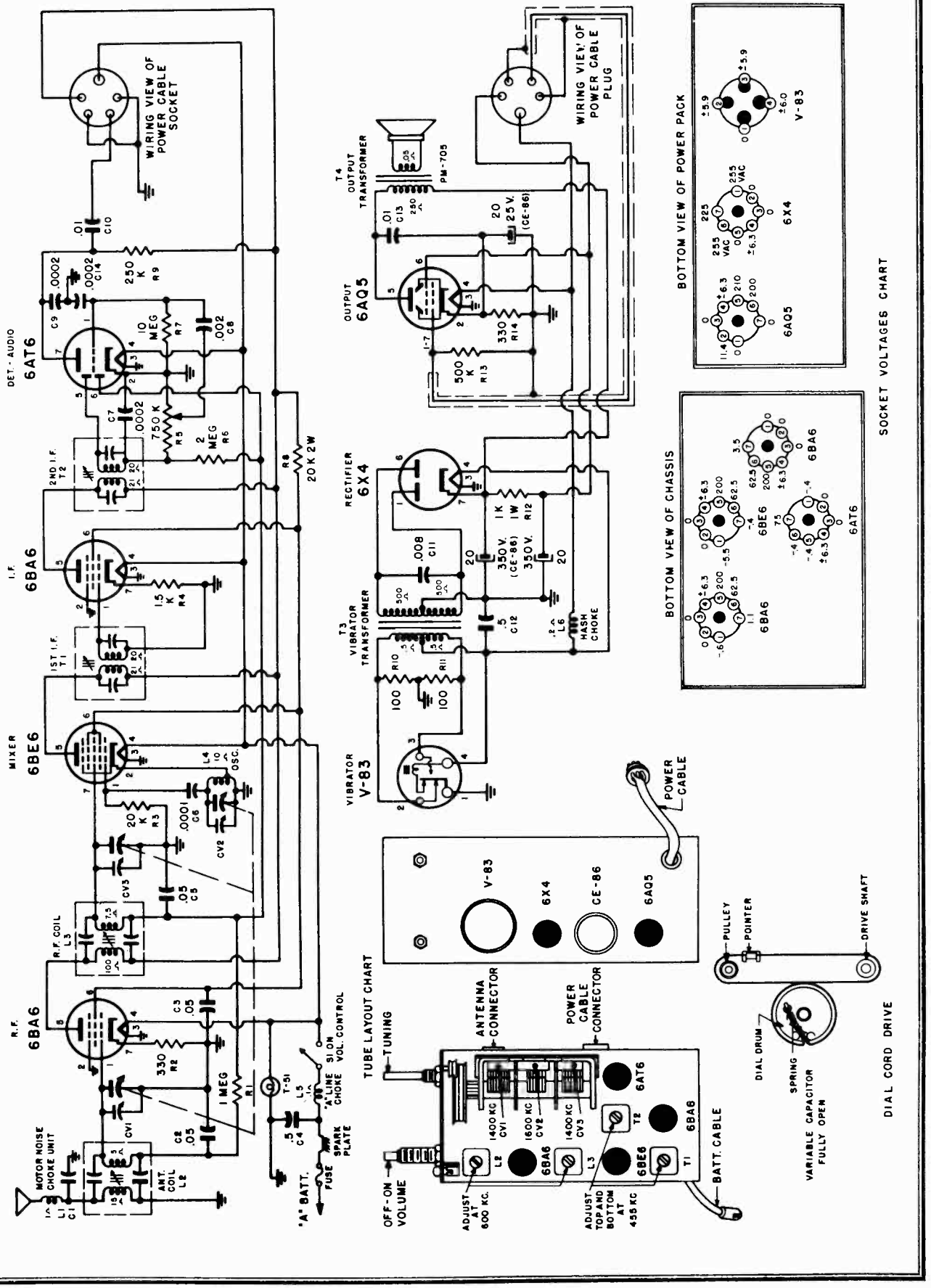
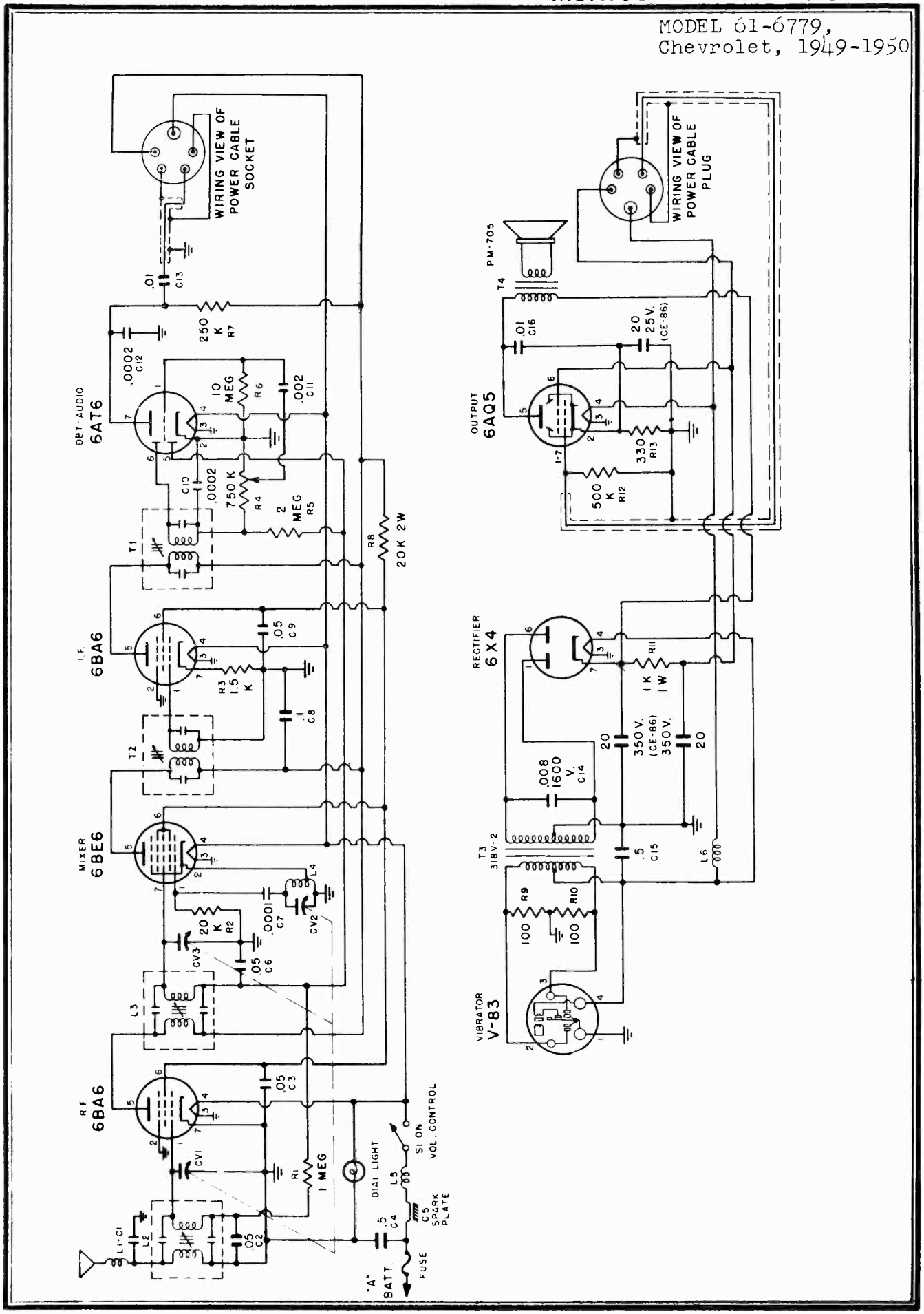


MODEL 61-6779,
Chevrolet, 1949-1950



MODELS 05FJB-6779B,
61-6779, Chevrolet,
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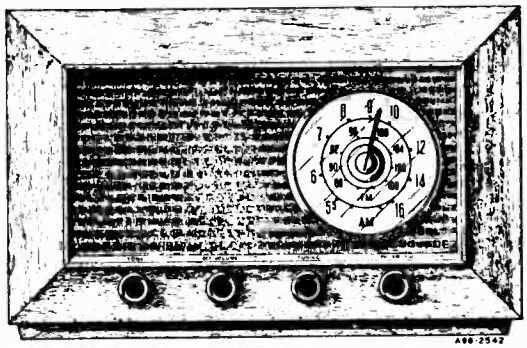
REPLACEMENT PARTS LIST

SCHEMATIC DIAGRAM REFERENCE	PART NO.	DESCRIPTION
		CONDENSERS
C2,C3,C5	C207	.05 MFD 200 Volt Condenser
C4, C12	C209	.5 MFD 100 Volt Condenser
C6	CC200	100 MMFD Ceramic Condenser
C7, C9. C14	CC201	200 MMFD Ceramic Condenser
C8	C203	.002 MFD 400 Volt Condenser
C10, C13	C206	.01 MFD 600 Volt Condenser
C11	C205	.008 MFD 1600 Volt Condenser
		20 MFD 350 Volt Electrolytic Condenser
CE-86	CE-86	20 MFD 350 Volt Electrolytic Condenser
		20 MFD 25 Volt Electrolytic Condenser
CV1-CV2-CV3	CV-300	3 Section Variable Tuning
		RESISTORS
R1	R309	1 megohm ½ Watt 20% Resistor
R2, R14	R303	330 Ohm ½ Watt 20% Resistor
R3	R306	20K Ohm ½ Watt 20% Resistor
R4	R314	1.5K Ohm ½ Watt 20% Resistor
R5	RV300	Volume Control ¾ megohm with switch
R6	R310	2 megohm ½ Watt 20% Resistor
R7	R311	10 megohm ½ Watt 20% Resistor
R8	R313	20K Ohm 2 Watt 20% Resistor
R9	R307	250K Ohm ½ Watt 20% Resistor
R10, R11	R301	100 Ohm ½ Watt 20% Resistor
R12	R312	1K Ohm 1 Watt 20% Resistor
R13	R308	500K Ohm ½ Watt 20% Resistor
		COILS AND TRANSFORMERS
L1-C1	L200	Motor noise elimination unit
L2	15053 or 57FB-3	Antenna coil
L3	15054 or 57FB-4	R.F. coil
L4	L201	R.F. oscillator coil
L5	L203	Choke, "A" line
L6	L202	Choke, vibrator hash
T1	14977 or 1655-16	1st IF transformer
T2	14977 or 1655-16	2nd IF transformer
T3	TV-100	Vibrator transformer
T4		Output transformer (Part of speaker not furnished separately)

PART NO.	DIAL PARTS
D300	Dial scale
PS300	Dial Pointer
DS300	Drive Shaft Assembly
H201	Grommet, rubber drive
T51	Pilot Light
H214	Pilot Light Socket
H203	Pulley, idler
H204	Spring, Dial drive String Tension
H215	String, dial drive
	MISCELLANEOUS
A300	"A" lead assembly
H301	Case, less covers for Power Supply Unit
H300	Case, complete with covers for R.F. tuning unit
H207	Clip, Anti-rattle
H208	Clip, coil mounting
H302	Cover, power supply unit mounting (with speaker louvres)
A201	Fuse, 15 Amp.
504PC-300	Power Cable Assembly (complete with plug)
H212	Receptacle, Antenna cable
504-FC	Socket, power cable
PM-705	Speaker, 5¼" PM (includes output transformer)
V-83	Vibrator
H310	Knob
H311	Cup washer
H312	Plastic Escutcheon
H313	½ x 28 hex nut
C100	.5 MFD Generator Condenser
R100	Distributor Suppressor

MODEL 94WG-1811A



GENERAL DESCRIPTION

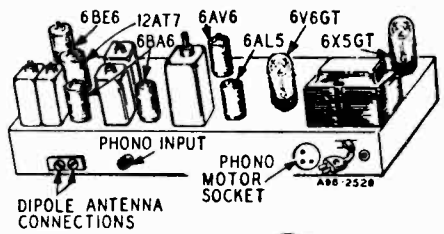
This is a two band, seven tube (plus rectifier tube) AM and FM receiver. Controls are provided at the front of the cabinet for tuning, volume, tone and band or phono selection. Phono input and phono motor sockets are provided at the rear of the receiver to which a record player may be connected. The I-F stages use high gain miniature type tubes. Air Wave Aerials are provided for the FM and Broadcast bands. Features include, a grounded grid R-F amplifier stage on the FM band, compensator circuits to prevent oscillator drift, automatic volume control, beam power output stage, PM dynamic loud speaker and an electrostatic shield in the power transformer to reduce power line noise.

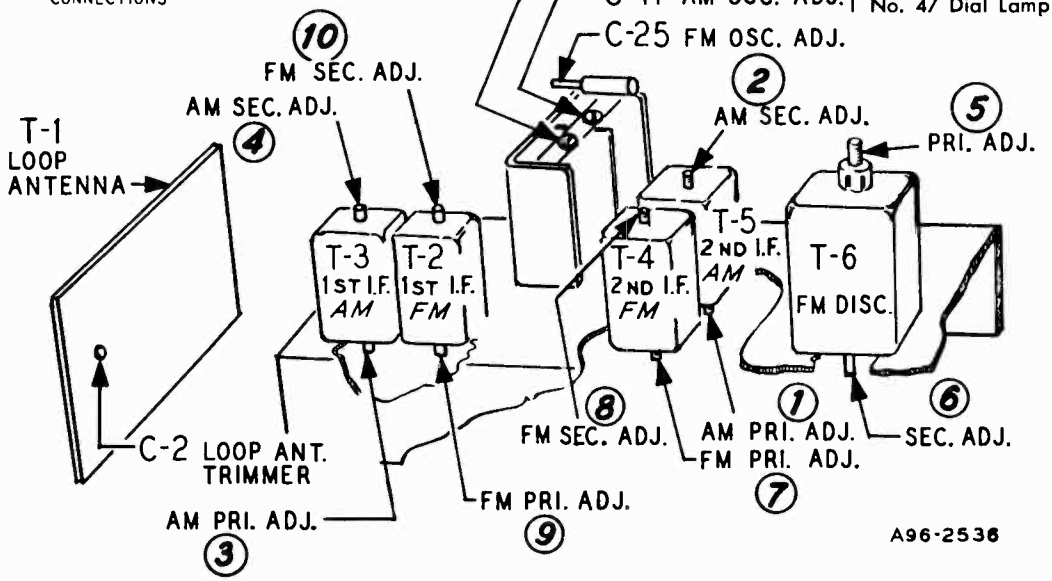
ELECTRICAL SPECIFICATIONS

Power Supply	105-125 volts AC 50-60 cycles, 40 watts.
Frequency Ranges	Broadcast 540-1600 KC Frequency Modulation 88-108 MC
Intermediate Frequency	AM—455KC FM—10.7 MC
Selectivity	AM—45 KC broad at 1000 times signal, measured at 1000 KC I.F. FM—200 KC broad at 2 times down I.F. FM—950 KC broad at 200 times down
AM Sensitivity	(For .5 watt output with external antenna) 50 microvolts average
FM Sensitivity	(For .5 watt output) 25 microvolts average
Power Output	1.9 watts maximum .8 watts 10% distortion
Loud Speaker	6" PM Dynamic
Voice Coil Impedance	3.2 ohms 400 cycles

Tube and Dial Lamp Complement

1 6BE6 AM Converter & FM Osc.
1 6BA6 1st I-F Amplifier
1 6BA6 2nd I-F Amplifier
1 6AL5 FM Discriminator
1 6AV6 Audio Amplifier, AM 2nd Detector and AVC
1 6V6GT Audio Output
1 6X5GT Rectifier
1 12AT7 R-F Amplifier & Mixer
1 No. 47 Dial Lamp





MODEL 94WG-1811A

ALIGNMENT PROCEDURES

AM STAGES

The following 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 mf, and 50mmf.
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						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid 1st 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (3) and Sec. (4)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-41	Maximum Output
1400 KC	External Antenna Clip	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.

FM STAGES

The following is required for aligning:

An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.

Non-metallic screwdriver.

Dummy Antennas and I-F Loading Resistor—2500 mmf, 300 ohms

Zero center scale DC vacuum tube voltmeter having a range of approximately 3 volts.
(If a zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negative readings).
Allow chassis and signal generator to "Heat Up" for several minutes.

	SIGNAL GENERATOR		THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO					
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
I-F	10.7 MC Note C	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	2nd I-F Pri. (7) Sec. (8) Note D	Maximum Deflection
Discriminator	10.7 MC	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note D	Maximum Deflection
I-F	10.7 MC	Junction C-32A & B (Dual 100 mmf cond.) And chassis	2500 mmf	FM	Rotor Fully Open	1st I-F Pri. (9) & Sec. (10) 2nd I-F Pri. (7) & Sec. (8) Disc. Pri. (5) In Order Shown Note D	Maximum Deflection
	10.7 MC	Same as above	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	Maximum Deflection
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN							
Oscillator	108.5	Disconnect hank antenna and connect generator to dipole terminals with resistor in series.	300 ohms	FM	Rotor Fully Open	Osc. C-25	Maximum Deflection
Antenna	104.5	Same as above	300 ohms	FM	Tune rotor for max. AVC voltage	Ant. C-39	Maximum Deflection

RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN

FM ALIGNMENT NOTES

NOTE A—The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line. A signal of .1 volt must be fed into the receiver for this adjustment.
Note output voltage on the zero center DC vacuum tube voltmeter

NOTE B—Disconnect zero center DC vacuum tube voltmeter from AVC and connect it at the audio takeoff point at the 27 K ohm resistor (R-10) and its junction with the terminal strip. Adjust for zero voltage indication.

NOTE C—AM I-F coils must be aligned before attempting to align the FM I-F coils.

NOTE D—Connect zero center DC vacuum tube voltmeter as in Note A. Adjust input to give some output on the zero center DC vacuum tube voltmeter as in Note A.

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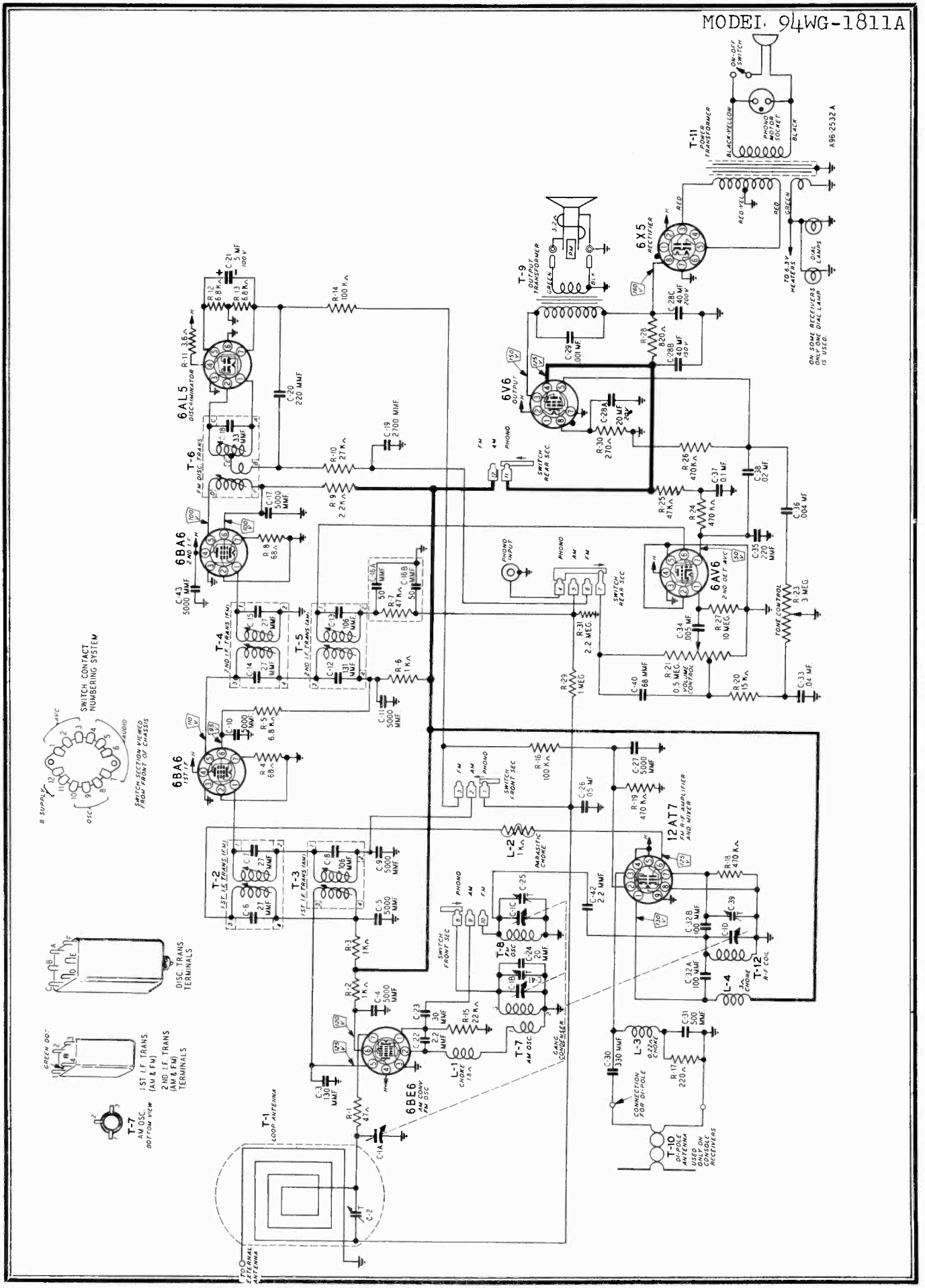


MODEL 94WG-1811A

REPLACEMENT PARTS INFORMATION

CAPACITORS

Ref. No.	Part No.	Description	Qty. Used in Set
C-1	14A210	Gang Condenser Assembly	1
C-2	17A256	2-24 mmf Trimmer	1
C-3	47X559	130 mmf Ceramic	1
C-4, C-5, C-9, C-10, C-11, C-17, C-27, C-43	47X507	5000 mmf Ceramic	8
C-6, C-7		Part of T-2 (1st I-F Trans. FM)	
C-8		Part of T-3 (1st I-F Trans. AM)	
C-12, C-13		Part of T-5 (2nd I-F Trans. AM)	
C-14, C-15		Part of T-4 (2nd I-F Trans. FM)	
C-16A, C-16B	47X112	50-50 mmf Dual Mica	1
C-18		Part of T-6 (Discriminator Trans.)	
C-19	47X492	2700 mmf Molded Mica	1
C-20, C-35	47X468	220 mmf Ceramic	2
C-21	45X361	5 mf 100 V Dry Electrolytic	1
C-22, C-42	47X557	2.2 mmf Ceramic	2
C-23	47X558	30 mmf Ceramic	1
C-24	47X516	20 mmf Ceramic	1
C-25	17A255	1-8 mmf Trimmer	1
C-26	B66503	.05 mf 200 V Tubular	1
C-28A, C-28B, C-28C	45X360	20 mf 20 V, 40 mf 150 V, 40 mf 200 V Dry Electrolytic	1
C-29	H66102	.001 mf 800 V Tubular	1
C-30	47X470	330 mmf Molded Mica	1
C-31	47X508	500 mmf Ceramic	1
C-32A, C-32B	76X4	100 mmf Dual Ceramic	1
C-33	B66403	.04 mf 200 V Tubular	1
C-34	D66502	.005 mf 400 V Tubular	1
C-36	B66402	.004 mf 200 V Tubular	1
C-37	D66104	.1 mf 400 V Tubular	1
C-38	D66203	.02 mf 400 V Tubular	1
C-39, C-41		Part of C-1 (Gang Condenser)	
C-40	47X471	68 mmf Ceramic	1

RESISTORS

Ref. No.	Part No.	Ohms	Watts		Qty. Used in Set
R-1	B85470	47	0.5	Carbon	1
R-2, R-3, R-6	B85102	1000	0.5	Carbon	3
R-4, R-8	B84680	68	0.5	Carbon	2
R-5, R-12, R-13	B84682	6800	0.5	Carbon	3
R-7, R-25	B85473	47 K	0.5	Carbon	2
R-9	B85222	2200	0.5	Carbon	1
R-10	B85273	27 K	0.5	Carbon	1
R-11	43X233	3.6	0.5	Wirewound	1
R-14, R-16	B85104	100 K	0.5	Carbon	2
R-15	B85223	22 K	0.5	Carbon	1
R-17	B84221	220	0.5	Carbon	1
R-18, R-19, R-24, R-26	B85474	470 K	0.5	Carbon	4
R-20	B85153	15 K	0.5	Carbon	1
R-21	36X385	.5 meg.		Volume Control & Switch	1
R-23	40X296	3 meg.		Tone Control	1
R-27	B85106	10 meg.	0.5	Carbon	1
R-28	D84821	820	2.0	Carbon	1
R-29	B85105	1 meg.	0.5	Carbon	1
R-30	B84271	270	0.5	Carbon	1
R-31	B85225	2.2 meg.	0.5	Carbon	1

TRANSFORMERS AND COILS

L-1	35A5	Insulated Choke	1
L-2	9A2068	Parasitic Choke Assembly	1
L-3	35A9	Insulated Choke	1
L-4	35A8	Insulated Choke	1
T-1	9A2079	"B" Range Loop Antenna	1
T-2	9A2060	1st I-F Trans. (FM)	1
T-3	9A2062	1st I-F Trans. (AM)	1
T-4	9A2061	2nd I-F Trans. (FM)	1
T-5	9A2063	2nd I-F Trans. (AM)	1
T-6	9A2064	Discriminator Transformer	1
T-7	9A2065	Oscillator Coil (AM)	1
T-8	9A2067	Oscillator Coil (FM)	1
T-9	51X144	Output Transformer	1
T-11	53X291	Power Transformer	1
T-12	9A2066	Antenna Coil (FM)	1

MODEL 94WG-1811A

REPLACEMENT PARTS LIST (continued)

Ref. No.	Part No.	Description	Qty. Used in Set

MISCELLANEOUS

12A498	6" P.M. Speaker	1
3A303	Tube Socket—Octal (8 prong) Molded	2
3A426	Tube Socket—Miniature	4
3A427	Tube Socket (12AT7)	1
3A443	Tube Socket (6BE6)	1
3A304	Phono Motor Socket	1
3A305	Phono Socket—Single Pin Tip	1
2A394	Band Change Switch	1
13X546	Line Cord and Plug Assembly	1
10A750	Knob	4
4X1071	Escutcheon	1

DRIVE CORD REPLACEMENTS

POINTER CORD

With the opening in the pointer shaft A in a horizontal position, insert looped end of cord through the opening and then one and one-half turns clockwise around pointer shaft A. Poss the cord around idler stud B and attach to tension spring at C. Then poss the remaining cord one turn counterclockwise and then down. Wind cord two complete turns counterclockwise around drive shaft D and then pass the cord through the slot and attach to tension spring at E.

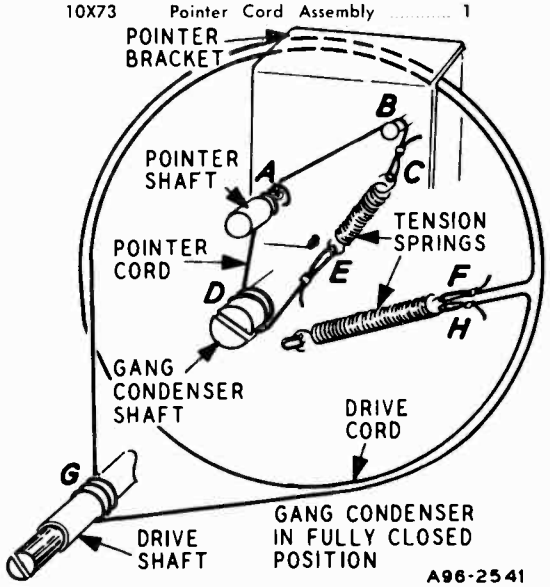
DIAL CORD

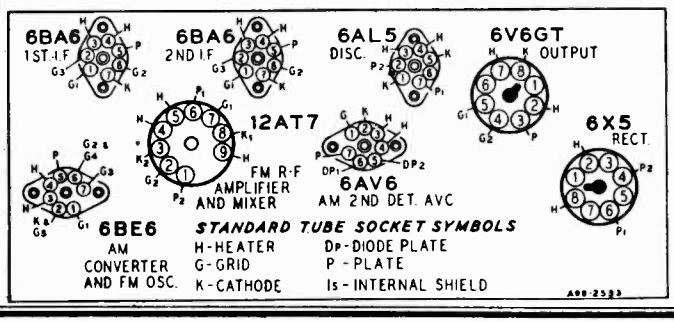
Install the cord as shown in the illustration, winding three turns counterclockwise around the drive shaft with the turns progressing away from the chassis. After completing the, installation rotate the drive shaft a few turns to take up the slack in the cord.

Ref. No.	Part No.	Description	Qty. Used in Set

DIAL AND DRIVE ASSEMBLY

58X728	Dial Glass	1
15X253.	Pointer	1
7A103	No. 47 Pilot Light Bulb	1
7A226	Pilot Light Socket Assembly	1
26X514	Drive Shaft	1
28X113	Drive Cord Tension Spring	1
10X74	Drive Cord Assembly	1
19X192	"C" Washer (Mtg. Drive Shaft)	2
28X292	Snap Button	4
6X66	Rubber Grommet (Mtg. Gang Condenser)	3
26X513	Pointer Shaft	1
28X206	Pointer Cord Tension Spring	1
25X1672	Pointer Bracket	1
10X73	Pointer Cord Assembly	1





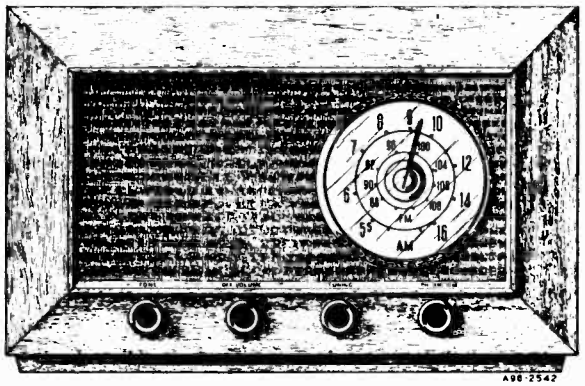
TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter. Conditions of measurement are:

Line voltage.....117 Volts AC
Signal Input.....None

A variation of ±10% is usually permissible.

MODEL 05WG-1811B



GENERAL DESCRIPTION

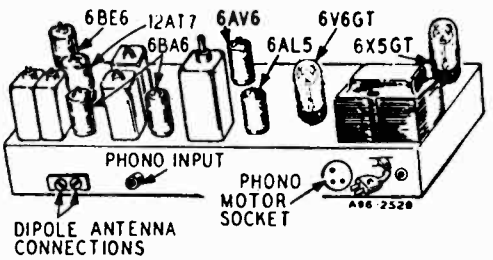
This is a two band, seven tube (plus rectifier tube) AM and FM receiver. Controls are provided at the front of the cabinet for tuning, volume, tone and band or phono selection. Phono input and phono motor sockets are provided at the rear of the receiver to which a record player may be connected. The I-F stages use high gain miniature type tubes. Air Wave Aerials are provided for the FM and Broadcast bands. Features include, a grounded grid R-F amplifier stage on the FM band, compensator circuits to prevent oscillator drift, automatic volume control, beam power output stage, PM dynamic loud speaker and an electrostatic shield in the power transformer to reduce power line noise.

ELECTRICAL SPECIFICATIONS

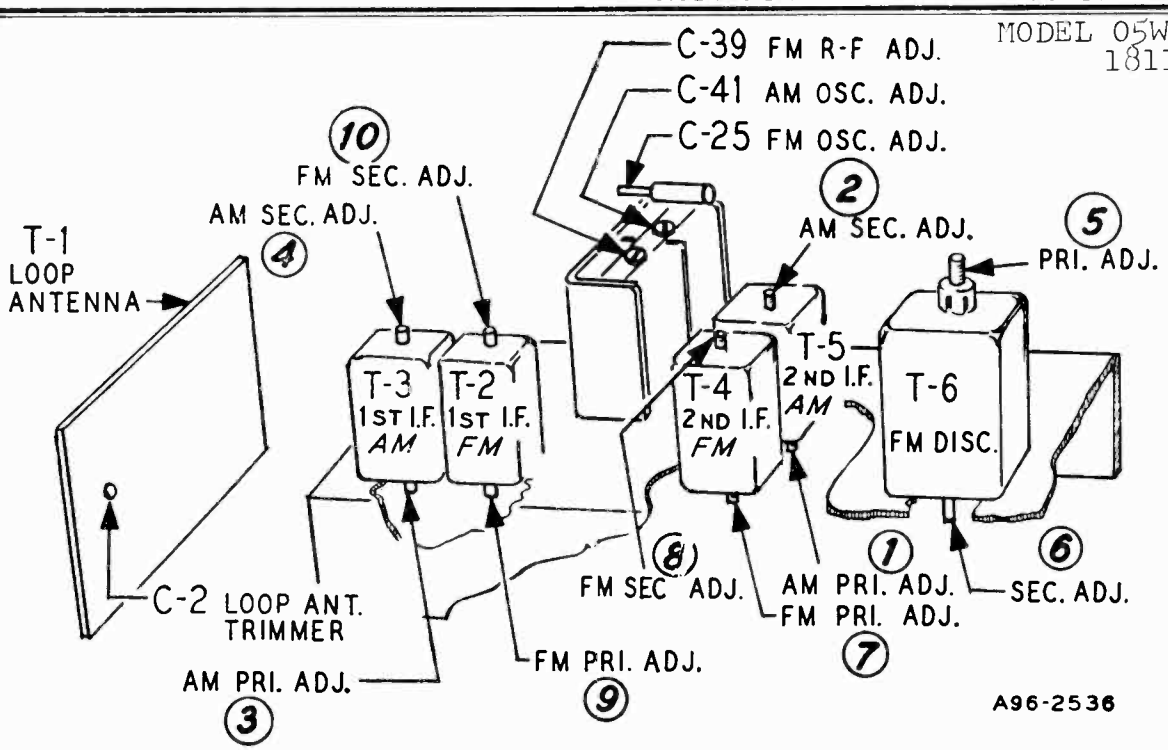
Power Supply	105-125 volts AC 50-60 cycles, 40 watts.
Frequency Ranges	Broadcast 540-1600 KC Frequency Modulation 88-108 MC
Intermediate Frequency	AM—455 KC FM—10.7 MC
Selectivity	AM—45 KC broad at 1000 times signal, measured at 1000 KC I.F. FM—200 KC broad at 2 times down I.F. FM—950 KC broad at 200 times down
AM Sensitivity	(For .5 watt output with external antenna) 25 microvolts average
FM Sensitivity	(For .5 watt output) 25 microvolts average
Power Output	1.9 watts maximum 0.8 watts 10% distortion
Loud Speaker	6" PM Dynamic
Voice Coil Impedance	3.2 ohms 400 cycles

Tube and Dial Lamp Complement

1 6BE6 AM Converter & FM Osc.
1 6BA6 1st I-F Amplifier
1 6BA6 2nd I-F Amplifier
1 6AL5 FM Discriminator
1 6AV6 Audio Amplifier, AM 2nd Detector and AVC
1 6V6GT Audio Output
1 6X5GT Rectifier
1 12AT7 R-F Amplifier & Mixer
1 No. 47 Dial Lamp



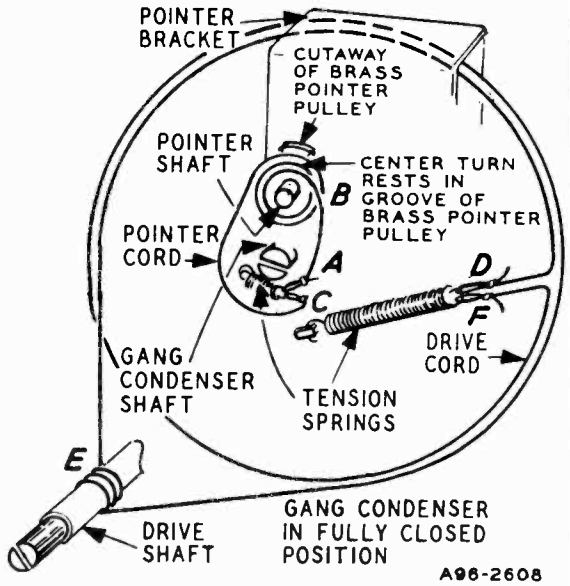
MODEL 05WG-1811B



DRIVE CORD REPLACEMENTS

POINTER CORD

Install the cord as shown in the illustration making sure that the center turn of the three turns rests in the groove of the brass pointer pulley.



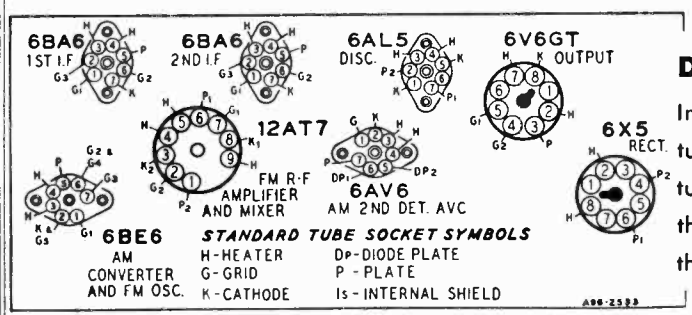
TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram of the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter.

Conditions of measurement are:

Line voltage .....117 Volts AC
Signal Input .....None

A variation of ±10% is usually permissible.



DIAL CORD

Install the cord as shown in the illustration, winding three turns counterclockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.

MODEL 05WG-1811B

ALIGNMENT PROCEDURES

AM STAGES

The following is required for aligning:
'An All Wave Signal Generator Which Will Pravide an Accurately Calibrated Signal at the Test Frequencies as Listed.
Output Indicating Meter, Non-Metallic Screwdriver, Dummy Antennas — .1 mf, and 50mmf.

Volume Control Maximum all Adjustments.
Connect Radia Chassis ta Ground Post af Signal Generator with a Short Heavy Lead.
Allow Chassis and Signal Generator to "Heat Up" for Several Minutes.

SIGNAL GENERATOR						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid 1st 6BA6 Pin No. 1	.1 mf	Chassis Base	Rator Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (3) and Sec. (4)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	Oscillatar C-41	Maximum Output
1400 KC	External Antenna Terminal	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.

FM STAGES

The following is required for aligning:
An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.
Non-metallic screwdriver.
Dummy Antennas and I-F Loading Resistor—2500 mmf, 300 ohms

Zero center scale DC vacuum tube voltmeter having a range of approximately 3 volts.
(If a zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negative readings).
Allow chassis and signal generator to "Heat Up" for several minutes.

	SIGNAL GENERATOR						
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotar Fully Open	Disc. Sec. (6) Note B	
I-F	10.7 MC Note C	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	2nd I-F Pri. (7) Sec. (8) Note D	Maximum Deflection
Discriminator	10.7 MC	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note D	Maximum Deflection
I-F	10.7 MC	Junction C-32A & B (Dual 100 mmf cond.) And chassis	2500 mmf	FM	Rotor Fully Open	1st I-F Pri. (9) & Sec. (10) 2nd I-F Pri. (7) & Sec. (8) Disc. Pri. (5) In Order Shown Note D	Maximum Deflection
	10.7 MC	Same as above	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN							
Oscillator	108.5	Disconnect hank antenna and connect generator to dipole terminals with resistor in series.	300 ohms	FM	Rotor Fully Open	Osc. C-25	Maximum Deflection
Antenna	104.5	Same as above	300 ohms	FM	Tune rotor for max. AVC voltage	Ant. C-39	Maximum Deflection
RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN							

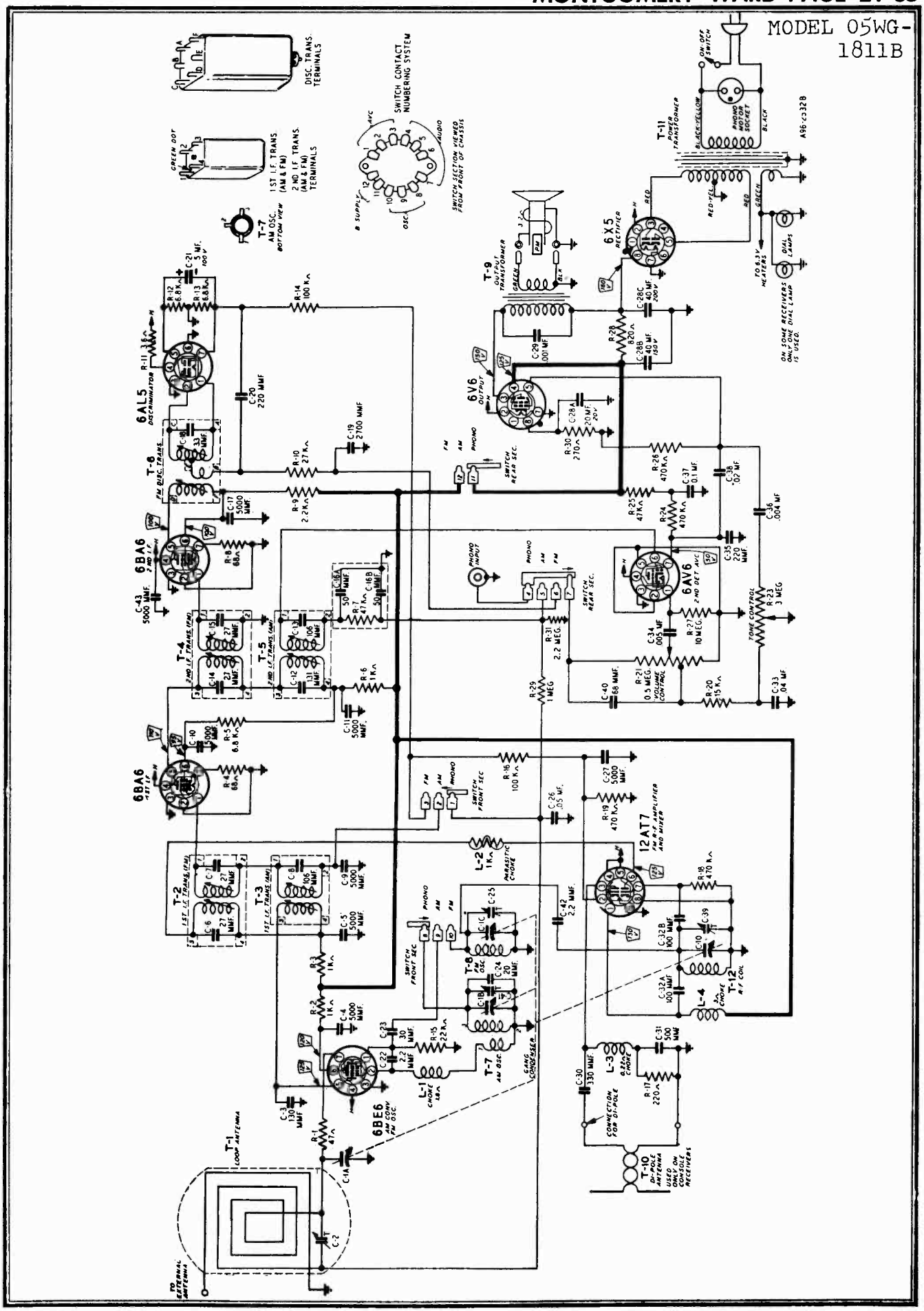
FM ALIGNMENT NOTES

NOTE A—The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line. A signal of .1 volt must be fed into the receiver for this adjustment.
Note output voltage on the zero center DC vacuum tube voltmeter.

NOTE B—Disconnect zero center DC vacuum tube voltmeter from AVC and connect it at the audio takeoff point at the 27 K ohm resistor (R-10) and its junctian with the terminal strip. Adjust for zero valtage indication.

NOTE C—AM I-F cails must be aligned before attempting to align the FM I-F coils.

NOTE D—Connect zero center DC vacuum tube voltmeter as in Note A. Adjust input to give same output on the zero center DC vacuum tube voltmeter as in Note A.



REPLACEMENT PARTS INFORMATION

HOW TO ORDER PARTS—Should it be necessary to write us or to order any repair parts, it is important that the complete model number which appears on the label attached to the rear of the chassis be specified.

Ref. No.	Part No.	Description	Qty. Used in Set
		CAPACITORS	
C-1	14A214	Gang Condenser Assembly	1
C-2	17A256	2-24 mmf Trimmer	1
C-3	47X559	130 mmf Ceramic	1
C-4, C-5, C-9, C-10, C-11, C-17, C-27, C-43	47X507	5000 mmf Ceramic	8
C-6, C-7		Part of T-2 (1st I-F Trans. FM)	
C-8		Part of T-3 (1st I-F Trans. AM)	
C-12, C-13		Part of T-5 (2nd I-F Trans. AM)	
C-14, C-15		Part of T-4 (2nd I-F Trans. FM)	
C-16A, C-16B	47X112	50-50 mmf Dual Mica	1
C-18		Part of T-6 (Discriminator Trans.)	
C-19	47X492	2700 mmf Molded Mica	1
C-20, C-35	47X468	220 mmf Ceramic	2
C-21	45X361	5 mf 100 V Dry Electrolytic	1
C-22, C-42	47X557	2.2 mmf Ceramic	2
C-23	47X558	30 mmf Ceramic	1
C-24	47X516	20 mmf Ceramic	1
C-25	17A255	1-8 mmf Trimmer	1
C-26	B66503	.05 mf 200 V Tubular	1
C-28A	45X360	20 mf 20 V	
C-28B		40 mf 150 V Dry Electrolytic	1
C-28C		40 mf 200 V	
C-29	H66102	.001 mf 800 V Tubular	1
C-30	47X470	330 mmf Molded Mica	1
C-31	47X508	500 mmf Ceramic	1
C-32A, C-32B	76X4	100 mmf Dual Ceramic	1
C-33	B66403	.04 mf 200 V Tubular	1
C-34	D66502	.005 mf 400 V Tubular	1
C-36	B66402	.004 mf 200 V Tubular	1
C-37	D66104	.1 mf 400 V Tubular	1
C-38	D66203	.02 mf 400 V Tubular	1
C-39, C-41		Part of C-1 (Gang Condenser)	
C-40	47X471	68 mmf Ceramic	1
		RESISTORS	
		Ohms Watts	
R-1	B85470	47 0.5 Carbon	1
R-2, R-3, R-6	B85102	1000 0.5 Carbon	3
R-4, R-8	B84680	68 0.5 Carbon	2
R-5, R-12, R-13	B84682	6800 0.5 Carbon	3
R-7, R-25	B85473	47 K 0.5 Carbon	2
R-9	B85222	2200 0.5 Carbon	1
R-10	B85273	27 K 0.5 Carbon	1
R-11	43X233	3.6 0.5 Wirewound	1
R-14, R-16	B85104	100 K 0.5 Carbon	2
R-15	B85223	22 K 0.5 Carbon	1
R-17	B84221	220 0.5 Carbon	1
R-18, R-19, R-24, R-26	B85474	470 K 0.5 Carbon	4
R-20	B85153	15 K 0.5 Carbon	1
R-21	36X385	.5 meg. Volume Control & Switch	1
R-23	40X296	3 meg. Tone Control	1
R-27	B85106	10 meg. 0.5 Carbon	1
R-28	D84821	820 2.0 Carbon	1
R-29	B85105	1 meg. 0.5 Carbon	1
R-30	B84271	270 0.5 Carbon	1
R-31	B85225	2.2 meg. 0.5 Carbon	1
		TRANSFORMERS AND COILS	
L-1	35A5	Insulated Choke	1
L-2	9A2103	Parasitic Choke Assembly	1
L-3	35A9	Insulated Choke	1
L-4	35A8	Insulated Choke	1
T-1	9A2079	"B" Range Loop Antenna	1
T-2	9A2060	1st I-F Trans. (FM)	1
T-3	9A2062	1st I-F Trans. (AM)	1
T-4	9A2061	2nd I-F Trans. (FM)	1
T-5	9A2063	2nd I-F Trans. (AM)	1
T-6	9A2064	Discriminator Transformer	1
T-7	9A2065	Oscillator Coil (AM)	1
T-8	9A2067	Oscillator Coil (FM)	1
T-9	51X144	Output Transformer	1
T-11	53X291	Power Transformer	1
T-12	9A2066	Antenna Coil (FM)	1
		MISCELLANEOUS	
	12A498	6" P.M. Speaker	1
	3A435	Tube Socket—Octal (8 prong) Molded	2
	3A426	Tube Socket (1st 6BA6)	1
	3A427	Tube Socket (6BE6)	1
	3A443	Tube Socket (12AT7)	1
	3A439	Tube Socket (Miniature)	3
	3A304	Phono Motor Socket	1
	3A305	Phono Socket—Single Pin Tip	1
	2A394	Band Change Switch	1
	13X546	Line Cord and Plug Assembly	1
	4X1071	Escutcheon	1
	10A757	Knob	4
		DIAL AND DRIVE ASSEMBLY	
	58X728	Dial Glass	1
	15X253	Pointer	1
	7A103	No. 47 Pilot Light Bulb	1
	7A226	Pilot Light Socket Assembly	1
	26X514	Drive Shaft	1
	28X113	Drive Cord Tension Spring	1
	10X74	Drive Cord Assembly	1
	19X192	"C" Washer (Mtg. Drive Shaft)	2
	28X292	Snap Button	4
	6X66	Rubber Grommet (Mtg. Gang Condenser)	3
	25A1079	Pointer Shaft & Pulley Assembly	1
	28X524	Pointer Cord Tension Spring	1
	25X1672	Pointer Bracket	1
	10X76	Pointer Cord Assembly	1

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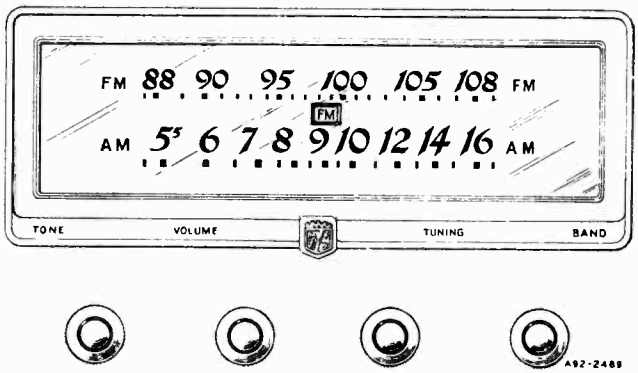
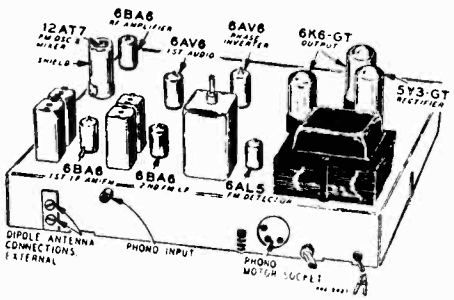


GENERAL DESCRIPTION

This is a two band, nine tube (plus rectifier tube) AM and FM receiver with automatic record changer. The I-F stages use high gain miniature type tubes. Built-in Air Wave Aerials are provided for the FM and Broadcast bands. Features include, compensator circuits to prevent oscillator drift, automatic volume control, push-pull pentode power output stage, PM dynamic loud speaker and an electrostatic shield in the power transformer to reduce power line noise.

The receiver and record changer are housed in a console combination cabinet with controls provided for tuning, volume, tone and band or phono selection.



DRIVE CORD REPLACEMENT

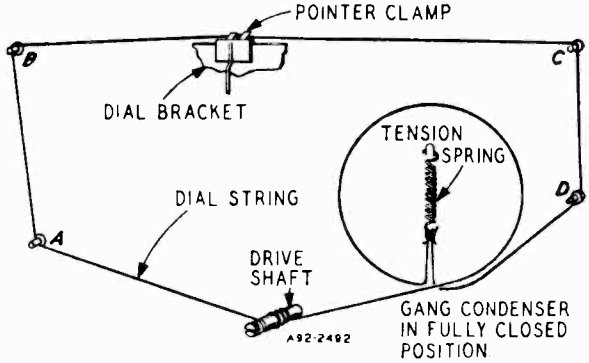
Use a new 10X54 drive cord assembly or a new length of cord 48 inches long for the installation, winding three turns clockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation, rotate the drive shaft a few turns to take up the slack in the cord.

ELECTRICAL SPECIFICATIONS

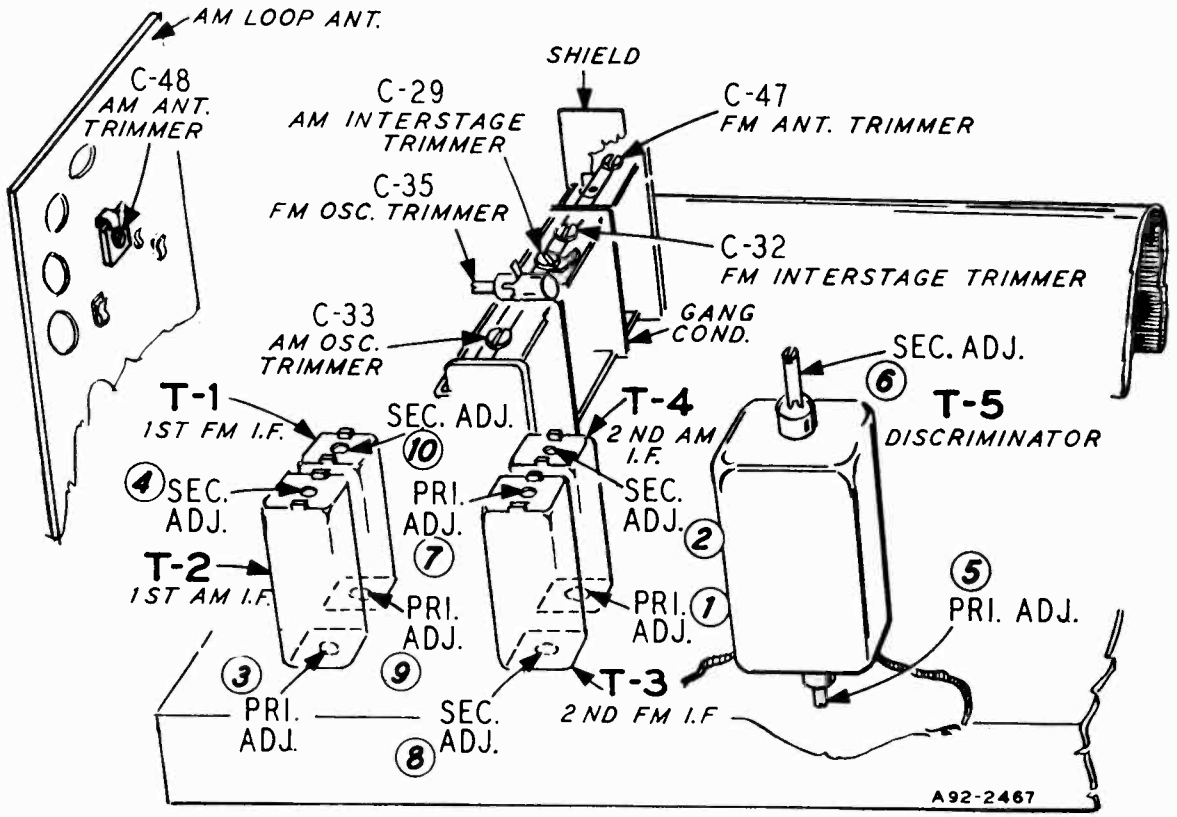
Power Supply	105-125 volts AC 60 cycles, 80 watts, 100 watts with record changer
Frequency Ranges	Broadcast 540-1600 KC Frequency Modulation 88-108 MC
Intermediate Frequency	AM—455 KC FM—10.7 MC
Selectivity	AM—43 KC broad at 1000 times signal, measured at 1000 KC I.F. FM—200 KC broad at 2 times down I.F. FM—760 KC broad at 200 times down
AM Sensitivity	(For .5 watt output with external antenna) 10 microvolts average
FM Sensitivity	(For .5 watt output) 30 microvolts average
Power Output	8.5 watts maximum 6.0 watts 10% distortion
Loud Speaker	12" PM Dynamic
Voice Coil Impedance	3.2 ohms 400 cycles
Record Changer	See Manual No. 5096A

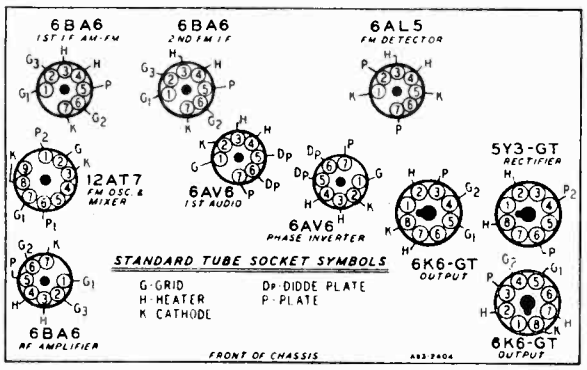
Tube and Dial Lamp Complement

1 6BA6 AM-FM R-F Amplifier
1 12AT7 FM & AM Osc. & Mixer
1 6BA6 FM-AM 1st I-F Amplifier
1 6BA6 FM 2nd I-F Amplifier
1 6AL5 FM Detector
1 6AV6 Audio Amplifier, AM 2nd Detector and AVC
2 6K6-GT Audio Output
1 5Y3-GT Rectifier
1 6AV6 Phase Inverter
2 No. 47 Dial Lamps



MODEL 05WG-2745B





TUBE SOCKET VOLTAGES

Socket voltages are shown on the Schematic diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter. Conditions of measurement are:

Line voltage ..... 117 Volts AC
Signal Input ..... None
A variation of ±10% is usually permissible.

ALIGNMENT PROCEDURE

AM STAGES

The following 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 mf, 200 mmf.

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		CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
	FREQUENCY SETTING						
I-F	455 kc	12AT7 Pin 7 and Chassis	.1 mf	Broadcast	Rotor Fully Open	2nd I-F Pri. & Sec. (1) & (2) 1st I-F Pri. & Sec. (3) & (4)	Maximum Output
Broadcast	1620 kc	External ant. lead	200 mmf	Broadcast	Rotor Fully Open	Broadcast Oscillator C-33	
	1400 kc	External ant. lead	200 mmf	Broadcast	Turn Rotor to Max. Output	Broadcast Interstage C-29	
	1400 kc	External ant. lead	200 mmf	Broadcast	Set pointer to 1400 kc See Note A	Loop Antenna C-48	

Note A—If the pointer is not at 1400 KC on dial, reset pointer at the 1400 KC mark on the dial scale.

MODEL 05WG-2745B

FM STAGES

The following equipment is required for aligning:

An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.

Non-metallic screwdriver.

Dummy Antennas and I-F Loading Resistor—.01 mf, 300 ohms and 1000 ohms.

Zero center scale DC vacuum tube valtmeter having a range of approximately 3 volts.

(If a zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negotive readings.)

Allow chassis and signal generator to warm up for several minutes.

	SIGNAL GENERATOR		THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO					
Discriminator	10.7 MC Note B	6BA6 2nd I-F Pin 1 and Chassis	.01 mf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Moximum Deflection
	10.7 MC Note B	6BA6 2nd I-F Pin 1 and Chassis	.01 mf	FM	Rotor Fully Open	Disc. Sec. (6) Note C	Zero Center
I-F	10.7 MC Note F	6BA6 1st I-F Pin 1 and Chassis	.01 mf	FM	Rotor Fully Open	2nd I-F Pri. Note A and D (7) 2nd I-F Sec. Note A and E (8)	Maximum Deflection
Discriminator	10.7 MC Note F	6BA6 1st I-F Pin 1 and Chassis	.01 mf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC Note F	6BA6 1st I-F Pin 1 and Chassis	.01 mf	FM	Rotor Fully Open	Disc. Sec. (6) Note C	Zero Center
	10.7 MC Note F	FM-RF Gang Condenser terminal	.01 mf	FM	Rotor Fully Open	1st I-F Pri. (9) 1st I-F Sec. (10) Notes A, D & E	Maximum Deflection
Recheck I-F Adjustments in order given							
R-F & Osc.	108.4 Note H	Disconnect dipole and connect generator to dipole terminals with resistor in series	300 ohms	FM	Rotor Fully Open	Oscillatar C-35 Note G	Maximum Deflection
	104.5	Disconnect dipole and connect generator to dipole terminals with resistor in series	300 ohms	FM	Tune Rotor for Max. AVC voltage	FM Interstage C-32	Maximum Deflection
	104.5	Disconnect dipole and connect generator to dipole terminals with resistor in series	300 ohms	FM	Tune Rotor for Max. AVC voltage	Ant. C-47	Maximum Deflection
Recheck R-F and Osc. Adjustments in order given							

NOTE A—Test Equipment connections are as given in the table. The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line at the junction of resistor R-22 and condenser C-18 for all adjustments except the discriminator secondary adjustment, for which See Note C.

NOTE B—A signal of .1 volt must be fed into the receiver for this adjustment.

NOTE C—Disconnect zero center DC vacuum tube voltmeter from AVC and connect to junction of R-18 and C-62. Adjust for zero voltage indication.

NOTE D—Before adjusting Pri. core connect 1000 ohm load resistor across the 2nd I.F. secondary terminals. Input may have to be increased ta .1 volt if receiver is *bodly* mis-aligned.

NOTE E—Disconnect 1000 ohm load resistor from secondary terminals and connect across the 2nd I.F. primary terminals. Input may have to be increased ta .1 volt if receiver is *bodly* mis-aligned.

NOTE F—Input can be reduced to 10,000 microvolts.

NOTE G—Oscillator frequency above signal frequency.

NOTE H—Remove the 1000 ohm load resistor before ottempting to check the R-F and oscillator adjustments.

REPLACEMENT PARTS INFORMATION

HOW TO ORDER PARTS — Should it be necessary to write us or to order any repair parts, it is important that the complete model number which appears on the label attached to the rear of the chassis be specified.

Ref. No.	Part No.	Description	Qty. Used in Set
C-48	Part of T-7 (Loop Antenna)		
C-50A, C-50B, C-50C	45X374	40 mf 450 V, 40 mf 450 V, 40 mf 25 V Dry Electrolytic	1
C-52	F66103	.01 mf 600 V Tubular	1
C-53	47X468	220 mmf Ceramic	1
C-54, C-59	F66203	.02 mf 600 V Tubular	2

REPLACEMENT PARTS LIST

C-55, C-60	F66102	.001 mf 600 V	Tubular	2
C-56	B66203	.02 mf 200 V	Tubular	1
C-57	F66602	.006 mf 600 V	Tubular	1
C-58	B66502	.005 mf 200 V	Tubular	1
C-61	47X471	68 mmf	Ceramic	1
C-62	47X492	2700 mmf	Molded Mica	1
C-63	46X328	.01 mf 120 V	Tubular	1

CAPACITORS

Ref. No.	Part No.	Description	Qty. Used in Set
C-1	14A207	Gang Condenser	1
C-2, C-3, C-7, C-9, C-12, C-16, C-17, C-18, C-19, C-27, C-42	47X507	5000 mmf Ceramic	11
C-4	47X497	100 mmf Ceramic	1
C-5	47X499	47 mmf Ceramic	1
C-8	47X498	47 mmf Ceramic	1
C-10, C-65		Part of T-1 1st I-F (FM)	
C-11, C-28	47X550	100 mmf Ceramic	2
C-15		Part of T-3 2nd I-F (FM)	
C-21		Part of T-5 Discriminator	
C-22, C-24, C-31, C-51	47X501	68 mmf Ceramic	4
C-23	45X361	5 mf 100 V Dry Electrolytic	1
C-25, C-26, C-45	47X496	500 mmf Ceramic	3
C-29, C-32, C-33, C-47		Part of Gang Condenser	
C-30	47X552	15 mmf Ceramic	1
C-34, C-46	47X516	20 mmf Ceramic	2
C-35	26A489	1-8 mmf Trimmer	1
C-36, C-64	47X549	5 mmf Ceramic	2
C-37, C-65	F66403	.04 mf 600 V Tubular	2
C-38, C-39		Part of T-2 1st I-F (AM)	
C-40	B66503	.05 mf 200 V Tubular	1
C-41, C-43		Part of T-4 2nd I-F (AM)	
C-44A, C-44B	47X112	50-50 mmf Dual Mica	1

RESISTORS

Ref. No.	Part No.	Ohms	Watts		Qty. Used in Set
R-1, R-10, R-22	B85105	1 meg.	0.5	Carbon	3
R-2, R-12, R-15	B83680	68	0.5	Carbon	3
R-3, R-11	B84563	56K	0.5	Carbon	2
R-4, R-6, R-8, R-13	B84102	1000	0.5	Carbon	4
R-5	B85104	100K	0.5	Carbon	1
R-7	B84103	10K	0.5	Carbon	1
R-9	B85225	2.2 meg.	0.5	Carbon	1
R-14	B85473	47K	0.5	Carbon	1
R-16	C84393	39K	1.0	Carbon	1
R-17	B85222	2200	0.5	Carbon	1
R-18	B84273	27K	0.5	Carbon	1
R-19	43X233	3.6	0.5	Wire wound	1
R-20, R-21	B83682	6800	0.5	Carbon	2
R-23	43X242	1400	5.0	Wire wound	1
R-24, R-31, R-35, R-38	B85474	470K	0.5	Carbon	4
R-25	36X383	0.5 meg.		Volume Control	1
R-26	B85153	15K	0.5	Carbon	1
R-27	40X285	3 meg.		Tone Control	1
R-28, R-33	B85106	10 meg.	0.5	Carbon	2
R-29, R-34	B85274	270K	0.5	Carbon	2
R-30	D83561	560	2.0	Carbon	1
R-32	B84822	8200	0.5	Carbon	1
R-36	B84682	6800	0.5	Carbon	1
R-37	B84562	5600	0.5	Carbon	1

TRANSFORMERS AND COILS

Ref. No.	Part No.	Description	Qty. Used in Set
L-2	9A2025	Interstage Coil (AM)	1
L-3	9A2024	Interstage Coil (FM)	1
L-4	9A2022	Oscillator Coil (AM)	1
L-5	35A5	Insulated Choke	1
L-6	9A1881	Filament Choke	1
L-7	9A2023	Oscillator Coil (FM)	1
L-8	35A7	Mixer Choke (FM)	1
L-9	9A2027	Antenna Coil (FM)	1
T-1	9A2043	1st I-F Trans. (FM)	1
T-2	9A2029	1st I-F Trans. (AM)	1
T-3	9A2030	2nd I-F Trans. (FM)	1
T-4	9A2042	2nd I-F Trans. (AM)	1
T-5	9A1970	Discriminator Coil	1
T-6	9A2004	Dipole Antenna	1
T-7	9A2041	"B" Range Loop Antenna	1
T-8	53X286	Power Transformer	1
T-9	51X142	Output Transformer	1

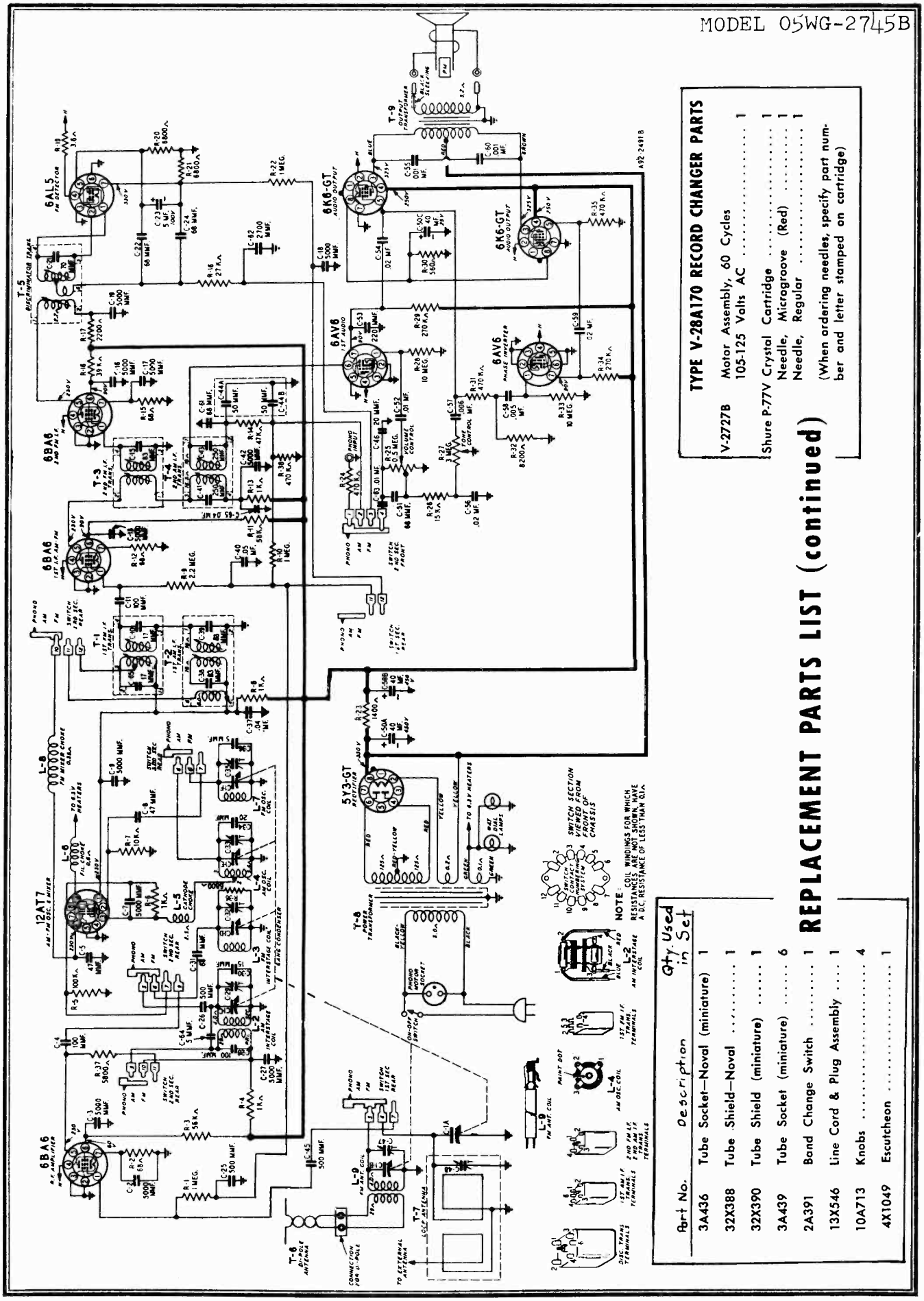
DIAL AND DRIVE ASSEMBLY

Part No.	Description	Qty. Used in Set
58X723	Dial Glass	1
25X1634	Dial Bracket	1
41X87	Dial Light Reflector	2

MISCELLANEOUS

Part No.	Description	Qty. Used in Set
12A490	Speaker 12" P.M.	1
3A304	Phono Motor Socket	1
3A305	Phono Socket—Single Pin Tip	1
3A435	Tube Socket—Octal (8 prong) Molded	3
15X246	Pointer	1
10X54	Drive Cord Assembly	1
28X113	Drive Cord Spring	1
7A103	No. 47 Pilot Light	2
7A199	Pilot Light Socket Assembly	1
19X192	"C" Washer (mtg. Drive Shaft)	2
26X512	Drive Shaft	1
6X67	Rubber Grommet	4

MODEL 05WG-2745B



TYPE V-28A170 RECORD CHANGER PARTS

V-2727B Motor Assembly, 60 Cycles 105-125 Volts AC 1

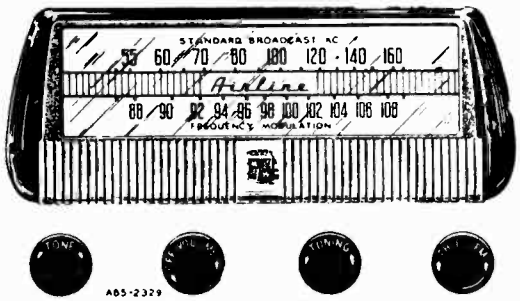
Shure P-77V Crystal Cartridge 1
Needle, Micrograove (Red) 1
Needle, Regular 1

(When ordering needles, specify part number and letter stamped on cartridge)

REPLACEMENT PARTS LIST (continued)

Part No.	Description	Qty. Used in Set
3A436	Tube Socket—Noval (miniature)	1
32X388	Tube Shield—Noval	1
32X390	Tube Shield (miniature)	1
3A439	Tube Socket (miniature)	6
2A391	Band Change Switch	1
13X546	Line Cord & Plug Assembly	1
10A713	Knobs	4
4X1049	Escutcheon	1

NOTE: COIL WINDINGS FOR WHICH RESISTANCES ARE NOT SHOWN, HAVE A D.C. RESISTANCE OF LESS THAN 0.1Ω



GENERAL DESCRIPTION

This is a two band, seven tube (plus rectifier tube) AM and FM receiver with automatic record changer. The I-F stages use high gain miniature type tubes. Built-in Air Wave Aerials are provided for the FM and Broadcast bands. Features include, a grounded grid R-F amplifier stage on the FM band, compensator circuits to prevent ascillator drift, automatic volume control, beam power output stage, PM dynamic loud speaker and an electrostatic shield in the power transformer to reduce power line noise.

The receiver and record changer are housed in a console combination cabinet with controls provided for tuning, volume, tone and band or phono selection.

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 volts AC 60 cycles, 40 watts. 60 watts with record changer.
Frequency Ranges	Broadcast 540-1600 KC Frequency Modulation 88-108 MC
Intermediate Frequency	AM—455KC FM—10.7 MC
Selectivity	AM—45 KC broad at 1000 times signal, measured at 1000 KC I.F. FM—200 KC broad at 2 times down I.F. FM—950 KC broad at 200 times down
AM Sensitivity	(For .5 watt output with external antenna) 25 microvolts average
FM Sensitivity	(For .5 watt output) 25 microvolts average
Power Output	1.9 watts maximum .8 watts 10% distortion
Loud Speaker	8" PM Dynamic
Voice Coil Impedance	3.2 ohms 400 cycles
Record Changer	See Manual No. 5081A.

Tube and Dial Lamp Complement

1 6BE6 AM Converter & FM Osc.
1 6BA6 1st I-F Amplifier
1 6BA6 2nd I-F Amplifier
1 6AL5 FM Discriminator
1 6AV6 Audio Amplifier, AM 2nd Detector and AVC
1 6V6GT Audio Output
1 6X5GT Rectifier
1 12AT7 R-F Amplifier & Mixer
2 No. 47 Dial Lamps

TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter.

Conditions of measurement are:

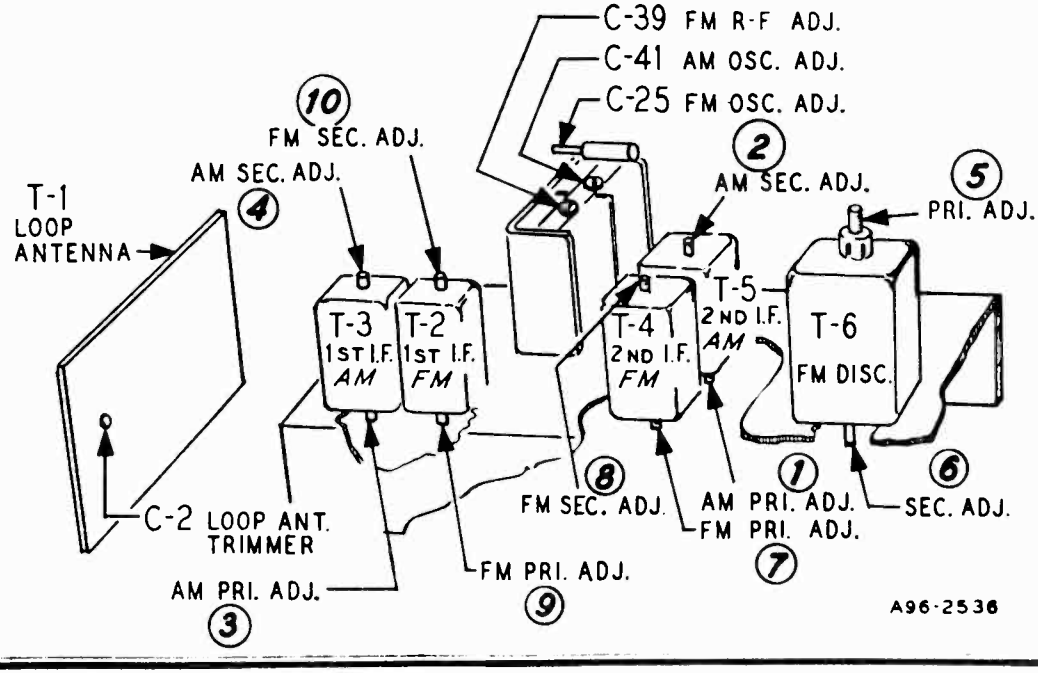
Line voltage.....117 Volts AC
Signal Input.....None

A variation of ±10% is usually permissible.

DRIVE CORD REPLACEMENT

DIAL POINTER CORD

Use a new 10X56 drive cord assembly or a new length of cord 46 inches long for the installation. Install the cord as shown in the illustratian, winding three turns clockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns ta take up the slack in the cord.



MODEL 05WG-2747B

ALIGNMENT PROCEDURES

AM STAGES

The following 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 mf, and 50mmf.

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						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid 1st 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (3) and Sec. (4)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I-F Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-41	Maximum Output
1400 KC	External Antenna Lead	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.

FM STAGES

The following is required for aligning:

An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.

Non-metallic screwdriver.

Dummy Antennas and I-F Loading Resistor—2500 mmf, 300 ohms

Zero center scale DC vacuum tube voltmeter having a range of approximately 3 volts.

(If a zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negative readings).

Allow chassis and signal generator to "Heat Up" for several minutes.

	SIGNAL GENERATOR *						
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
I-F	10.7 MC Note C	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	2nd I-F Pri. (7) Sec. (8) Note D	Maximum Deflection
Discriminator	10.7 MC	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note D	Maximum Deflection
I-F	10.7 MC	Junction C-32A & B (Dual 100 mmf cond.) And chassis	2500 mmf	FM	Rotor Fully Open	1st I-F Pri. (9) & Sec. (10) 2nd I-F Pri. (7) & Sec. (8) Disc. Pri. (5) In Order Shown Note D	Maximum Deflection
	10.7 MC	Same as above	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	Maximum Deflection
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN							
Oscillator	108.5	Disconnect built-in dipole antenna and connect generator to dipole terminals with resistor in series.	300 ohms	FM	Rotor Fully Open	Osc. C-25	Maximum Deflection
Antenna	104.5	Same as above	300 ohms	FM	Tune rotor for max. AVC voltage	Ant. C-39	Maximum Deflection
RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN							

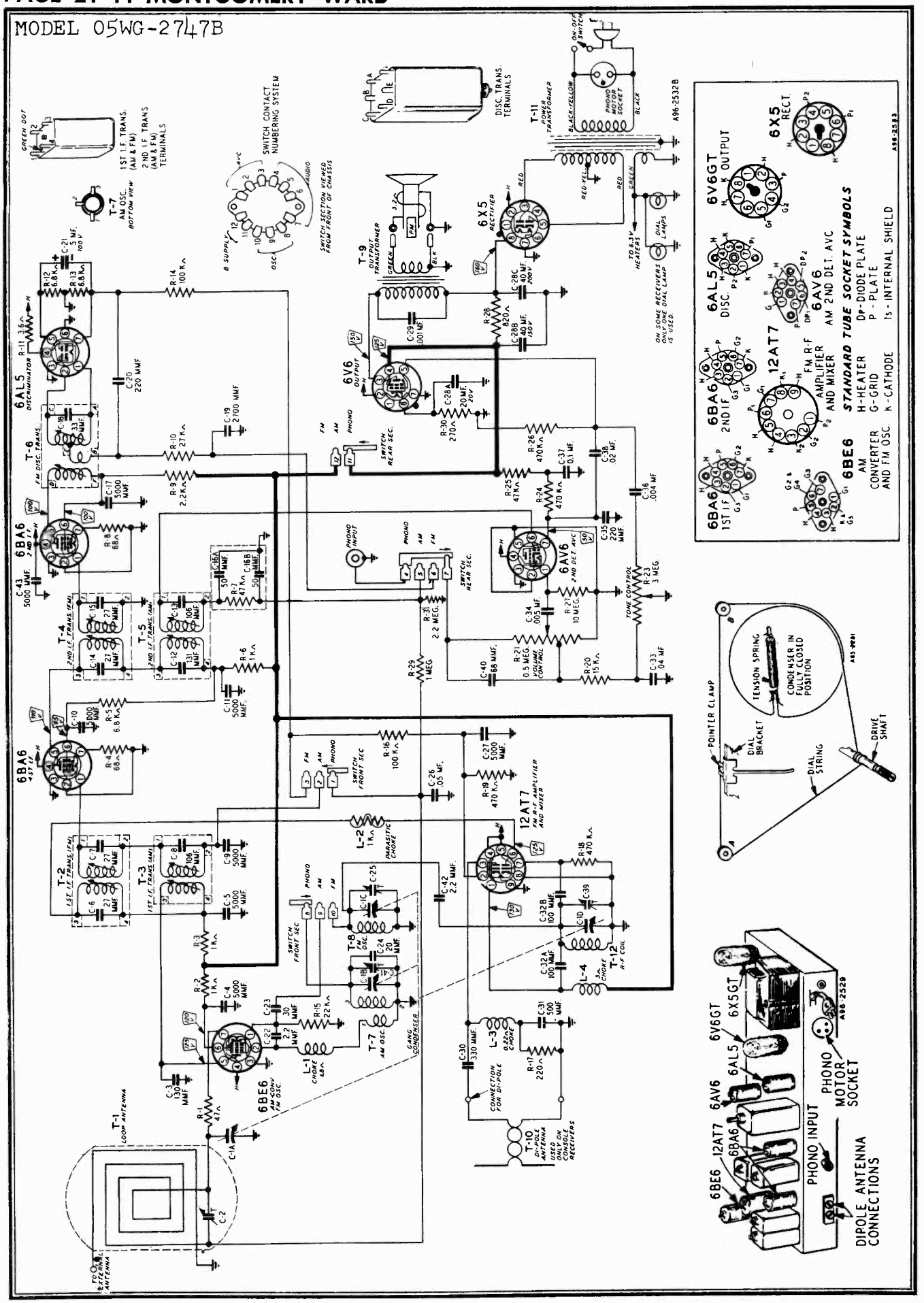
FM ALIGNMENT NOTES

NOTE A—The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line. A signal of .1 volt must be fed into the receiver for this adjustment.
Note output voltage on the zero center DC vacuum tube voltmeter

NOTE B—Disconnect zero center DC vacuum tube voltmeter from AVC and connect it at the audio takeoff point at the 27 K ohm resistor (R-10) and its junction with the terminal strip. Adjust for zero voltage indication.

NOTE C—AM I-F coils must be aligned before attempting to align the FM I-F coils.

NOTE D—Connect zero center DC vacuum tube voltmeter as in Note A. Adjust input to give same output on the zero center DC vacuum tube voltmeter as in Note A.



REPLACEMENT PARTS

Ref. No.	Part No.	Description	Qty. Used in Set
TRANSFORMERS AND COILS			
L-1	35A5	Insulated Choke	1
L-2	9A2068	Parasitic Choke Assembly	1
L-3	35A9	Insulated Choke	1
L-4	35A8	Insulated Choke	1
T-1	9A2099	"B" Range Loop Antenna	1
T-2	9A2060	1st I-F Trans. (FM)	1
T-3	9A2062	1st I-F Trans. (AM)	1
T-4	9A2061	2nd I-F Trans. (FM)	1
T-5	9A2063	2nd I-F Trans. (AM)	1
T-6	9A2064	Discriminator Transformer	1
T-7	9A2065	Oscillator Coil (AM)	1
T-8	9A2067	Oscillator Coil (FM)	1
T-9	51X134	Output Transformer	1
T-10	9A2002	Dipole Antenna	1
T-11	53X291	Power Transformer	1
T-12	9A2066	Antenna Coil (FM)	1
CAPACITORS			
C-1	14A209	Gang Condenser Assembly	1
C-2	17A256	2-24 mmf Trimmer	1
C-3	47X559	130 mmf Ceramic	1
C-4, C-5, C-9, C-10, C-11, C-17, C-27, C-43	47X507	5000 mmf Ceramic	8
C-6, C-7		Part of T-2 (1st I-F Trans. FM)	
C-8		Part of T-3 (1st I-F Trans. AM)	
C-12, C-13		Part of T-5 (2nd I-F Trans. AM)	
C-14, C-15		Part of T-4 (2nd I-F Trans. FM)	
C-16A, C-16B	47X112	50-50 mmf Dual Mica	1
C-18		Part of T-6 (Discriminator Trans.)	
C-19	47X492	2700 mmf Molded Mica	1
C-20, C-35	47X468	220 mmf Ceramic	2
C-21	45X361	5 mf 100 V Dry Electrolytic	1
C-22, C-42	47X557	2.2 mmf Ceramic	2
C-23	47X558	30 mmf Ceramic	1
C-24	47X516	20 mmf Ceramic	1
C-25	17A255	1-8 mmf Trimmer	1
C-26	B66503	.05 mf 200 V Tubular	1
C-28A, C-28B, C-28C	45X360	20 mf 20 V, 40 mf 150 V, 40 mf 200 V Dry Electrolytic	1
C-29	H66102	.001 mf 800 V Tubular	1
C-30	47X470	330 mmf Molded Mica	1
C-31	47X508	500 mmf Ceramic	1
C-32A, C-32B	76X4	100 mmf Dual Ceramic	1
C-33	B66403	.04 mf 200 V Tubular	1
C-34	D66502	.005 mf 400 V Tubular	1
C-36	B66402	.004 mf 200 V Tubular	1
C-37	D66104	.1 mf 400 V Tubular	1
C-38	D66203	.02 mf 400 V Tubular	1
C-39, C-41		Part of C 1 (Gang Condenser)	
C-40	47X471	68 mmf Ceramic	1
RESISTORS			
R-1	B85470	47 Ohms 0.5 Watts Carbon	1
R-2, R-3, R-6	B85102	1000 0.5 Carbon	3
R-4, R-8	B84680	68 0.5 Carbon	2
R-5, R-12, R-13	B84682	6800 0.5 Carbon	3
R-7, R-25	B85473	47 K 0.5 Carbon	2
R-9	B85222	2200 0.5 Carbon	1
R-10	B85273	27 K 0.5 Carbon	1
R-11	43X233	3.6 0.5 Wirewound	1
R-14, R-16	B85104	100 K 0.5 Carbon	2
R-15	B85223	22 K 0.5 Carbon	1
R-17, R-18, R-19	B84221	220 0.5 Carbon	1
R-24, R-26	B85474	470 K 0.5 Carbon	4
R-20	B85153	15 K 0.5 Carbon	1
R-21	36X372	.5 meg. Volume Control & Switch	1
R-23	40X285	3 meg. Tone Control	1
R-27	B85106	10 meg. 0.5 Carbon	1
R-28	D84821	820 2.0 Carbon	1
R-29	B85105	1 meg. 0.5 Carbon	1
R-30	B84271	270 0.5 Carbon	1
R-31	B85225	2.2 meg. 0.5 Carbon	1

TYPE V-28A166 RECORD CHANGER PARTS

V-2727B	Motor Assembly, 60 cycles 105-125 Volts AC	1
Shure P-81	Crystal Cartridge	1
	Semi-Permanent Needle	1
	(When ordering needles, specify part number and letter stamped on cartridge.)	

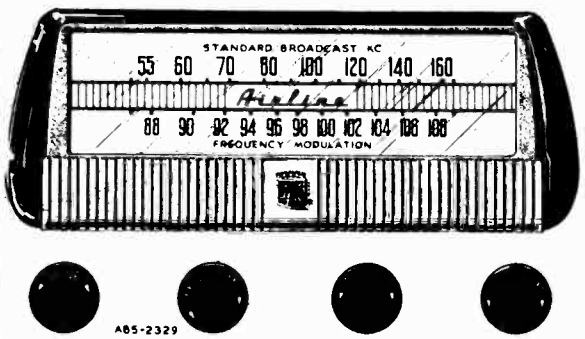
MISCELLANEOUS

12A477	8" P.M. Speaker	1
3A303	Tube Socket—Octal (8 prong) Molded	2
3A426	Tube Socket—Miniature	4
3A427	Tube Socket (12AT7)	1
3A443	Tube Socket (6BE6)	1
3A304	Phono Motor Socket	1
3A305	Phono Socket—Single Pin Tip	1
2A395	Band Change Switch	1
13X546	Line Cord and Plug Assembly	1
4X1020	Escutcheon	1
10A695	Knob (Tuning)	1
10A696	Knob (Volume Control & Switch)	1
10A697	Knob (Tone)	1
10A698	Knob (Phono—BC—FM)	1

DIAL AND DRIVE ASSEMBLY

58X727	Dial Glass	1
24X446	Idler Pulley	2
15X257	Pointer	1
25X1569	Dial Bracket	1
7A103	No. 47 Pilot Light Bulb	2
7A202	Pilot Light Socket Assembly	1
26X486	Drive Shaft	1
41X26	Reflector, Dial Light	2
28X113	Drive Cord Tension Spring	1
10X56	Drive Cord Assembly	1
19X192	"C" Washer (Mtg. drive Shaft)	2
6X66	Rubber Grommet (Mtg. gang cond.)	3

MODELS 94WG-2748C,
05WG-2748C



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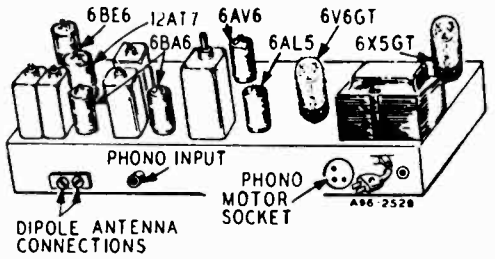
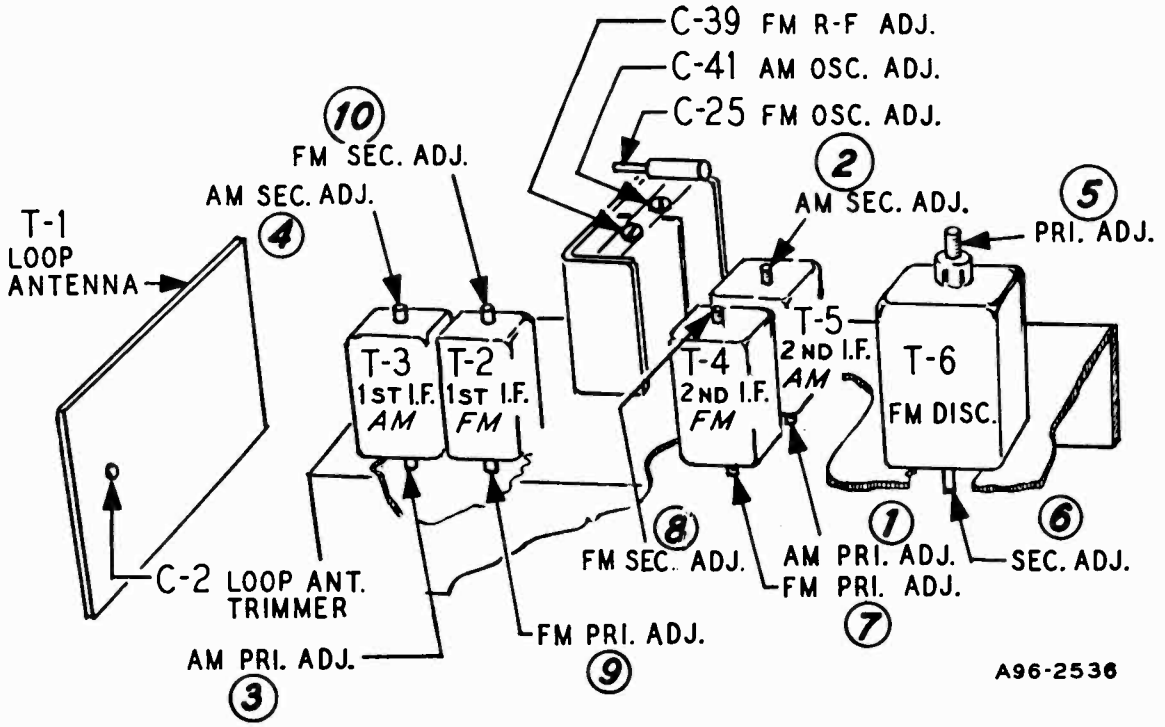


ELECTRICAL SPECIFICATIONS

Power Supply	105-125 volts AC 60 cycles, 40 watts. 60 watts with record changer.
Frequency Ranges	Broadcast 540-1600 KC Frequency Modulation 88-108 MC
Intermediate Frequency	AM—455 KC FM—10.7 MC
Selectivity	AM—45 KC broad at 1000 times signal, measured at 1000 KC I.F. FM—200 KC broad at 2 times down I.F. FM—950 KC broad at 200 times down
AM Sensitivity	(For .5 watt output with external antenna) 25 microvolts average
FM Sensitivity	(For .5 watt output) 25 microvolts average
Power Output	1.9 watts maximum 0.8 watts 10% distortion
Loud Speaker	10" PM Dynamic
Voice Coil Impedance	3.2 ohms 400 cycles

Tube and Dial Lamp Complement

1 6BE6 AM Converter & FM Osc.
1 6BA6 1st I-F Amplifier
1 6BA6 2nd I-F Amplifier
1 6AL5 FM Discriminator
1 6AV6 Audio Amplifier, AM 2nd Detector and AVC
1 6V6GT Audio Output
1 6X5GT Rectifier
1 12AT7 R-F Amplifier & Mixer
2 No. 47 Dial Lamps

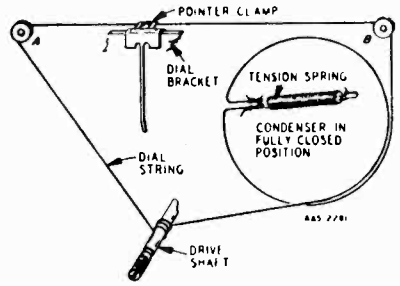


MODELS 94WG-2748C,
05WG-2748C

DRIVE CORD REPLACEMENT

DIAL POINTER CORD

Use a new 10X56 drive cord assembly or a new length of cord 46 inches long for the installation. Install the cord as shown in the illustration, winding three turns clockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.



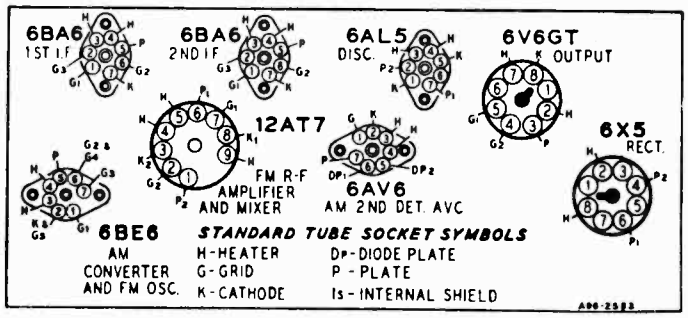
TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram of the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter.

Conditions of measurement are:

Line voltage ..... 117 Volts AC
Signal Input ..... None

A variation of ±10% is usually permissible.



ALIGNMENT PROCEDURES

AM STAGES

The following 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 mf, and 50mmf.

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						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid 1st 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (3) and Sec. (4)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-41	Maximum Output
1400 KC	External Antenna Terminal	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.

FM STAGES

The following is required for aligning:
An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.
Non-metallic screwdriver.
Dummy Antennas and I-F Loading Resistor—2500 mmf, 300 ohms

Zero center scale DC vacuum tube voltmeter having a range of approximately 3 volts.
(If a zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negative readings).
Allow chassis and signal generator to "Heat Up" for several minutes.

MODELS 94WG-2748C,
05WG-2748C

	SIGNAL GENERATOR		THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO					
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
I-F	10.7 MC Note C	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	2nd I-F Pri. (7) Sec. (8) Note D	Maximum Deflection
Discriminator	10.7 MC	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note D	Maximum Deflection
I-F	10.7 MC	Junction C-32A & B (Dual 100 mmf cond.) And chassis	2500 mmf	FM	Rotor Fully Open	1st I-F Pri. (9) & Sec. (10) 2nd I-F Pri. (7) & Sec. (8) Disc. Pri. (5) In Order Shown Note D	Maximum Deflection
	10.7 MC	Same as above	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN							
Oscillator	108.5	Disconnect built-in dipole antenna and connect generator to dipole terminals with resistor in series.	300 ohms	FM	Rotor Fully Open	Osc. C-25	Maximum Deflection
Antenna	104.5	Same as above	300 ohms	FM	Tune rotor for max. AVC voltage	Ant. C-39	Maximum Deflection
RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN							

FM ALIGNMENT NOTES

NOTE A—The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line. A signal of .1 volt must be fed into the receiver for this adjustment.
Note output voltage on the zero center DC vacuum tube voltmeter.

NOTE B—Disconnect zero center DC vacuum tube voltmeter from AVC and connect it at the audio takeoff point at the 27 K ohm resistor (R-10) and its junction with the terminal strip. Adjust for zero voltage indication.

NOTE C—AM I-F coils must be aligned before attempting to align the FM I-F coils.

NOTE D—Connect zero center DC vacuum tube voltmeter as in Note A. Adjust input to give same output on the zero center DC vacuum tube voltmeter as in Note A.

Ref. No.	Part No.	Description	Qty. Used in Set
		CAPACITORS	
C-1	14A209	Gang Condenser Assembly	1
C-2	17A255	2-24 mmf Trimmer	1
C-3	47X559	130 mmf Ceramic	1
C-4, C-5, C-9, C-10, C-11, C-17, C-27, C-43	47X507	5000 mmf Ceramic	8
C-6, C-7		Part of T-2 (1st I-F Trans. FM)	
C-8		Part of T-3 (1st I-F Trans. AM)	
C-12, C-13		Part of T-5 (2nd I-F Trans. AM)	
C-14, C-15		Part of T-4 (2nd I-F Trans. FM)	
C-16A, C-16B	47X112	50-50 mmf Dual Mica	1
C-18		Part of T-6 (Discriminator Trans.)	
C-19	47X492	2700 mmf Molded Mica	1
C-20, C-35	47X468	220 mmf Ceramic	2
C-21	45X361	5 mf 100 V Dry Electrolytic	1
C-22, C-42	47X557	2.2 mmf Ceramic	2
C-23	47X558	30 mmf Ceramic	1
C-24	47X516	20 mmf Ceramic	1
C-25	17A255	1-8 mmf Trimmer	1
C-26	B66503	.05 mf 200 V Tubular	1
C-28A C-28B C-28C	45X360	20 mf 20 V 40 mf 150 V 40 mf 200 V Dry Electrolytic	1
C-29	H66102	.001 mf 800 V Tubular	1
C-30	47X470	330 mmf Molded Mica	1
C-31	47X508	500 mmf Ceramic	1
C-32A, C-32B	76X4	100 mmf Dual Ceramic	1
C-33	B66403	.04 mf 200 V Tubular	1
C-34	D66502	.005 mf 400 V Tubular	1
C-36	B66402	.004 mf 200 V Tubular	1
C-37	D66104	.1 mf 400 V Tubular	1
C-38	D66203	.02 mf 400 V Tubular	1
C-39, C-41		Part of C-1 (Gang Condenser)	
C-40	47X471	68 mmf Ceramic	1

MODELS 94WG-2748C,
05WG-2748C

Ref. No.	Part No.	Description	Qty. Used in Set
		RESISTORS	
		Ohms Watts	
R-1	B85470	47 0.5 Carbon	1
R-2, R-3, R-6	B85102	1000 0.5 Carbon	3
R-4, R-8	B84680	68 0.5 Carbon	2
R-5, R-12, R-13	B84682	6800 0.5 Carbon	3
R-7, R-25	B85473	47 K 0.5 Carbon	2
R-9	B85222	2200 0.5 Carbon	1
R-10	B85273	27 K 0.5 Carbon	1
R-11	43X233	3.6 0.5 Wirewound	1
R-14, R-16	B85104	100 K 0.5 Carbon	2
R-15	B85223	22 K 0.5 Carbon	1
R-17	B84221	220 0.5 Carbon	1
R-18, R-19, R-24, R-26	B85474	470 K 0.5 Carbon	4
R-20	B85153	15 K 0.5 Carbon	1
R-21	36X372	.5 meg. Volume Control & Switch	1
R-23	40X285	3 meg. Tone Control	1
R-27	B85106	10 meg. 0.5 Carbon	1
R-28	D84821	820 2.0 Carbon	1
R-29	B85105	1 meg. 0.5 Carbon	1
R-30	B84271	270 0.5 Carbon	1
R-31	B85225	2.2 meg. 0.5 Carbon	1

TRANSFORMERS AND COILS

L-1	35A5	Insulated Choke	1
L-2	9A2103	Parasitic Choke Assembly	1
L-3	35A9	Insulated Choke	1
L-4	35A8	Insulated Choke	1
T-1	9A2146	"B" Range Loop Antenna	1
T-2	9A2060	1st I-F Trans. (FM)	1
T-3	9A2062	1st I-F Trans. (AM)	1
T-4	9A2061	2nd I-F Trans. (FM)	1
T-5	9A2063	2nd I-F Trans. (AM)	1
T-6	9A2064	Discriminator Transformer	1
T-7	9A2065	Oscillator Coil (AM)	1
T-8	9A2067	Oscillator Coil (FM)	1
T-9	51X134	Output Transformer	1
T-10	9A2004	Dipole Antenna	1
T-11	53X291	Power Transformer	1
T-12	9A2066	Antenna Coil (FM)	1

Ref. No.	Part No.	Description	Qty. Used in Set
		MISCELLANEOUS	
	12A480	10" P.M. Speaker	1
	3A435	Tube Socket—Octal (8 prong) Molded	2
	3A426	Tube Socket (1st 6BA6)	1
	3A427	Tube Socket (6BE6)	1
	3A443	Tube Socket (12AT7)	1
	3A439	Tube Socket (Miniature)	3
	3A304	Phono Mator Socket	1
	3A305	Phono Socket—Single Pin Tip	1
	2A393	Band Change Switch	1
	13X546	Line Cord and Plug Assembly	1
	4X1020	Escutcheon	1
	10A695	Knob (Tuning)	1
	10A696	Knob (Volume Control & Switch)	1
	10A697	Knob (Tone)	1
	10A698	Knob (Phono-BC-FM)	1
		DIAL AND DRIVE ASSEMBLY	
	58X727	Dial Glass	1
	24X446	Idler Pulley	2
	15X257	Pointer	1
	25X1569	Dial Bracket	1
	7A103	No. 47 Pilot Light Bulb	2
	7A202	Pilot Light Socket Assembly	1
	26X486	Drive Shaft	1
	41X26	Reflector, Dial Light	2
	28X113	Drive Cord Tension Spring	1
	10X55	Drive Cord Assembly	1
	19X192	"C" Washer (Mtg. drive Shaft)	2
	6X66	Rubber Grommet (Mtg. gang cond.)	3

TYPE G.I.-28A168 RECORD CHANGER PARTS

(Model 94WG-2748C)

G.I.-56-76527	Motor Assembly, 60 cycles 105-125 Volts AC	1
AST-LT3D	Crystal Cartridge	1
	Needle, Regular	1
	Needle, Microgroove (Red)	1

(When ordering needles, specify part number and letter stamped on cartridge.)

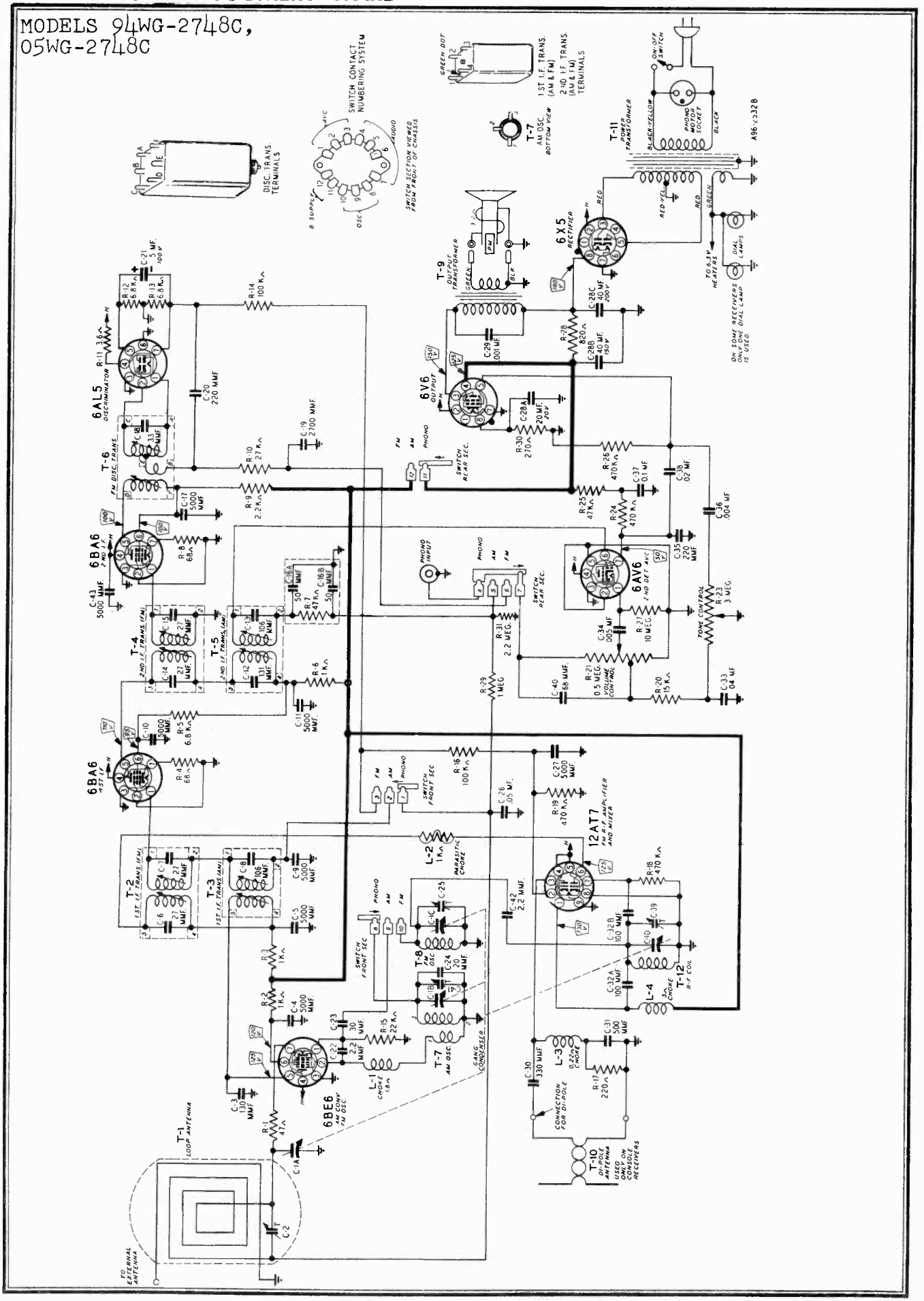
TYPE G.I.-29A169 RECORD CHANGER PARTS

(Model 05WG-2748C)

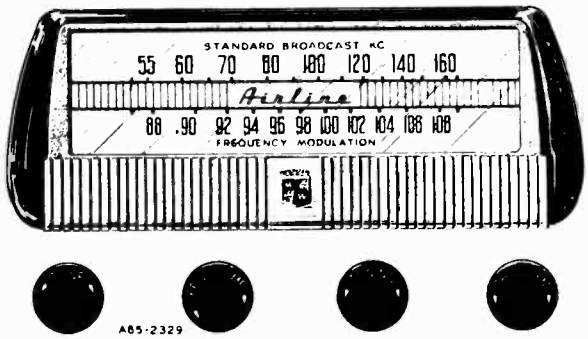
G.I.-56-76507	Motor Assembly, 60 cycles 105-125 Volts AC	1
E-V No. 33-4	Crystal Cartridge with Needle	1
	Semi-Permanent Needle Only	1

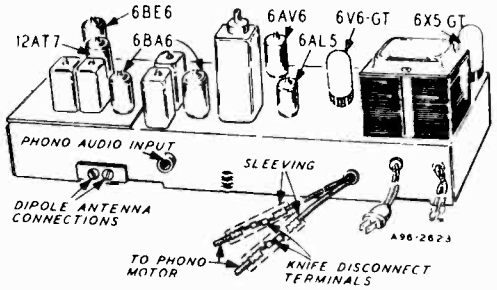
(When ordering needles, specify part number and letter stamped on cartridge.)

MODELS 94WG-2748C,
05WG-2748C



MODEL 05WG-2748D



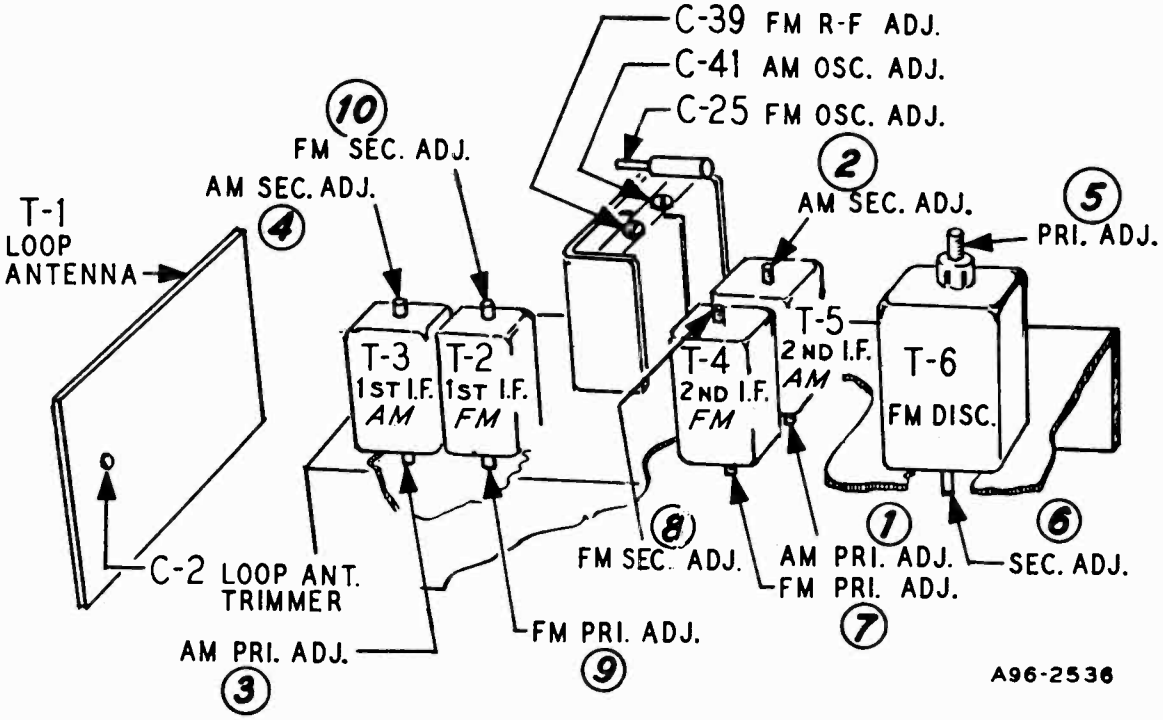


ELECTRICAL SPECIFICATIONS

Power Supply	105-125 volts AC 60 cycles, 40 watts. 60 watts with record changer.
Frequency Ranges	Broadcast 540-1600 KC Frequency Modulation 88-108 MC
Intermediote Frequency	AM—455 KC FM—10.7 MC
Selectivity	AM—45 KC broad at 1000 times signal, measured at 1000 KC I.F. FM—200 KC broad at 2 times down I.F. FM—950 KC broad at 200 times down
AM Sensitivity	(For .5 watt output with external antenna) 25 microvolts average
FM Sensitivity	(For .5 watt output) 25 microvolts average
Power Output	1.9 watts maximum 0.8 watts 10% distortion
Loud Speaker	10" PM Dynamic
Voice Coil Impedance	3.2 ohms 400 cycles

Tube and Dial Lamp Complement

1 6BE6 AM Converter & FM Osc.
1 6BA6 1st I-F Amplifier
1 6BA6 2nd I-F Amplifier
1 6AL5 FM Discriminator
1 6AV6 Audio Amplifier, AM 2nd Detector and AVC
1 6V6GT Audio Output
1 6X5GT Rectifier
1 12AT7 R-F Amplifier & Mixer
2 No. 47 Dial Lamps

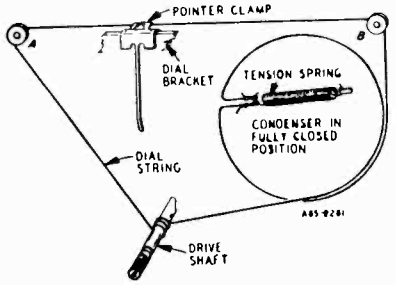


MODEL 05WG-2748D

DRIVE CORD REPLACEMENT

DIAL POINTER CORD

Use a new 10X56 drive cord assembly or a new length of cord 46 inches long for the installation. Install the cord as shown in the illustration, winding three turns clockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.



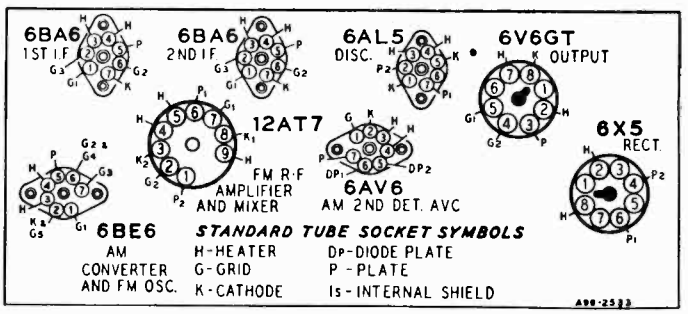
TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram of the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter.

Conditions of measurement are:

Line voltage .....117 Volts AC
Signal Input .....None

A variation of ±10% is usually permissible.



ALIGNMENT PROCEDURES

AM STAGES

The following 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 mf, and 50mmf.

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						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid 1st 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (3) and Sec. (4)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-41	Maximum Output
1400 KC	External Antenno Terminal	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.

FM STAGES

The following is required for aligning:
An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.
Non-metallic screwdriver.
Dummy Antennas and I-F Loading Resistor—2500 mmf, 300 ohms

Zero center scale DC vacuum tube voltmeter having a range of approximately 3 volts.
(If a zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negative readings).
Allow chassis and signal generator to "Heat Up" for several minutes.

MODEL 05WG-2748D

	SIGNAL GENERATOR		THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO					
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
I-F	10.7 MC Note C	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	2nd I-F Pri. (7) Sec. (8) Note D	Maximum Deflection
Discriminator	10.7 MC	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note D	Maximum Deflection
I-F	10.7 MC	Junction C-32A & B (Dual 100 mmf cond.) And chassis	2500 mmf	FM	Rotor Fully Open	1st I-F Pri. (9) & Sec. (10) 2nd I-F Pri. (7) & Sec. (8) Disc. Pri. (5) In Order Shown Note D	Maximum Deflection
	10.7 MC	Same as above	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN							
Oscillator	108.5	Disconnect built-in dipole antenna and connect generator to dipole terminals with resistor in series.	300 ohms	FM	Rotor Fully Open	Osc. C-25	Maximum Deflection
Antenna	104.5	Same as above	300 ohms	FM	Tune rotor for max. AVC voltage	Ant. C-39	Maximum Deflection
RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN							

FM ALIGNMENT NOTES

NOTE A—The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line. A signal of .1 volt must be fed into the receiver for this adjustment.
Note output voltage on the zero center DC vacuum tube voltmeter.

NOTE B—Disconnect zero center DC vacuum tube voltmeter from AVC and connect it at the audio takeoff point at the 27 K ohm resistor (R-10) and its junction with the terminal strip. Adjust for zero voltage indication.

NOTE C—AM I-F coils must be aligned before attempting to align the FM I-F coils.

NOTE D—Connect zero center DC vacuum tube voltmeter as in Note A. Adjust input to give same output on the zero center DC vacuum tube voltmeter as in Note A.

Ref. No.	Part No.	Description	Qty. Used in Set
		CAPACITORS	
C-1	14A209	Gang Condenser Assembly	1
C-2	17A256	2-24 mmf Trimmer	1
C-3	47X559	130 mmf Ceramic	1
C-4, C-5, C-9, C-10, C-11, C-17, C-27, C-43	47X507	5000 mmf Ceramic	8
C-6, C-7		Part of T-2 (1st I-F Trans. FM)	
C-8		Part of T-3 (1st I-F Trans. AM)	
C-12, C-13		Part of T-5 (2nd I-F Trans. AM)	
C-14, C-15		Part of T-4 (2nd I-F Trans. FM)	
C-16A, C-16B	47X112	50-50 mmf Dual Mica	1
C-18		Part of T-6 (Discriminator Trans.)	
C-19	47X492	2700 mmf Molded Mica	1
C-20, C-35	47X468	220 mmf Ceramic	2
C-21	45X361	5 mf 100 V Dry Electrolytic	1
C-22, C-42	47X557	2.2 mmf Ceramic	2
C-23	47X558	30 mmf Ceramic	1
C-24	47X516	20 mmf Ceramic	1
C-25	17A255	1-8 mmf Trimmer	1
C-26, C-44	B66503	.05 mf 200 V Tubular	2
C-28A, C-28B, C-28C	45X360	20 mf 20 V, 40 mf 150 V, 40 mf 200 V Dry Electrolytic	1
C-29	H66102	.001 mf 800 V Tubular	1
C-30	47X470	330 mmf Molded Mica	1
C-31	47X508	500 mmf Ceramic	1
C-32A, C-32B	76X4	100 mmf Dual Ceramic	1
C-33	B66403	.04 mf 200 V Tubular	1
C-34	D66502	.005 mf 400 V Tubular	1
C-36	B66402	.004 mf 200 V Tubular	1
C-37	D66104	.1 mf 400 V Tubular	1
C-38	D66203	.02 mf 400 V Tubular	1
C-39, C-41		Part of C-1 (Gang Condenser)	
C-40	47X471	68 mmf Ceramic	1

MODEL 05WG-2748D

Ref. No.	Part No.	Description	Ohms	Watts		Qty. Used in Set
		RESISTORS				
R-1	B85470		47	0.5	Carbon	1
R-2, R-3, R-6	B85102		1000	0.5	Carbon	3
R-4, R-8	B84680		68	0.5	Carbon	2
R-5, R-12, R-13	B84682		6800	0.5	Carbon	3
R-7, R-25	B85473		47 K	0.5	Carbon	2
R-9	B85222		2200	0.5	Carbon	1
R-10	B85273		27 K	0.5	Carbon	1
R-11	43X233		3.6	0.5	Wirewound	1
R-14, R-16	B85104		100 K	0.5	Carbon	2
R-15	B85223		22 K	0.5	Carbon	1
R-17	B84221		220	0.5	Carbon	1
R-18, R-19, R-24, R-26	B85474		470 K	0.5	Carbon	4
R-20	B85153		15 K	0.5	Carbon	1
R-21	36X372		.5 meg.		Volume Control & Switch	1
R-23	40X285		3 meg.		Tone Control	1
R-27	B85106		10 meg.	0.5	Carbon	1
R-28	D84821		820	2.0	Carbon	1
R-29	B85105		1 meg.	0.5	Carbon	1
R-30	B84271		270	0.5	Carbon	1
R-31	B84274		270 K	0.5	Carbon	1

Ref. No.	Part No.	Description	Qty. Used in Set
		TRANSFORMERS AND COILS	
L-1	35A5	Insulated Choke	1
L-2	9A2103	Parasitic Choke Assembly	1
L-3	35A9	Insulated Choke	1
L-4	35A8	Insulated Choke	1
T-1	9A2146	"B" Range Loop Antenna	1
T-2	9A2060	1st I-F Trans. (FM)	1
T-3	9A2062	1st I-F Trans. (AM)	1
T-4	9A2061	2nd I-F Trans. (FM)	1
T-5	9A2063	2nd I-F Trans. (AM)	1
T-6	9A2064	Discriminator Transformer	1
T-7	9A2065	Oscillator Coil (AM)	1
T-8	9A2067	Oscillator Coil (FM)	1
T-9	51X134	Output Transformer	1
T-10	9A2004	Dipole Antenna	1
T-11	53X291	Power Transformer	1
T-12	9A2066	Antenna Coil (FM)	1

Ref. No.	Part No.	Description	Qty. Used in Set
		MISCELLANEOUS	
	12A480	10" P.M. Speaker	1
	3A435	Tube Socket—Octal (8 prong) Molded	2
	3A426	Tube Socket (1st 6BA6)	1
	3A427	Tube Socket (6BE6)	1
	3A443	Tube Socket (12AT7)	1
	3A439	Tube Socket (Miniature)	3
	*3A304	Phono Motor Socket	1
	3A305	Phono Socket—Single Pin Tip	1
	2A393	Band Change Switch	1
	13X546	Line Cord and Plug Assembly	1
	4X1020	Escutcheon	1
	10A695	Knob (Tuning)	1
	10A696	Knob (Volume Control & Switch)	1
	10A697	Knob (Tone)	1
	10A698	Knob (Phono-BC-FM)	1

*In some receivers knife type connectors are used.

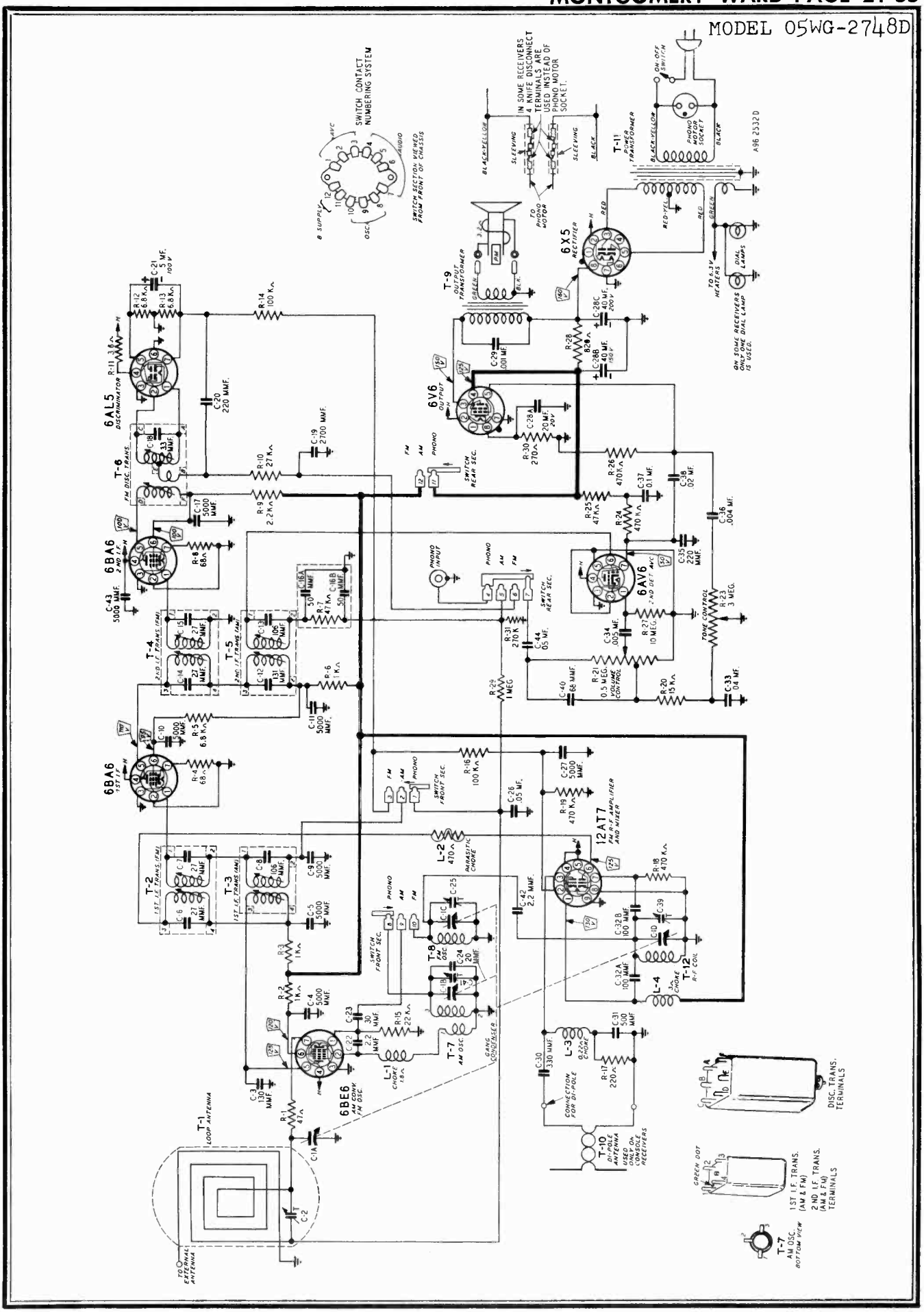
		DIAL AND DRIVE ASSEMBLY	
	58X727	Dial Glass	1
	24X446	Idler Pulley	2
	15X257	Pointer	1
	25X1569	Dial Bracket	1
	7A103	No. 47 Pilot Light Bulb	2
	7A202	Pilot Light Socket Assembly	1
	26X486	Drive Shaft	1
	41X26	Reflector, Dial Light	2
	28X113	Drive Cord Tension Spring	1
	10X56	Drive Cord Assembly	1
	19X192	"C" Washer (Mtg. drive Shaft)	2
	6X66	Rubber Grommet (Mtg. gang cond.)	3

TYPE G.I. 28A169 RECORD CHANGER PARTS

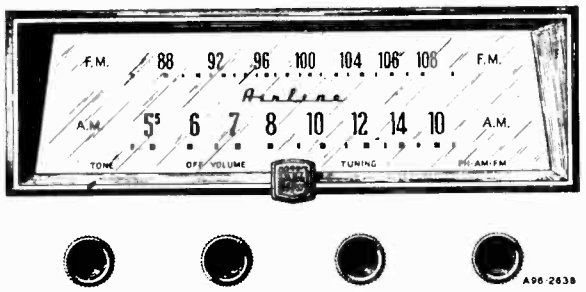
G.I.-56-76507	Motor Assembly, 60 cycles 105-125 Volts AC	1
E.V. No. 33-4	Crystal Cartridge with Needle	1
	Semi-Permanent Needle Only	1

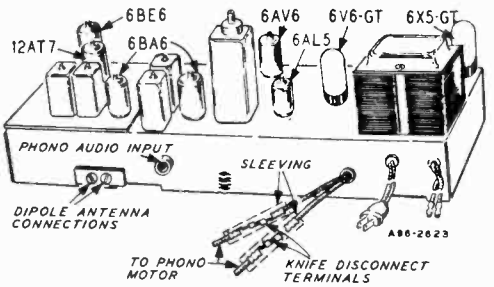
(When ordering needles, specify part number and letter stamped on cartridge.)

MODEL 05WG-2748D



MODEL 05WG-2748E





ELECTRICAL SPECIFICATIONS

Power Supply..... 105-125 volts AC 60 cycles, 40 watts. 60 watts with record changer.

Frequency Ranges..... Broadcast 540-1600 KC
Frequency Modulation 88-108 MC

Intermediate Frequency.... AM—455 KC
FM—10.7 MC

Selectivity..... AM—45 KC broad at 1000 times signal, measured at 1000 KC
I.F. FM—200 KC broad at 2 times down
I.F. FM—950 KC broad at 200 times down

AM Sensitivity..... (For .5 watt output with external antenna) 25 microvolts average

FM Sensitivity..... (For .5 watt output) 25 microvolts average

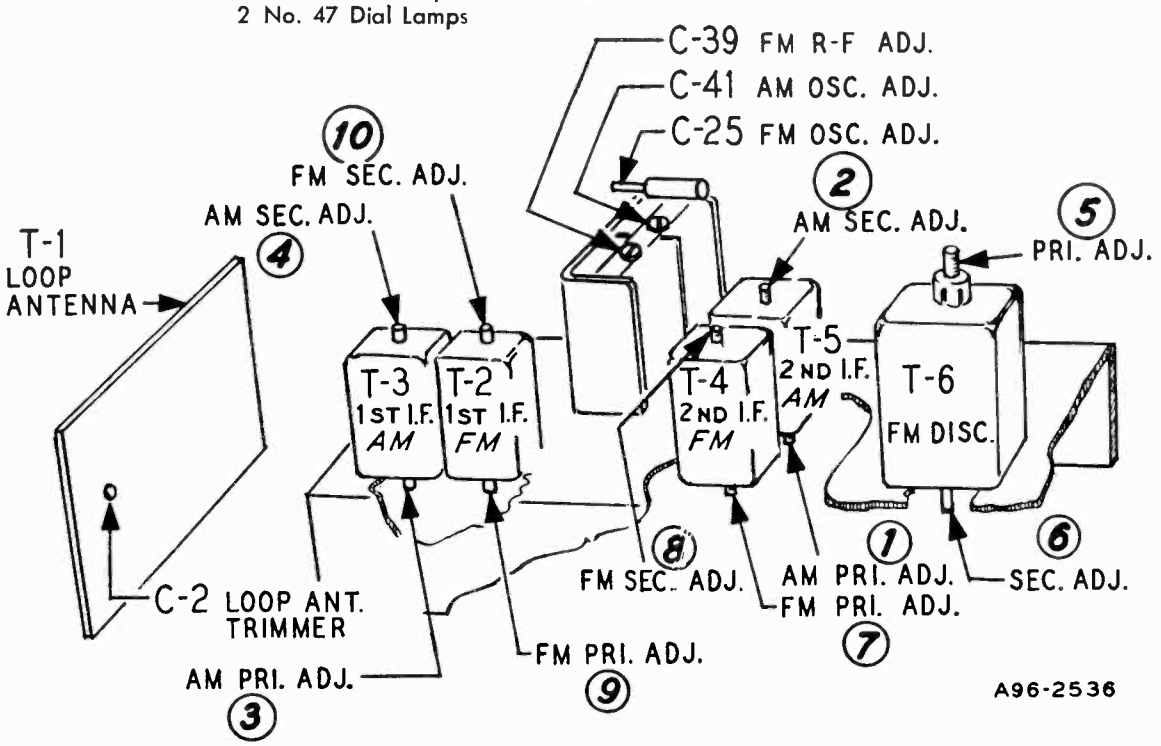
Power Output..... 1.9 watts maximum
0.8 watts 10% distortion

Loud Speaker..... 10" PM Dynamic

Voice Coil Impedance..... 3.2 ohms 400 cycles

Tube and Dial Lamp Complement

1 6BE6 AM Converter & FM Osc.
1 6BA6 1st I-F Amplifier
1 6BA6 2nd I-F Amplifier
1 6AL5 FM Discriminator
1 6AV6 Audio Amplifier, AM 2nd Detector and AVC
1 6V6GT Audio Output
1 6X5GT Rectifier
1 12AT7 R-F Amplifier & Mixer
2 No. 47 Dial Lamps

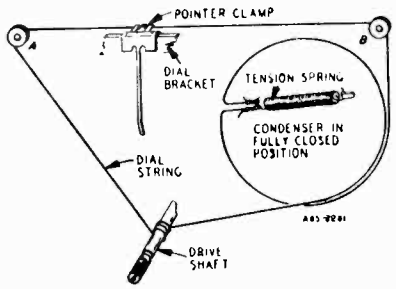


MODEL 05WG-2748E

DRIVE CORD REPLACEMENT

DIAL POINTER CORD

Use a new 10X72 drive cord assembly or a new length of cord 44 inches long for the installation. Install the cord as shown in the illustration, winding three turns clockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.



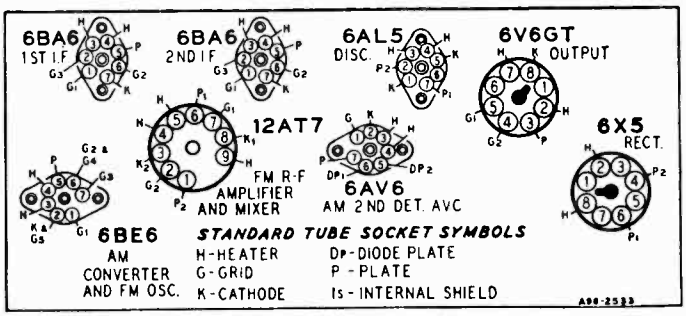
TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter.

Conditions of measurement are:

Line voltage .....117 Volts AC
Signal Input .....None

A variation of ±10% is usually permissible.



ALIGNMENT PROCEDURES

AM STAGES

The following 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 mf, and 50mmf.

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						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid 1st 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (3) and Sec. (4)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I-F Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-41	Maximum Output
1400 KC	External Antenna Terminal	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the diol scale.

FM STAGES

The following is required for aligning:

An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.

Non-metallic screwdriver.

Dummy Antennas and I-F Loading Resistor—2500 mmf, 300 ohms

Zero center scale DC vacuum tube voltmeter having a range of approximately 3 volts.
(If o zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negative readings).
Allow chassis and signal generator to "Heat Up" for several minutes.

MODEL 05WG-2748E

SIGNAL GENERATOR							
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC	68A6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
I-F	10.7 MC Note C	68A6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	2nd I-F Pri. (7) Sec. (8) Note D	Maximum Deflection
Discriminator	10.7 MC	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note D	Maximum Deflection
I-F	10.7 MC	Junction C-32A & B (Dual 100 mmf cond.) And chassis	2500 mmf	FM	Rotor Fully Open	1st I-F Pri. (9) & Sec. (10) 2nd I-F Pri. (7) & Sec. (8) Disc. Pri. (5) In Order Shown Note D	Maximum Deflection
	10.7 MC	Same as above	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN							
Oscillator	108.5	Disconnect built-in dipole antenna and connect generator to dipole terminals with resistor in series.	300 ohms	FM	Rotor Fully Open	Osc. C-25	Maximum Deflection
Antenna	104.5	Same as above	300 ohms	FM	Tune rotor for max. AVC voltage	Ant. C-39	Maximum Deflection
RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN							

FM ALIGNMENT NOTES

NOTE A—The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line. A signal of .1 volt must be fed into the receiver for this adjustment.
Note output voltage on the zero center DC vacuum tube voltmeter

NOTE B—Disconnect zero center DC vacuum tube voltmeter from AVC and connect it at the audio takeoff point at the 27 K ohm resistor (R-10) and its junction with the terminal strip. Adjust for zero voltage indication.

NOTE C—AM I-F coils must be aligned before attempting to align the FM I-F coils.

NOTE D—Connect zero center DC vacuum tube voltmeter as in Note A. Adjust input to give same output on the zero center DC vacuum tube voltmeter as in Note A.

Ref. No.	Part No.	Description	Qty. Used in Set
CAPACITORS			
C-1	14A209	Gang Condenser Assembly	1
C-2	17A235	2-24 mmf Trimmer	1
C-3	47X559	130 mmf Ceramic	1
C-4, C-5, C-9, C-10, C-11, C-17, C-27, C-43	47X507	5000 mmf Ceramic	8
C-6, C-7		Part of T-2 (1st I-F Trans. FM)	
C-8		Part of T-3 (1st I-F Trans. AM)	
C-12, C-13		Part of T-5 (2nd I-F Trans. AM)	
C-14, C-15		Part of T-4 (2nd I-F Trans. FM)	
C-16A, C-16B	47X112	50-50 mmf Dual Mica	1
C-18		Part of T-6 (Discriminator Trans.)	
C-19	47X492	2700 mmf Molded Mica	1
C-20, C-35	47X468	220 mmf Ceramic	2
C-21	45X361	5 mf 100 V Dry Electrolytic	1
C-22, C-42	47X557	2.2 mmf Ceramic	2
C-23	47X558	30 mmf Ceramic	1
C-24	47X516	20 mmf Ceramic	1
C-25	17A255	1-8 mmf Trimmer	1
C-26, C-44	B66503	.05 mf 200 V Tubular	2
C-28A	45X360	20 mf 20 V	
C-28B		40 mf 150 V Dry Electrolytic	1
C-28C		40 mf 200 V	
C-29	H66102	.001 mf 800 V Tubular	1
C-30	47X470	330 mmf Molded Mica	1
C-31	47X508	500 mmf Ceramic	1
C-32A, C-32B	76X4	100 mmf Dual Ceramic	1
C-33	B66403	.04 mf 200 V Tubular	1
C-34	D66502	.005 mf 400 V Tubular	1
C-36	B66103	.01 mf 200 V Tubular	1
C-37	D66104	.1 mf 400 V Tubular	1
C-38	D66203	.02 mf 400 V Tubular	1
C-39, C-41		Part of C-1 (Gang Condenser)	
C-40	47X471	68 mmf Ceramic	1

MODEL 05WG-2748E

Ref. No.	Part No.	Description	Qty. Used in Set
		RESISTORS	
		Ohms Watts	
R-1	B85470	47 0.5 Carbon	1
R-2, R-3, R-6, R-9	B85102	1000 0.5 Carbon	4
R-4, R-8	B84680	68 0.5 Carbon	2
R-5, R-12, R-13	B84682	6800 0.5 Carbon	3
R-7, R-25	B85473	47 K 0.5 Carbon	2
R-10	B85273	27 K 0.5 Carbon	1
R-11	43X233	3.6 0.5 Wirewound	1
R-14, R-16	B85104	100 K 0.5 Carbon	2
R-15	B85223	22 K 0.5 Carbon	1
R-17	B84221	220 0.5 Carbon	1
R-18, R-19, R-24, R-26	B85474	470 K 0.5 Carbon	4
R-20	B85153	15 K 0.5 Carbon	1
R-21	36X372	.5 meg. Volume Control & Switch	1
R-23	40X310	.5 meg. Tone Control	1
R-27	B85106	10 meg. 0.5 Carbon	1
R-28	D84821	820 2.0 Carbon	1
R-29	B85105	1 meg. 0.5 Carbon	1
R-30	B84271	270 0.5 Corbon	1
R-31	B84274	270 K 0.5 Carbon	1
		TRANSFORMERS AND COILS	
L-1	35A5	Insulated Choke	1
L-2	9A2103	Parasitic Choke Assembly	1
L-3	35A9	Insulated Choke	1
L-4	35A8	Insulated Choke	1
T-1	9A2146	"B" Range Loop Antenna	1
T-2	9A2060	1st I-F Trans. (FM)	1
T-3	9A2062	1st I-F Trans. (AM)	1
T-4	9A2061	2nd I-F Trans. (FM)	1
T-5	9A2063	2nd I-F Trans. (AM)	1
T-6	9A2064	Discriminator Transformer	1
T-7	9A2065	Oscillator Coil (AM)	1
T-8	9A2067	Oscillator Coil (FM)	1
T-9	51X134	Output Transformer	1
T-10	9A2004	Dipole Antenna	1
T-11	53X291	Power Transformer	1
T-12	9A2066	Antenna Coil (FM)	1

Ref. No.	Part No.	Description	Qty. Used in Set
		MISCELLANEOUS	
	12A480	10" P.M. Speaker	1
	3A435	Tube Socket—Octal (8 prong) Molded	2
	3A426	Tube Socket (1st 6BA6)	1
	3A427	Tube Socket (6BE6)	1
	3A443	Tube Socket (12AT7)	1
	3A439	Tube Socket (Miniature)	3
	*3A304	Phono Motor Socket	1
	3A305	Phono Socket—Single Pin Tip	1
	2A393	Band Change Switch	1
	13X546	Line Cord and Plug Assembly	1
	4X1114	Escutcheon	1
	10A759	Knob	4

*In some receivers knife type connectors are used.

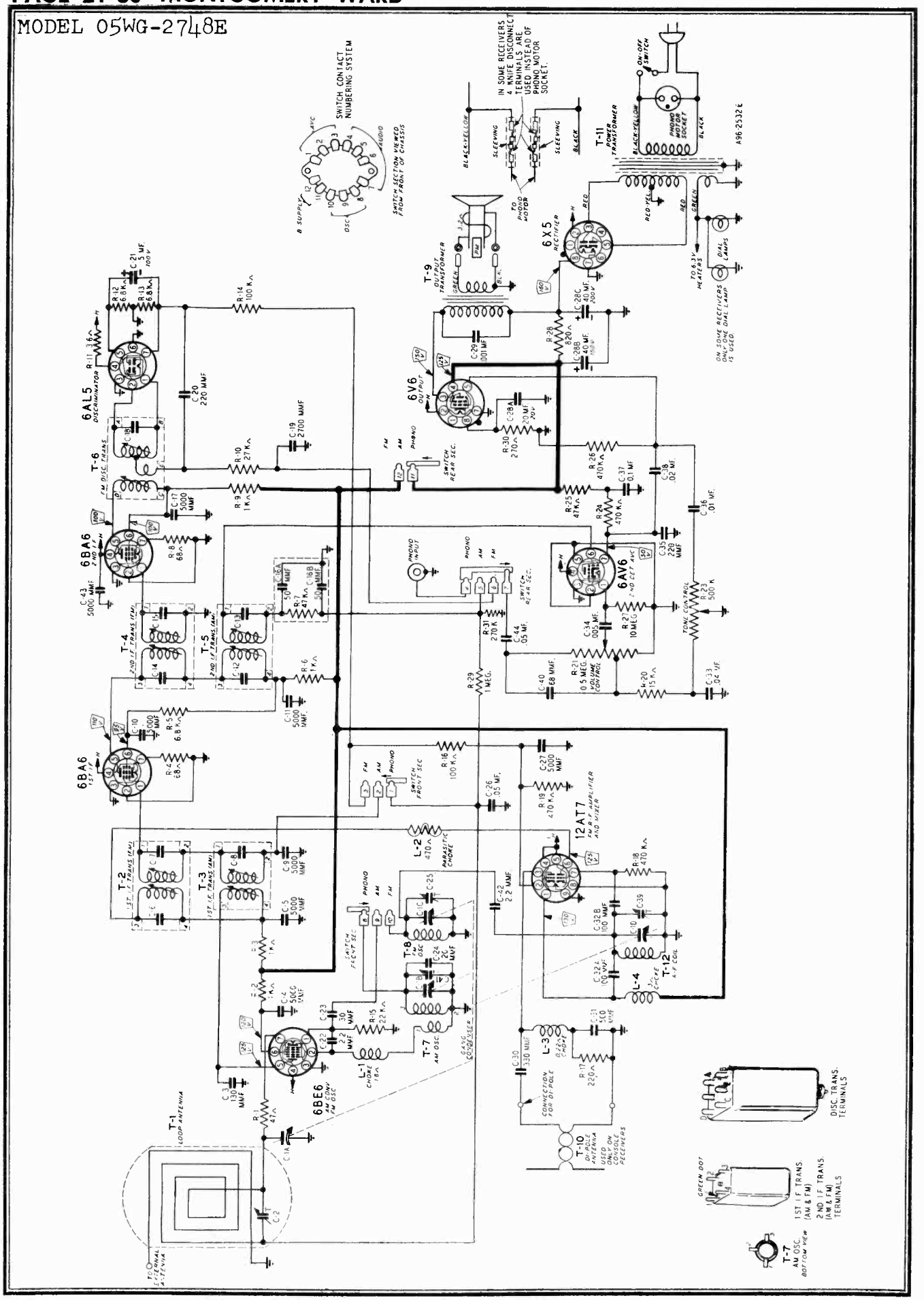
DIAL AND DRIVE ASSEMBLY

58X741	Dial Glass	1
24X446	Idler Pulley	2
15X251	Pointer	1
25X1650	Dial Bracket	1
7A103	No. 47 Pilot Light Bulb	2
7A199	Pilot Light Socket Assembly	1
26X486	Drive Shaft	1
41X88	Reflector, Dial Light	2
28X113	Drive Cord Tension Spring	1
10X72	Drive Cord Assembly	1
19X192	"C" Washer (Mtg. drive Shaft)	2
6X66	Rubber Grommet (Mtg. gang cond.)	3

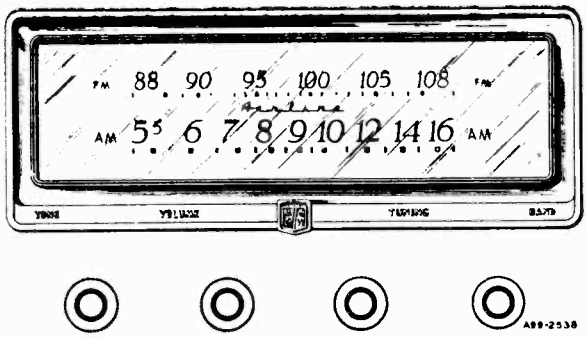
TYPE G.I. 28A168 RECORD CHANGER PARTS

G.I.-56-76507	Motor Assembly, 60 cycles 105-125 Volts AC	1
G.I.-69-75506	Tone Arm	1
AST-LT3D	Crystal Cartridge & Needle Assembly	1
AST-4999-D	Needle, Regular	1
AST-4999-D-033	Needle, Microgroove	1

MODEL 05WG-2748E



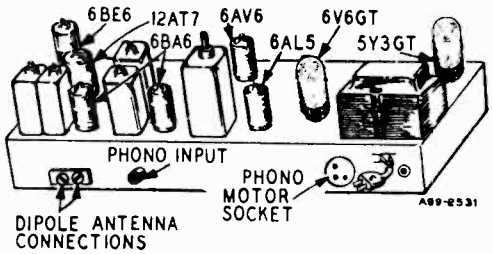
MODELS 05WG-2751A,
05WG-2752B



GENERAL DESCRIPTION

This is a two band, seven tube (plus rectifier tube) AM and FM receiver with automatic record changer. The I-F stages use high gain miniature type tubes. Built-in Air Wave Aerials are provided for the FM and Broadcast bands. Features include, a grounded grid R-F amplifier stage on the FM band, compensator circuits to prevent oscillator drift, automatic volume control, beam power output stage, PM dynamic loud speaker and an electrostatic shield in the power transformer to reduce power line noise.

The receiver and record changer are housed in a console combination cabinet with controls provided for tuning, volume, tone and band or phono selection.



DRIVE CORD REPLACEMENT

DIAL POINTER CORD

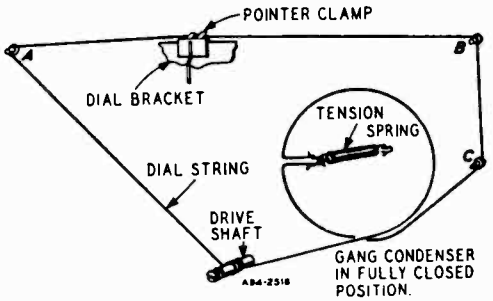
Use a new 10X38 drive cord assembly or a new length of cord 48 inches long for the installation. Install the cord as shown in the illustration, winding three turns clockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.

ELECTRICAL SPECIFICATIONS

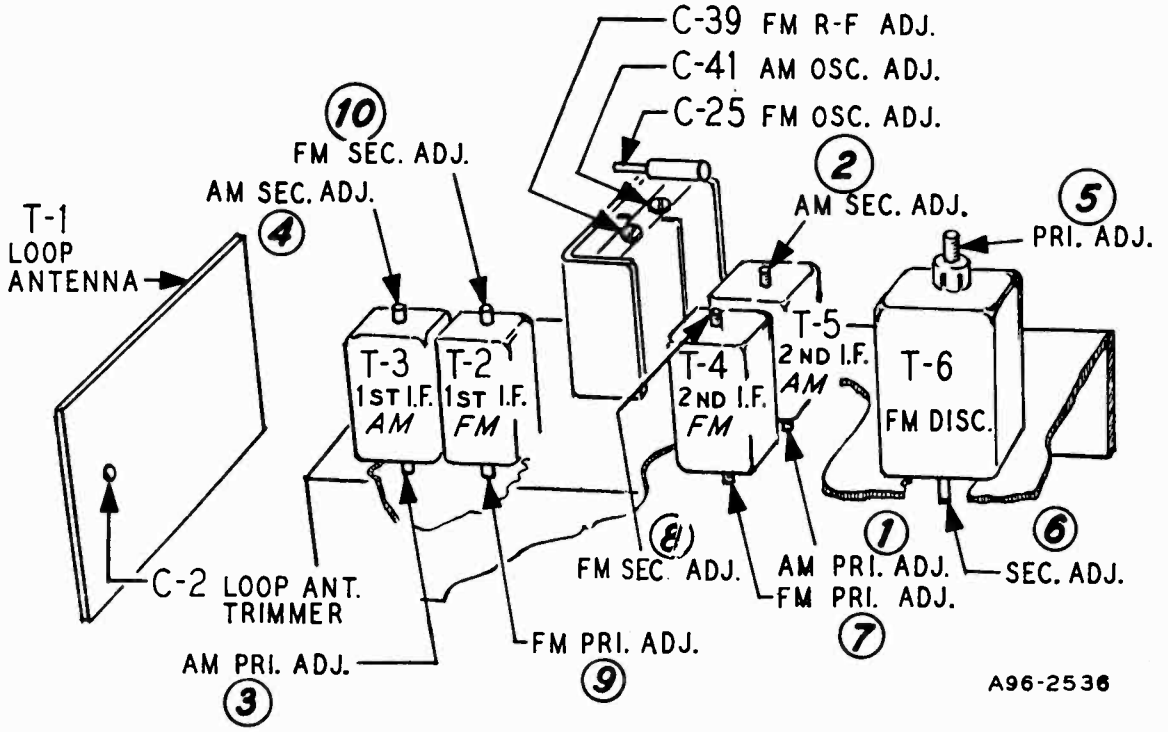
Power Supply	105-125 volts AC 60 cycles, 60 watts. 80 watts with record changer.
Frequency Ranges	Broadcast 540-1600 KC Frequency Modulation 88-108 MC
Intermediate Frequency	AM—455KC FM—10.7 MC
Selectivity	AM—45 KC broad at 1000 times signal, measured at 1000 KC I.F. FM—200 KC broad at 2 times down I.F. FM—950 KC broad at 200 times down
AM Sensitivity	(For .5 watt output with external antenna) 25 microvolts average
FM Sensitivity	(For .5 watt output) 25 microvolts average
Power Output	4.5 watts maximum 2.5 watts 10% distortion
Loud Speaker	12" PM Dynamic
Voice Coil Impedance	3.2 ohms 400 cycles
Record Changer	See Manual 5089A

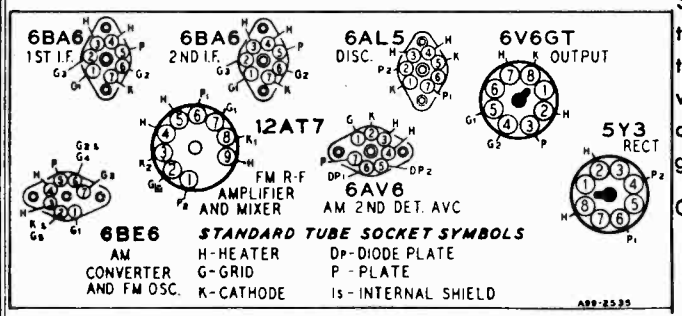
Tube and Dial Lamp Complement

1 6BE6 AM Converter & FM Osc.
1 6BA6 1st I-F Amplifier
1 6BA6 2nd I-F Amplifier
1 6AL5 FM Discriminator
1 6AV6 Audio Amplifier, AM 2nd Detector and AVC
1 6V6GT Audio Output
1 5Y3GT Rectifier
1 12AT7 R-F Amplifier & Mixer
2 No. 47 Dial Lamps



MODELS 05WG-2751A,
05WG-2752B





TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter.

Conditions of measurement are:

Line voltage.....117 Volts AC

Signal Input.....None

A variation of ±10% is usually permissible.

ALIGNMENT PROCEDURES

AM STAGES

The following 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 mf, and 50mmf.

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						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid 1st 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (3) and Sec. (4)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-41	Maximum Output
1400 KC	External Antenna Lead	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale

MODELS 05WG-2751A, 05WG-2752B

FM STAGES

The following is required for aligning:

An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.

Non-metallic screwdriver.

Dummy Antennas and I-F Loading Resistor—2500 mmf, 300 ohms

Zero center scale DC vacuum tube voltmeter having a range of approximately 3 volts.
(If a zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negative readings).

Allow chassis and signal generator to "Heat Up" for several minutes.

	SIGNAL GENERATOR		THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO					
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
I-F	10.7 MC Note C	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	2nd I-F Pri. (7) Sec. (8) Note D	Maximum Deflection
Discriminator	10.7 MC	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note D	Maximum Deflection
I-F	10.7 MC	Junction C-32A & B (Dual 100 mmf cond.) And chassis	2500 mmf	FM	Rotor Fully Open	1st I-F Pri. (9) & Sec. (10) 2nd I-F Pri (7) & Sec. (8) Disc. Pri. (5) In Order Shown Note D	Maximum Deflection
	10.7 MC	Same as above	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	Maximum Deflection
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN							
Oscillator	108.5	Disconnect built-in dipole antenna and connect generator to dipole terminals with resistor in series.	300 ohms	FM	Rotor Fully Open	Osc. C-25	Maximum Deflection
Antenna	104.5	Same as above	300 ohms	FM	Tune rotor for max AVC voltage	Ant. C-39	Maximum Deflection
RECHECK ANTENNA & OSC ADJUSTMENTS IN ORDER GIVEN							

FM ALIGNMENT NOTES

NOTE A—The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line. A signal of .1 volt must be fed into the receiver for this adjustment.
Note output voltage on the zero center DC vacuum tube voltmeter

NOTE B—Disconnect zero center DC vacuum tube voltmeter from AVC and connect it at the audio takeoff point at the 27 K ohm resistor (R-10) and its junction with the terminal strip. Adjust for zero voltage indication.

NOTE C—AM I-F coils must be aligned before attempting to align the FM I-F coils.

NOTE D—Connect zero center DC vacuum tube voltmeter as in Note A. Adjust input to give same output on the zero center DC vacuum tube voltmeter as in Note A.

REPLACEMENT PARTS INFORMATION

HOW TO ORDER PARTS—Should it be necessary to write us or to order any repair parts, it is important that the complete model number which appears on the label attached to the rear of the chassis be specified. Repair parts should be ordered from your nearest Wards Retail Store, Catalog Order office or Mail Order House.

REPLACEMENT PARTS LIST

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

Ref. No.	Part No.	Description	Qty. Used in Set
		CAPACITORS	
C-1	14A209	Gang Condenser Assembly	1
C-2	17A256	2-24 mmf Trimmer	1
C-3	47X559	130 mmf Ceramic	1
C-4, C-5, C-9, C-10, C-11, C-17, C-27, C-43	47X507	5000 mmf Ceramic	8
C-6, C-7		Part of T-2 (1st I-F Trans. FM)	
C-8		Part of T-3 (1st I-F Trans. AM)	
C-12, C-13		Part of T-5 (2nd I-F Trans. AM)	
C-14, C-15		Part of T-4 (2nd I-F Trans. FM)	
C-16A, C-16B	47X112	50-50 mmf Dual Mica	1
C-18		Part of T-6 (Discriminator Trans.)	
C-19	47X492	2700 mmf Molded Mica	1
C-20, C-35	47X468	220 mmf Ceramic	2
C-21	45X361	5 mf 100 V Dry Electrolytic	1
C-22, C-42	47X557	2.2 mmf Ceramic	2

MODELS 05WG-2751A, 05WG-2752B

REPLACEMENT PARTS LIST (continued)

Ref. No.	Part No.	Description			Qty. Used In Set
C-23	47X558	30 mmf		Ceramic	1
C-24	47X516	20 mmf		Ceramic	1
C-25	17A255	1-8 mmf		Trimmer	1
C-26	B66503	.05 mf	200 V	Tubular	1
C-28A, C-28B, C-28C, C-28D	45X359	20 mf 20 mf 40 mf 40 mf	25 V 350 V 350 V 350 V	Dry Electrolytic	1
C-29	H66102	.001 mf	800 V	Tubular	1
C-30	47X470	330 mmf		Molded Mica	1
C-31	47X508	500 mmf		Ceramic	1
C-32A, C-32B	76X4	100 mmf		Dual Ceromic	1
C-33	B66403	.04 mf	200 V	Tubular	1
C-34	D66502	.005 mf	400 V	Tubular	1
C-36	B66402	.004 mf	200 V	Tubular	1
C-37	D66104	.1 mf	400 V	Tubular	1
C-38	D66203	.02 mf	400 V	Tubular	1
C-39, C-41		Part of C-1 (Gang Condenser)			
C-40	47X471	68 mmf		Ceramic	1

RESISTORS

		Ohms	Watts		
R-1	B85470	47	0.5	Carbon	1
R-2, R-3, R-6	B85102	1000	0.5	Carbon	3
R-4, R-8	B84680	68	0.5	Carbon	2
R-5, R-12, R-13	B84682	6800	0.5	Carbon	3
R-7, R-25	B85473	47 K	0.5	Carbon	2
R-9	B85222	2200	0.5	Carbon	1
R-10	B85273	27 K	0.5	Carbon	1
R-11	43X233	3.6	0.5	Wirewound	1
R-14, R-16	B85104	100 K	0.5	Carbon	2
R-15	B85223	22 K	0.5	Carbon	1
R-17	B84221	220	0.5	Carbon	1
R-18, R-19, R-24, R-26	B85474	470 K	0.5	Carbon	4
R-20	B85153	15 K	0.5	Carbon	1
R-21	36X372	.5 meg.	Volume	Control & Switch	1
R-23	40X285	3 meg.		Tone Control	1
R-27	B85106	10 meg.	0.5	Carbon	1
R-28	D84821	820	2.0	Carbon	1
R-28A, R-28B	43X224	1000 1400	4.0 6.0	Wirewound	1
R-29	B85105	1 meg.	0.5	Carbon	1
R-30	B84271	270	0.5	Carbon	1
R-31	B85225	2.2 meg.	0.5	Carbon	1

TRANSFORMERS AND COILS

L-1	35A5	Insulated Choke	1
L-2	9A2103	Parositic Choke Assembly	1
L-3	35A9	Insulated Choke	1
L-4	35A8	Insulated Choke	1
T-1	9A1972	"B" Range Loop Antenna	1
T-2	9A2060	1st I-F Trans. (FM)	1
T-3	9A2062	1st I-F Trans. (AM)	1
T-4	9A2061	2nd I-F Trans. (FM)	1
T-5	9A2063	2nd I-F Trans. (AM)	1
T-6	9A2064	Discriminator Transformer	1
T-7	9A2065	Oscillator Coil (AM)	1
T-8	9A2067	Oscillator Coil (FM)	1
T-9	51X134	Output Transformer	1
T-10	9A2004	Dipole Antenna	1
T-11	53X290	Power Transformer	1
T-12	9A2066	Antenna Coil (FM)	1

MISCELLANEOUS

12A490	12" P.M. Speaker	1
3A435	Tube Socket—Octal (8 prong) Molded	2
3A426	Tube Socket (1st 6BA6)	1
3A427	Tube Socket (6BE6)	1
3A443	Tube Socket (12AT7)	1
3A439	Tube Socket (Miniature)	3
3A304	Phono Motor Socket	1
3A305	Phono Socket—Single Pin Tip	1
2A393	Band Change Switch	1
13X546	Line Cord and Plug Assembly	1
4X1049	Escutcheon (2752)	1
4X1088	Escutcheon (2751)	1
10A754	Knob (2752)	4
10A758	Knob (2751)	4

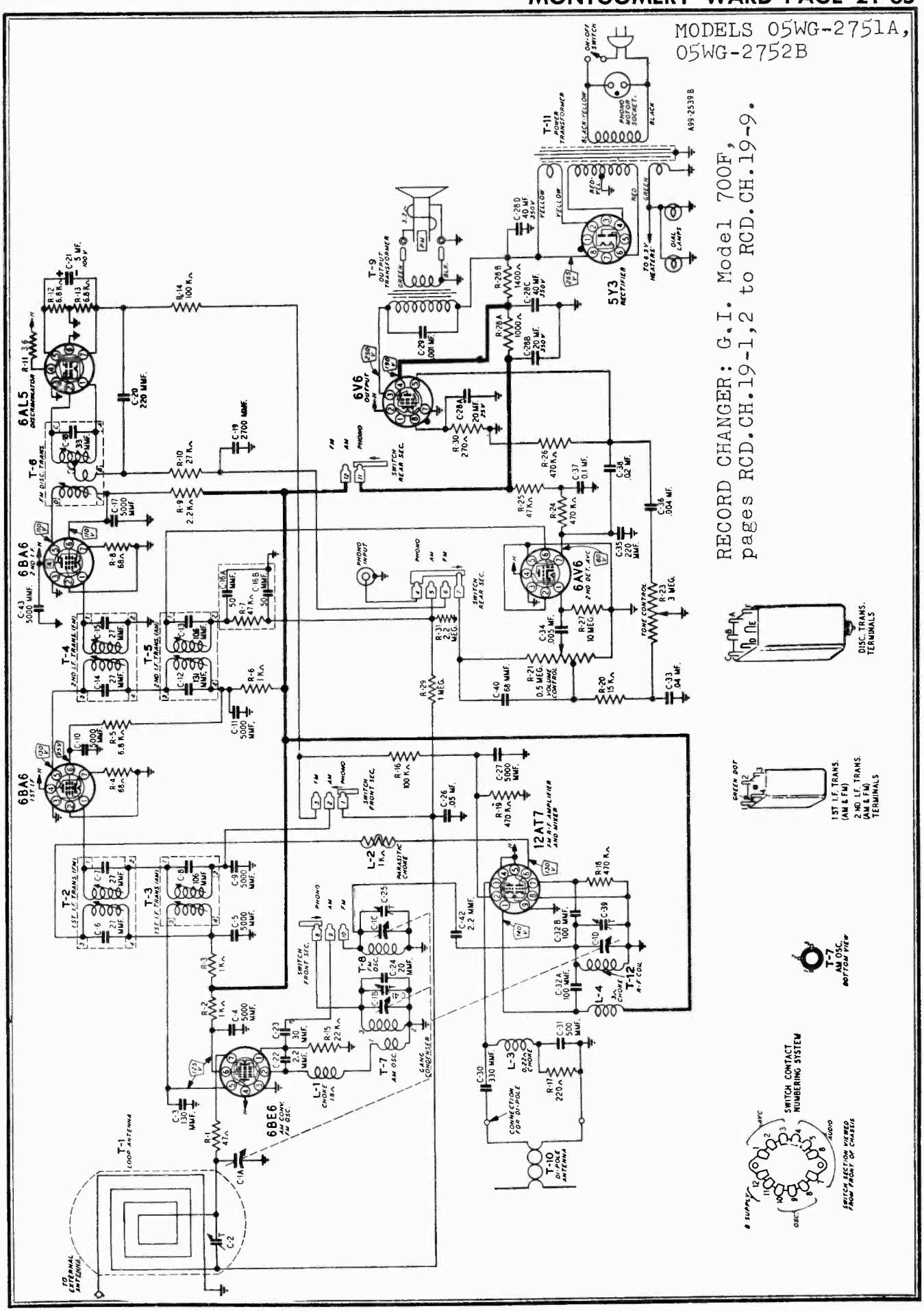
DIAL AND DRIVE ASSEMBLY

58X729	Dial Glass	1
24X446	Idler Pulley	2
15X251	Pointer	1
25X1616	Dial Bracket	1
7A103	No. 47 Pilot Light Bulb	2
7A199	Pilot Light Socket Assembly	1
26X486	Drive Shaft	1
41X88	Reflector, Dial Light	2
28X113	Drive Cord Tension Spring	1
10X38	Drive Cord Assembly	1
19X192	"C" Washer (Mtg. drive Shaft)	2
6X66	Rubber Grommet (Mtg. gang cond.)	3

TYPE G.I.-28A168 RECORD CHANGER PARTS

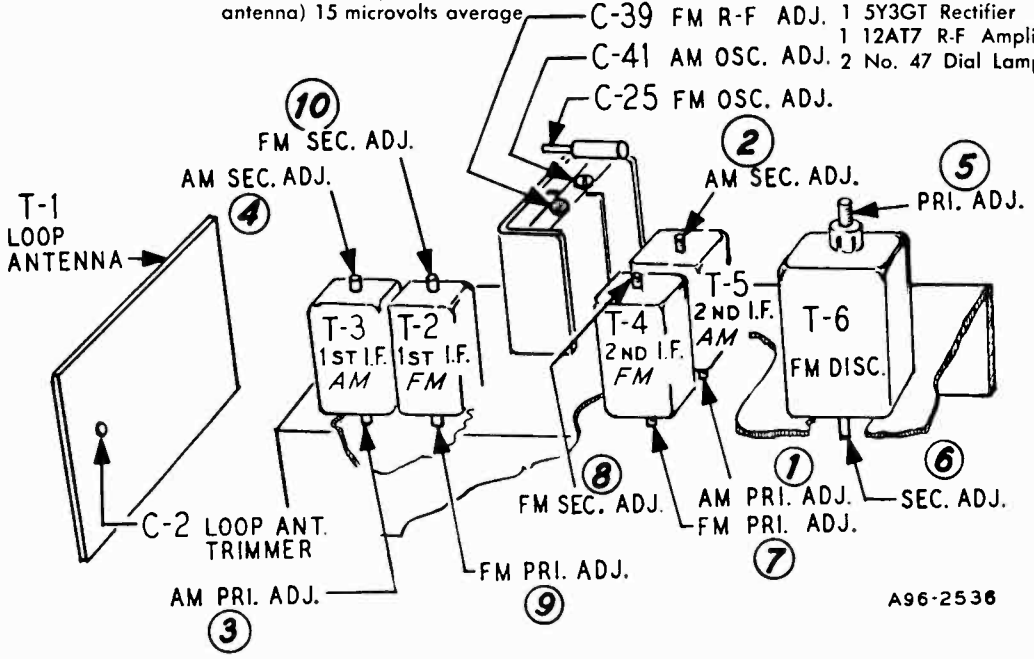
G.I.-56-76507	Motor Assembly, 60 cycles 105-125 Volts AC	1
AST-LT3D	Crystal Cartridge	1
	Needle, Regular	1
	Needle, Microgroove (Red)	1

(When ordering needles, specify part number and letter stamped on cartridge.)



ELECTRICAL SPECIFICATIONS

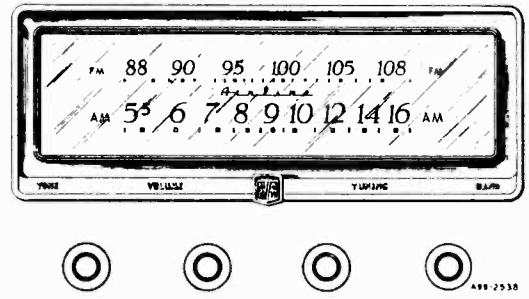
Power Supply	105-125 volts AC 60 cycles, 60 watts. 80 watts with record changer.
Frequency Ranges	Broadcast 540-1600 KC Frequency Modulation 88-108 MC
Intermediate Frequency	AM—455KC FM—10.7 MC
Selectivity	AM—45 KC broad at 1000 times signal, meosured at 1000 KC I.F. FM—200 KC broad at 2 times down I.F. FM—950 KC broad at 200 times down
AM Sensitivity	(For .5 watt output with external antenna) 15 microvolts average
FM Sensitivity	(For .5 watt output) 25 microvolts average
Power Output	4.5 watts maximum 2.5 watts 10% distortion
Loud Speaker	12" PM Dynamic
Voice Coil Impedance	3.2 ohms 400 cycles
Record Changer	See Manual No. 5081A.
Tube and Dial Lamp Complement	1 6BE6 AM Converter & FM Osc. 1 6BA6 1st I-F Amplifier 1 6BA6 2nd I-F Amplifier 1 6AL5 FM Discriminator 1 6AV6 Audio Amplifier, AM 2nd Detector and AVC 1 6V6GT Audio Output 1 5Y3GT Rectifier 1 12AT7 R-F Amplifier & Mixer 2 No. 47 Dial Lamps

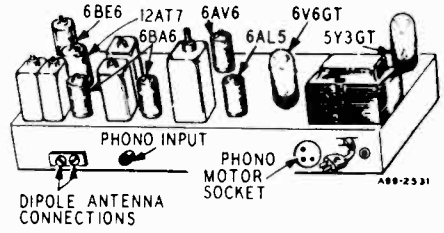


GENERAL DESCRIPTION

This is a two band, seven tube (plus rectifier tube) AM and FM receiver with automatic record changer. The I-F stages use high gain miniature type tubes. Built-in Air Wave Aerials are provided for the FM and Broadcast bands. Features include, a grounded grid R-F amplifier stage on the FM band, compensator circuits to prevent oscillator drift, automatic volume control, beam power output stage, PM dynamic loud speaker and an electrostatic shield in the power transformer to reduce power line noise.

The receiver and record changer are housed in a console combination cabinet with controls provided for tuning, volume, tone and band or phono selection.





TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter.

Conditions of measurement are:

Line voltage	117 Volts AC
Signal Input	None

A variation of ± 10% is usually permissible.

MODEL 05WG-2752

ALIGNMENT PROCEDURES

AM STAGES

The following 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 mf, and 50mmf.

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						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid 1st 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (3) and Sec. (4)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I-F Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-41	Maximum Output
1400 KC	Externol Antenna Lead	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.

FM STAGES

The following is required for aligning:

An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.

Non-metallic screwdriver.

Dummy Antennas and I-F Loading Resistor—2500 mmf, 300 ohms

Zero center scale DC vacuum tube voltmeter having a range of approximately 3 volts.
(If a zero center scale meter is not available, a standard scale vacuum tube voltmeter may be used by reversing the meter connections for negative readings).
Allow chassis and signal generator to "Heat Up" for several minutes.

	SIGNAL GENERATOR		THROUGH DUMMY ANTENNA	BAND SWITCH SETTING	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
	FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO					
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note A	Maximum Deflection
	10.7 MC	6BA6 2nd I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	
I-F	10.7 MC Note C	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	2nd I-F Pri. (7) Sec. (8) Note D	Maximum Deflection
Discriminator	10.7 MC	6BA6 1st I-F Pin 1 and Chassis	2500 mmf	FM	Rotor Fully Open	Disc. Pri. (5) Note D	Maximum Deflection
I-F	10.7 MC	Junction C-32A & B (Dual 100 mmf cond.) And chassis	2500 mmf	FM	Rotor Fully Open	1st I-F Pri. (9) & Sec. (10) 2nd I-F Pri. (7) & Sec. (8) Disc. Pri. (5) In Order Shown Note D	Maximum Deflection
	10.7 MC	Same as above	2500 mmf	FM	Rotor Fully Open	Disc. Sec. (6) Note B	Maximum Deflection
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN							
Oscillator	108.5	Disconnect built-in dipole antenna and connect generator to dipole terminals with resistor in series.	300 ohms	FM	Rotor Fully Open	Osc. C-25	Maximum Deflection
Antenna	104.5	Same as above	300 ohms	FM	Tune rotor for max. AVC voltage	Ant. C-39	Maximum Deflection

RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN

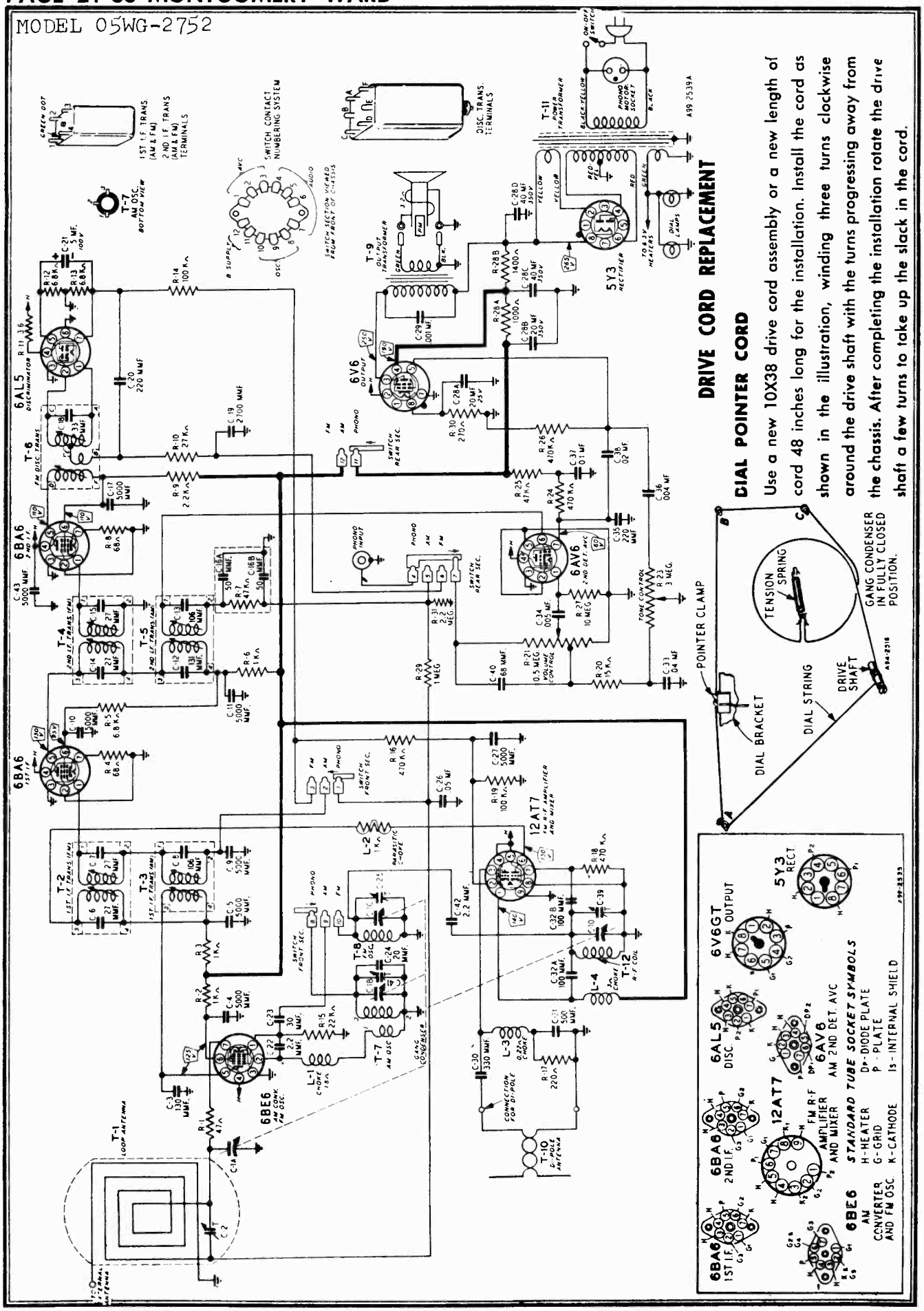
FM ALIGNMENT NOTES

NOTE A—The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the AVC line. A signal of .1 volt must be fed into the receiver for this adjustment.
Note output voltage on the zero center DC vacuum tube voltmeter.

NOTE B—Disconnect zero center DC vacuum tube voltmeter from AVC and connect it at the audio takeoff point at the 27 K ohm resistor (R-10) and its junction with the terminal strip. Adjust for zero voltage indication.

NOTE C—AM I-F coils must be aligned before attempting to align the FM I-F coils.

NOTE D—Connect zero center DC vacuum tube voltmeter as in Note A. Adjust input to give same output on the zero center DC vacuum tube voltmeter as in Note A.



REPLACEMENT PARTS

CAPACITORS

Ref. No.	Part No.	Description	Qty. Used in Set
C-1	14A209	Gang Condenser Assembly	1
C-2	17A256	2-24 mmf Trimmer	1
C-3	47X559	130 mmf Ceramic	1
C-4, C-5, C-9, C-10, C-11, C-17, C-27, C-43	47X507	5000 mmf Ceramic	8
C-6, C-7		Part of T-2 (1st I-F Trans. FM)	
C-8		Part of T-3 (1st I-F Trans. AM)	
C-12, C-13		Part of T-5 (2nd I-F Trans. AM)	
C-14, C-15		Part of T-4 (2nd I-F Trans. FM)	
C-16A, C-16B	47X112	50-50 mmf Dual Mica	1
C-18		Part of T-6 (Discriminator Trans.)	
C-19	47X492	2700 mmf Molded Mica	1
C-20, C-35	47X468	220 mmf Ceramic	2
C-21	45X361	5 mf 100 V Dry Electrolytic	1
C-22, C-42	47X557	2.2 mmf Ceramic	2
C-23	47X558	30 mmf Ceramic	1
C-24	47X516	20 mmf Ceramic	1
C-25	17A255	1-8 mmf Trimmer	1
C-26	B66503	.05 mf 200 V Tubular	1
C-28A	45X359	20 mf 25 V	
C-28B		20 mf 350 V	
C-28C		40 mf 350 V Dry Electrolytic	1
C-28D		40 mf 350 V	
C-29	H66102	.031 mf 800 V Tubular	1
C-30	47X470	330 mmf Molded Mica	1
C-31	47X508	500 mmf Ceramic	1
C-32A, C-32B	76X4	100 mmf Dual Ceramic	1
C-33	B66403	.04 mf 200 V Tubular	1
C-34	D66502	.005 mf 400 V Tubular	1
C-36	B66402	.004 mf 200 V Tubular	1
C-37	D66104	.1 mf 400 V Tubular	1
C-38	D66203	.02 mf 400 V Tubular	1
C-39, C-41		Part of C-1 (Gang Condenser)	
C-40	47X471	68 mmf Ceramic	1

RESISTORS

		Ohms	Watts		
R-1	B85470	47	0.5	Carbon	1
R-2, R-3, R-6	B85102	1000	0.5	Carbon	3
R-4, R-8	B84680	68	0.5	Carbon	2
R-5, R-12, R-13	B84682	6800	0.5	Carbon	3
R-7, R-25	B85473	47 K	0.5	Carbon	2
R-9	B85222	2200	0.5	Carbon	1
R-10	B85273	27 K	0.5	Carbon	1
R-11	43X233	3.6	0.5	Wirewound	1
R-14, R-16	B85104	100 K	0.5	Carbon	2
R-15	B85223	22 K	0.5	Carbon	1
R-17	B84221	220	0.5	Carbon	1
R-18, R-19, R-24, R-26	B85474	470 K	0.5	Carbon	4
R-20	B85153	15 K	0.5	Carbon	1
R-21	36X372	.5 meg.		Volume Control & Switch	1
R-23	40X285	3 meg.		Tone Control	1
R-27	B85106	10 meg.	0.5	Carbon	1
R-28A	43X224	1000	4.0	Wirewound	1
R-28B		1400	6.0		
R-29	B85105	1 meg.	0.5	Carbon	1
R-30	B84271	270	0.5	Carbon	1
R-31	B85225	2.2 meg.	0.5	Carbon	1

TRANSFORMERS AND COILS

L-1	35A5	Insulated Choke	1
L-2	9A2068	Parasitic Choke Assembly	1
L-3	35A9	Insulated Choke	1
L-4	35A8	Insulated Choke	1
T-1	9A1972	"B" Range Loop Antenna	1
T-2	9A2060	1st I-F Trans. (FM)	1
T-3	9A2062	1st I-F Trans. (AM)	1
T-4	9A2061	2nd I-F Trans. (FM)	1
T-5	9A2063	2nd I-F Trans. (AM)	1
T-6	9A2064	Discriminator Transformer	1
T-7	9A2065	Oscillator Coil (AM)	1
T-8	9A2067	Oscillator Coil (FM)	1
T-9	51X134	Output Transformer	1
T-10	9A2004	Dipole Antenna	1
T-11	53X290	Power Transformer	1
T-12	9A2066	Antenna Coil (FM)	1

MISCELLANEOUS

12A490	12" P.M. Speaker	1
3A303	Tube Socket—Octal (8 prong) Molded	2
3A426	Tube Socket—Miniature	4
3A427	Tube Socket (12AT7)	1
3A443	Tube Socket (6BE6)	1
3A304	Phono Motor Socket	1
3A305	Phono Socket—Single Pin Tip	1
2A393	Band Change Switch	1
13X546	Line Cord and Plug Assembly	1
4X1049	Escutcheon	1
10A754	Knob	4

DIAL AND DRIVE ASSEMBLY

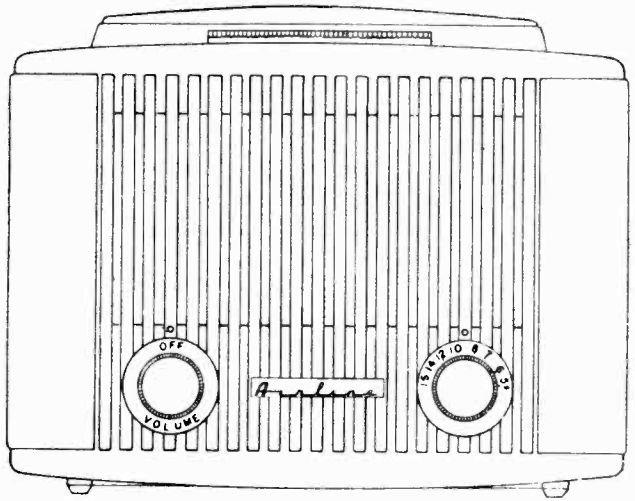
58X729	Dial Glass	1
24X446	Idler Pulley	2
15X251	Pointer	1
25X1616	Dial Bracket	1
7A103	No. 47 Pilot Light Bulb	2
7A199	Pilot Light Socket Assembly	1
26X486	Drive Shaft	1
41X26	Reflector, Dial Light	2
28X113	Drive Cord Tension Spring	1
10X38	Drive Cord Assembly	1
19X192	"C" Washer (Mtg. drive Shaft)	2
6X66	Rubber Grommet (Mtg. gang cond.)	3

TYPE V-28A166 RECORD CHANGER PARTS

V-27278	Motor Assembly, 60 cycles 105-125 Volts AC	1
Shure P-81	Crystal Cartridge	1
	Semi-Permanent Needle	1

(When ordering needles, specify part number and letter stamped on cartridge.)

SERVICE DATA



DESCRIPTION

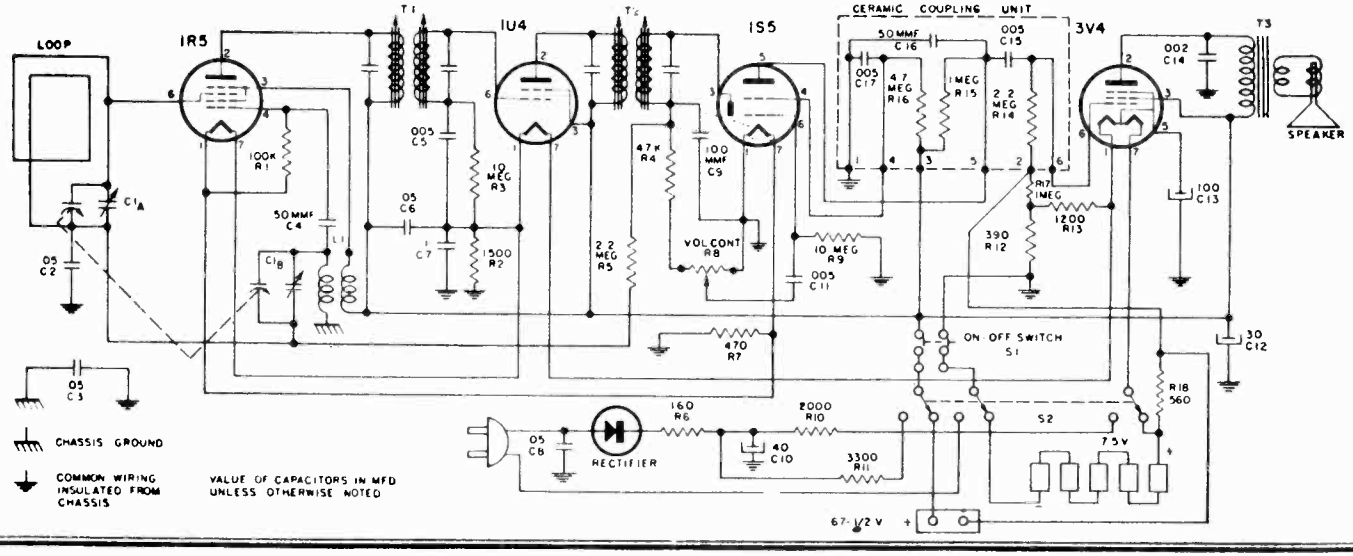
This receiver is a single band four tube superhetrodyne designed for operation on AC-DC current or from batteries. It has a selenium rectifier for use on AC current. It is equipped with a loop antenna and incorporates an automatic volume control circuit.

SPECIFICATIONS

Power Supply	105, 125 volt AC-DC or Batteries
Batteries	Five 1½ volt "A" Airline No. 23
	One 67½ volt "B" Airline No. 43
Tuning Range	540 to 1610 KC
I.F. Frequency	455 KC
Loud Speaker	4 inch P.M.
Voice Coil Impedence	3.2 ohms at 400 cycles
Power Output	Maximum 100 milliwatts

Tube Complement

1R5—Oscillator Converter
1U4—I.F. Amplifier
1S5—AVC, Detector, 1st Audio
3V4—Power Output



MODEL 84GWM-1058A

ALIGNMENT INSTRUCTIONS

The following equipment is necessary for proper alignment:

Signal generator that will provide the test freauencies as listed.

Output meter.

Non-metallic screwdriver.

Dummy antenna—.1 mfd.

Volume control—Maximum: all adjustments.

Connect ground lead of signal generator to common negative.

Connect dummy antenna in series with output lead of signal generator.

Connect output meter across voice coil of speaker.

ALIGNMENT PROCEDURE

Position of Variable	Generator Frequency	Dummy Ant. Mfd.	Generator Connections	Trimmer Adjustment	Adjust Trimmer for	Trimmer Function
Fully open	455 KC	.1	*1R5 Grid (Stator of C1A)	T2	Maximum	Output I.F.
Fully open	455 KC	.1	*1R5 Grid (Stator of C1A)	T1	Maximum	Input I.F.
Fully open	1610 KC	.1	*1R5 Grid (Stator of C1A)	C1B	Maximum	Oscillator
Tune in signal from generator	1400 KC	—	Loosely coupled to loop	C1A	Maximum	Antenna

*Connect ground lead of signal generator to common negative.

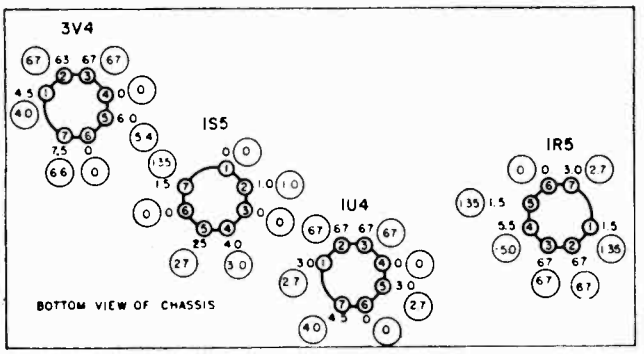
RECEIVER STAGE SENSITIVITIES

The table below lists the sensitivity at the input of each stage. The receiver should be tuned to 1000 KC for all readings. All measurements are based on an output of 50 milliwatts. This may be measured by disconnecting the speaker voice coil and substituting a 3.2 ohm 5 watt resistor across the secondary winding of the output transformer. A reading of .4 volt across this resistor will be equivalent to a 50 milliwatt output. The volume control must be set to maximum. The signal source must be an accurately calibrated signal generator capable of supplying both 1000 KC and 455 KC signals modulated 30% with a 400 cycle audio signal. Variations in sensitivity of plus or minus 25% are usually permissible.

SIGNAL GENERATOR

Freq.	Coupling Condenser	Connection to Receiver	Ground Connection	INPUT FOR 50 MILLIWATT OUTPUT
1000 kc	.1 mfd	1R5 Mixer Pin 6	Common Negative	150 microvolts
455 kc	.1 mfd	1R5 Mixer Pin 6	Common Negative	120 microvolts
455 kc	.1 mfd	1U4 IF Amp. Pin 6	Common Negative	4000 microvolts
400 cycles	.1 mfd	1S5 2nd Det. Pin 6	Common Negative	.028 volts
400 cycles	.1 mfd	3V4 Output Pin 6	Common Negative	2.8 volts

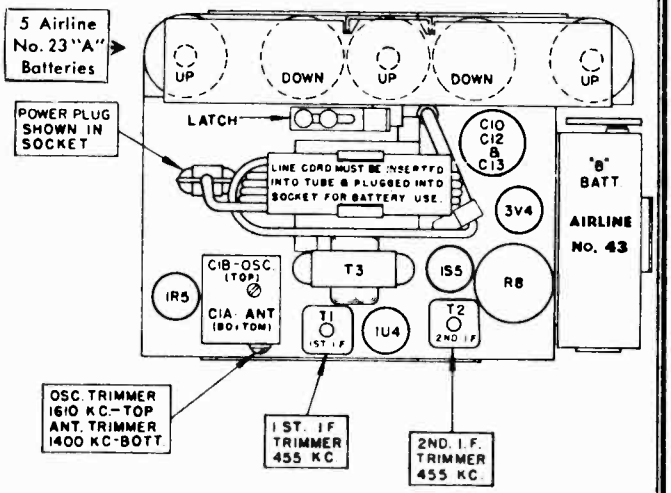
MODEL 84GWM-1058A



All voltages are measured from tube pin to common negative with a 20,000 ohm per volt voltmeter.

Voltages shown in circles are obtained when set is operated on 117 volt current.

Voltages shown outside the circles are obtained when the set is operated on batteries. New batteries in good condiiion should be used for these measurements.



REPLACEMENT PARTS LIST

Circuit Diagram Reference	Part No.	Description
		CONDENSERS
C1A, C1B	B19-197	Variable condenser
C2, C6	A16-152	.05 MFD 200 volt condenser
C3	A16-158	.05 MFD 400 volt condenser
C4	A15-175	50 MMF mica condenser
C5, C11	A16-153	.005 MFD 600 volt condenser
C7	A16-157	.1 MFD 200 volt condenser
C8	A16-189	.05 MFD 400 volt condenser
C9	A15-188	100 MMF mica condenser
C10, C12, C13	A18-290	40 MFD 150 volt electrolytic condenser; 30 MFD 150 volt electrolytic condenser; 100 MFD 10 volt electrolytic condenser
C14	A16-182	.002 MFD 200 volt condenser
C15, C16, C17	*A17-100	.005 MFD; 50 MMF; .005 MFD — See Note Below
		RESISTORS
R1	A60-671	100K ohm ½ watt 20% resistor
R2	A60-680	1500 ohm ½ watt 10% resistor
R3, R9	A60-663	10 megohm ½ watt 20% resistor
R4	A60-685	47K ohm ½ watt 20% resistor
R5	A60-684	2.2 megohm ½ watt 20% resistor
R6	A60-725	160 ohm 5 watt 10% resistor
R7	A60-722	470 ohm ½ watt 10% resistor
R8	A24-178	Volume control, with switch
R10	A60-757	2000 ohm 10 watt 10% resistor
R11	A60-724	3300 ohm 1 watt, 10% resistor
R12	A60-665	390 ohm ½ watt 10% resistor
R13	A60-756	1200 ohm ½ watt 10% resistor
R14, R15, R16	*A17-100	2.2 megohm; 1 megohm; 4.7 megohm — See Note Below

Circuit Diagram Reference	Part No.	Description
		COILS
L1	A10-514	Oscillator coil
T1, T2	C10-475	1st and 2nd I.F. transformer
T3	B80-245	Output transformer
		MISCELLANEOUS
	B83-586	Baffle, speaker
	A11-322	Brocket, handle, mounting
	S84-242	Bracket, "A" battery retainer
	A72-32	Bushing, thimble, chassis mounting
	D42-448	Cabinet, (includes back cover)
		Cover, Back for Cabinet
	S84-257	Chassis Cover Assembly
	A83-421	Clip, I.F. transformer mounting
	B98-9	Grille Cloth
	C83-585	Handle, molded
	C52-278	Knob, dial
	C52-277	Knob, tuning
	C52-276	Knob, volume
	A83-568	Rectifier, selenium
	A71-38	Retainer, paper tube, for line cord
	A68-35	Socket, tube
	B79-367	Speaker, 4" P.M.
	A70-141	Spring, compression for handle
S2	A69-182	Switch AC-DC battery
	A76-49	Terminal for "B" battery
	B82-58	Loop Antenna

*NOTE. C15, C16, C17, R14, R15, R16, are contained in the Ceramic Coupling Unit, Part No. A17-100.

MODELS BKO-A, CT8-A, GM9T-A, HNO, ILOT, PC9-A, Ch. 10A

GENERAL INFORMATION

TYPE - Chassis 10A is a universal, push-button tuned, automotive type, superheterodyne chassis, used in Motorola Models CT8-A, GM9T-A, BKO-A, PC9-A, HNO, ILOT, etc. An external speaker is used.

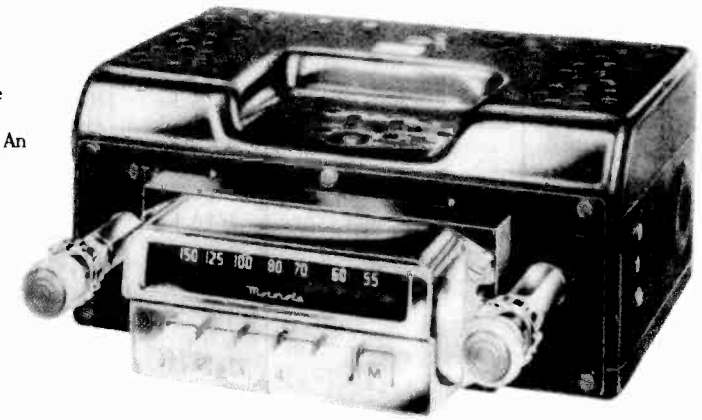
TUNING RANGE - 535 to 1600 Kc IF - 455 Kc

TUBE COMPLEMENT - 6BA6 - RF Amplifier
6BE6 - Converter
6BA6 - IF Amplifier
6AT6 - Det AVC & 1st AF Amp
6AQ5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 6.8 amps at 6.3V DC

POWER OUTPUT - 3 watts (max.)

PUSH BUTTON TUNER - Automatic Tuner AT-58. For complete service information on this tuner, refer to Motorola AT-58 Service Manual.



Typical Auto Receiver Using 10A Chassis
(Model CT8-A Illustrated)

NOTE:

This manual contains a complete list of replacement parts for the 10A chassis. Replacement parts for specific receivers in which the 10A chassis is used, will be found in separate service manuals bearing the appropriate receiver model numbers.

TO SET THE PUSH BUTTONS

1. Turn radio ON and allow it to warm up for a few minutes.
2. Push the number '1' button in as far as it will go and HOLD IT THAT WAY.
3. With the tuning knob, tune in the station you desire to set up. Tune carefully until you are exactly on the station; tuning to either side of it will result in poor tone quality. Release button and knob after tuning-in station.
4. Follow above steps 2 and 3 for the remaining four buttons.

ALIGNMENT

Expose alignment adjustment screws as follows: Remove the top and bottom covers; replace front plate screws to hold front plate in position after making sure that the plastic idler gear engages gear on tuner. On some models it will also be necessary to remove the escutcheon and escutcheon spacer.

Connect a PM speaker (3.2 ohm VC) to VC and GND terminals and connect a low range output meter across voice coil.

Connect a 6 volt storage battery to GND (or chassis) and BAT terminals of receiver; turn receiver on and allow it to warm up for a few minutes. Set receiver volume control at maximum. Push 'M' button (far enough so it will lock in) to place tuner in manual position.

For greatest accuracy, keep output of receiver at approximately 1 watt (1 watt = 1.79 volts on output meter) throughout alignment by reducing generator output as stages are brought into alignment. Use a small fibre screwdriver when aligning IF and diode transformers. A special tool, Motorola Part Number 66A76278, is required for adjusting the tuner cores. IMPORTANT: Do not push in on the alignment tool when adjusting the tuner cores; the slightest inward pressure may move the tuner carriage and result in inaccurate alignment.

Construct a dummy antenna as shown in Fig. 1.

POINTER ADJUSTMENT. The pointer can be moved slightly for calibration correction by turning the eccentric adjustment rivet. This rivet has a slotted head and is exposed only when tuner is tuned to high frequency end. See Figure 1 for its location.

MODELS BKO-A, CT8-A, GM9T-A,
HNO, ILOT, PC9-A, Ch. 10A

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	6BE6 grid (pin #7) & chassis	455 Kc	High frequency end-(cores out)	1, 2, 3 & 4	Peak for maximum in order indicated. Check by re-peating step.
RF ALIGNMENT						
2.	See Fig. 1	Ant receptacle thru dummy	1610 Kc	High frequency end; cores should project 1-1/8" from cans. (Screw out if necessary)	5, 6 & 7	Peak for maximum in order indicated.
3.	"	"	1425 Kc	1425 Kc-Per Fig. 1	8, 9 & 10	Peak for maximum in order indicated.
4.	"	"	Turn generator power off.	'Osc Pad' Adj per Fig. 1	11	Peak oscillator padder for maximum noise. See*

5. When receiver is installed in car, extend antenna fully, set dial to approximately 1400 Kc and repeak antenna trimmer (7) for maximum volume of a weak station or noise between stations.

* If padder core (11) must be moved more than 1/2 turn from its original position, repeat steps 2, 3 & 4 until it is necessary to move the padder core less than 1/2 turn in this step.

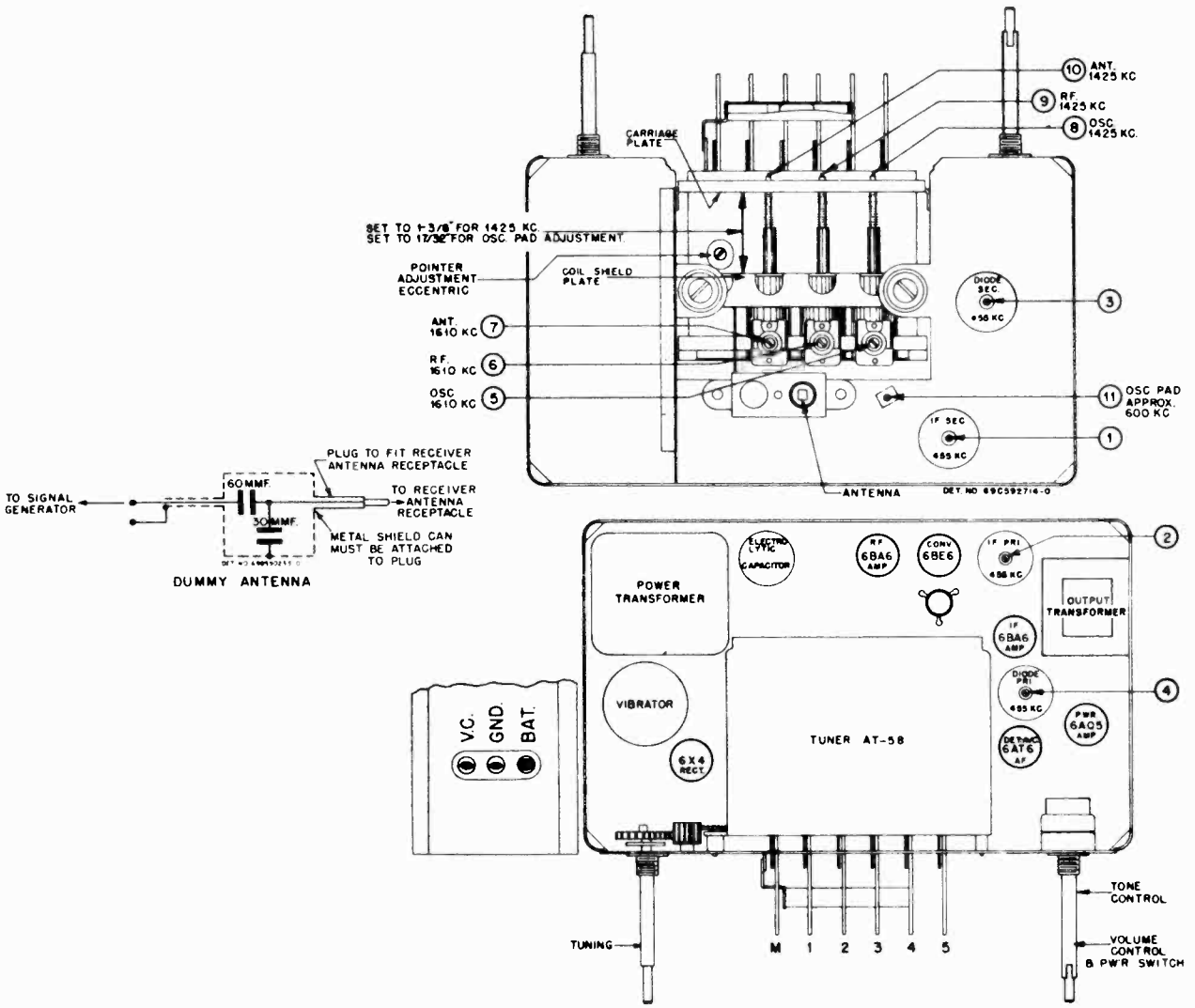
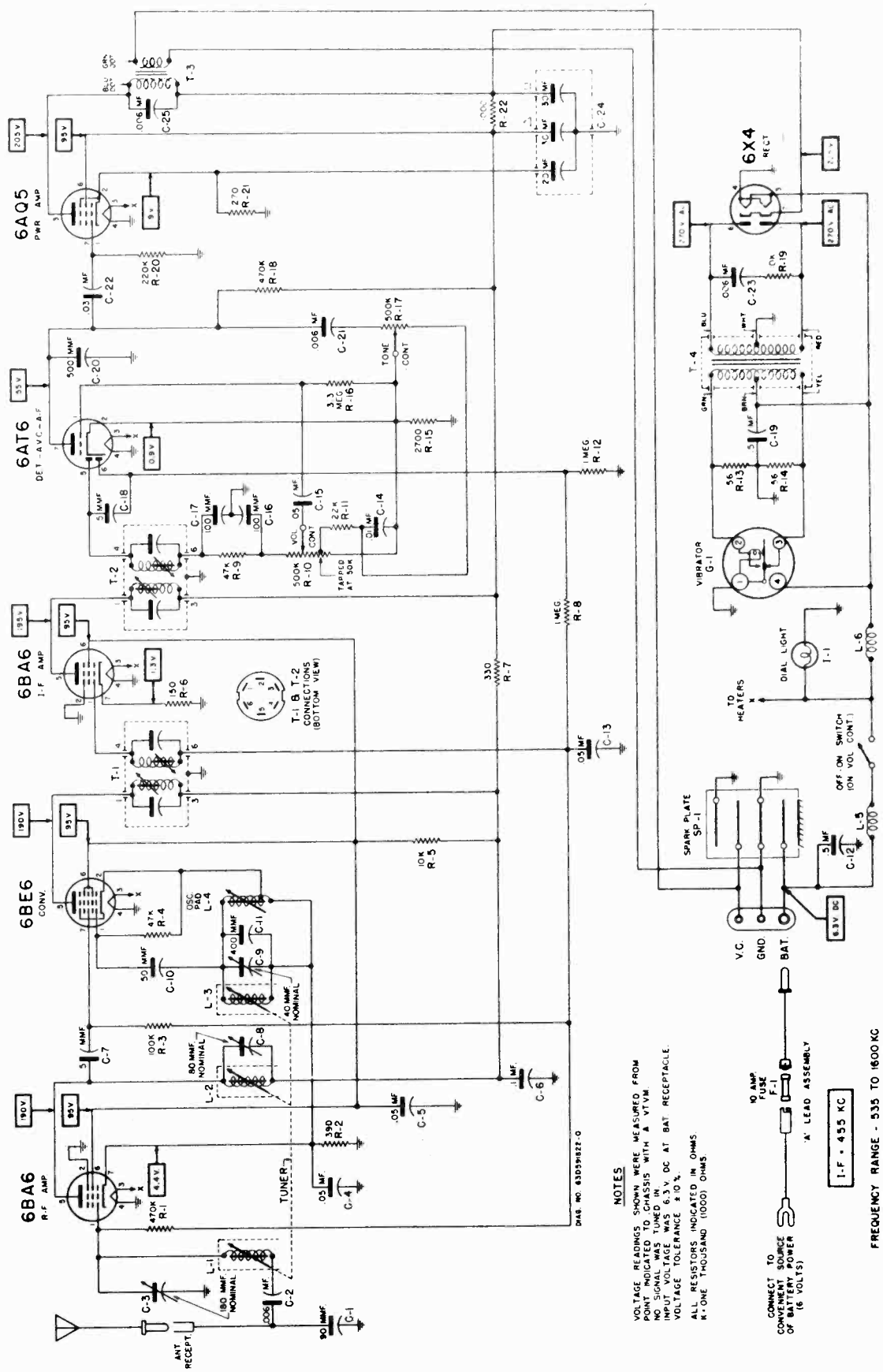


FIGURE 1. TUBE & TRIMMER LOCATIONS AND DUMMY ANTENNA

MODELS BKO-A, CT8-A, GM9T-A,
HNO, ILOT, PC9-A, Ch. 10A



NOTES

VOLTAGE READINGS SHOWN WERE MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM.
NO SIGNAL WAS USED IN INPUT VOLTAGE WAS 6.3 V. DC AT BAT. RECEPTACLE.
VOLTAGE TOLERANCE ± 10 %.

ALL RESISTORS INDICATED IN OHMS
K = ONE THOUSAND (1000) OHMS

FIGURE 2. SCHEMATIC DIAGRAM

MODELS BK0-A, CT8-A, GM9T-A,
HN0, ILOT, PC9-A, Ch. 10A

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - ELECTRICAL		
CAPACITORS		
C-1	21B591682	Ceramic: 90 mmf 500V
C-2	8A4529	Paper: .006 mf 100V
C-3	20A480600	Trimmer, variable: mica; 50 to 280 mmf; on same bracket as C-8 and C-9
C-4	8R13514	Paper: .05 mf 100V
C-5	8R14791	Paper: .05 mf 400V
C-6	8R13166	Paper: .1 mf 400V
C-7	21K70720	Molded: 5 mmf 500V
C-8	20A480600	Trimmer, variable: mica; 50 to 180 mmf; on same bracket as C-3 and C-9
C-9	20A480600	Trimmer, variable: mica; 30 to 60 mmf; on same bracket as C-3 and C-8
C-10	21R6513	Mica: 50 mmf 300V
C-11	21A71872	Ceramic: 400 mmf 5% 500V
C-12	8K17028	Paper: .5 mf 100V
C-13	8R13514	Paper: .05 mf 100V
C-14	8R472754	Paper: .01 mf 100V
C-15	8R13514	Paper: .05 mf 100V
C-16	21B77562	Paper: 100 mmf 500V
C-17	21B77562	Paper: 100 mmf 500V
C-18	21K70720	Molded: 5 mmf 500V
C-19	8K17028	Paper: .5 mf 100V
C-20	21R6639	Mica: 500 mmf 500V 20%
C-21	8K71910	Paper: .006 mf 400V
C-22	8R71911	Paper: .03 mf 400V
C-23	8K12840	Paper: .006 mf 1600V
C-24	23A473015	Electrolytic: 30-30-20 mf/350-300-25V
C-25	8K71910	Paper: .006 mf 400V
FUSE		
F-1	65A10266	Fuse: 10 amp; 3AG
VIBRATOR		
G-1	48B3333	Vibrator, non-sync: 4-pin
DIAL LIGHT		
I-1	65X10867	Bulb: 6.3V; .25A; bayonet base; clear
COILS		
L-1,2	24B71881	RF and Antenna (specify color of paint dot on old coil when ordering)
L-3	24B71879	Oscillator (specify color of paint dot on old coil when ordering)
L-4	24B70227	Oscillator Padder: complete with iron core
L-5	24K591605	Choke, RF
L-6	24A472535	Choke, hash
RESISTORS		
	Note:	All resistors are carbon insulated type unless otherwise specified.
R-1	6R6032	470,000 20% 1/2W
R-2	6R5554	390 10% 1/2W
R-3	6R6075	100,000 20% 1/2W
R-4	6R6056	47,000 20% 1/2W
R-5	6R476060	10,000 20% 2W
R-6	6R3992	150 20% 1/2W
R-7	6R6010	330 20% 1/2W
R-8	6R6004	1 meg 20% 1/2W
R-9	6R6056	47,000 20% 1/2W
R-10	18A591550	Volume Control: 500,000; tapped at 50,000 (dual - also includes tone control R-17)
R-11	6R6028	22,000 20% 1/2W
R-12	6R6004	1 meg 20% 1/2W
R-13	6R5614	56 10% 1/2W
R-14	6R5614	56 10% 1/2W
R-15	6R5577	2700 10% 1/2W
R-16	6R2118	3.3 meg 20% 1/2W
R-17		Tone Control: See volume control R-10
R-18	6R6032	470,000 20% 1/2W
R-19	6R6054	10,000 20% 1/2W
R-20	6R6015	220,000 20% 1/2W
R-21	6R6336	270 10% 1W
R-22	6R476004	1000 20% 2W
SPARK PLATE		
SP-1	1A472606	Spark Plate Assembly
TRANSFORMERS		
T-1,2	24B485670	IF and Diode, 455 Kc: complete with padding capacitors and tuning cores but less shield
T-3	25B70171	Output Transformer
T-4	25B472533	Power Transformer
TUNER		
	1X472770	AT-58 Automatic Tuner (see Service Manual Motorola Part No. 54P480955 for complete breakdown)

PART NUMBER	DESCRIPTION
CHASSIS PARTS - MECHANICAL	
7A472580	Bracket, antenna receptacle mtg
42A4215	Clip, vibrator grounding
15C472596	Cover, bottom
15K591601	Cover, top
4A51289	Cupwasher (tuner mtg)
37A12949	Grommet, rubber (tuner mtg)
4S7671	Lockwasher, split: #8; cad pl (tuner mtg)
29R5239	Lug, soldering
1X70646	Receptacle, antenna
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket and soldering lug mtg)
5S7706	Rivet: .122 x 1/8; stl; nkl pl (term strip mtg)
5S7707	Rivet: .122 x 5/32; stl; nkl pl (ant receptacle, tuner shield, hash shield and output trans mtg)
5S7701	Rivet: .122 x 3/16; stl; nkl pl (vib socket mtg)
5S7751	Rivet: .122 x 1/4; stl; antique copper finish (spark plate mtg)
3S7454	Screw, sheet metal: #8 x 1/4; PKZ plain hex head; stl; cad pl (pilot light socket mtg).
3S7475	Screw, sheet metal: #8 x 1/4; PKZ slotted acorn head; stl; cad pl (housing screws)
3S7154	Screw, machine: 8-32 x 1/4 slotted binderhead; stl; cad pl (tuner mtg)
3S3397	Screw, sheet metal: #8 x 5/16; PKZ plain hex head; stl; cad pl (pwr trans mtg)
1X473150	Shield Assembly, light
26A472560	Shield, hash
26K485936	Shield, coil (for T-1 and T-2)
26A472602	Shield, tuner
9A472905	Socket, pilot light: includes brackets
9A70208	Socket, tube: 4-pin; with grounding lug (vibrator socket)
9A472534	Socket, tube: miniature; 7-prong
9A580002	Socket, tube: miniature; 7-prong (for 6AQ5 tube).
31C490140	Strip, terminal: 1 insulated lug, #1 mtg
31K86126	Strip, terminal: 2 insulated lugs, #2 mtg
31A472574	Strip, terminal: 4 insulated lugs, #4 mtg
39A26068	Wiper, grounding

MODEL CTO
Chevrolet

GENERAL INFORMATION

TYPE - Automotive type superheterodyne receiver specifically designed to fit the 1950 and 1949 Chevrolet. Receiver consists of two units; the RF tuner and the Power & Audio Unit.

TUNING RANGE - 535 to 1600 Kc

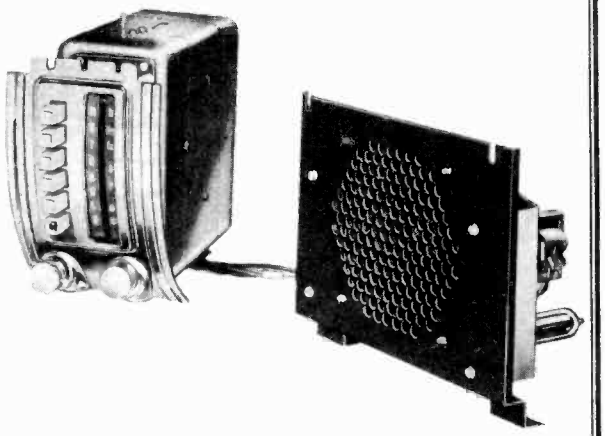
IF - 455 Kc

TUBE COMPLEMENT - 6BA6 - RF Amplifier
6BE6 - Converter
6BA6 - IF Amplifier
6AT6 - Diode detector, AVC & 1st AF Amp
6AQ5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 6.8 amps at 6.3V DC

POWER OUTPUT - 3 watts (max)

PUSH BUTTON TUNER - Automatic Tuner AT-71



ALIGNMENT

EQUIPMENT REQUIRED

1. A special tool for adjusting the tuner cores. Use Alignment Tool, Motorola Part No. 66A76278.

2. A small screwdriver for IF & RF alignment.

3. An accurately calibrated AM modulated signal generator.

4. A low range output meter.

5. A special dummy antenna for RF alignment. Construct dummy antenna as shown in Figure 1. The 21" coaxial lead needed in its construction is the same type as used for lead-in on Motorola car antennas.

PROCEDURE

1. Expose the alignment screws as follows: remove escutcheon, dial background and rear cover.

2. Connect the power & audio unit to the tuner unit and connect the output meter across the voice coil.

3. Connect a 6 volt storage battery to the power & audio unit chassis and 'A' lead. Turn on the receiver and allow it to warm up a few minutes. Set the receiver volume control at maximum and the tone control on 'high'.

4. For greatest accuracy, keep the output of the receiver at approximately 1 watt (1 watt = 1.79 volts on output meter) throughout alignment by reducing generator output (not receiver volume control) as stages are brought into alignment.

5. IF & RF ALIGNMENT - See Alignment Chart & Fig. 1
IMPORTANT: Do not push in on the alignment tool when adjusting the tuner cores. The slightest inward pressure on the alignment tool may move the tuner carriage and result in inaccurate alignment.

6. ANTENNA TRIMMER ADJUSTMENT. Once alignment has been satisfactorily performed, no further adjustment of any alignment screws should be made except to align the antenna trimmer (7) to the antenna after receiver is installed in car. This adjustment should be made with the antenna fully extended and receiver set to approximately 1400 Kc. Peak the trimmer for maximum volume of a weak station or background noise between stations. Trimmer can be reached from front by removing the top push button.

7. POINTER ADJUSTMENT. The pointer can be moved slightly for calibration correction by turning the eccentric adjustment rivet. This rivet has a slotted head and is exposed only when tuner is tuned to high frequency end. See Figure 1 for its location.

MODEL CTO,
Chevrolet

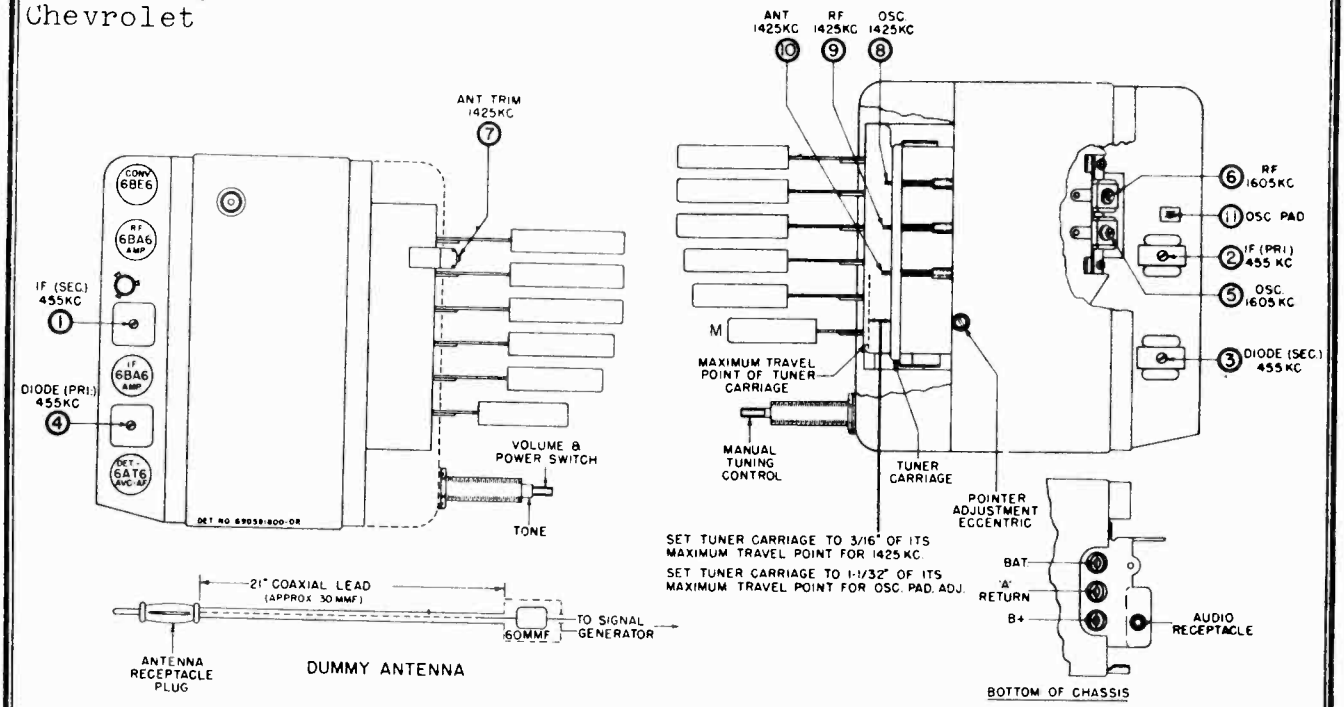
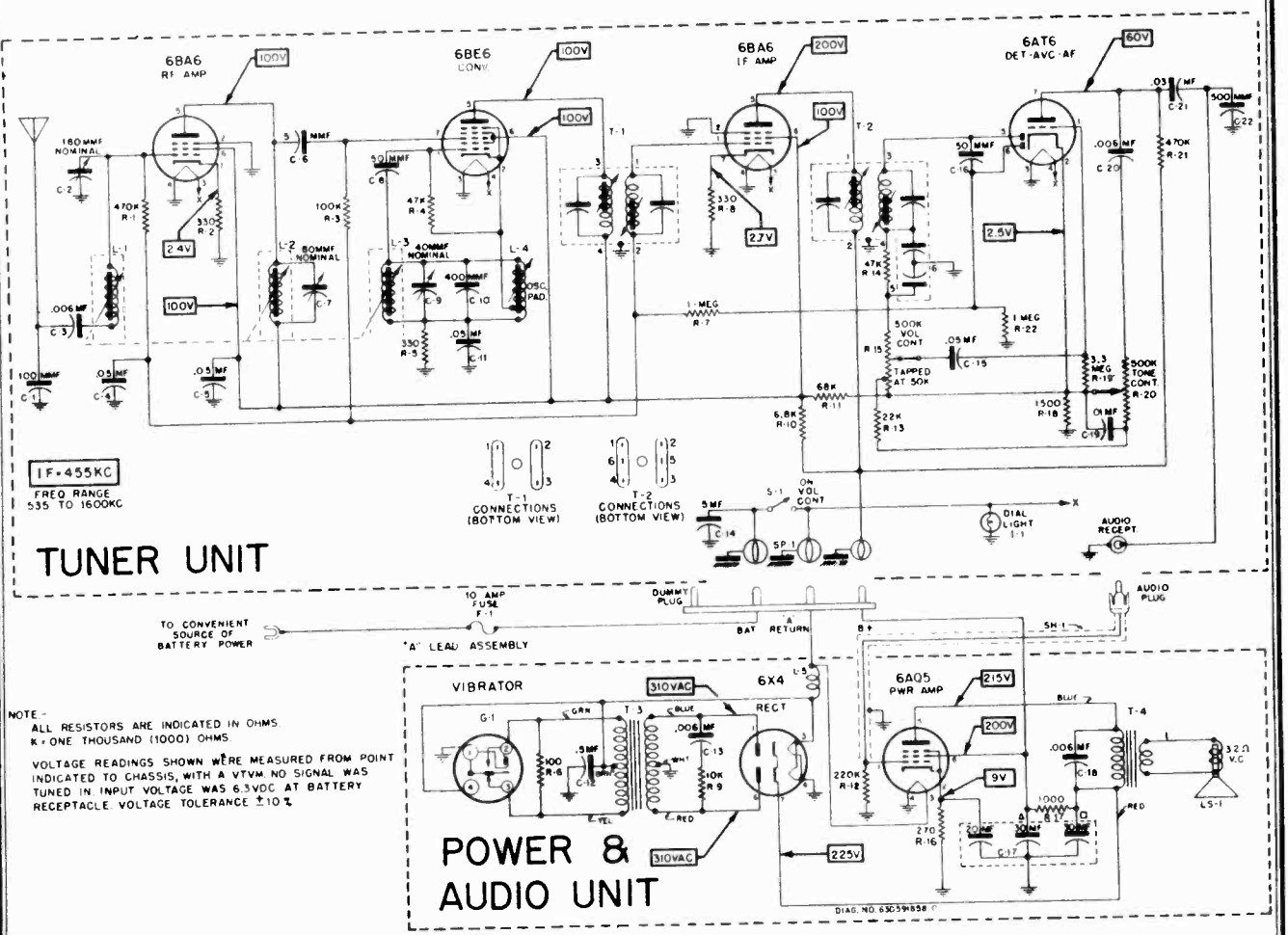


FIGURE 1. TUBE & TRIMMER LOCATIONS

ALIGNMENT CHART

STEP	TUNER SET TO	DUMMY ANTENNA	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR FREQUENCY	ADJUST	REMARKS
1.	High frequency end (cores out)	.1 mf	Hi side -6BE6 grid (pin #7) Lo side -chassis.	455 Kc	1, 2, 3 & 4	Peak for maximum in order indicated. Check by repeating procedure.
2.	High frequency end; Core screws should project 5/16" from core adjustment clip	Special -See Fig. 1	Ant. receptacle through special dummy.	1605 Kc	5, 6, & 7	Peak for maximum in order indicated.
3.	Using manual knob, set tuner to extreme HF position, then move carriage inward 3/16" (see 'Measurements', Fig. 1)	Special -See Fig. 1	Ant. receptacle through special dummy.	1425 Kc	8, 9 & 10	Peak for max. in order indicated.
4.	Move carriage 1-1/32" inward from point of maximum travel	Special -See Fig. 1	Ant. receptacle through special dummy.	Turn generator power off.	11	Peak oscillator padder for maximum noise. See*
5.	Approx. 1400 Kc	-	-		7	With set installed in car, peak antenna trimmer for maximum noise or volume of a weak station. Car antenna should be fully extended.

* If padder core (11) must be moved more than 1/2 turn from its original position, repeat steps 2, 3 & 4 until it is necessary to move the padder core less than 1/2 turn in this step.



NOTE -
ALL RESISTORS ARE INDICATED IN OHMS.
K = ONE THOUSAND (1000) OHMS.

VOLTAGE READINGS SHOWN WERE MEASURED FROM POINT INDICATED TO CHASSIS, WITH A VTVM. NO SIGNAL WAS TUNED IN. INPUT VOLTAGE WAS 6.3VDC AT BATTERY RECEPTACLE. VOLTAGE TOLERANCE ±10%

FICURE 2. SCHEMATIC DIAGRAM

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
		TUNER UNIT - ELECTRICAL PARTS
		CAPACITORS
C-1	21B77562	Ceramic: 100 mmf 500V
C-2	20A590629	Trimmer, variable mica: 50-220 mmf; with brkt
C-3	8C4529	Paper: .006 mf 100V
C-4	8k13514	Paper: .05 mf 100V
C-5	8k14791	Paper: .05 mf 400V
C-6	21k70720	Ceramic: 5 mmf 500V
C-7	20A590639	Trimmer, variable mica: 20-180 mmf; includes C-9 and brkt
C-8 or	21k74661 21H6513	Ceramic: 50 mmf 300V Mica: 50 mmf 300V
C-9	20A590639	Trimmer, variable mica: 5-80 mmf; includes C-7 & brkt
C-10	21A71872	Ceramic: 400 mmf 5% 500V
C-11	8k13514	Paper: .05 mf 100V
C-14	8k17028	Paper: .5 mf 100V
C-15	8k13514	Paper: .05 mf 100V
C-16	21k74661	Ceramic: 50 mmf 300V
C-19	8B472754	Paper: .01 mf 100V
C-20	8C4529	Paper: .006 mf 100V
C-21	8k71911	Paper: .03 mf 400V
C-22	21k481377	Ceramic: 500 mmf 500V
		DIAL LIGHT
I-1	65X10867	Bulb: 6.3V; .25A; bayonet base; clear #44
		COILS
L-1	24B71881*	RF & Antenna coil (specify color of paint dot on old coil when ordering)
L-2	24B71881*	RF & Antenna coil (specify color of paint dot on old coil when ordering)
L-3	24B71879*	Oscillator coil (specify color of paint dot on old coil when ordering)

*Part of Tuner AT-71

REF. NO.	PART NO.	DESCRIPTION
L-4	24A70227	Oscillator padder coil: complete with iron tuning core
		RESISTORS
		Note: All resistors are insulated carbon type, unless otherwise specified.
R-1	6R6032	470,000 20% 1/2W
R-2	6R6010	330 20% 1/2W
R-3	6R6075	100,000 20% 1/2W
R-4	6R6056	47,000 20% 1/2W
R-5	6R6010	330 20% 1/2W
R-7	6R6004	1 meg 20% 1/2W
R-8	6R6010	330 20% 1/2W
R-10	6R6287	6800 20% 1W N.I.
R-11	6R6001	68,000 20% 1/2W
R-13	6R6028	22,000 20% 1/2W
R-14	6R6056	47,000 20% 1/2W
R-15	18B590604	Volume Control: 500,000 ohms; tapped at 50,000 ohms (includes tone control R-20 and switch S-1)
R-18	6R6161	1500 20% 1/2W
R-19	6R2118	3.3 meg 20% 1/2W
R-20		500,000 ohm tone control (part of vol cont).
R-21	6R6032	470,000 20% 1/2W
R-22	6R6004	1 meg 20% 1/2W
		SWITCH
S-1		Switch (Part of Volume Control)
		SPARK PLATE
SP-1	1A590637	Spark Plate Assembly

MODEL CTO,
Chevrolet

REF. NO.	PART NO.	DESCRIPTION
TRANSFORMERS		
T-1	24B485553	IF, 455 Kc: complete with padding capacitors and tuning cores
T-2	24K485555	Diode, 455 Kc: complete with padding capacitors and tuning core
TUNER		
	1X590784	AT-71 Automatic Tuner
POWER & AUDIO UNIT - ELECTRICAL PARTS		
CAPACITORS		
C-12	8K17028	Paper: .5 mf 100V
C-13	8K12840	Paper: .006 mf 1600V
C-17	23A473015	Electrolytic: 30-30-20 mf/350-300-25V
C-18	8K71910	Paper: .006 mf 400V
FUSE		
F-1	65A10266	Fuse, 10 amp: type 3AG
VIBRATOR		
G-1	48B3333	Vibrator, non-sync: 4-pin
COILS		
L-5	24A472535	Choke, hash
SPEAKER		
LS-1	50K590681	Speaker: 6" PM; 3.2 ohm VC
RESISTORS		
Note:		All resistors are insulated carbon type unless otherwise specified.
R-6	6R6415	100 10% 1 watt
R-9	6R6054	10,000 20% 1/2W
R-12	6R6015	220,000 20% 1/2W
R-16	6R6336	270 10% 1 watt
R-17	6R6184	1000 20% 1 watt N.I.
TRANSFORMERS		
T-3	25K590650	Power transformer
T-4	25B590648	Output transformer

PART NUMBER	DESCRIPTION
TUNER UNIT - CHASSIS MECHANICAL PARTS	
43A590605	Bushing, tuning shaft
42A485548	Clip, coil can mounting (T-1 & T-2)
2S8397	Nut, hex: 1/2-28 x 5/8 stl; cad pl (volume control and tuning control bushings mtg)
1X590785	Pointer and Sleeve Assembly
1X590794	Receptacle, antenna input: includes bracket and terminal strip
9A54664	Receptacle, 1-pin (audio input)
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg)
5S7706	Rivet: .122 x 1/8 stl; pol nkl (terminal strip mtg)
5S7701	Rivet: .122 x 3/16; stl; pol nkl (audio receptacle mtg)
3S7205	Screw, machine: 8-32 x 1/4; slotted hex head; locking type; stl; cad pl(automatic tuner mtg)
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; stl; cad pl (variable cap brkt, antenna receptacle brkt, and pilot lamp brkt mtg)
26A473011	Shield, light
9A472905	Socket, pilot light & brkt
9A472534	Socket, tube: miniature; 7-prong
9K580218	Socket, tube: miniature; 8-prong
31K490141	Strip, terminal: 1 ins lug, #2 mtg (part of antenna receptacle brkt)
31K490143	Strip, terminal: 2 ins lugs, #2 mtg
1K590623	Tuning Shaft and Gear Assembly
4A21577	Washer, 'C' (tuning shaft mtg)
4S490351	Washer, flat: 11/16 x .515 x .033 thick; stl; cad pl (tuning shaft bushing and volume control mtg)
4A580282	Washer, spring (tuning shaft mtg)

PART NUMBER	DESCRIPTION
TUNER UNIT HOUSING PARTS	
7B590696	Background, dial
1X590783	Cover, front: includes gear mounting stud
15D590615	Cover, rear
13K590702	Escutcheon, dial
7B590693	Frame, dial retaining
44B472872	Gear, idler (mounted on front cover)
2S8397	Nut, hex: 1/2-28 x 5/8 stl; cad pl (tuner bushing mtg)
34C590802	Scale, dial
3S7156	Screw, machine: 6-32 x 3/16 slotted binderhead; stl; cad pl (dial retaining frame mtg)
3S7205	Screw, machine: 8-32 x 1/4 slotted hex head; stl; cad pl (shell housing)
3S7475	Screw, sheet metal: #8 x 1/4 plain acorn head; stl; cad pl (front cover and rear cover mtg)
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; stl; cad pl (front cover mtg)
15D590600	Shell, housing
46A590602	Stud, idler gear mtg
4K73809	Washer, 'C' (idler gear mtg)
4S490351	Washer: 11/16 x .515 x .033 thick; stl; cad pl (tuner bushing mtg)
POWER & AUDIO UNIT - CHASSIS MECHANICAL PARTS	
42A4215	Clip, vibrator grounding
14A590633	Insulator, armite (used on 4- pin connector)
14K590653	Insulator, armite (cable insulator)
1X590689	Lead Assembly, 'A': includes fuse & fuse receptacle, 4-pin connector and insulator
1X590691	Lead Assembly, audio: includes plug
4S7666	Lockwasher, ext: #6; stl; cad pl (power trans mtg)
2S7005	Nut, hex: 6-32 x 1/4; stl; cad pl (power trans mtg)
64C590641	Plate, speaker mtg
28K71775	Plug, 1-pin (audio plug)
28A590611	Plug, 4-pin ('A' lead connector)
9B591314	Receptacle, fuse (complete)
5S7769	Rivet: .088 x 3/32 stl; pol nkl (connector plug insulator mtg)
5S7771	Rivet: .088 x 3/16; stl; pol nkl (miniature socket mtg)
5S7701	Rivet: .122 x 3/16; stl; pol nkl (vibrator socket and output trans mtg)
5S7707	Rivet: .122 x 5/32; stl; pol nkl (terminal strip mtg)
3S7475	Screw, sheet metal: #8 x 1/4 PKZ slotted acorn head; stl; cad pl (spkr plate mtg)
3S8176	Screw, sheet metal: #10 x 3/8 PKZ plain hex head; stl; cad pl (spkr mtg)
9A472534	Socket, tube: miniature; 7-prong
9K580218	Socket, tube: miniature (for 6AQ5 tube)
9A70208	Socket, tube: 4-prong (for vibrator)
31K490143	Strip, terminal: 2 ins lugs, #2 mtg
4S1706	Washer, flat: 3/8 x .203 x .033 thick; stl; cad pl (spkr mtg)
4S7555	Washer, flat: 1/4 x .128 x .033 thick; stl; cad pl (output transformer mtg)
MOUNTING PARTS & ACCESSORIES	
7B590609	Bracket, tuning unit mtg
1X590563	Button, push: includes clip; 2-3/32" long
1X590656	Button, push: includes clip; 2-3/64" long
1X590661	Button, push: includes clip; 1-15/16" long
1X590662	Button, push: includes clip; 1-25/32" long
1X590663	Button, push: includes clip; 'M'
43A590621	Bushing, spacer: chrome pl (large)
43A590603	Bushing, spacer (small)
8A4491	Capacitor, generator
32C590643	Gasket, speaker: rubber
36K472939	Knob, reset: chrome pl (tone control)
36K590638	Knob, volume and tuning control
4S7693	Lockwasher, split: 1/4 stl; cad pl (tuner unit mtg)
2S7022	Nut, hex: 1/4-20 x 7/16; stl; cad pl (tuner unit mtg)
2S8397	Nut, hex: 1/2-28 x 5/8; stl; cad pl (tuner unit mtg to instrument panel)
64A13637	Plate, serrated (tuner unit mtg)
64D590704	Plate, trim: chrome pl
2S490342	Speednut: 10-24 blued (power & audio unit mtg)
46A590644	Stud, threaded shoulder (power & audio unit mtg)
6A4141	Suppressor, distributor
4K590606	Washer, cup: chrome pl
4K489323	Washer, felt (reset knob)

GENERAL INFORMATION

TYPE - Specifically designed for installation in the 1950 and 1949 Chevrolet

TUNING RANGE - 540 to 1600 Kc

IF FREQUENCY - 455 Kc

TUBE COMPLEMENT - 6BE6 - Converter
6BA6 - IF Amplifier
6AV6 - Det, AVC & 1st AF Amp
6AS5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 5.0 amps at 6.3V DC

POWER OUTPUT - 2 watts (maximum)

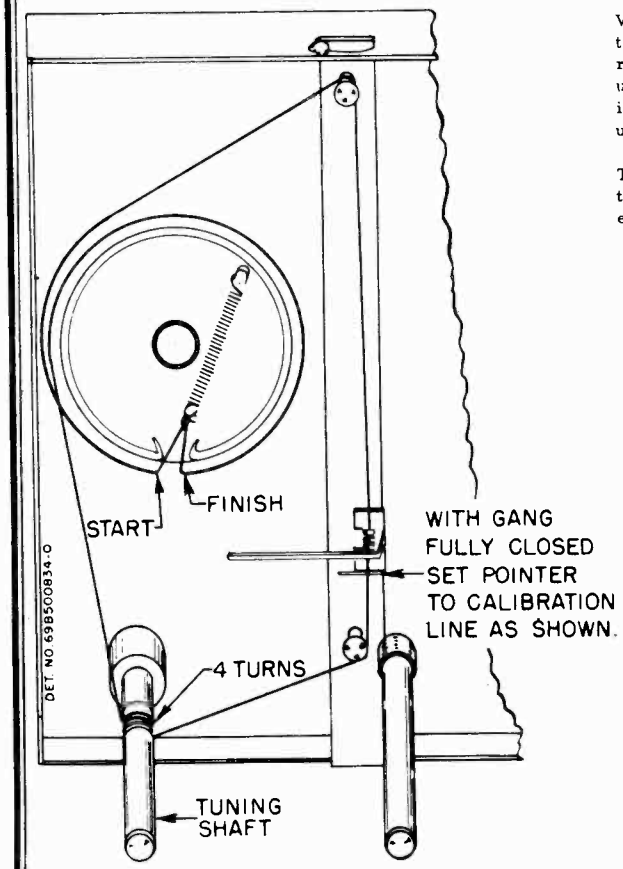
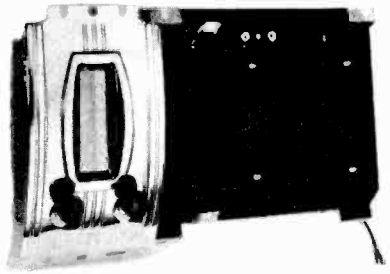


FIGURE 1. STRING DRIVE DETAIL



OPERATING INSTRUCTIONS

VOLUME CONTROL & ON-OFF SWITCH. The volume control and on-off switch are combined and are operated by the right-hand knob. Turn radio on by turning knob to the right until a "click" is heard. Continued rotation to the right will increase volume. To turn radio off, turn knob fully to left until a "click" is heard.

TUNING. Tune stations with the left-hand knob. Always tune carefully until you are exactly on the station; tuning to either side of it will result in poor tone quality.

ALIGNMENT

EQUIPMENT REQUIRED

1. A small screwdriver for IF & RF alignment.
2. An accurately calibrated 400 cycle, AM modulated signal generator.
3. A low range output meter.
4. A special dummy antenna for RF alignment. Construct dummy antenna as shown in Figure 2.

PROCEDURE

1. All adjustments are accessible without removing the covers, through holes provided.
2. Connect an output meter across the voice coil.
3. Connect a 6 volt storage battery to chassis and BATT terminal of receiver; turn receiver on and allow it to warm up for a few minutes.
4. For greatest accuracy, keep output of receiver at approximately 1/2 watt (1/2 watt = 1.25 volts on output meter) throughout alignment by reducing generator output (not receiver volume control) as stages are brought into alignment.

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTED TO	GENERATOR FREQUENCY	GANG SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Hi side - 6BE6 grid (pin #7) Lo side - chassis	455 Kc	High freq. end	1, 2, 3 & 4	Peak for maximum in order indicated. Check by repeating procedure.
RF ALIGNMENT						
2.	Special see Fig. 2.	Ant. receptacle thru special dummy	1605 Kc	Gang open	5	Peak for maximum
3.	"	"	1400 Kc	Tune in signal	6	Peak for maximum
4.	"	"	600 Kc	"	7	Peak antenna padder for maximum while rocking gang.

5. Repeat steps 3 & 4 until maximum output is obtained. The last adjustment should be trimmer (6).

6. With set installed in car, peak antenna trimmer (6) for maximum noise or volume of a weak station. Car antenna should be fully extended, and receiver set to approximately 1400 Kc.

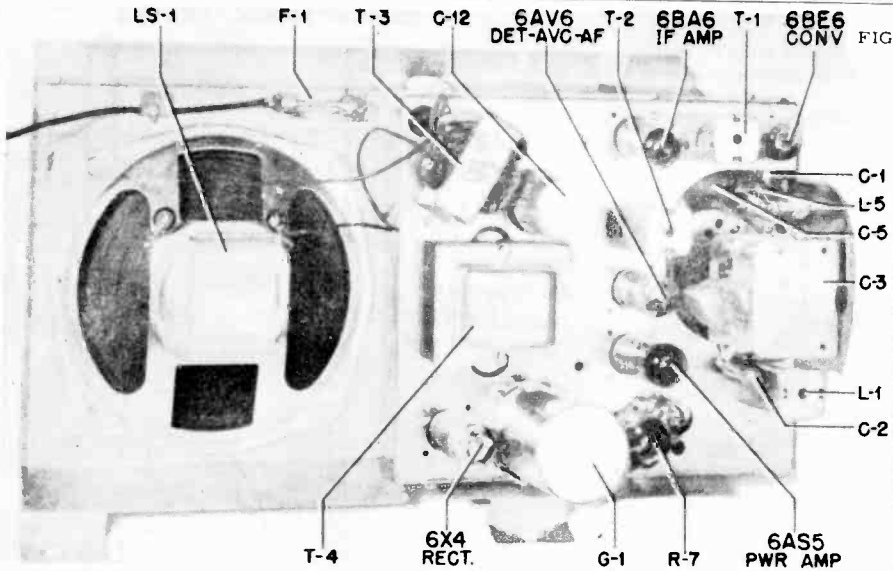


FIGURE 3. PARTS LOCATION - RECEIVER REAR VIEW

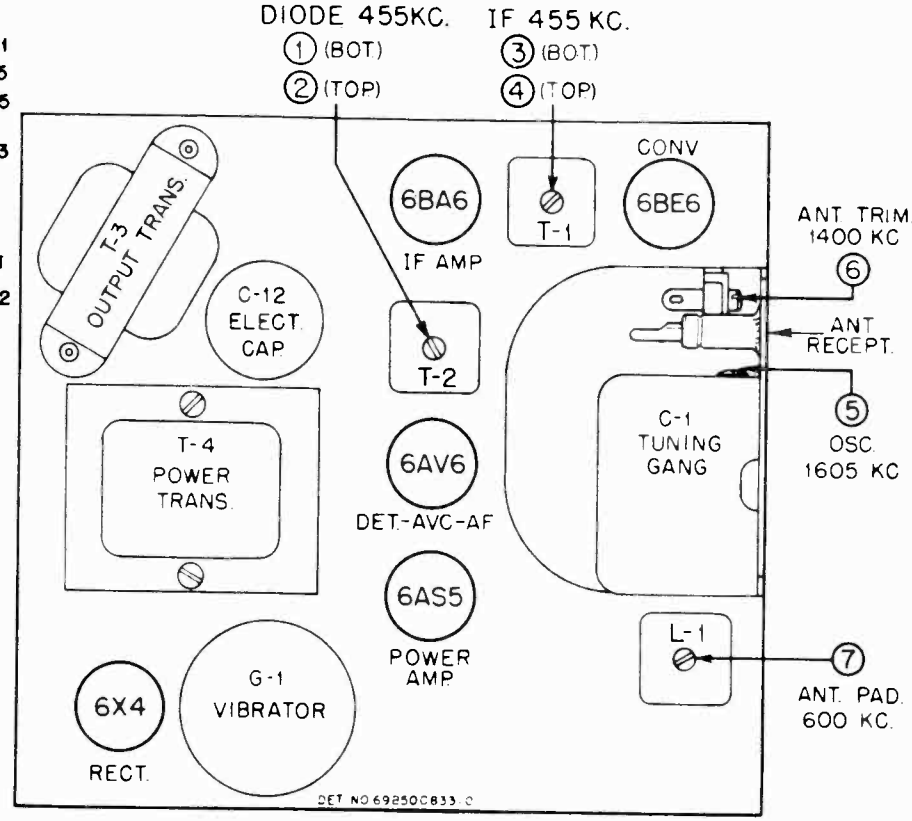
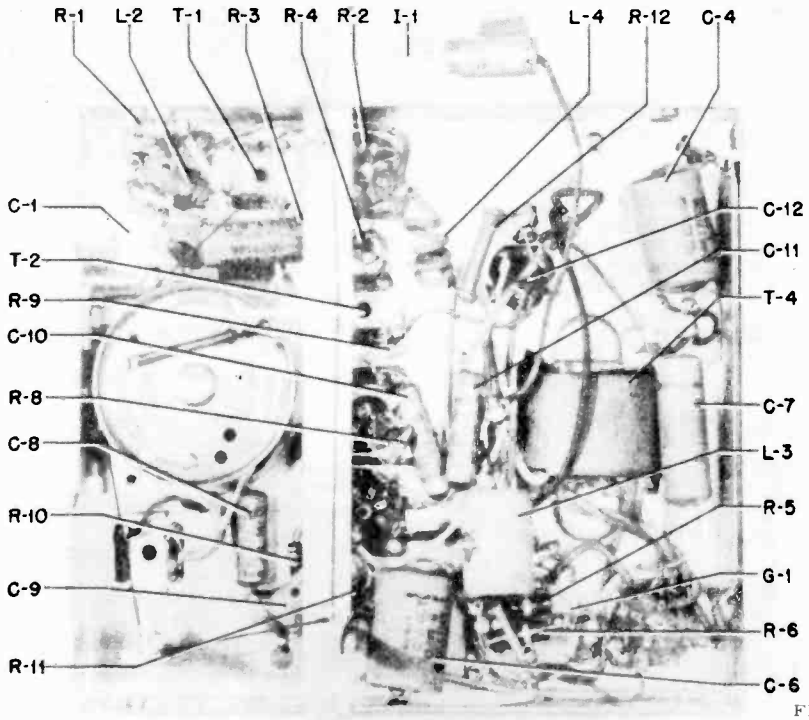


FIGURE 2. TUBE & TRIMMER LOCATIONS



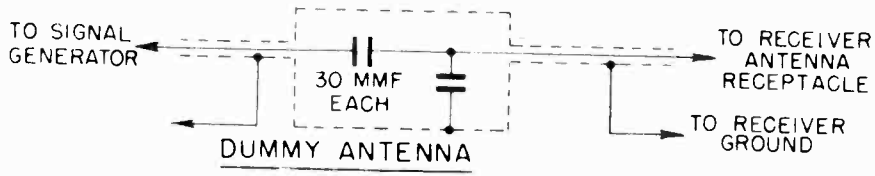


FIGURE 4. PARTS LOCATION - CHASSIS BOTTOM VIEW

MODEL CTOM,
Chevrolet, 1949-1950

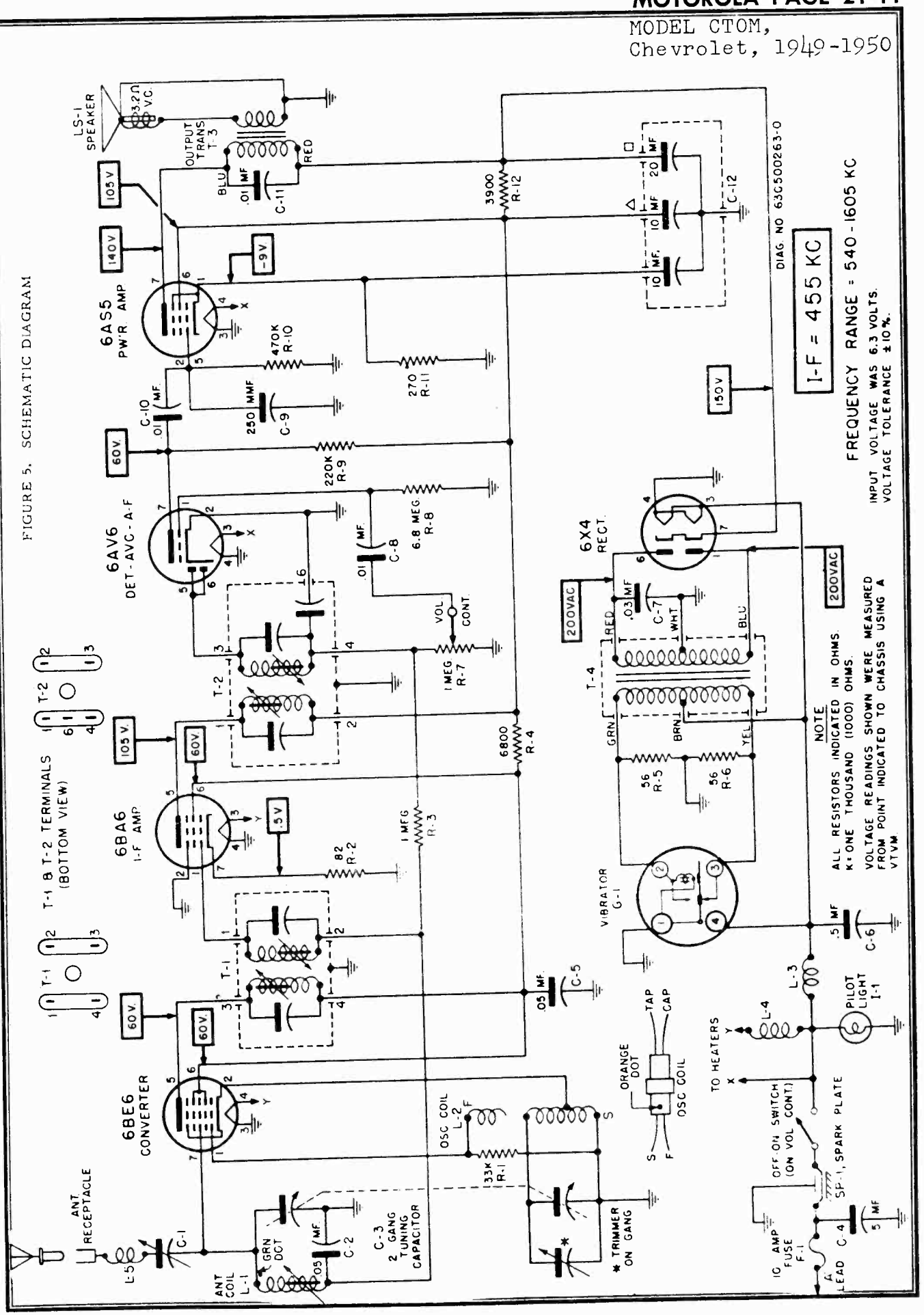


FIGURE 5. SCHEMATIC DIAGRAM

MODEL C TOM,
Chevrolet, 1949-1950

REPLACEMENT PARTS LIST

NOTE: When ordering parts specify model number of set in addition to part number and description of part.

Ref. No.	Part No.	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	20K500197	Trimmer, variable mica: 70 mmf; includes mounting brkt.....
C-2	8R13514	Paper: .05 mf 100V.....
C-3	19B500195	Variable, 2-gang.....
C-4	8K17028	Paper: .5 mf 100V.....
C-5	8R23146	Paper: .05 mf 200V.....
C-6	8K17028	Paper: .5 mf 100V.....
C-7	8R592154	Paper: .03 mf 600V.....
C-8	8R472754	Paper: .01 mf 100V.....
C-9	21R6662	Mica: 250 mmf 500V.....
C-10	8R23690	Paper: .01 mf 400V.....
C-11	8R23053	Paper: .01 mf 200V.....
C-12	23A500059	Electrolytic: 20 mf-10 mf 250V; 10 mf 25V.....
Fuse		
F-1	65A10266	Fuse: 10 amp.....
Vibrator		
G-1	48B3333	Vibrator: non-sync; 4-pin full wave.....
Bulb		
I-1	65X11854	Bulb: 6-8V; .20 amp; round; bayonet base; clear.....
Coils		
L-1	24B591628	Antenna coil.....
L-2	24A591629	Oscillator coil.....
L-3	24A472535	Choke, hash.....
L-4	24K78026	Choke, hash.....
L-5	24K592197	Choke, antenna spark.....
Speaker		
LS-1	50B500460	Speaker, PM: 5-1/4"; 3.2 ohm VC....
Resistors		
		Note: All resistors are carbon, insulated type unless otherwise specified.
R-1	6R6012	33,000 20% 1/2W.....
R-2	6R2035	82 10% 1/2W.....
R-3	6R6004	1 meg 20% 1/2W.....
R-4	6R6428	6800 10% 1/2W.....
R-5	6R5614	56 10% 1/2W.....
R-6	6R5614	56 10% 1/2W.....
R-7	18A500423	Volume control: 1 meg; includes on-off switch.....
R-8	6R3987	6.8 meg 20% 1/2W.....
R-9	6R6015	220,000 20% 1/2W.....
R-10	6R6032	470,000 20% 1/2W.....
R-11	6R6336	270 10% 1W.....
R-12	6R488313	3900 10% 1W N.I.....
Spark Plate		
SP-1	1A591512	Spark Plate Assembly.....
Transformers		
T-1	24K591556	IF, 455 Kc: complete with padding capacitors, tuning cores and shield.....
T-2	24K591555	Diode, 455 Kc: complete with padding capacitors, tuning cores and shield.....
T-3	25K500194	Output Transformer.....
T-4	25C500189	Power Transformer.....
CHASSIS PARTS - MECHANICAL		
	1X500445	Bracket, pointer: with two shoulder rivets.....
	43A500497	Bushing, tuning shaft.....
	42A4215	Clip, vibrator grounding.....
	11M8877	Cord, dial: #20 nylon black.....
	15C500406	Cover, rear.....
	4S7666	Lockwasher ext: #6; stl; cad pl (power trans mtg).....
	2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (power trans mtg).....
	2S7051	Nut, hex: 3/8-32; Palnut; stl; cad pl (volume control mtg).....
	1K500174	Pointer and Slider Assembly.....
	9A472148	Receptacle, antenna contact.....
	5S7771	Rivet: .088 x 3/16 stl; nkl pl (tube socket mtg).....
	5S7707	Rivet: .122 x 5/32; stl; nkl pl (terminal strip, spark plate and capacitor bracket mtg).....
	5S7701	Rivet: .122 x 3/16 stl; nkl pl (vibrator clip and output transformer mtg)..
	5K12814	Rivet, shoulder: stl; nkl pl (dial cord guide).....
	3S7350	Screw, machine: 6-32 x 1/4; slotted hex head; locking type; stl; cad pl (gang mtg).....
	3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; stl; cad pl (dial bracket mtg).....
	47A500422	Shaft, tuning.....
	9A500198	Socket, pilot light: includes bracket
	9A70208	Socket, tube: 4 prong.....
	9A472534	Socket, tube: 7 prong.....
	9K580218	Socket, tube: 8 prong.....
	41A14111	Spring, slider tension.....
	22S7906	Staple, flat head.....
	31A500418	Strip, terminal: 1 insulated lug #2 mtg.....
	4S7555	Washer: 1/4 x .128 x .033 thick; stl; cad pl (output trans mtg).....
	4A11291	Washer "C" (tuning shaft retainer)..
HOUSING PARTS & ACCESSORIES		
	7C500409	Bracket, dial background.....
	8A4491	Capacitor, noise suppression.....
	42A500196	Clip, dial scale retainer.....
	1X500450	Cover Assembly, front: includes fuse mtg strip.....
	4K590653	Insulator, armite (used on "A" lead)..
	36B500459	Knob,control.....
	1X500451	Lead Assembly, "A".....
	64D500416	Plate, trim: chrome pl.....
	34B500179	Scale, dial.....
	3S7454	Screw, sheet metal: #8 x 1/4; PKZ plain hex head; stl; cad pl (chassis to front plate and dial bracket mtg).....
	3S8176	Screw, sheet metal: #10 x 3/8 PKZ plain hex head; stl; cad pl (speaker mtg).....
	3S7104	Setscrew: 8-32 x 3/16 slotted headless; stl; cad pl (knob retainer).....
	2S490342	Speednut: 10-24; blued (receiver mtg).
	6A4141	Suppressor, noise.....

CHASSIS HS-190, HS-190A, HS-234

RECEIVER MODELS

Model	Radio Chassis Used	Record Changer Used	TV Chassis Used
12VF4R	HS-190	M4RC	TS-23 Series
12VF4B	HS-190	M4RC	TS-23 Series
12VF4R-C	HS-190	W6RC	TS-23 Series
12VF26R	HS-190A	M3RC	TS-23 Series
12VF26B	HS-190A	M3RC	TS-23 Series
12VF26R-C	HS-190A	W5RC	TS-23 Series
12VF26B-C	HS-190A	W5RC	TS-23 Series
16F1	HS-234	RC-36	TS-60
16F1B	HS-234	RC-36	TS-60

RECORD CHANGER: Model RC-36, page RCD.CH.21-1.

RADIO CHASSIS - HS-190: Radio chassis HS-190 contains 6 tubes, plus a selenium rectifier, and it receives both AM and FM broadcast programs. Except for common speakers, it operates entirely independently of the television receiver.

HS-190A: Same as chassis HS-190 except for shorter AC power lead and loop lead.

HS-234: Similar to chassis HS-190 except for different lead lengths, different phono motor and pick-up connectors, and the addition of a phono power switch to the tone control.

RADIO TUNING RANGE - AM - 535 to 1620 Kc
FM - 88 to 108 Mc

RADIO IF FREQUENCIES - AM IF - 455 Kc
FM IF - 10.7 Mc

ANTENNAS - AM: Loop antenna mounted in the cabinet
FM: Built into the power cord, with terminals for connection of an external antenna, if required.

SPEAKERS - RADIO: 10" PM
TV: Dual 10" PM and 5" electrodynamic

POWER SUPPLY - 117 volts, 60 cycle alternating current only

RADIO POWER CONSUMPTION - 60 watts, including phono motor

RADIO AUDIO OUTPUT - 2 watts.

RADIO CHASSIS TUBE COMPLEMENT - 12BA6 - FM-AM RF Amplifier
12BA7 - FM-AM Converter
12BA6 - FM-AM IF Amplifier
12BA6 - FM-IF Amplifier
19T8 - FM Ratio Detector, AM Detector & 1st Audio Amp
50C5 - Power Amplifier
Rectifier - Selenium type

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNAS

No outside antenna or ground is normally required for standard broadcast (AM) reception, as a loop antenna is located at the rear of the cabinet. In locations where additional pick-up is desired, an external antenna may be connected to the loop antenna by taping the lead-in wire over the dashed lines on the loop panel. Do not use a shorted turn.

An FM antenna, built into the power cord, eliminates the need for an external FM antenna when the receiver is used in normal FM service areas, such as are found in and for a few miles around metropolitan areas. In 'fringe' or weak signal areas, improved FM reception can be obtained by using an outside FM antenna. The external antenna should be connected through a 300 ohm twin transmission line to screws #1 and #2 on the terminal strip on the loop antenna panel, as in Figure 1. The link between screws #2 and #3 should be opened. Orient the antenna to obtain maximum volume of the FM stations.

For best FM reception from the built-in power line cord antenna, it is important to stretch the cord to its full length. Changing the direction or position of the line cord, or reversing the plug in the wall outlet, will often improve reception from weak stations. Connect the link between screws #2 and #3 on the terminal strip on the loop antenna when the built-in antenna is used.

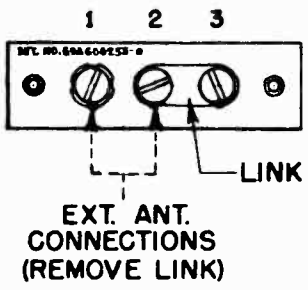


FIGURE 1 ANTENNA CONNECTIONS

CAUTION: Do not connect the antenna or chassis to a water pipe, radiator, or other ground.

CHASSIS HS-190,
HS-190A, HS-234

CONTROLS

Refer to Figure 2 for the location of the radio controls.

POWER SWITCH AND VOLUME CONTROL. The volume control and power switch for both radio and phonograph operation are combined and are operated with the extreme left-hand knob. **CAUTION:** The power switches on the AM-FM radio and on the television receiver are independent. Make sure both are turned off when the set is not in use.

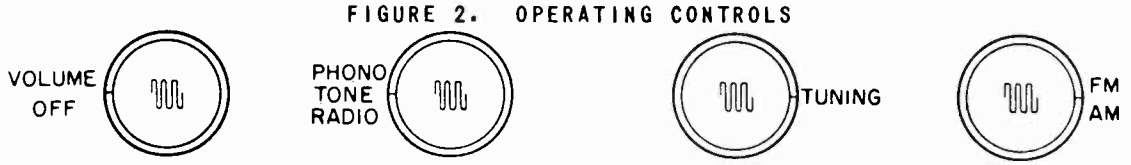
PHONO-TONE-RADIO CONTROL. For phonograph operation, rotate the second knob from the left fully clockwise until a 'click' is heard. For radio operation, rotate the knob fully counterclockwise until a 'click' is heard. Tone may be varied between these two positions. **NOTE:** On the 16F1 model, rotating the control to the "PHONO" position also starts the phono motor. Models 12VF4 and 12VF26 have separate power switches on the phonograph itself.

FM-AM SELECTOR SWITCH. Rotate the extreme right-hand control clockwise for AM (Standard Broadcast) or counterclockwise for FM (Frequency Modulation), as desired.

TUNING CONTROL. The third control from the left selects the desired FM or AM station. The standard broadcast scale (AM) is read in kilocycles by adding one '0' to the figures. The frequency modulation scale (FM) is read in megacycles (88 to 108).

Tuning of FM stations should be done very carefully, for best sound reproduction, not necessarily for strongest volume received.

FIGURE 2. OPERATING CONTROLS



SERVICE NOTES

DET. NO. 6986916A3-O

The chassis of this receiver is connected directly to the power line. When operating the chassis outside of its cabinet, use an isolation transformer between the power line and the receiver to reduce the possibility of electrical shock. If an isolation transformer is not available, check the AC voltage between the chassis and the bench ground. If there is any indication of voltage, reverse the line plug before handling the set.

TO REMOVE RADIO CHASSIS FROM CABINET

1. Remove the large panel covering the rear of the cabinet.
2. Pull off the four knobs on the front of the cabinet.
3. Remove the five screws holding the radio loop panel to the cabinet.
4. Pull the loop panel loose from the interlock plug.
5. Disconnect the power and loop leads between the loop panel and the television and radio chassis.
6. Disconnect the speaker and phonograph leads.
7. Remove the two screws holding the interlock plug bracket.
8. Remove the three chassis mounting screws.
9. Slide the chassis from the cabinet.
10. Refer to Figure 3 when reassembling the chassis into the cabinet.

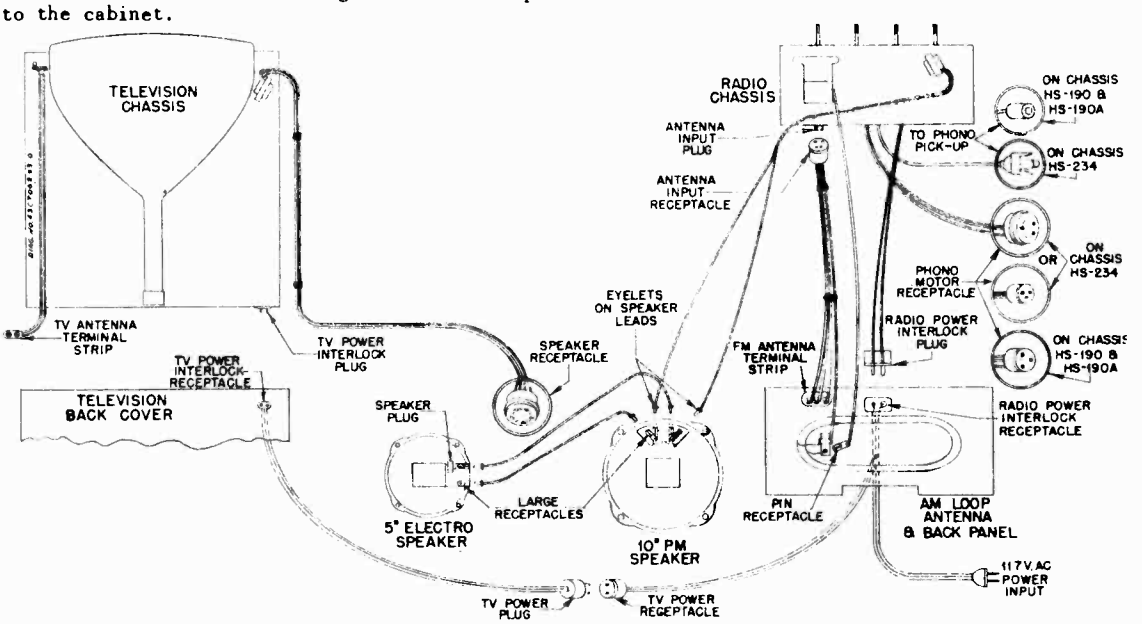


FIGURE 3. INTERCONNECTING CABLE DIAGRAM

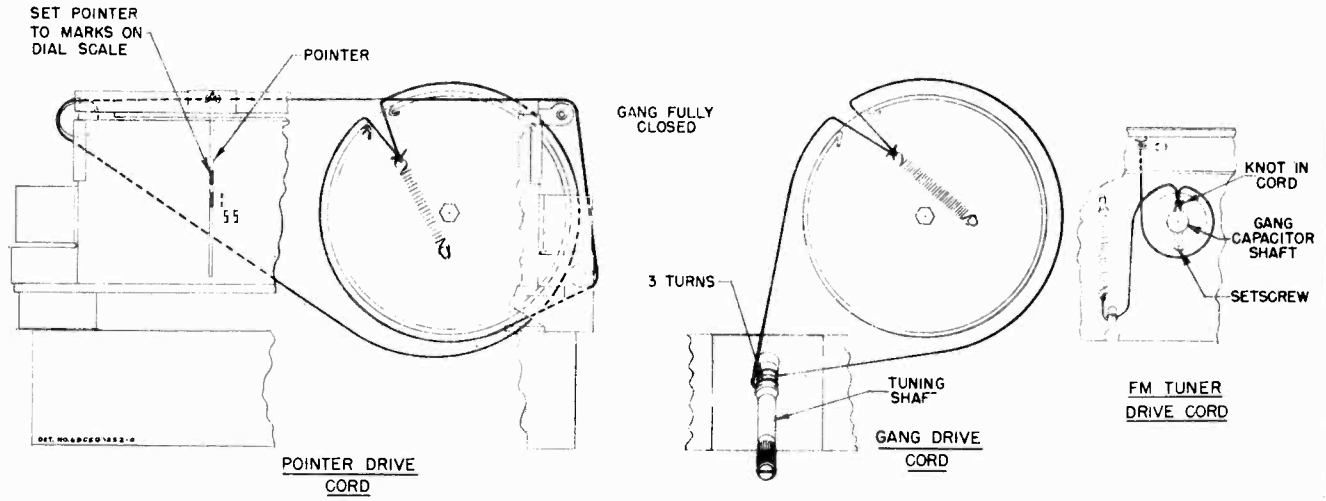


FIGURE 4. DIAL RESTRINGING DETAIL

ALIGNMENT

GENERAL INFORMATION

1. Maximum performance can be obtained only if extreme care is exercised during alignment.

2. It is recommended that an isolation transformer be placed between the power line and the receiver during alignment to avoid hum and electrical shocks. If an isolation transformer is not available, connect the low side of the signal generator to the receiver chassis through a .1 mf capacitor.

3. Use a small fibre screwdriver for aligning the IF transformer.

4. Refer to Figure 5 for the location of all alignment trimmers and cores.

5. As the stages are brought into alignment, reduce the signal generator output to a low value to avoid overloading the receiver.

ORDER OF ALIGNMENT AND EQUIPMENT REQUIRED

1. Broadcast Band IF & RF Alignment
   a. 455 to 1620 Kc AM signal generator
   b. Low range output meter

2 (A) FM Band IF & RF Alignment (Preferred Method)
   a. 10.7 to 108 Mc FM signal generator
   b. Oscilloscope

(B) FM Band IF & RF Alignment (Alternate Method)
   a. 10.7 to 108 Mc signal generator (unmod.)
   b. Low range DC electronic voltmeter

BROADCAST BAND - IF & RF ALIGNMENT

1. With the gang fully closed, adjust the pointer to coincide with the calibration marks at the left of "55" on the dial scale. See Figure 4.

2. Connect the AM signal generator as in chart below, with 400 cycle, 30% modulation.

3. Connect the output meter across the speaker voice coil. Throughout alignment, reduce the generator output to a level which produces less than 1.27 volts across the voice coil to avoid overloading the receiver.

4. Set the bandswitch to the AM position.

5. Turn the receiver volume control to maximum.

6. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. V-2 (pin 7, 12BA7)	455 Kc	Fully opened	1, 2, 3 & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv. V-2 (pin 7, 12BA7)	1620 Kc	Fully opened	5 (BC osc)	Adjust for maximum.*
3.	-	Across radiation loop**	1400 Kc	Tune in signal	8 (BC ant)	Adjust for maximum.

4. If, after the receiver has been aligned as above, it is found to be badly off calibration, it will be necessary to adjust oscillator core (7) as follows: connect the generator to the grid of the converter tube and, with the gang fully closed, adjust core (7) at 535 kc. It is advisable to repeat the oscillator adjustments at 1620 Kc and 535 kc several times until the tuning range is correct. Core (7) has been preset at the factory and normally should require no retuning.

* If difficulty is encountered in tuning trimmer (5), adjust trimmer (6) to ½ turn from tight.

** Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

CHASSIS HS-190,
HS-190A, HS-234

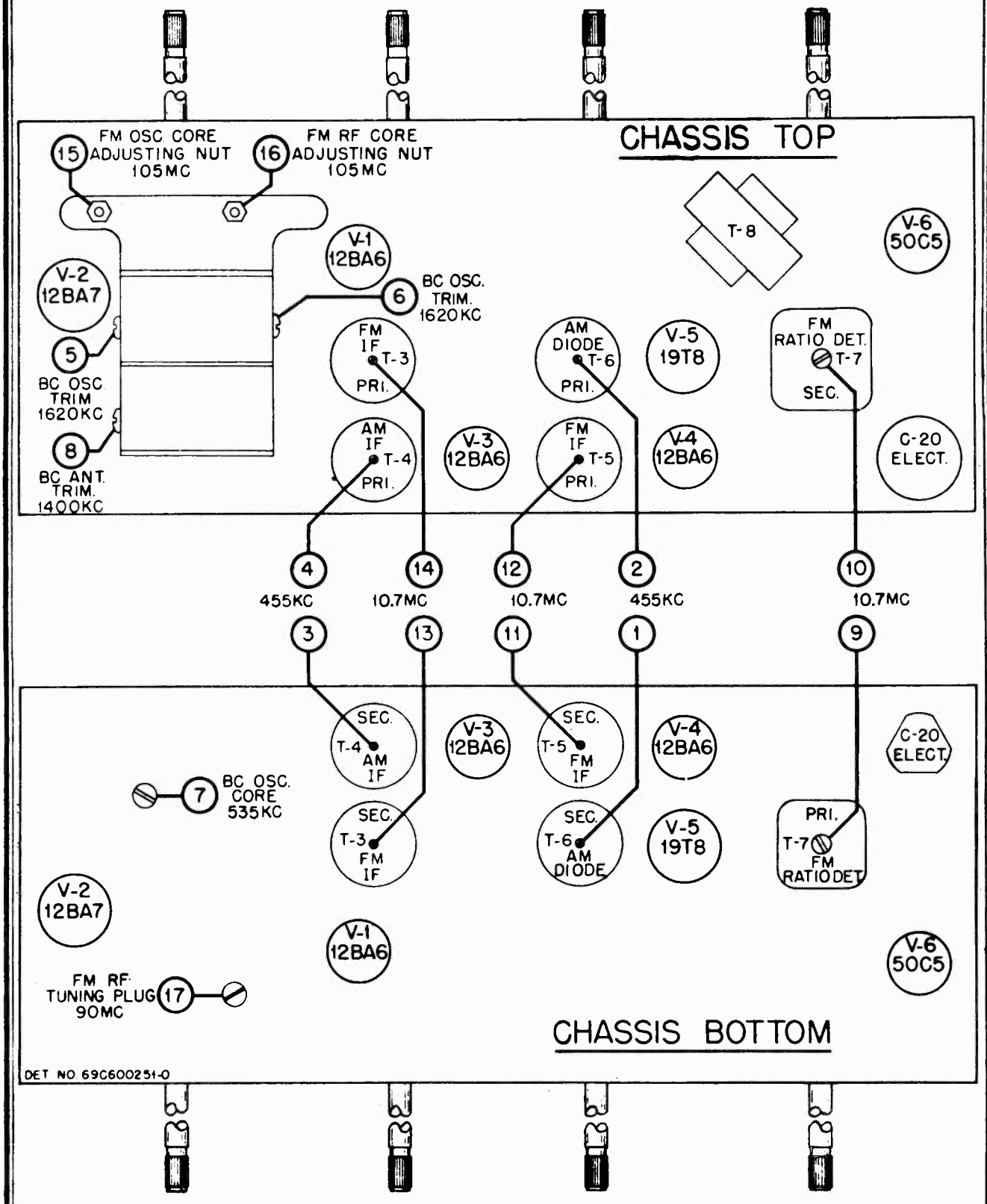


FIGURE 5. TUBE & TRIMMER LOCATION

CHASSIS HS-190, HS-190A, HS-234

FM BAND - IF & RF ALIGNMENT (PREFERRED METHOD)

1. The following FM alignment procedure, using an FM signal generator and an oscilloscope, is to be preferred because the actual response pattern may be observed on the scope and adjusted for best symmetry and maximum amplitude.

2. Connect the vertical input terminals of the oscilloscope between the chassis and the junction of resistor R-24 (22K) and capacitor C-35 (1000 mmf).

3. Connect the FM signal generator sync voltage output terminals, through a phase shifting network, to the horizontal input terminals of the scope, as in Figure 6. (Other values of resistance and capacitance may be required, depending upon the scope). The phasing control should be adjusted to give only one trace on the scope. **NOTE:** If the FM generator has a built-in phase control, the phase shifting network is not necessary.

4. Set the bandswitch to the FM position.

5. Throughout alignment, reduce the generator output to keep the signal just above the noise level, to avoid overloading the receiver.

6. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 12BA6)	10.7 mc ±100 kc dev	Fully opened	9 (ratio det pri)	Adjust for maximum amplitude of pattern.*
2.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 12BA6)	10.7 mc ±100 kc dev	Fully opened	10 (ratio det sec)	Adjust for symmetrical curve, as shown in Figure 7.
3.	-	-	-	-	-	Repeat steps 1 & 2 for maximum amplitude and best symmetry.
4.	1000 mmf	Grid of 1st IF Amp V-3 (pin 1, 12BA6)	10.7 mc ±100 kc dev	Fully opened	11 & 12 (2nd IF sec & pri)	Adjust for maximum amplitude of pattern.*
5.	1000 mmf	Grid of conv V-2 (pin 7, 12BA7)	10.7 mc ±100 kc dev	Fully opened	13 & 14 (1st IF sec & pri)	Adjust for maximum amplitude of pattern.*
6.	1000 mmf	Grid of conv V-2 (pin 7, 12BA7)	10.7 mc ±100 kc dev	Fully opened	11, 12, 13 & 14	Readjust for maximum amplitude and best symmetry.
RF ALIGNMENT						
7.	270 ohms	FM terminals on loop	105 mc ±22½ kc dev	105 mc on dial	15 (osc adj nut)	Adjust for maximum amplitude of pattern.*
8.	-	-	-	Fully closed	16 (RF adj nut)	Turn counterclockwise until core is at bottom of pipe, then turn four turns clockwise.
9.	270 ohms	FM terminals on loop	90 mc ± 22½ kc dev	Tune in signal	17 (RF tuning plug)	Adjust for maximum amplitude of pattern.*
10.	270 ohms	FM terminals on loop	105 mc ± 22½ kc dev	Tune in signal	16 (RF adj nut)	Adjust for maximum amplitude of pattern.*
11.	-	-	-	-	-	Repeat steps 9 & 10, until no further adjustment is necessary.

*An output meter across the speaker voice coil will also indicate maximum amplitude. It should not be used in place of the scope, however, since it will not show symmetry of the curve.

CHASSIS HS-190,
HS-190A, HS-234

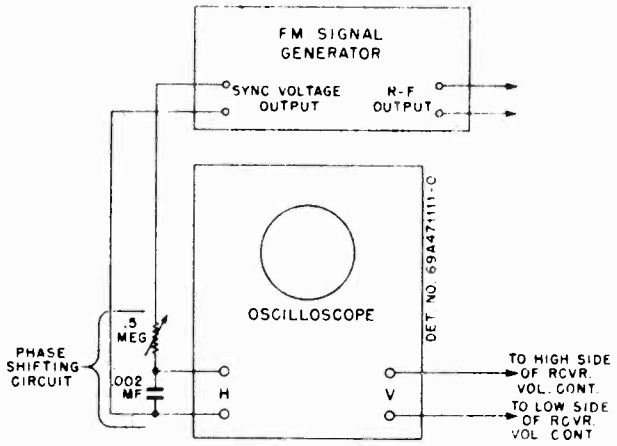


FIGURE 6.

FM SIGNAL GENERATOR & OSCILLOSCOPE HOOK-UP

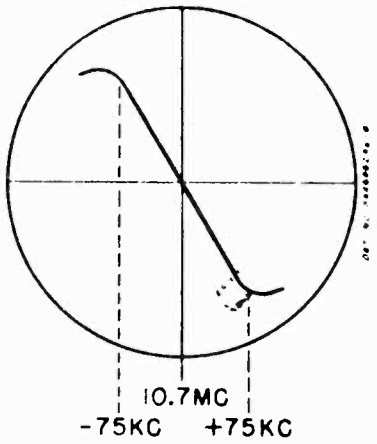


FIGURE 7.

RATIO DETECTOR WAVEFORM

FM BAND - IF & RF ALIGNMENT (ALTERNATE METHOD)

1. The following procedure for FM alignment, with an unmodulated carrier generator and a DC electronic voltmeter, is not as desirable as the preceding method; but it may be used if no FM generator is available.

2. Connect the signal generator as in chart below, with no modulation.

3. Set the bandswitch to the FM position.

4. Except in step 2 below, connect the electronic voltmeter across resistor R-33 (33K) in the ratio detector stage.

5. Throughout alignment reduce the signal generator output to a value which produces no more than a 5 volt rise above no signal voltage, to avoid overloading the receiver.

6. In step 2 below, connect two 100K ohm resistors in series across R-33. Connect the electronic voltmeter between the volume control side of resistor R-24 (22K) and the junction of the two 100K resistors, with the low side of the meter at the 100K resistors.

7. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of conv V-2 (pin 7, 12BA7)	10.7 mc	Fully opened	9, 11, 12, 13 & 14 (IF cores)	Adjust for maximum.
2.	1000 mmf	Grid of conv V-2 (pin 7, 12BA7)	10.7 mc	Fully opened	10 (ratio det sec)	Adjust for zero (connect meter as in step 6 above)
RF ALIGNMENT						
3.	270 ohms	FM terminals on loop	105 mc	105 mc on dial	15 (osc adj nut)	Adjust for maximum
4.	-	-	-	Fully closed	16 (RF adj nut)	Turn counterclockwise until core is at bottom of pipe, then turn four turns clockwise.
5.	270 ohms	FM terminals on loop	90 mc	Tune in signal	17 (RF tuning plug)	Adjust for maximum.
6.	270 ohms	FM terminals on loop	105 Mc	Tune in signal	16 (RF adj nut)	Adjust for maximum.
7.	-	-	-	-	-	Repeat steps 5 & 6 until no further adjustment is necessary.

CHASSIS HS-190, HS-190A

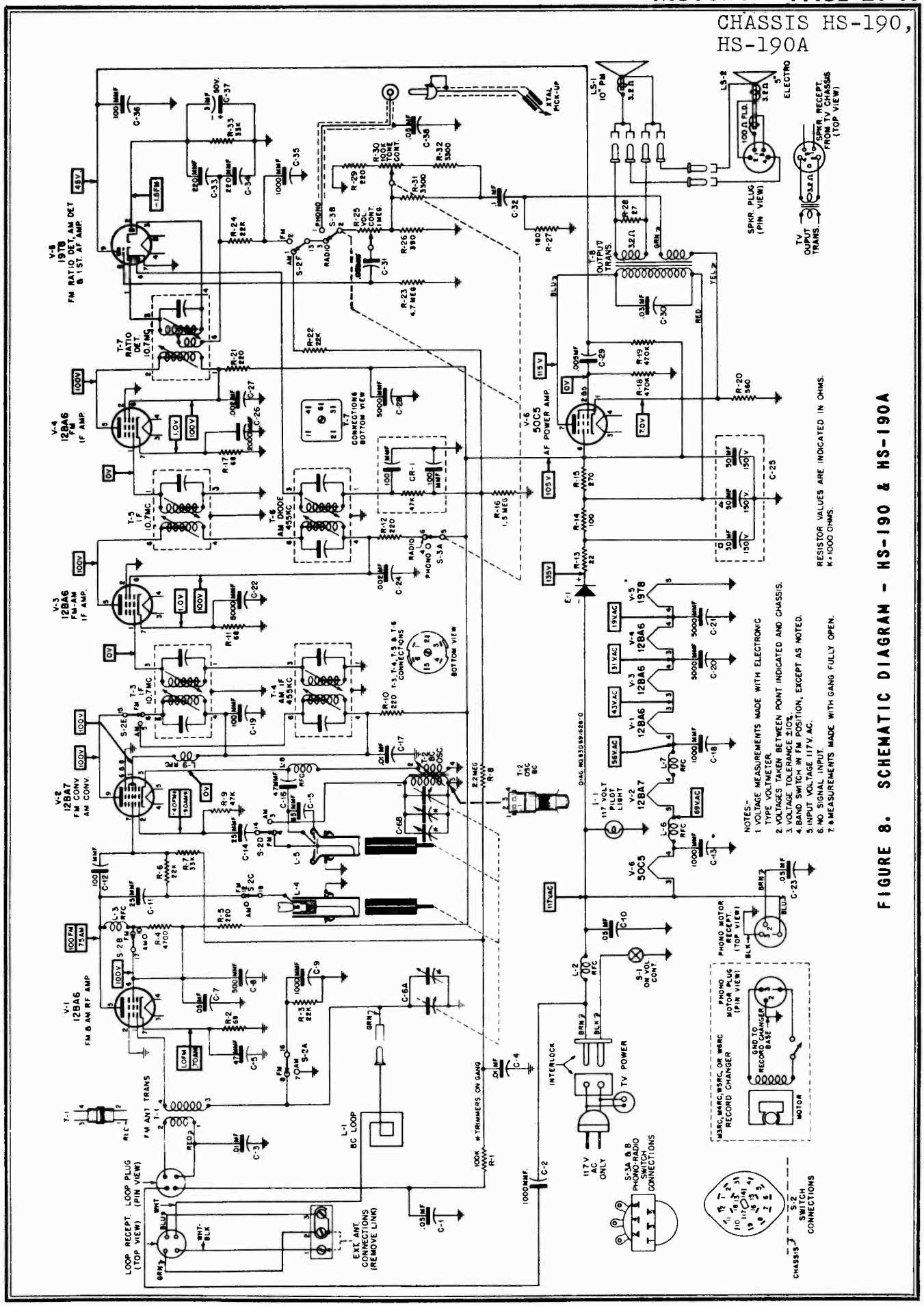
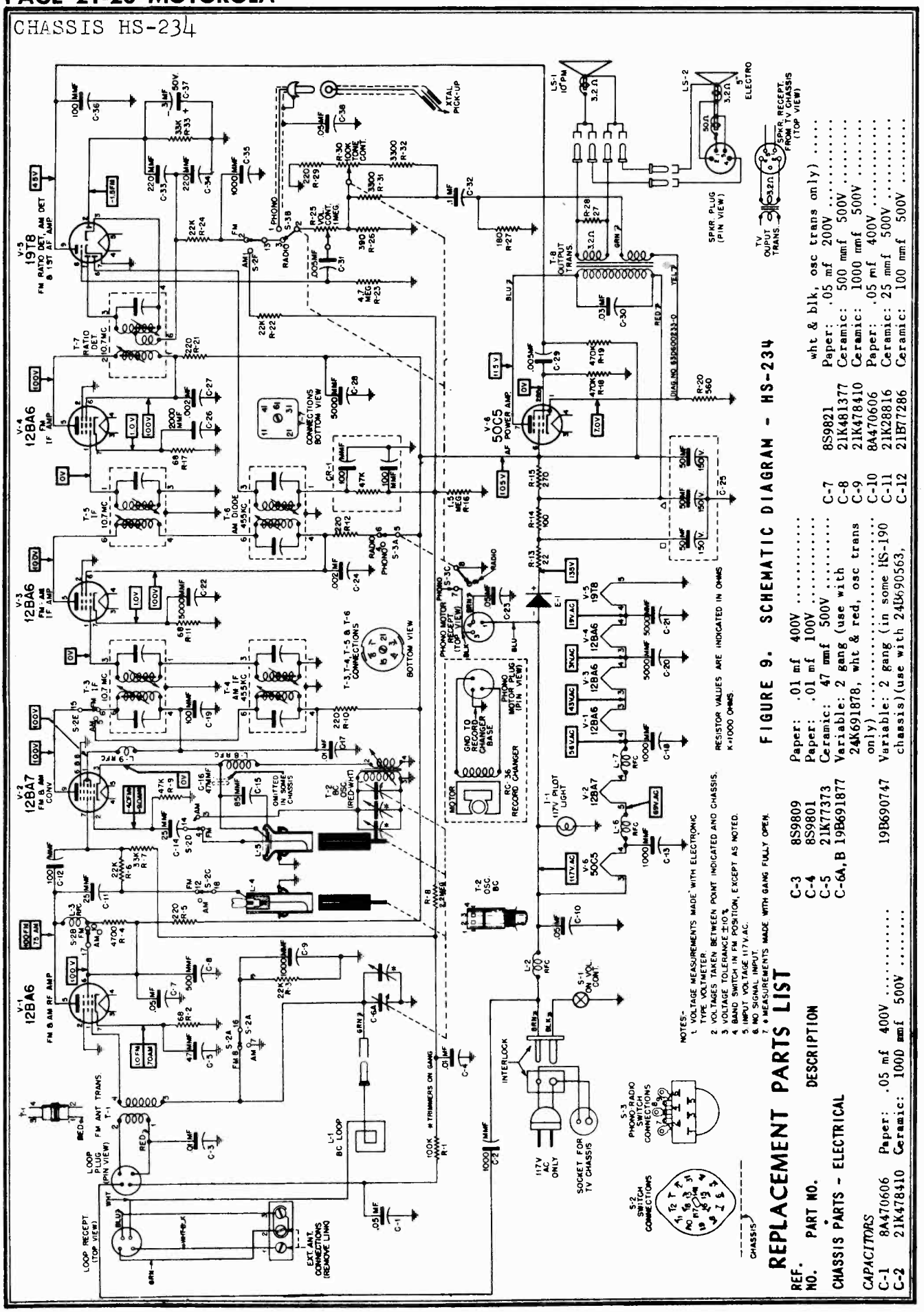


FIGURE 8. SCHEMATIC DIAGRAM - HS-190 & HS-190A

CHASSIS HS-234



REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
		CHASSIS PARTS - ELECTRICAL
		CAPACITORS
C-1	8A470606	Paper: .05 mf 400V .....
C-2	21K478410	Ceramic: 1000 mmf 500V .....
C-3	8S9809	
C-4	8S9801	
C-5	21K77373	
C-6A,B	19B691877	
	19B690747	

NOTES-
1. VOLTAGE MEASUREMENTS MADE WITH ELECTRONIC TYPE VOLTMETER
2. VOLTAGES TAKEN BETWEEN POINT INDICATED AND CHASSIS.
3. VOLTAGE TOLERANCE ±10%
4. BAND SWITCH IN FM POSITION, EXCEPT AS NOTED.
5. INPUT VOLTAGE 117 V.AC.
6. NO SIGNAL INPUT.
7. * MEASUREMENTS MADE WITH GANG FULLY OPEN.

RESISTOR VALUES ARE INDICATED IN OHMS
K=1000 OHMS.

FIGURE 9. SCHEMATIC DIAGRAM - HS-234

Paper: .01 mf 400V		C-7	8S9821
Paper: .01 mf 100V		C-8	21K481377
Ceramic: 47 mmf 500V		C-9	21K478410
Variable: 2 gang (use with 24K691878, wht & red, osc trans only)		C-10	8A470606
Variable: 2 gang (in some HS-190 chassis)(use with 24K690563,		C-11	21K28816
		C-12	21B77286

wht & blk, osc trans only) .....
Paper: .05 mf 200V .....
Ceramic: 500 mmf 500V .....
Ceramic: 1000 mmf 500V .....
Paper: .05 mf 400V .....
Ceramic: 25 mmf 500V .....
Ceramic: 100 mmf 500V .....

PART NUMBER		DESCRIPTION
C-13	21K478410	Ceramic: 1000 mmf 500V
C-14	21K28816	Ceramic: 25 mmf 500V
C-15	21A690688	Ceramic: 85 mmf 500V
C-16	21K77373	Ceramic: 47 mmf 500V
C-17	8S9809	Paper: .01 mf 400V
C-18	21K471761	Ceramic: 1000 mmf 500V
C-19	21B77286	Ceramic: 100 mmf 500V
C-20	21A470789	Ceramic, disc type: 5000 mmf 450V
C-21	21A470789	Ceramic, disc type: 5000 mmf 450V
C-22	21A470789	Ceramic, disc type: 5000 mmf 450V
C-23	8A470606	Paper: .05 mf 400V
C-24	8S9824	Paper: .002 mf 400V
C-25	23B690539	Electrolytic: 50-50-50 mf/150V...
C-26	21K790912	Ceramic: 2000 mmf 500V
C-27	8S9824	Paper: .002 mf 400V
C-28	21A470789	Ceramic, disc type: 5000 mmf 450V
C-29	8A24966	Paper: .005 mf 100V
C-30	8R9872	Paper: .03 mf 600V
C-31	8A24966	Paper: .005 mf 100V
C-32	8K471636	Paper: .1 mf 200V
C-33	21K77375	Ceramic: 220 mmf 500V
C-34	21K77375	Ceramic: 220 mmf 500V
C-35	21K478410	Ceramic: 1000 mmf 500V
C-36	21B77286	Ceramic: 100 mmf 500V
C-37	23K690543	Electrolytic: 3 mf 50V
C-38	8A470606	Paper: .05 mf 400V
CAPACITOR-RESISTOR		
CR-1	21A473040	Capacitor-Resistor: 100 mmf, 100 mmf, 47,000 ohms
RECTIFIER		
E-1	48B482807	Selenium rectifier: half-wave; 150 ma
PILOT LIGHT		
I-1	65K691040	Bulb, incandescent: 117V; 10W bayonet base
COILS		
L-1	1X790757	Antenna Loop, Panel, and Leads Assembly: complete with line cord (12VF4)
	1X790758	Antenna Loop & Panel Assembly: complete with antenna terminal strip and interlock receptacle cover; less line cord and leads (12VF4)
	1X791664	Antenna Loop, Panel, and Leads Assembly: complete with line cord (12VF26)
	1X791665	Antenna Loop & Panel Assembly: complete with antenna terminal strip and interlock receptacle cover; less line cord and leads (12VF26)
	1X792539	Antenna Loop, Panel, and Leads Assembly: complete with line cord (16F1)
	1X792541	Antenna Loop & Panel Assembly: complete with antenna terminal strip and interlock receptacle cover; less line cord and leads (16F1)
L-2	24K691041	RF choke: insulated
L-3	24A90064	RF choke
L-4	24C690584	Inductor & Capacitor Assembly: FM RF; less tuning core
L-5	24K600519	Inductor & Capacitor Assembly: FM osc; less tuning core
L-6	24K780128	RF choke: insulated
L-7	24K780128	RF choke: insulated
L-8	24K780128	RF choke: insulated
L-9	24A691847	RF choke
SPEAKERS		
LS-1	50C791427	Speaker: 10" PM; 3.2 ohm VC..
LS-2	50C791426	Speaker: 5" electrodynamic; 3.2 ohm VC (12VF4 & 12VF26).
	50K792776	Speaker: 5" electrodynamic; 3.2 ohm VC (16F1)
RESISTORS		Note: All resistors are insulated carbon type unless otherwise specified.
R-1	6R6075	100,000 20% ½W
R-2	6R2039	68 10% ½W
R-3	6R6028	22,000 20% ½W
R-4	6R6039	4700 20% ½W
R-5	6R3933	220 20% ½W
R-6	6R6028	22,000 20% ½W
R-7	6R6012	33,000 20% ½W
R-8	6R3927	2.2 meg 20% ½W
R-9	6R6056	47,000 20% ½W
R-10	6R3933	220 20% ½W
R-11	6R2039	68 10% ½W
R-12	6R3933	220 20% ½W
R-13	17A690578	Wire wound: 22 10% 1.5W
R-14	6R3963	100 10% 2W
R-15	6R476116	270 10% 2W
R-16	6R3966	1.5 meg 20% ½W
R-17	6R2039	68 10% ½W
R-18	6R6032	470,000 20% ½W
R-19	6R6032	470,000 20% ½W
R-20	6R6291	560 10% ½W
R-21	6R3933	220 20% ½W
R-22	6R6028	22,000 20% ½W
R-23	6R2122	4.7 meg 20% ½W
R-24	6R6028	22,000 20% ½W
R-25	18A690549	Volume control: 1 meg; with ON-OFF switch
R-26	6R5554	390 10% ½W
R-27	6R5660	180 10% ½W
R-28	6R5683	27 10% ½W
R-29	6R3933	220 20% ½W
R-30	18B691152	Tone Control: 100,000; with phono-radio switch (HS-190 & HS-190A)
	18B691882	Tone Control: 100,000; with phono-radio switch (HS-234).
R-31	6R6036	3300 20% ½W
R-32	6R6036	3300 20% ½W
R-33	6R6012	33,000 20% ½W
SWITCHES		
S-1	-	On-off Switch (on volume control)
S-2	40B690538	Band Switch, AM-FM
S-3	-	Phono-radio switch (on tone cont)
TRANSFORMERS		
T-1	24A690544	FM Antenna Input Transformer
T-2	24k691878	BC Oscillator Transformer: wht & red dot (use with 19B691877 gang only)
	24B690563	BC Oscillator Transformer: wht & blk dot (in some HS-190 chassis) (use with 19B690747 gang only)..
T-3	24B690540	1st FM IF Transformer (orange dot): 10.7 mc; complete with capacitor and cores; less shield
T-4	24B482863	AM IF Transformer (brown dot); 455 Kc: complete with capacitors and cores; less shield.....
T-5	24B690541	2nd FM IF Transformer (yellow dot): 10.7 mc; complete with capacitor and cores; less shield
T-6	24B482865	AM Diode Transformer (red dot): 455 kc; complete with capacitors and cores; less shield.....
T-7	24B690542	Ratio Detector Transformer: 10.7 mc; complete with capacitors, cores, and shield.....
T-8	25B690805	Audio Output Transformer

CHASSIS PARTS - MECHANICAL

1X691054	Bracket and Shield Assembly, pilot light
1X690717	Bracket Assembly, tuning core mtg: includes shoulder rivet and anti-backlash clip
7C690567	Bracket, tuner mtg (gang mtg)
7A77337	Bracket, tuning shaft
42K690561	Clip, anti-backlash: single (on core mtg bracket)
42A690560	Clip, anti-backlash: double (on tuner mtg brkt)
42B482867	Clip, spring: blued finish (holds IF transformers)
39K17396	Contact, pin terminal (in molded phono motor receptacle)(HS-234).
11M488137	Cord, dial (core drive)
11M8944	Cord, dial (pointer drive)
30K21859	Cord, line: with plug; 9 ft long (AC power cord on loop panel).....
46B692164	Core, iron and screw: green dot (FM osc tuning core)
46K692165	Core, iron and screw (FM RF tuning core)
15A690556	Cover, interlock receptacle (on loop panel)
34C691014	Dial Scale: glass
1X691065	Dial Scale and Plate Assembly: complete with cord pulleys
5S7866	Eyelet: .125 x .091 brass; nkl pl (core drive cord retainer).....
5S3113	Eyelet: .182 x .194 brass (pilot light bracket mtg)
5S7820	Eyelet: .450 x .125 (on speaker leads)
5S7855	Eyelet: .484 x .156 (on speaker leads)
5A691144	Grommet, rubber (pilot light bracket mtg)
14A691961	Insulator, bracket: fibre (dial plate bracket mtg)

PART NUMBER	DESCRIPTION
14A690802	Insulator, chassis front: fibre (tuning shaft mtg) .....
14A690535	Insulator, chassis front: fibre (volume, tone, and bandswitch mtg)
14A484225	Insulator, chassis mtg: white plastic.
14A690548	Insulator, control: bakelite (volume, tone, and bandswitch mtg).....
14A690619	Insulator, tuning shaft: bakelite ..
1X691969	Lead and Plug Assembly, phono pick-up (HS-234) .....
1X691032	Lead and Receptacle Assembly, phono pick-up (HS-190 & HS-190A) .....
4S7650	Lockwasher, internal: #6; cad pl (interlock receptacle cover mtg)
4S9751	Lockwasher, int-ext: #8; cad pl (pointer drive pulley mtg) .....
29R5252	Lug, soldering: #6 (holds spkr leads) .....
2S7019	Nut, hex: 4-40 x 1/4; cad pl (FM tuning core mtg) .....
2S7051	Nut, hex palnut: 3/8-32 x 9/16; cad pl (volume, tone and bandswitch mtg) .....
35K691846	Pad, rubber: 1-hole (gang mtg).....
35A691845	Pad, rubber: 2-hole (gang mtg).....
1X691062	Plug and Bracket Assembly, interlock.
28A690615	Plug, antenna input: 4-pin .....
28K71775	Plug, phono pick-up (HS-234) .....
52B481704	Pointer, dial .....
49A23960	Pulley, cord: 1/4" groove (on dial plate assembly) .....
49A21552	Pulley, cord: 1/2" groove (on dial plate assembly) .....
49A690562	Pulley, core drive: brass .....
1A691015	Pulley, pointer drive: 3½" diam....
9K690618	Receptacle, antenna: 4-prong; includes shell .....
9A15907	Receptacle, interlock: 2-prong (on loop panel) .....
9A30680	Receptacle, phono motor: 3-prong; includes shell (HS-190 & HS-190A).....
9K470402	Receptacle, phono motor: 5-prong; molded; includes contacts (HS-234)..
9A600040	Receptacle, phono motor: 3-prong; includes shell (HS-234) .....
9A71639	Receptacle, phono pick-up (HS-190 & HS-190A) .....
9A470980	Receptacle, pin (on lead from gang to loop) .....
9A791031	Receptacle, TV power: 2-prong; includes shell .....
5S8497	Rivet: .088 x 1/8 steel; nkl pl (anti-backlash clip mtg).....
5S7771	Rivet: .088 x 3/16 steel; nkl pl (min socket mtg) .....
5S7774	Rivet: .088 x 1/4 steel; nkl pl (noval socket mtg) .....
5S7707	Rivet: .122 x 5/32 steel; nkl pl (term strip mtg) .....
5S7701	Rivet: .122 x 3/16 steel; nkl pl (ant input plug mtg) .....
5S7700	Rivet: .122 x 1/4 steel; nkl pl (interlock receptacle cover mtg)
5S7728	Rivet: .122 x 5/16 steel; nkl pl (tuning shaft bracket mtg) .....
5K27675	Rivet, shoulder (cord pulley mtg).
5K13896	Rivet, shoulder (on core mtg bracket) .....
3S7163	Screw, machine: 8-32 x 1/4 plain hex head; cad pl (pointer drive pulley mtg) .....
3S7205	Screw, machine: 8-32 x 1/4 slotted locking hex head; cad pl (gang mtg)...
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (tuner brkt mtg)
3S3360	Screw, sheet metal: #6 x ¼ PKZ plain hex head; cad pl (pilot light bracket mtg) .....
3S490325	Screw, sheet metal: #6 x 1-1/8" PKZ plain hex head; cad pl (selenium rectifier mtg) .....
3S7512	Screw, sheet metal: #8 x ¼ PKZ plain hex head; cad pl (dial plate bracket mtg) .....
3S7471	Screw, thread-cutting: 6-32 x 1/4 plain hex head; cad pl (interlock receptacle mtg) .....
3S7103	Setscrew: 8-32 x 1/8 Allen head; cad pl (core drive pulley mtg) .....
1X691025	Shaft, tuning: complete with pulley....
15A690616	Shell, receptacle (on antenna receptacle)
15K74443	Shell, receptacle (on TV power receptacle) .....
26K485936	Shield, coil (for IF transformers)...
26A481521	Shield, tube: spring type .....
9K691017	Socket, pilot light .....
9K484167	Socket, tube: miniature; 7-prong .....
9A485495	Socket, tube: noval; 9-prong .....
41A690598	Spring, coil: 7 turns; cosmoline dipped (FM RF core mtg) .....
41K691840	Spring, coil: 8 turns; cop pl (FM osc core mtg) .....
41A14244	Spring, tension (core & pointer drive cord) .....
37K21114	Strip, channel: rubber; 1" long (dial scale mtg) .....
41A470403	Strip, terminal: 3-screw (FM ant conn on loop panel) .....
31K85348	Strip, terminal: 1 insulated lug, #2 mtg; 3/8" spacing .....
31K86126	Strip, terminal: 2 insulated lugs; #2 mtg; 3/8" spacing .....
31K470746	Strip, terminal: 3 insulated lugs, #2 mtg; 3/8" spacing .....
31K471568	Strip, terminal: 4 insulated lugs, #2 gnd; 3/8" spacing .....
31K470747	Strip, terminal: 5 insulated lugs; #3 mtg; 3/8" spacing .....
4A70015	Washer, 'C' (tuning shaft mtg)...
4S7554	Washer, flat: 3/8 x 1/8 x .033 steel; cad pl (tuning shaft brkt mtg)...
4S7557	Washer, flat: 3/8 x 11/64 x .033 stl; cad pl (dial plate brkt mtg).....
4S7582	Washer, flat: ¼ x .195 x .033; cad pl (pointer drive pulley mtg)....
4K690812	Washer, shoulder: fibre (tuning shaft brkt mtg) .....
4K690571	Washer, shoulder: fibre (volume, tone and bandswitch mtg) .....
4K691959	Washer, shoulder: fibre (dial plate bracket mtg) .....

CABINET PARTS

42A470832	Clamp, cable: plastic (holds line cord)
13K790751	Escutcheon, radio dial (12VF4) .....
13K791032	Escutcheon, radio dial (12VF26) .....
13K792535	Escutcheon, radio dial (16F1) .....
14K790743	Insulator, chassis base: bakelite (under radio chassis) .....
14K791482	Insulator, fibre (clamps power and phono leads) .....
36K791432	Knob, control: tan (radio controls) (12VF4B) .....
36K691195	Knob, control: tan (radio controls) (12VF26B & 12VF26B-C) .....
36K792561	Knob, control: tan (radio controls) (16F1B) .....
36K691070	Knob, control: wal-mahogany (radio controls)(12VF4R & 12VF4R-C) .....
36K690886	Knob, control: wal-mahogany (radio controls)(12VF26R & 12VF26R-C) .....
36K792562	Knob, control: wal-mahogany (radio controls)(16F1) .....
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (interlock plug mtg)(12VF26 & 16F1).
64C791006	Panel, cabinet back (covers radio, phono, and album compartments)(12VF4)
64C791659	Panel, cabinet back (covers radio, phono, and album compartments)(12VF26)
64C792544	Panel, cabinet back (covers radio, phono, and album compartments)(16F1)
3S490354	Screw, machine: 6-32 x 5/8 slotted hex head; cad pl (interlock plug mtg)(12VF26 & 16F1) .....
3S7439	Screw, sheet metal: #4 x ⅛ slotted acorn head; ant cop (loop panel mtg)(12VF4) .....
3S490453	Screw, sheet metal: #6 x 3/8 PKA plain acorn head; ant cop (cabinet back panel mtg)(12VF4) .....
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; ant cop (cabinet back panel mtg)(16F1).....
3S3387	Screw, sheet metal: #6 x ⅛ PKA plain hex head; ant cop (loop panel mtg) (12VF26) .....
3S490454	Screw, sheet metal: #6 x 5/8 PKA plain acorn head; ant cop (cable clamp & cabinet back panel mtg)(12VF4 & 12VF26) .....
3S7509	Screw, sheet metal: #6 x 5/8 PKA slotted acorn head; ant cop (loop panel & cable clamp mtg)(16F1)...
3S490452	Screw, sheet metal: #8 x 3/8 PKA plain acorn head; ant cop (loop panel and interlock plug mtg)(12VF4 & 12VF26) .....
3S7457	Screw, sheet metal: #8 x 7/8 PKA plain hex head; cad pl (chassis mtg)....
4S1720	Washer, flat: 3/8 x .156 x .030 stl; cad pl (loop panel mtg)(12VF26).
4S7562	Washer, flat: 7/16 x .187 x .033 stl; cad pl (interlock plug mtg)(12VF26 & 16F1) .....
4S490412	Washer, flat: 11/16 x .156 x .031 stl; cad pl (chassis mtg) .....
4S7607	Washer, flat: 9/32 x .125 x .027 stl; cad pl (loop panel mtg)(12VF4)..

CHASSIS HS-211, HS-230

RECEIVER MODELS

Model	Radio Chassis Used	Record Changer Used	TV Chassis Used
16VF8R	HS-211	M3RC	TS-16 series
16VF8B	HS-211	M3RC	TS-16 series
19F1	HS-230	RC-36	TS-67 series
19F1B	HS-230	RC-36	TS-67 series

RADIO CHASSIS - HS-211: Radio chassis HS-211 contains 9 tubes and receives both AM and FM broadcast programs. Except for common speakers, it operates entirely independently of the television receiver.

HS-230: Similar to chassis HS-211 except for the addition of a separate phono motor power switch, connected to the AM-FM-PHONO switch control shaft.

RADIO TUNING RANGE - AM -535 to 1620 Kc
FM - 88 to 108 Mc

RADIO IF FREQUENCIES - AM IF - 455 Kc
FM IF - 10.7 Mc

RADIO ANTENNAS - Separate AM and FM loop antennas, mounted in cabinet

SPEAKERS - Dual 12" PM and 5" PM, common to both radio and television chassis.

POWER SUPPLY - 117 volts, 60 cycle alternating current only

RADIO POWER CONSUMPTION - 100 watts, including phono motor

RADIO AUDIO OUTPUT - 8 watts

RADIO CHASSIS TUBE COMPLEMENT -
6AU6 - FM-AM RF Amplifier
6BA7 - FM-AM Converter
6BA6 - FM-AM IF Amplifier
6AU6 - FM IF Amplifier
6AL5 - FM Ratio Detector
6AV6 - AM Detector & 1st Audio Amp
6V6GT - Power Amplifier
6V6GT - Power Amplifier
7Z4 - Rectifier

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNAS

No outside antenna or ground is normally required for standard broadcast (AM) reception, as a loop antenna is located inside the cabinet. Antenna connections are shown in Figure 1. In locations where additional pick-up is desired, an external antenna may be connected to the clip marked "EXT BC ANT" on the loop antenna.

An FM loop antenna, mounted inside the cabinet, eliminates the need for an external FM antenna when the receiver is used in normal FM service areas such as are found in and for a few miles around metropolitan areas.

In "fringe" or weak signal areas, improved FM reception can be obtained by using an outside FM antenna. The loop connections should be removed from the terminal strip on the rear of the chassis and the outside antenna should be connected, through a 300 ohm twin transmission line, to the terminal strip, as shown in Figure 1. Orient the antenna to obtain maximum volume of the FM stations.

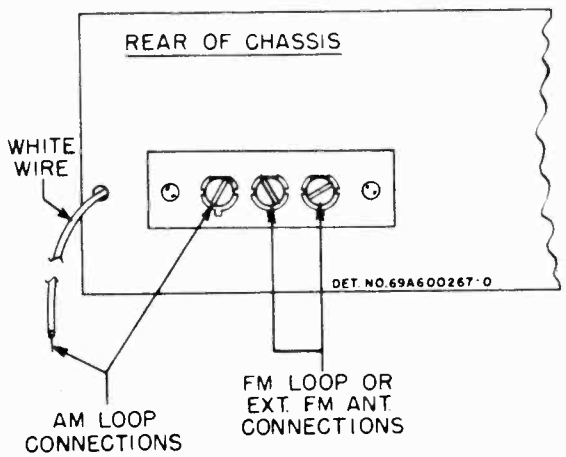


FIGURE 1. EXTERNAL ANTENNA CONNECTIONS

CHASSIS HS-211,
HS-230

CONTROLS

Refer to Figure 2 for the location of the radio controls.

POWER SWITCH AND VOLUME CONTROL. The volume control and power switch for both radio and phonograph operation are combined and are operated with the extreme left-hand knob. **CAUTION:** The power switches on the AM-FM radio and on the television receiver are independent. Make sure both are turned off when the set is not in use.

TONE CONTROL. Tone is varied by adjusting the second knob from the left.

AM-FM-PHONO SWITCH. The third control from the left operates a three-position switch. The extreme counterclockwise position selects the AM (Standard Broadcast) band, the center position selects the FM (Frequency Modulation) band, and the extreme clockwise position is used for phonograph operation. **NOTE:** On the 19F1 model, rotating the control to the "PHONO" position also starts the phono motor, whereas model 16VF8 has a separate power switch on the record changer itself.

TUNING CONTROL. The extreme right-hand control selects the desired FM or AM station. The standard broadcast scale (AM) is read in kilocycles by adding one '0' to the figures. The frequency modulation scale (FM) is read in megacycles (88 to 108).

Tuning of FM stations should be done very carefully, for best sound reproduction, not necessarily for strongest volume received.

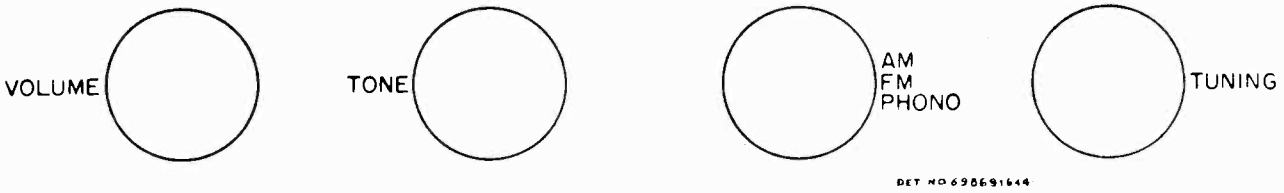


FIGURE 2. RADIO CONTROLS

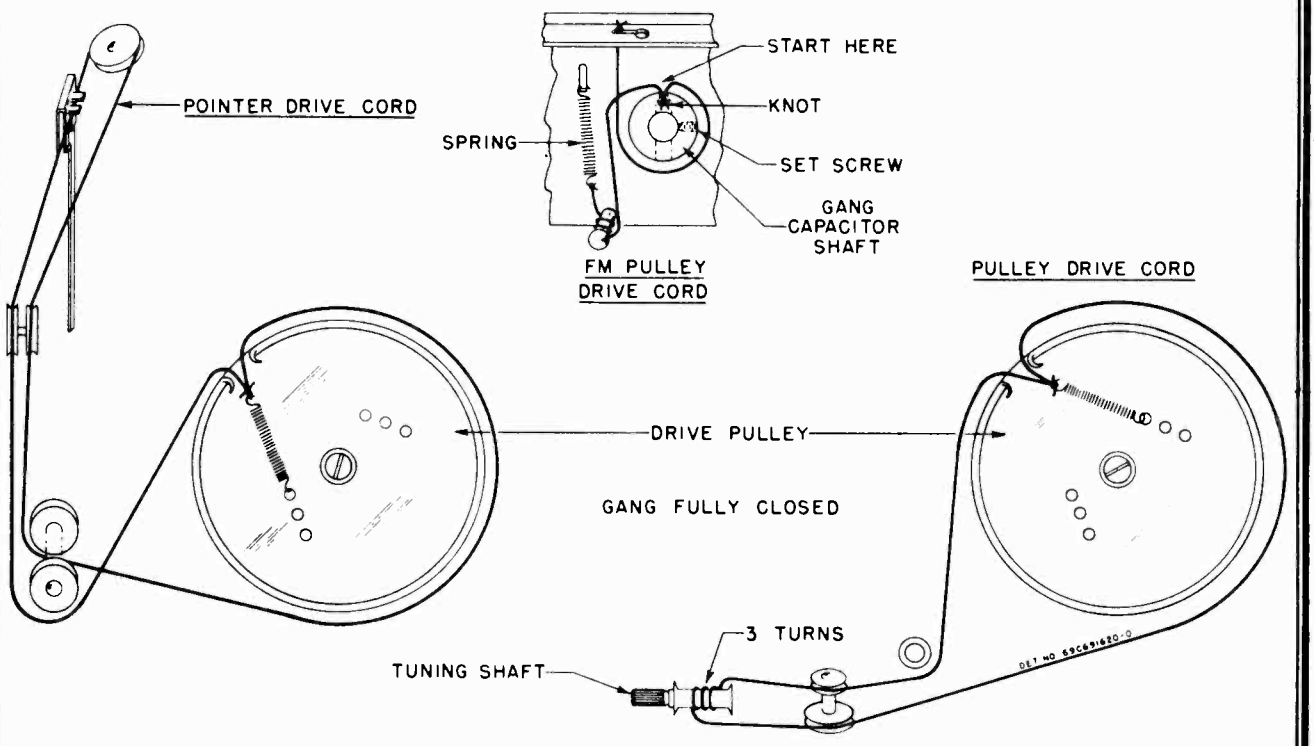


FIGURE 3. STRING DRIVE DETAIL

CHASSIS HS-211, HS-230

SERVICE NOTE

TO REMOVE RADIO CHASSIS FROM CABINET

1. Pull off the four radio knobs on the front of the cabinet.
2. Remove the AC power plug from the receptacle attached to the cabinet.
3. Remove the large panel covering the rear of the cabinet.
4. Disconnect the AM and FM loop leads from the receiver.
5. Disconnect the phono power plug from the chassis.
6. Disconnect the speaker leads.
7. Remove the three chassis mounting screws.
8. Slide the chassis from the cabinet.

ALIGNMENT

GENERAL INFORMATION

1. Maximum performance can be obtained only if extreme care is exercised during alignment.
2. Use a small fibre screwdriver for aligning the IF transformers.
3. Refer to Figure 4 for the location of all alignment trimmers and cores.
4. As the stages are brought into alignment, reduce the signal generator output to a low value to avoid overloading the receiver.

ORDER OF ALIGNMENT AND EQUIPMENT REQUIRED

1. Broadcast Band IF & RF Alignment
   a. 455 to 1620 Kc AM Signal Generator
   b. Low range output meter

2 (A) FM Band IF & RF Alignment (Preferred Method)
   a. 10.7 to 108 Mc FM signal generator
   b. Oscilloscope

(B) FM Band IF & RF Alignment (Alternate Method)
   a. 10.7 to 108 Mc signal generator (unmod.)
   b. Low range DC electronic voltmeter.

BROADCAST BAND - IF & RF ALIGNMENT

1. With the gang fully closed, adjust the pointer to coincide with the calibration marks at the left of the "55" on the dial scale.
2. Connect the AM signal generator as in chart below, with 400 cycle, 30% modulation.
3. Connect the output meter across the speaker voice coil. Throughout alignment reduce the generator output to a level which produces less than 1.27 volts (.5 watt) across the voice coil, to avoid overloading the receiver.
4. Set the bandswitch to the AM position.
5. Turn the receiver volume control to maximum.
6. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	455 Kc	Fully opened	1, 2, 3, & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	1620 Kc	Fully opened	5 (AM osc)	Adjust for maximum.
3.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	1400 Kc	Tune in signal	6 (AM RF)	Adjust for maximum.
4.	-	-	-	-	-	Connect AM loop to chassis.
5.	-	Across radiation loop*	1400 Kc	Tune in signal	7 (AM ant)	Adjust for maximum.

*Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

CHASSIS HS-211,
HS-230

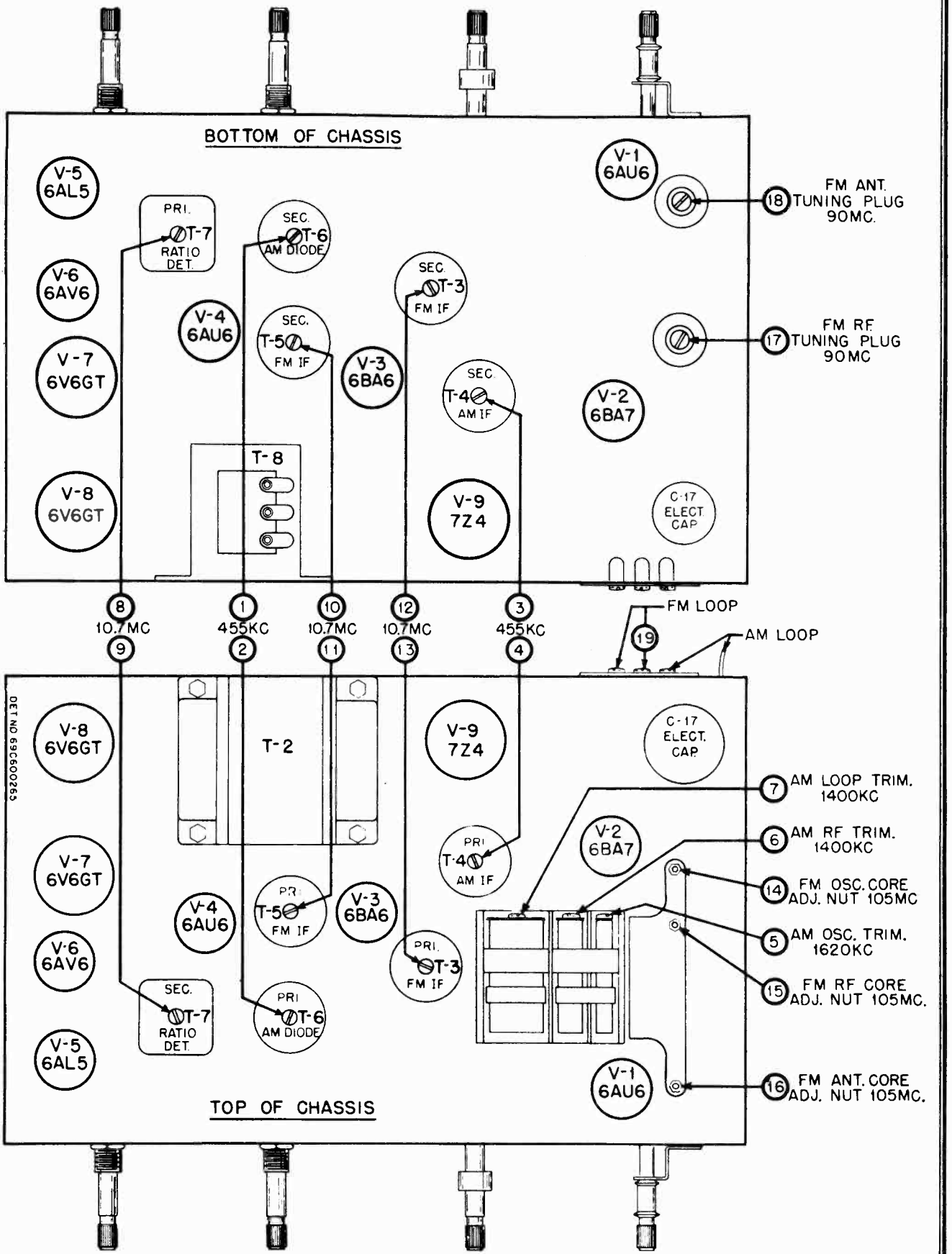


FIGURE 4. TUBE & TRIMMER LOCATIONS

CHASSIS HS-211, HS-230

FM BAND - IF & RF ALIGNMENT (PREFERRED METHOD)

1. The following FM alignment procedure, using an FM signal generator and an oscilloscope, is to be preferred because the actual response pattern may be observed on the scope and adjusted for best symmetry and maximum amplitude.

2. Connect the vertical input terminals of the oscilloscope between the chassis and the junction of resistor R-17 (47K) and capacitor C-21 (1000 mmf).

3. Connect the FM signal generator sync voltage output terminals, through a phase shifting network, to the horizontal input terminals of the scope, as in Figure 5. (Other values of resistance and capacitance may be required, depending upon the scope). The phasing control should be adjusted to give only one trace on the scope. NOTE: If the FM generator has a built-in phase control, the phase shifting network is not necessary.

4. Set the bandswitch to the FM position.

5. Throughout alignment, reduce the generator output to keep the signal just above the noise level, to avoid overloading the receiver.

6. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6AU6)	10.7 mc ±100 Kc dev.	Fully opened	8 (ratio det pri)	Adjust for maximum amplitude of pattern.*
2.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6AU6)	10.7 mc ±100 Kc dev.	Fully opened	9 (ratio det sec)	Adjust for symmetrical curve, as shown in Figure 6.
3.	-	-	-	-	-	Repeat steps 1 & 2 for maximum amplitude and best symmetry.
4.	1000 mmf	Grid of 1st IF Amp V-3 (pin 1, 6BA6)	10.7 mc ±100 Kc dev.	Fully opened	10 & 11 (2nd IF sec & pri)	Adjust for maximum amplitude of pattern.*
5.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc ±100 Kc dev.	Fully opened	12 & 13 (1st IF sec & pri)	Adjust for maximum amplitude of pattern.*
6.	1000 mmf	Grid of conv. V-2(pin 7, 6BA7)	10.7 mc ±100 Kc dev.	Fully opened	10, 11 12 & 13	Readjust for maximum amplitude and best symmetry.
RF ALIGNMENT						
7.	270 ohms	FM terminal 19 on rear of chassis	105 mc ±22½ Kc dev.	105 mc on dial	14 (osc core)	Adjust for maximum amplitude of pattern.*
8.	-	-	-	Fully closed	15 & 16 (RF & ant cores)	Turn counterclockwise until cores are at bottom of pipe, then turn two turns clockwise.
9.	270 ohms	FM terminal 19 on rear of chassis	90 mc ±22½ kc dev.	Tune in signal	17 & 18 (RF & ant tuning pluga)	Adjust for maximum amplitude of pattern.*
10.	270 ohms	FM terminal 19 on rear of	105 mc ±22½ kc dev.	Tune in signal	15 & 16 (RF & ant cores)	Adjust for maximum amplitude of pattern.*
11.	-	-	-	-	-	Repeat steps 9 & 10 until no further adjustment is necessary.

An output meter across the speaker voice coil will also indicate maximum amplitude. It should not be used in place of the scope, however, since it will not show symmetry of the curve.

CHASSIS HS-211,
HS-230

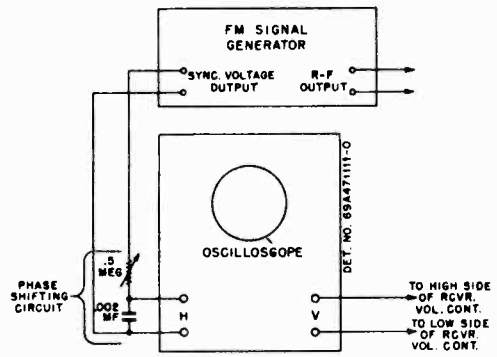


FIGURE 5.

FM SIGNAL GENERATOR & OSCILLOSCOPE HOOK-UP

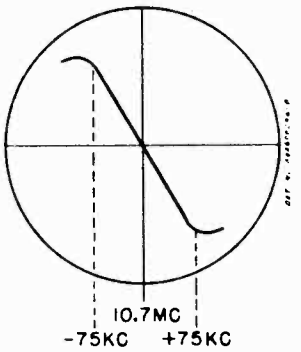


FIGURE 6.

RATIO DETECTOR WAVEFORM

FM BAND - IF & RF ALIGNMENT (ALTERNATE METHOD)

1. The following procedure for FM alignment, with an unmodulated carrier generator and a DC electronic voltmeter, is not as desirable as the preceding method; but it may be used if no FM generator is available.

2. Connect the signal generator as in chart below, with no modulation.

3. Set the bandswitch to the FM position.

4. Except in step 2 below, connect the electronic voltmeter across resistor R-21 (33K) in the ratio detector stage.

5. Throughout alignment reduce the signal generator output to a value which produces no more than a 5 volt rise above no signal voltage, to avoid overloading the receiver.

6. In step 2 below, connect two 100K ohm resistors in series across R-21. Connect the electronic voltmeter between the volume control side of resistor R-17 (47K) and the junction of the two 100K resistors, with the low side of the meter at the 100K resistors.

7. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	8, 10, 11, 12 & 13 (IF cores)	Adjust for maximum.
2	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	9 (ratio det sec)	Adjust for zero. (Connect meter as in step 6 above)
RF ALIGNMENT						
3.	270 ohms	FM terminal 19 on rear of chassis	105 mc	105 mc on dial	14 (osc core)	Adjust for maximum.
4.	-	-	-	Fully closed	15 & 16 (RF & ant cores)	Turn counterclockwise until cores are at bottom of pipe, then turn two turns clockwise.
5.	270 ohms	FM terminal 19 on rear of chassis	90 mc	Tune in signal	17 & 18 (RF & ant tuning plugs)	Adjust for maximum.
6.	270 ohms	FM terminal 19 on rear of chassis	105 mc	Tune in signal	15 & 16 (RF & ant cores)	Adjust for maximum.
7.	-	-	-	-	-	Repeat steps 5 & 6 until no further adjustment is necessary.

CHASSIS HS-211, HS-230

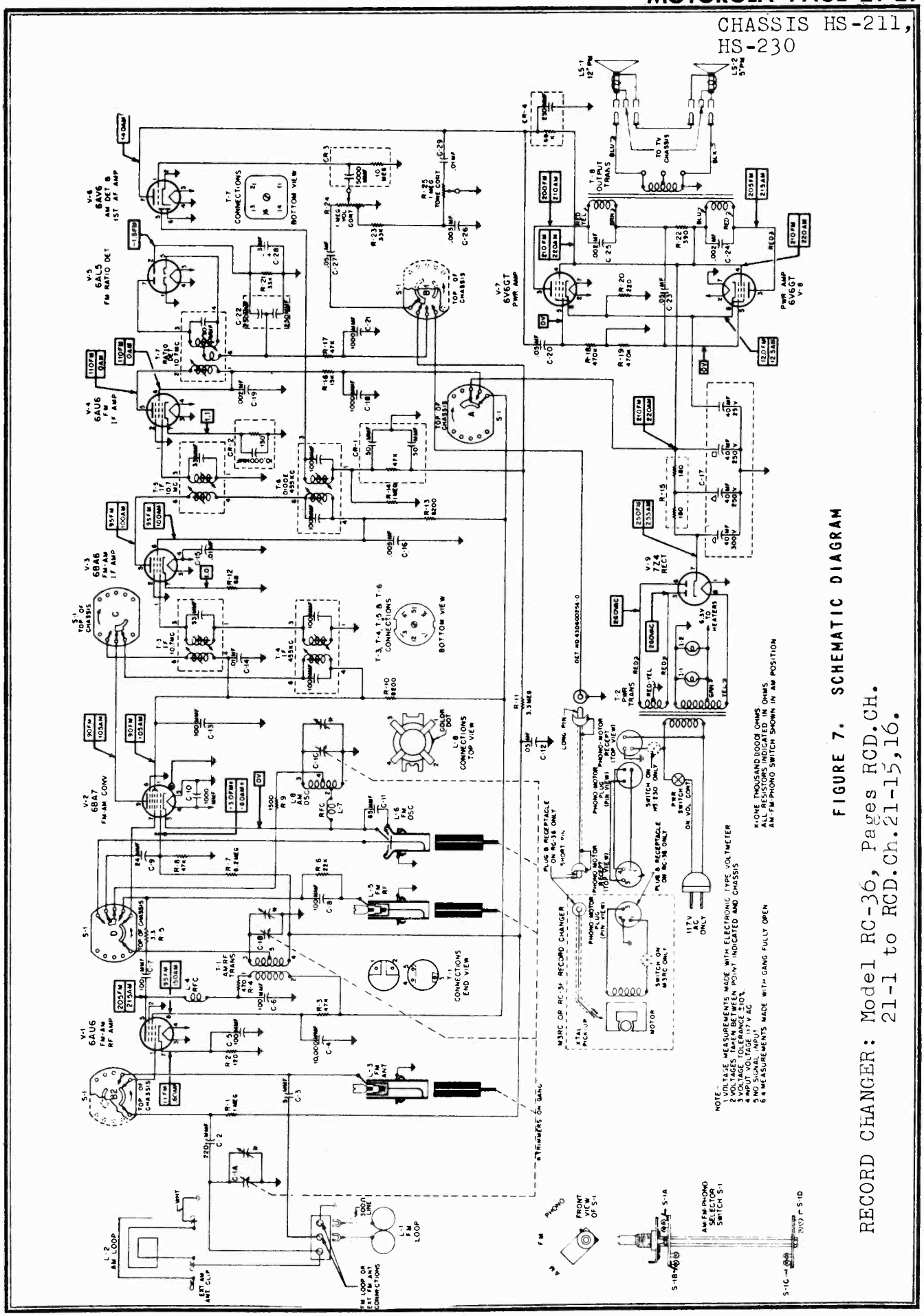


FIGURE 7. SCHEMATIC DIAGRAM

RECORD CHANGER: Model RC-36, Pages RCD.CH. 21-1 to RCD.Ch.21-15,16.

CHASSIS HS-211,
HS-230

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - ELECTRICAL		
CAPACITORS		
C-1	19B690978	Variable, 3 gang .....
C-2	21K77375	Ceramic: 220 mmf 500V .....
C-3	21K70720	Ceramic: 5 mmf 500V .....
C-4	21K482726	Ceramic, disc type: 10,000 mmf 450V .....
C-5	21B77286	Ceramic: 100 mmf 500V .....
C-6	21B77286	Ceramic: 100 mmf 500V .....
C-7	21B77286	Ceramic: 100 mmf 500V .....
C-8	21R6554	Mica: 100 mmf 10% 500V .....
C-9	21K28816	Ceramic: 24 mmf 500V .....
C-10	21K478410	Ceramic: 1000 mmf 500V .....
C-11	21K691203	Ceramic: 85 mmf 500V .....
C-12	8R9821	Paper: .05 mf 200V .....
C-13	21B77286	Ceramic: 100 mmf 500V .....
C-14	8R9809	Paper: .01 mf 400V .....
C-15	8R9809	Paper: .01 mf 400V .....
C-16	8R9813	Paper: .005 mf 600V .....
C-17	23B690975	Electrolytic: 40 mf/300V, 40-40 mf/250V, 40 mf/25V..... ....
C-18	21K478410	Ceramic: 1000 mmf 500V .....
C-19	8R9824	Paper: .002 mf 400V .....
C-20	8K470606	Paper: .05 mf 400V .....
C-21	21K478410	Ceramic: 1000 mmf 500V .....
C-22	21B484337	Ceramic: dual; 250-250 mmf/450V.
C-23	8K470606	Paper: .05 mf 400V .....
C-24	8R9824	Paper: .002 mf 400V .....
C-25	8R9824	Paper: .002 mf 400V .....
C-26	8R9813	Paper: .005 mf 600V .....
C-27	8R9821	Paper: .05 mf 200V .....
C-28	23K690543	Electrolytic: 3 mf 50V .....
C-29	8R9809	Paper: .01 mf 400V .....
CAPACITOR-RESISTOR		
CR-1	21K690980	Capacitor-Resistor: 50 mmf-50 mmf 47,000 ohms .....
CR-2	21K680007	Capacitor-Resistor: 10,000 mmf 150 ohms .....
CR-3	21K691125	Capacitor-Resistor: 5000 mmf 10 meg .....
CR-4	21K690979	Capacitor-Resistor: 250 mmf 68,000 ohms .....
DIAL LIGHT		
I-1, I-2	65X11854	Bulb, dial light: #47; 6-8V; .15 amp; clear; bayonet base .....
COILS		
L-1	24K690985	FM Loop antenna: with lead.....
L-2	24C690896	AM Loop antenna .....
L-3	24C690584	Inductor and Capacitor Assembly: FM antenna: less tuning core...
L-4	24A484025	RF choke .....
L-5	24C690584	Inductor and Capacitor Assembly: FM RF; less tuning core .....
L-6	24K690996	Inductor and Capacitor Assembly: FM oscillator; less tuning core
L-7	24K780128	RF choke: insulated .....
L-8	24B690976	AM oscillator coil .....

REF. NO.	PART NO.	DESCRIPTION
SPEAKERS		
LS-1	50C791631	Speaker: 12" PM; 3.2 ohm VC
LS-2	50C790701 or 50C791430	Speaker: 5" PM; 3.2 ohm VC.
RESISTORS		
		Note: All resistors are carbon insulated type unless otherwise specified.
R-1	6R6004	1 meg 20% ½W .....
R-2	6R5551	120 10% ½W .....
R-3	6R6048	47,000 10% ½W .....
R-4	6R3949	470 20% ½W .....
R-5	6R490131	3.3 10% ½W .....
R-6	6R6028	22,000 20% ½W .....
R-7	6R5585	8.2 meg 10% ½W .....
R-8	6R6048	47,000 10% ½W .....
R-9	6R6038	1500 10% ½W .....
R-10	6R5725	8200 10% 2W .....
R-11	6R6497	3.3 meg 10% ½W .....
R-12	6R2039	68 10% ½W .....
R-13	6R5725	8200 10% 2W .....
R-14	6R6046	1 meg 10% ½W .....
R-15	17A690973	Wirewound: 360 10% 3W; center tapped .....
R-16	6R6431	15,000 10% 1W .....
R-17	6R6056	47,000 20% ½W .....
R-18	6R6032	470,000 20% ½W .....
R-19	6R6032	470,000 20% ½W .....
R-20	6R6389	220 10% 1W.....
R-21	6R6410	33,000 10% ½W .....
R-22	6R5598	390 10% 1W .....
R-23	6R6012	33,000 20% ½W .....
R-24	18K691192	Volume Control: 1 meg; tapped at 300,000 ohms; includes on-off switch .....
R-25	18K77399	Tone Control: 1 meg .....
SWITCHES		
S-1	40B690977	Band Switch: AM-FM-PHONO.....
S-2	-	On-off Switch (on volume control)
S-3	40A691922	Phono-Radio-Switch; SPST (HS-234)
TRANSFORMERS		
T-1	24B690899	AM RF Transformer .....
T-2	25B691035	Power Transformer .....
T-3	24B690540	1st FM IF Transformer (orange dot): 10.7 mc; complete with capacitor and cores; less shield
T-4	24B482863	AM IF Transformer (brown dot): 455 Kc: complete with capacitors and cores; less shield....
T-5	24B690541	2nd FM IF Transformer (yellow dot): 10.7 mc; complete with capacitor and cores; less shield
T-6	24B482865	AM Diode Transformer (red dot): 455 Kc: complete with capacitors and cores; less shield....
T-7	24B690542	Ratio Detector Transformer: 10.7 mc: complete with capacitors, cores and shield.....
T-8	25B690898	Audio Output Transformer.....

PART NUMBER	DESCRIPTION
CHASSIS PARTS - MECHANICAL	
1X690717	Bracket Assembly, tuning core mtg: includes shoulder rivet and aingle anti-backlash clip
1X691127	Bracket & Pullies Assembly: includes two pullies and shoulder rivet (cord guides on chassis front)
7C690567	Bracket, tuner mtg (gang mtg)
7A77337	Bracket, tuning shaft
43K890398	Bushing, line cord retainer (use with 43A890397)
43A890397	Bushing, line cord strain relief (use with 43K890398)
42A690560	Clip, anti-backlash: double (on tuner mounting brkt)
42K690561	Clip, anti-backlash: single (on core mtg brkt)
42B482867	Clip, spring: blued finish (holds IF transformer)
11M488137	Cord, dial (core drive)
11M8944	Cord, dial (pointer drive)
30K21859	Cord, line: with plug: 9 ft long
46B692164	Core, iron and screw: green dot (FM osc tuning core)
46K692165	Core, iron and screw (FM RF and ant tuning core)
34C690897	Dial scale: glass
1X691136	Dial Scale and Plate Assembly: complete with cord pulleys
5S7866	Eyelet: .125 x .091; brass; nkl pl (core drive cord retainer)
1X600081	Link Assembly, bandswitch actuating: complete with bushings; less setscrews
4S9751	Lockwasher, int-ext: #8; cad pl (pointer drive pulley mtg)
2S7019	Nut, hex: 4-40 x 1/4; cad pl (FM tuning core mtg)
2S7051	Nut, hex palnut: 3/8-32 x 9/16; cad pl (bandswitch, tone and volume control mtg)
52B481704	Pointer, dial
49A21741	Pulley, cord: 3/8" groove (on chassis front)
49A73807	Pulley, cord: 1/2" groove (on chassis side and on dial plate)
49A26433	Pulley, cord: 21/32" groove (on chassis front)
49A690562	Pulley, core drive: brass
1K691145	Pulley, pointer drive: 3-1/2" diameter
9K592170	Receptacle, phono pick-up: 1 prong
9A27674	Receptacle, phono power: 3-prong
5S8497	Rivet: .088 x 1/8 stl; nkl pl (single anti-backlash clip mtg)
5S7771	Rivet: .088 x 3/16; stl; nkl pl (min and midget tube socket mtg)
5S7707	Rivet: .122 x 5/32; stl; nkl pl (loctal tube socket, terminal strip, output transformer mtg)
5S7701	Rivet: .122 x 3/16 stl; nkl pl (power receptacle, ant term strip, and tuning shaft bracket mtg)
5S7700	Rivet: .122 x 1/4; stl; nkl pl (octal tube socket mtg)
5K13896	Rivet, shoulder (tuning core cord guide and pulley mtg on front of chassis)
5K71246	Rivet, shoulder (pulley mtg on side of chassis and on left side of dial plate)
5K481770	Rivet, shoulder (for double pullies on dial plate)
3S7462	Screw, machine: 6-32 x 3/16 plain hex head; cad pl (electrostatic shield mtg)
3S7326	Screw, machine: 8-32 x 3/16 plain locking hex head; cad pl (gang mtg)
3S7163	Screw, machine: 8-32 x 1/4 plain hex head; cad pl (pointer drive pulley mtg)
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (tuner brkt mtg)
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; cad pl (dial plate assembly mtg)
3S7475	Screw, sheet metal: #8 x 1/4 PKZ slotted acorn head; cad pl (power trans mtg)
3S7103	Setscrew: 8-32 x 1/8 Allen head; cad pl (core drive pulley mtg)
3S7113	Setscrew: 8-32 x 1/4 slab head; cad pl (bandswitch link assembly mtg).
47A690893	Shaft, bandswitch actuating (HS-211)
1X691134	Shaft, tuning: complete with pulley..
26K485936	Shield, coil: for IF transformers
26A470013	Shield, dial light
26K690984	Shield, electrostatic (gang shield)
26K690981	Shield, tube: spring type
26A692080	Shield, tube (for V-9)
9K471935	Socket, dial light: includes brkt
9A72519	Socket, tube: loctal
9A690129	Socket, tube: midget; 7 prong (for V-1)
9K484167	Socket, tube: miniature; 7 prong
9A485495	Socket, tube: noval; 9-prong
9A76209	Socket, tube: octal
41A690598	Spring, coil: 7 turns; cosmoline dipped (FM RF & ant core mtg)
41K691840	Spring, coil: 8 turns; copper plated (FM osc core mtg)
41A14244	Spring, tension (core & pointer drive cord)
41K692081	Spring, tube shield retaining (for V-9 shield)
37K21114	Strip, channel: rubber; 1" long (dial scale mtg)
31K37504	Strip, terminal: 1 insulated lug; #1 mtg; 3/8" spacing
31K51251	Strip, terminal: 1 insulated lug, #1 gnd; 3/8" spacing
31K471565	Strip, terminal: 3 insulated lugs, #4 gnd; 3/8" spacing
31A690974	Strip, terminal: 7 insulated lugs, #4 & 9 gnd; 3/8" spacing
31K471498	Strip, terminal: 3-screw (antenna input)
29K5412	Terminal, plain pin (on speaker leads)
4A70015	Washer, 'C' (tuning shaft retainer)
CABINET PARTS	
39K17396	Contact, pin terminal (in molded phono motor receptacle)(19F1)
13C791478	Escutcheon, radio dial: brass
5A71081	Eyelet (radio chassis mtg)
5A71092	Grommet, rubber (radio chassis mtg)
14K791482	Insulator, fibre (clamps phono and antenna leads)
36B790569	Knob, control: no dot; beige plastic (radio controls)
36K791630	Knob, control: with dot; beige plastic (radio controls)
1X792530	Lead and Plugs Assembly, phono pick-up (shielded lead with two phono pick-up plugs)(19F1)
64D791510	Panel, cabinet back: fibre (covers radio and phono compartments)(16VF8)
64K792522	Panel, cabinet back: fibre (covers radio and phono compartments)(19F1)
28K71775	Plug, phono pick-up (short plug on phono lead)(19F1)
28K22183	Plug, phono pick-up (long plug on phono lead)(19F1)
28K30736	Plug, phono motor: 3-pin; includes shell (on phono motor lead)
9K470402	Receptacle, phono motor: 5-prong; molded; includes contacts (19F1)
9A600040	Receptacle, phono motor: 3-prong; includes shell (19F1)
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; antique copper finish (cabinet back panel mtg).
3S7534	Screw, sheet metal: #8 x 1-3/8 PKA plain hex head; cad pl (radio chassis mtg)
15K74443	Shell, plug (on 28K30736 phono motor plug)
15A690616	Shell, receptacle (on 9A600040 phono motor receptacle)(19F1)
4S490513	Washer, flat: 3/4 x 7/32 x .042 stl; cad pl (radio chassis mtg)

CHASSIS HS-253

USED WITH 17F2 Series
TV MODELS 17F3 Series
17F1 Series 17F4 Series

GENERAL INFORMATION

POWER SUPPLY - 117 volts, 60 cycle alternating current only.

RADIO CHASSIS - Radio chassis HS-253 contains 8 tubes and receives both AM and FM broadcast programs. Except for common speakers, it operates entirely independently of the television receiver.

RADIO TUNING RANGE - AM 535 to 1620 Kc
FM 88 to 108 Mc

RADIO IF FREQUENCIES - AM IF - 455 Kc
FM IF - 10.7 Mc

RADIO ANTENNAS - AM: Loop antenna mounted in cabinet.
FM: Built into the power cord, with terminals for connection of an external antenna, if required.

SPEAKER - PM type, common to both radio and television chassis.

RADIO POWER CONSUMPTION - 85 watts, including phono motor.

RADIO AUDIO OUTPUT - 3 watts

RADIO CHASSIS TUBE COMPLEMENT -

6BA6 - FM-AM RF Amplifier
6BA7 - FM-AM Converter
6BA6 - FM-AM IF Amplifier
6BA6 - FM IF Amplifier
6AL5 - FM Ratio Detector
6AV6 - AM Detector & 1st Audio Amp
6K6GT - Power Amplifier
5Y3GT - Rectifier

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNAS

No outside antenna or ground is normally required for standard broadcast (AM) reception, as a loop antenna is located inside the cabinet. Antenna connections are shown in Figure 1. In locations where additional pick-up is desired, an external antenna may be connected to the clip marked "EXT BC ANT" on the loop antenna.

An FM antenna, built into the power cord, eliminates the need for an external FM antenna when the receiver is used in normal FM service areas, such as are found in and for a few miles around metropolitan areas. In "fringe" or weak signal areas, improved FM reception can be obtained by using an outside FM antenna. The external antenna should be connected through a 300 ohm twin transmission line to the 1st & 2nd screws on the terminal strip on the chassis, as in Figure 1. The link between the 2nd & 3rd screws should be opened. Orient the antenna to obtain maximum volume of the FM stations.

For best FM reception from the built-in power line cord antenna, it is important to stretch the cord to its full length. Changing the direction or position of the line cord, or reversing the plug in the wall outlet, will often improve reception from weak stations. Connect the link between the 2nd & 3rd screws on the terminal strip on the chassis when the built-in antenna is used.

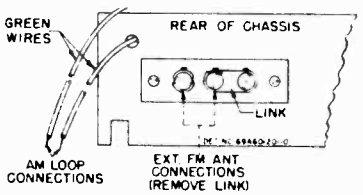


FIGURE 1.
ANTENNA CONNECTIONS

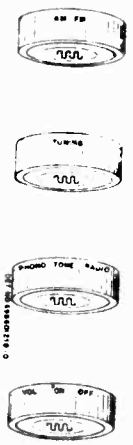


FIGURE 2.
OPERATING CONTROLS

CONTROLS

Refer to Figure 2 for the locations of the radio operating controls.

Power for both the radio and the record changer is controlled by the VOL-ON-OFF knob. The phonograph motor will not operate, however, until the PHONO-TONE-RADIO knob is rotated also to "PHONO". CAUTION: The power switches on the AM-FM radio and on the television receiver are independent. Make sure both are turned off when the set is not in use.

Tuning of FM stations should be done very carefully, for best sound reproduction, not necessarily for the strongest volume received.

ALIGNMENT

GENERAL INFORMATION

1. Maximum performance can be obtained only if extreme care is exercised during alignment.
2. Use a small fibre screwdriver for aligning the IF transformers.
3. Refer to Figure 4 for the location of all alignment trimmers and cores.
4. As the stages are brought into alignment, reduce the signal generator output to a low value to avoid overloading the receiver.

ORDER OF ALIGNMENT AND EQUIPMENT REQUIRED

1. AM Broadcast Band IF & RF Alignment
   a. 455 to 1620 Kc AM Signal Generator
   b. Low range output meter

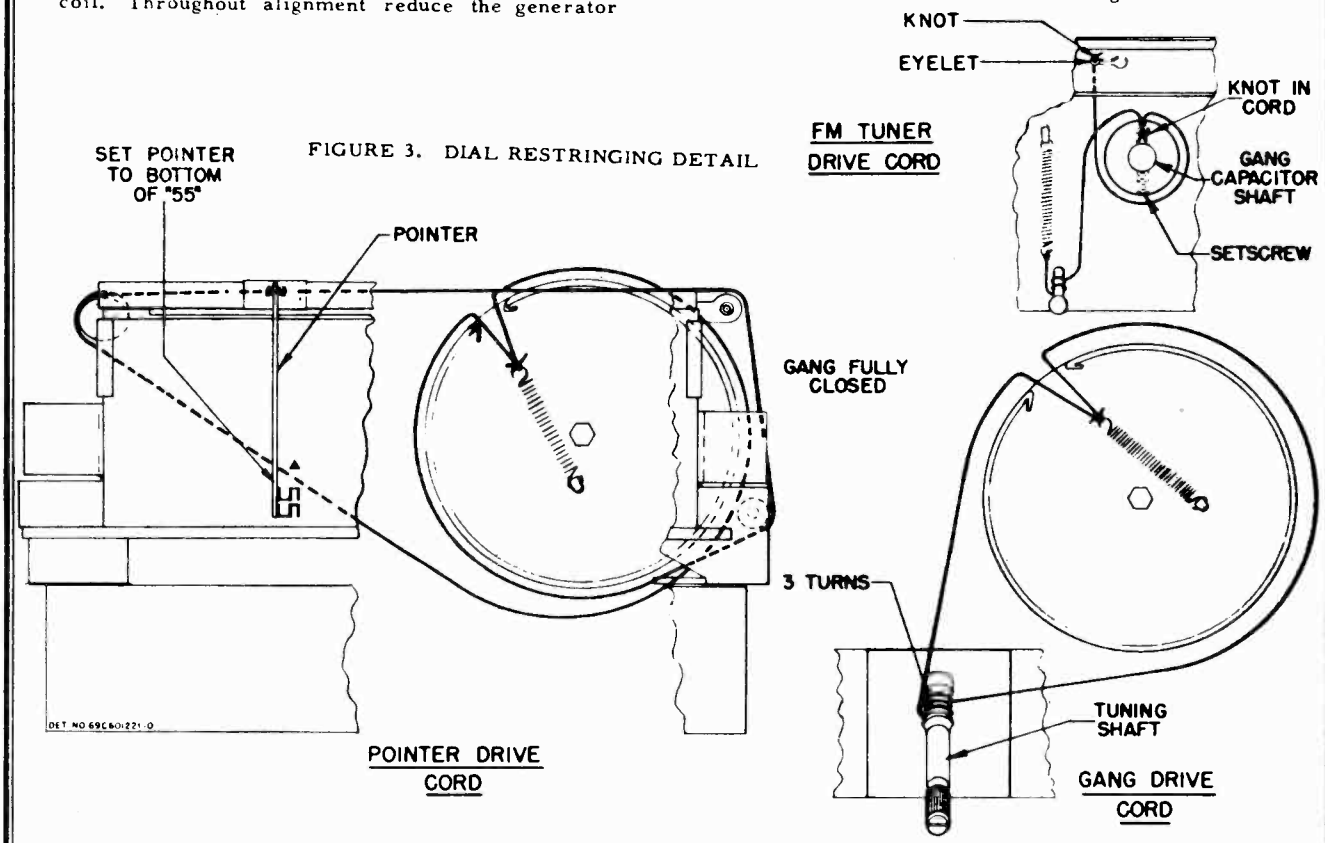
2(A) FM Band IF & RF Alignment (preferred method)
   a. 10.7 to 108 Mc FM signal generator
   b. Oscilloscope

(B) FM Band IF & RF Alignment (alternate method)
   a. 10.7 to 108 Mc signal generator (unmodulated)
   b. Low range DC electronic voltmeter.

AM BROADCAST BAND - IF & RF ALIGNMENT

1. With the gang fully closed, adjust the pointer to coincide with the bottom of the "55" on the dial scale. See Figure 3.
2. Connect the AM signal generator as in chart below, with 400 cycle, 30% modulation.
3. Connect the output meter across the speaker voice coil. Throughout alignment reduce the generator output to a level which produces less than 1.27 volts (.5 watt) across the voice coil, to avoid overloading the receiver.
4. Set the bandswitch to the AM position.
5. Turn the receiver volume control to maximum.
6. Proceed as shown in the following chart.

FIGURE 3. DIAL RESTRINGING DETAIL



STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	455 Kc	Fully opened	1, 2, 3, & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	1620 Kc	Fully opened	5 (AM osc)	Adjust for maximum. *
3.	-	-	-	-	-	Connect AM loop to chassis.
4.	-	Across radiation loop**	1400 Kc	Tune in signal	8 (AM ant)	Adjust for maximum.

CHASSIS HS-253

5. If, after the receiver has been aligned as above, it is found to be badly off calibration, it will be necessary to adjust oscillator core (7) as follows: connect the generator to the grid of the converter tube and, with the gang fully closed, adjust core (7) at 535 kc. It is advisable to repeat the oscillator adjustments at 1620 kc and 535 kc several times until the tuning range is correct. Core (7) has been pre-set at the factory and normally should require no retuning.

* If, difficulty is encountered in tuning trimmer (5), adjust trimmer (6) to 1/2 turn from tight.

** Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

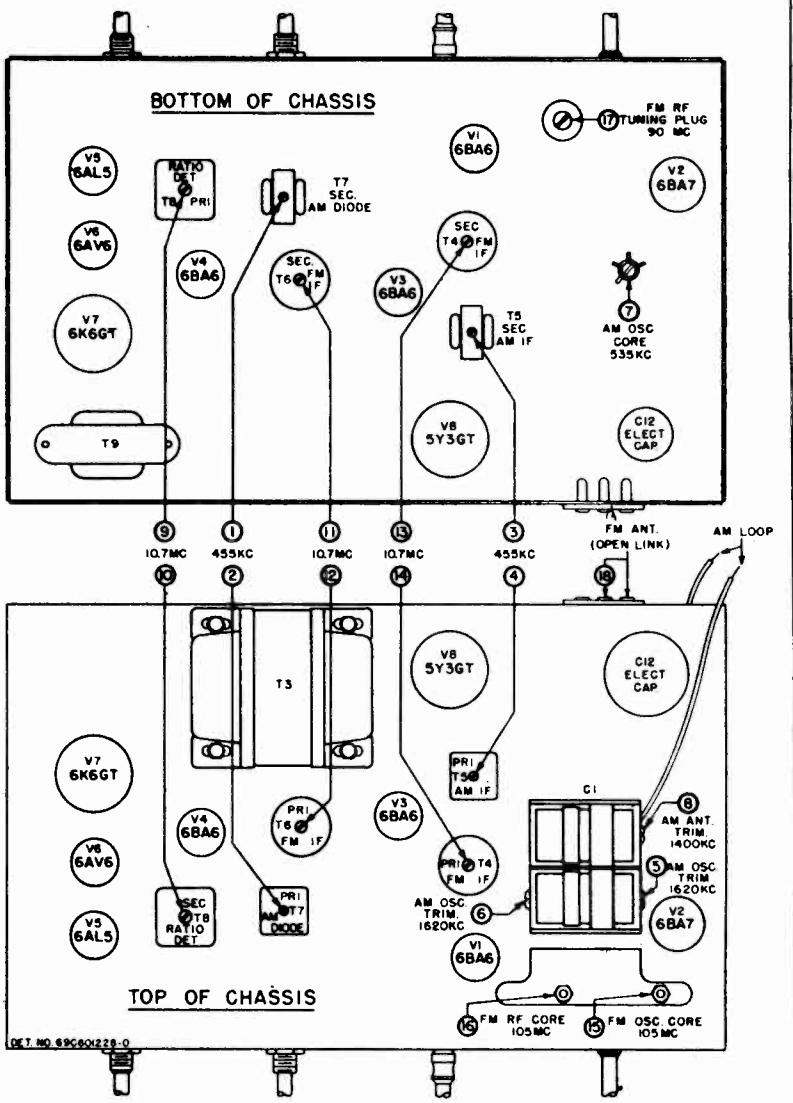


FIGURE 4.

TUBE & TRIMMER LOCATIONS

FM BAND - IF & RF ALIGNMENT (PREFERRED METHOD)

1. The following FM alignment procedure, using an FM signal generator and an oscilloscope, is to be preferred because the actual response pattern may be observed on the scope and adjusted for best symmetry and maximum amplitude.

2. Connect the vertical input terminals of the oscilloscope between the chassis and the junction of resistor R-18 (47K) and capacitor C-23 (1000 mmf).

3. Connect the FM signal generator sync voltage output terminals, through a phase shifting network, to the horizontal input terminals of the scope, as in Figure 5. (Other values of resistance and capacitance may be required, depending upon the scope). The phasing control should be adjusted to give only one trace on the scope. NOTE: If the FM generator has a built-in phase control, the phase shifting network is not necessary.

4. Set the bandswitch to the FM position.

5. Throughout alignment, reduce the generator output to keep the signal just above the noise level, to avoid overloading the receiver.

6. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	9 (ratio det pri)	Adjust for maximum amplitude of pattern. *
2.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	10 (ratio det sec)	Adjust for symmetrical curve, as shown in Figure 6.
3.	-	-	-	-	-	Repeat steps 1 & 2 for maximum amplitude and best symmetry.
4.	1000 mmf	Grid of 1st IF Amp V-3 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	11 & 12 (2nd IF sec & pri)	Adjust for maximum amplitude of pattern. *
5.	1000 mmf	Grid of conv V-2 (pin 7, 6BA7)	10.7 mc ±100 kc dev	Fully opened	13 & 14 (1st IF sec & pri)	Adjust for maximum amplitude of pattern. *
6.	1000 mmf	Grid of conv V-2 (pin 7, 6BA7)	10.7 mc ±100 kc dev	Fully opened	11, 12, 13 & 14	Readjust for maximum amplitude and best symmetry.
RF ALIGNMENT						
7.	270 ohms	FM terminal 18 on rear of chassis (open link)	105 mc ±22-1/2 kc dev	105 mc on dial	15 (osc core)	Adjust for maximum amplitude of pattern. *
8.	-	-	-	Fully closed	16 (RF core)	Turn counterclockwise until core is at bottom of pipe, then turn four turns clockwise.
9.	270 ohms	FM terminal 18 on rear of chassis	90 mc ±22-1/2 kc dev	Tune in signal	17 (RF tuning plug)	Adjust for maximum amplitude of pattern. *
10.	270 ohms	FM terminal 18 on rear of chassis	105 mc ±22-1/2 kc dev	Tune in signal	16 (RF core)	Adjust for maximum amplitude of pattern. *
11.	-	-	-	-	-	Repeat steps 9 & 10, until no further adjustment is necessary.

* An output meter across the speaker voice coil will also indicate maximum amplitude. It should not be used in place of the scope, however, since it will not show symmetry of the curve.

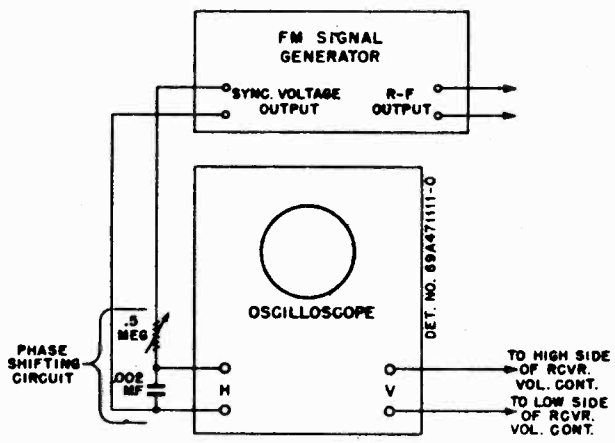


FIGURE 5.
FM SIGNAL GENERATOR & OSCILLOSCOPE HOOK-UP

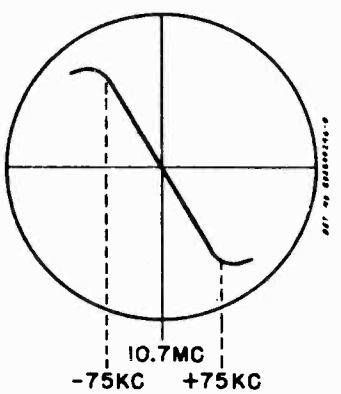


FIGURE 6. RATIO DETECTOR WAVEFORM

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FM BAND 1 IF & RF ALIGNMENT (ALTERNATE METHOD)

1. The following procedure for FM alignment, with an unmodulated carrier generator and a DC electronic voltmeter, is not as desirable as the preceding method; but it may be used if no FM generator is available.
2. Connect the signal generator as in chart below, with no modulation.
3. Set the bandswitch to the FM position.
4. Except in step 2 below, connect the electronic voltmeter across resistor R-19 (33K) in the ratio detector stage.
5. Throughout alignment reduce the signal generator output to a value which produces no more than a 5 volt rise above no signal voltage, to avoid overloading the receiver.
6. In step 2 below, connect two 100K ohm resistors in series across R-19. Connect the electronic voltmeter between the volume control side of resistor R-18 (47K) and the junction of the two 100K resistors, with the low side of the meter at the 100K resistors.
7. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	9, 11, 12, 13 & 14 (IF cores)	Adjust for maximum.
2.	1000 mmf	Grid of conv V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	10 (ratio det sec)	Adjust for zero (connect meter as in step 6 above)
RF ALIGNMENT						
3.	270 ohms	FM terminal 18 on rear of chassis (open link)	105 mc	105 mc on dial	15 (osc core)	Adjust for maximum.
4.	-	-	-	Fully closed	16 (RF core)	Turn counterclockwise until core is at bottom of pipe, then turn four turns clockwise.
5.	270 ohms	FM terminal 18 on rear of chassis	90 mc	Tune in signal	17 (RF tuning plug)	Adjust for maximum.
6.	270 ohms	FM terminal 18 on rear of chassis.	105 mc	Tune in signal	16 (RF core)	Adjust for maximum.
7.	-	-		-	-	Repeat steps 5 & 6 until no further adjustment is necessary.

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part No.	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	19B691877	Variable, 2-gang .....
C-2	21B77286	Ceramic: 100 mmf 500V .....
C-3	21K478410	Ceramic: 1000 mmf 500V .....
C-4	21K481377	Ceramic: 500 mmf 500V .....
C-5	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-6	21K77373	Ceramic: 47 mmf 500V .....
C-7	21B77286	Ceramic: 100 mmf 500V .....
C-8	8R9816	Paper: .05 mf 400V .....
C-9	21K77373	Ceramic: 47 mmf 500V .....
C-10	21A690688	Ceramic: 85 mmf 500V .....
C-11	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-12	23B690975	Electrolytic: 40 mf/300V, 40-40 mf/250V, 40 mf/25V .....
C-13	21A470789	Ceramic, disc type: 5000 mmf 450V.
C-14	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-15	21A470789	Ceramic, disc type: 5000 mmf 450V.
C-16	8R9809	Paper: .01 mf 400V .....
C-17	21K482726	Ceramic, disc type: 10,000 450V...
C-18	21K790912	Ceramic: 2000 mmf 500V .....
C-19	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-20	21K478410	Ceramic: 1000 mmf 500V .....
C-21	21B484337	Ceramic: dual; 250-250 mmf/450V....
C-22	23K690543	Electrolytic: 3 mf 50V .....
C-23	21K478410	Ceramic: 1000 mmf 500V .....
C-24	8R9809	Paper: .01 mf 400V .....
C-25	8R490232	Tubular, molded: .047 mf 400V .....
C-26	8R9813	Paper: .005 mf 600V .....
C-27	8R9809	Paper: .01 mf 400V .....
C-28	21B77286	Ceramic: 100 mmf 500V .....
C-29	8R9813	Paper: .005 mf 600V .....
C-30	8R9813	Paper: .005 mmf 600V .....
C-31	8R9847	Paper: .002 mmf 600V .....
C-32	21K482726	Ceramic, disc type: 10,000 mmf 450V
Pilot Light		
I-1,2	65X11854	Bulb, pilot light: #47; 6-8V; .15 amp; clear; bayonet base .....

Coils

L-1	24C690896	AM loop antenna
L-2	24A692148	RF choke
L-3	24A90064	RF choke
L-4	24C690584	Inductor and Capacitor Assembly: FM RF; less tuning core
L-5	24K600519	Inductor and Capacitor Assembly: FM osc; less tuning core
L-6	24A791081	RF choke

Resistors

Note: All resistors are insulated carbon type unless otherwise specified.

R-1	6R6004	1 meg 20% 1/2W
R-2	6R5551	120 10% 1/2W
R-3	6R5725	8200 10% 2W
R-4	6R2089	1800 10% 1/2W
R-5	6R6028	22,000 20% 1/2W
R-6	6R6410	33,000 10% 1/2W
R-7	6R6056	47,000 20% 1/2W
R-8	6R2108	47 20% 1/2W
R-9	6R5725	8200 10% 2W
R-10	17A690973	Wire wound: 360 10% 3W; center-tapped
R-11	6R2039	68 10% 1/2W
R-12	6R5725	8200 10% 2W
R-13	6R5551	120 10% 1/2W
R-14	6R6056	47,000 20% 1/2W
R-15	6R3927	2.2 meg 20% 1/2W
R-16	6R6377	470,000 10% 1/2W

Ref. No.	Part No.	Description
R-17	6R5732	15,000 10% 2W
R-18	6R6056	47,000 20% 1/2W
R-19	6R6410	33,000 10% 1/2W
R-20	18A600974	Volume control: 2 meg; tapped at 600,000 ohms; includes on-off sw
R-21	6R2109	10 meg 20% 1/2W
R-22	6R6074	68,000 10% 1/2W
R-23	6R6032	470,000 20% 1/2W
R-24	18B600683	Tone control: 1 meg; with phono-radio switch
R-25	6R5593	470 10% 1W
R-26	6R6015	220,000 20% 1/2W

Switches

S-1	40B690538	Bandswitch, AM-FM
S-2	-	Phono-radio switch (on tone control)

Transformers

T-1	24A690544	FM Antenna Input Transformer
T-2	24K691878	AM Oscillator Transformer: white & red dot
T-3	25B600684	Power Transformer
T-4	24B690540	1st FM IF Transformer (orange dot): 10.7 mc; complete with capacitors and cores; less shield
T-5	24B485553	AM IF Transformer (green dot): 455 kc; complete with capacitors, cores, and shield
T-6	24B690541	2nd FM IF Transformer (yellow dot): 10.7 mc; complete with capacitors and cores, less shield
T-7	24K485555	AM Diode Transformer (pink dot): 455 Kc: complete with capacitors, cores, and shield
T-8	24K600893	Ratio Detector Transformer: 10.7 mc; complete with capacitors, cores and shield
T-9	25B600969	Audio Output Transformer

CHASSIS PARTS - MECHANICAL

1X690717	Bracket Assembly, tuning core mtg: includes shoulder rivet and anti-backlash clip

Part Number	Description
7A600672	Bracket, chassis mtg (on rear of chassis)
7C690567	Bracket, tuner mtg (gang mtg)
7A600476	Bracket, tuning shaft
43A890397	Bushing, line cord strain relief (use with 43K890398)
43K890398	Bushing, line cord retainer (use with 43A890397)
42K690561	Clip, anti-backlash: single (on core mtg bracket)
42A690560	Clip, anti-backlash: double (on tuner mtg bracket)
42A485548	Clip, coil can mtg (AM IF transformer)
42B482867	Clip, spring: blued finish (holds FM IF transformer)
11M8944	Cord, dial (pointer drive)
11M488137	Cord, dial (core drive)
30K21859	Cord, line: with plug; 9 ft long
46B692164	Core, iron and screw: green dot (FM osc tuning core)
46K692165	Core, iron and screw (FM RF tuning core).
1X600490	Dial Plate and Pulleys Assembly: complete, less dial scale
34C600811	Dial scale: glass
5S7866	Eyelet: .125 x .091 brass; nkl pl (core drive cord retainer)
1X600495	Lead and Plug Assembly, phono-pick-up...
4S9751	Lockwasher, int-ext: #8; cad pl (pointer drive pulley mtg)
2S7019	Nut, hex: 4-40 x 1/4; cad pl (FM tuning core mtg)
2S7051	Nut, hex palnut: 3/8-32 x 9/16; cad pl (control mtg)
35K691846	Pad, rubber: 1-hole (gang mtg)
35A691845	Pad, rubber: 2-hole (gang mtg)
28K71775	Plug, phono pick-up
52B481704	Pointer, dial
49A23960	Pulley, cord: 1/4" groove (on dial plate assembly)
49A21552	Pulley, cord: 1/2" groove (on dial plate assembly)
49A690562	Pulley, core drive: brass
1A691015	Pulley, pointer drive: 3-1/2" diameter
9A600040	Receptacle, phono motor: 3-prong; includes shell
9A791031	Receptacle, TV power: 2-prong; includes shell
5S8497	Rivet: .088 x 1/8 stl; nkl pl (anti-backlash clip mtg)
5S7771	Rivet: .088 x 3/16 stl; nkl pl (min socket mtg)
5S7774	Rivet: .088 x 1/4 stl; nkl pl (noval socket mtg)
5S7707	Rivet: .122 x 5/32 stl; nkl pl (term strip mtg)
5S7701	Rivet: .122 x 3/16 stl; nkl pl (ant term strip & output transformer mtg)
5S7700	Rivet: .122 x 1/4 stl; nkl pl (octal socket mtg)
5A27675	Rivet, shoulder (cord pulley mtg)...
5K13896	Rivet, shoulder (on core mtg brkt)..
3S7163	Screw, machine: 8-32 x 1/4 plain hex head; cad pl (pointer drive pulley mtg)..
3S7205	Screw, machine: 8-32 x 1/4 slotted locking hex head; cad pl (gang mtg)
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (tuner brkt mtg)..
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; cad pl (power trans & dial plate mtg)
3S7103	Setscrew: 8-32 x 1/8 Allen head; cad pl (core drive pulley mtg)
1X600489	Shaft, tuning: complete with pulley.....
15A690616	Shell, receptacle (on phono motor receptacle)
15K7443	Shell, receptacle (on TV power receptacle)
26K485936	Shield, coil (for FM IF transformers)....
26A470013	Shield, pilot light
9K600685	Socket, pilot light
9K484167	Socket, tube: miniature; 7-prong
9A485495	Socket, tube: noval; 9-prong
9A76209	Socket, tube: octal

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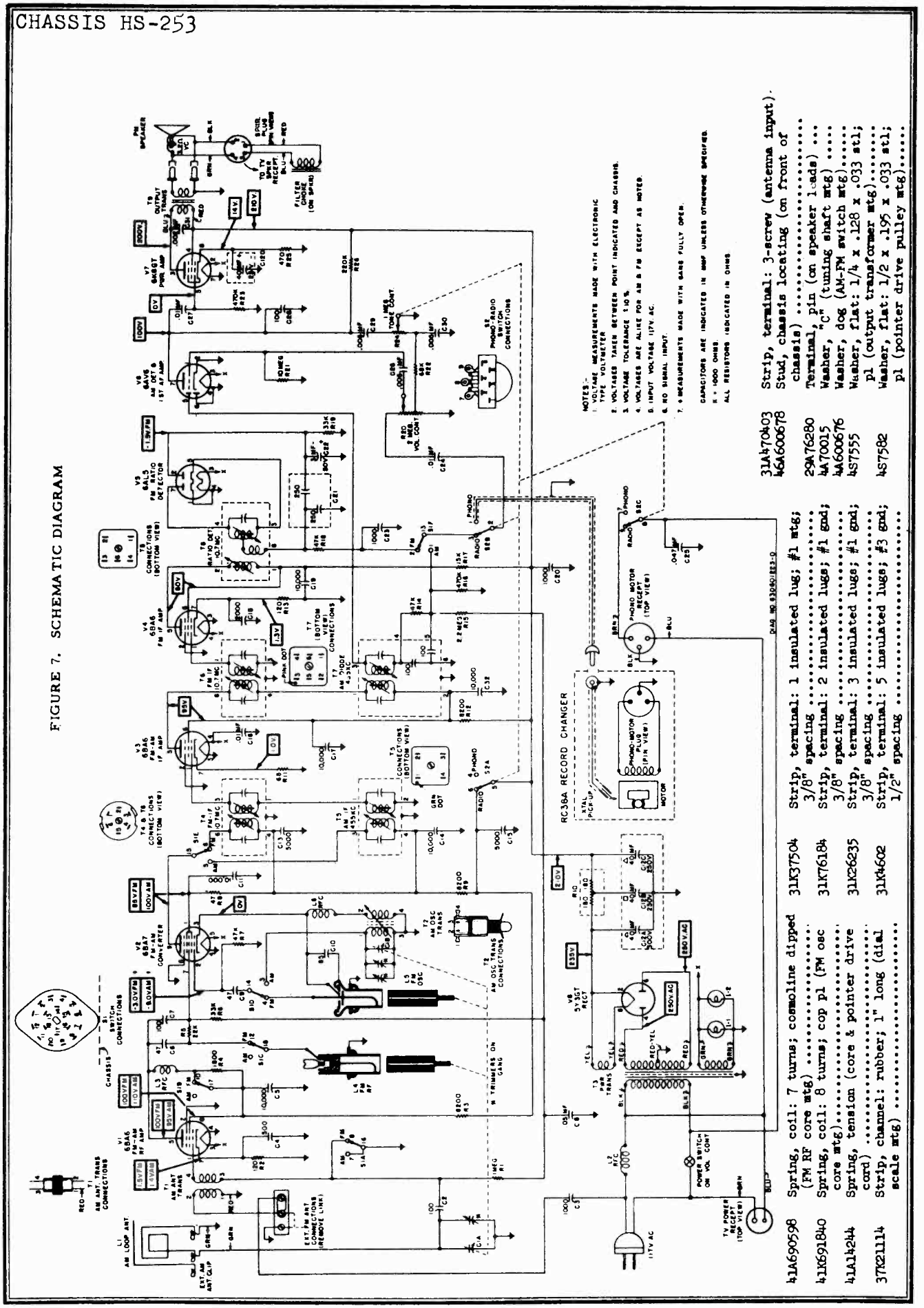


FIGURE 7. SCHEMATIC DIAGRAM

31A470403		Strip, terminal: 3-screw (antenna input).
46A600678		Stud, chassis locating (on front of chassis)
29A76280		Terminal, pin (on speaker leads)
4A70015		Washer, "C" (tuning shaft mtg)
4A600676		Washer, dog (AM-FM switch mtg)
4S7555		Washer, flat: 1/4 x .128 x .033 stl; pl (output transformer mtg)
4S7582		Washer, flat: 1/2 x .195 x .033 stl; pl (pointer drive pulley mtg)
41A690598	Spring, coil: 7 turns; comoline dipped (FM RF core mtg)	31K37504
41K691840	Spring, coil: 8 turns; cop pl (FM osc core mtg)	31K76184
41A14244	Spring, tension (core & pointer drive card)	31K26235
37K21114	Strip, channel: rubber; 1" long (dial scale mtg)	31K4602
	Strip, terminal: 1 insulated lug; #1 mtg; 3/8" spacing	
	Strip, terminal: 2 insulated lugs; #1 gnd; 3/8" spacing	
	Strip, terminal: 3 insulated lugs; #1 gnd; 3/8" spacing	
	Strip, terminal: 5 insulated lugs; #3 gnd; 1/2" spacing	

CHASSIS HS-261

USED WITH TV MODELS

17F5 Series

SPEAKER - PM type; common to both radio and television chassis

RADIO CHASSIS - Radio chassis HS-261 contains 8 tubes and receives both AM and FM broadcast programs. Except for common speakers, it operates entirely independently of the television receiver.

RADIO TUNING RANGE - AM - 535 to 1620 Kc
FM - 88 to 108 Mc

RADIO IF FREQUENCIES - AM IF - 455 Kc
FM IF - 10.7 Mc

RADIO ANTENNAS - AM: Loop antenna mounted in cabinet.
FM: Built into the power cord, with terminals for connection of an external antenna, if required.

POWER SUPPLY - 117 volts, 60 cycle alternating current only.

RADIO POWER CONSUMPTION - 85 watts, including phono motor

RADIO AUDIO OUTPUT - 3 watts

RADIO CHASSIS TUBE COMPLEMENT -

6BA6	FM-AM RF Amplifier
6BA7	FM-AM Converter
6BA6	FM-AM IF Amplifier
6BA6	FM IF Amplifier
6AL5	FM Ratio Detector
6AV6	AM Detector & 1st Audio Amp
6K6GT	Power Amplifier
5Y3GT	Rectifier

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNAS

No outside antenna or ground is normally required for standard broadcast (AM) reception, as a loop antenna is located inside the cabinet. Antenna connections are shown in Figure 1. In locations where additional pick-up is desired, an external antenna may be connected to the clip marked "EXT BC ANT" on the loop antenna.

An FM antenna, built into the power cord, eliminates the need for an external FM antenna when the receiver is used in normal FM service areas, such as are found in and for a few miles around metropolitan areas. In "fringe" or weak signal areas, improved FM reception can be obtained by using an outside FM antenna. The external antenna should be connected through a 300 ohm twin transmission line to the 1st & 2nd screws on the terminal strip on the chassis, as in Figure 1. The link between the 2nd & 3rd screws should be opened. Orient the antenna to obtain maximum volume of the FM stations.

For best FM reception from the built-in power line cord antenna, it is important to stretch the cord to its full length. Changing the direction or position of the line cord, or reversing the plug in the wall outlet, will often improve reception from weak stations. Connect the link between the 2nd & 3rd screws on the terminal strip on the chassis when the built-in antenna is used.

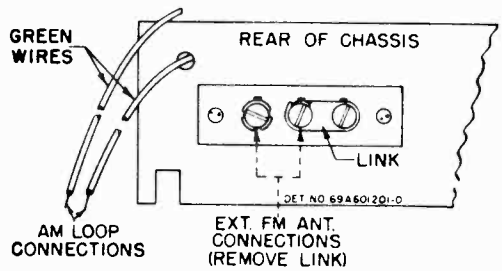


FIGURE 1. ANTENNA CONNECTIONS

CONTROLS

Refer to Figure 2 for the locations of the radio operating controls.

Power for both the radio and the record changer is controlled by the VOL-ON-OFF knob. The phonograph motor will not operate, however, until the PHONO-TONE-RADIO knob is rotated also to "PHONO". CAUTION: The power switches on the AM-FM radio and on the television receiver are independent. Make sure both are turned off when the set is not in use.

Tuning of FM stations should be done very carefully, for best sound reproduction, not necessarily for the strongest volume received.

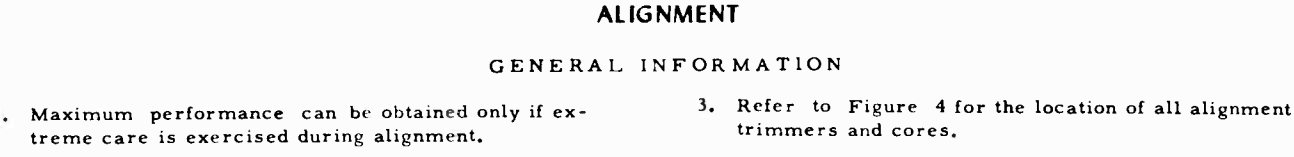


FIGURE 2. OPERATING CONTROLS

ALIGNMENT

GENERAL INFORMATION

1. Maximum performance can be obtained only if extreme care is exercised during alignment.
2. Use a small fibre screwdriver for aligning the IF transformers.
3. Refer to Figure 4 for the location of all alignment trimmers and cores.
4. As the stages are brought into alignment, reduce the signal generator output to a low value to avoid overloading the receiver.

CHASSIS HS-261

ORDER OF ALIGNMENT AND EQUIPMENT REQUIRED

1. AM Broadcast Band IF & RF Alignment
   a. 455 to 1620 Kc AM Signal Generator
   b. Low range output meter

2(A) FM Band IF & RF Alignment (preferred method)
   a. 10.7 to 108 Mc FM signal generator
   b. Oscilloscope

(B) FM Band IF & RF Alignment (alternate method)
   a. 10.7 to 108 Mc signal generator (unmodulated)
   b. Low range DC electronic voltmeter

AM BROADCAST BAND - IF & RF ALIGNMENT

1. With the gang fully closed, adjust the pointer to coincide with the left of the "55" marking on the dial scale. See Figure 3.
2. Connect the AM signal generator as in chart below, with 400 cycle, 30% modulation.
3. Connect the output meter across the speaker voice coil. Throughout alignment reduce the generator output to a level which produces less than 1.27 volts (.5 watt) across the voice coil, to avoid overloading the receiver.
4. Set the bandswitch to the AM position.
5. Turn the receiver volume control to maximum.
6. Proceed as shown in the following chart.

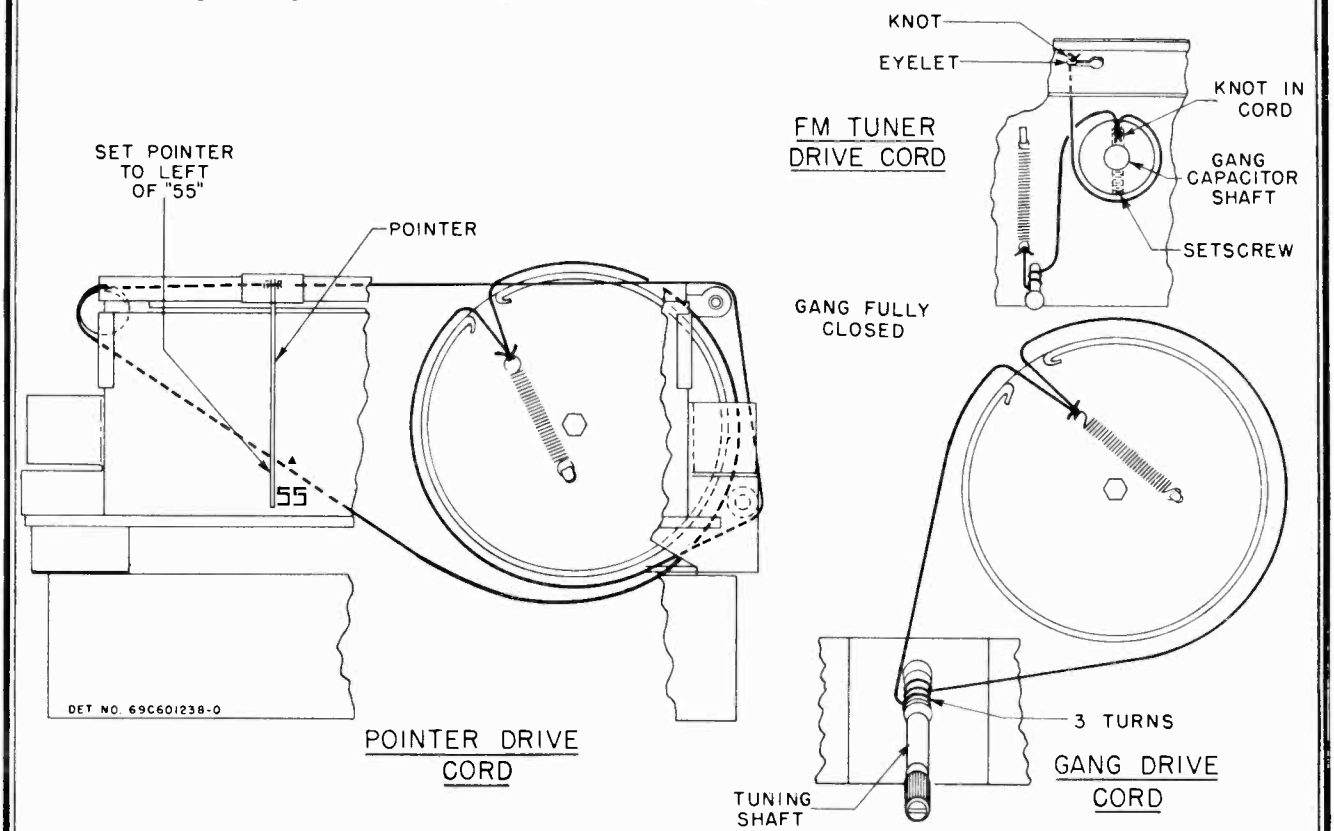


FIGURE 3. DIAL RESTRINGING DETAIL

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv V-2 (pin 7, 6BA7)	455 Kc	Fully opened	1, 2, 3, & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv V-2 (pin 7, 6BA7)	1620 Kc	Fully opened	5 (AM osc)	Adjust for maximum. *
3.	-	-	-	-	-	Connect AM loop to chassis.
4.	-	Across radiation loop**	1400 Kc	Tune in signal	8 (AM ant)	Adjust for maximum.

5. If, after the receiver has been aligned as above, it is found to be badly off calibration, it will be necessary to adjust oscillator core (7) as follows: connect the generator to the grid of the converter tube and, with the gang fully closed, adjust core (7) at 535 kc. It is advisable to repeat the oscillator adjustments at 1620 Kc and 535 Kc several times until the tuning range is correct. Core (7) has been pre-set at the factory and normally should require no retuning.

* If difficulty is encountered in tuning trimmer (5), adjust trimmer (6) to 1/2 turn from tight.

**Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

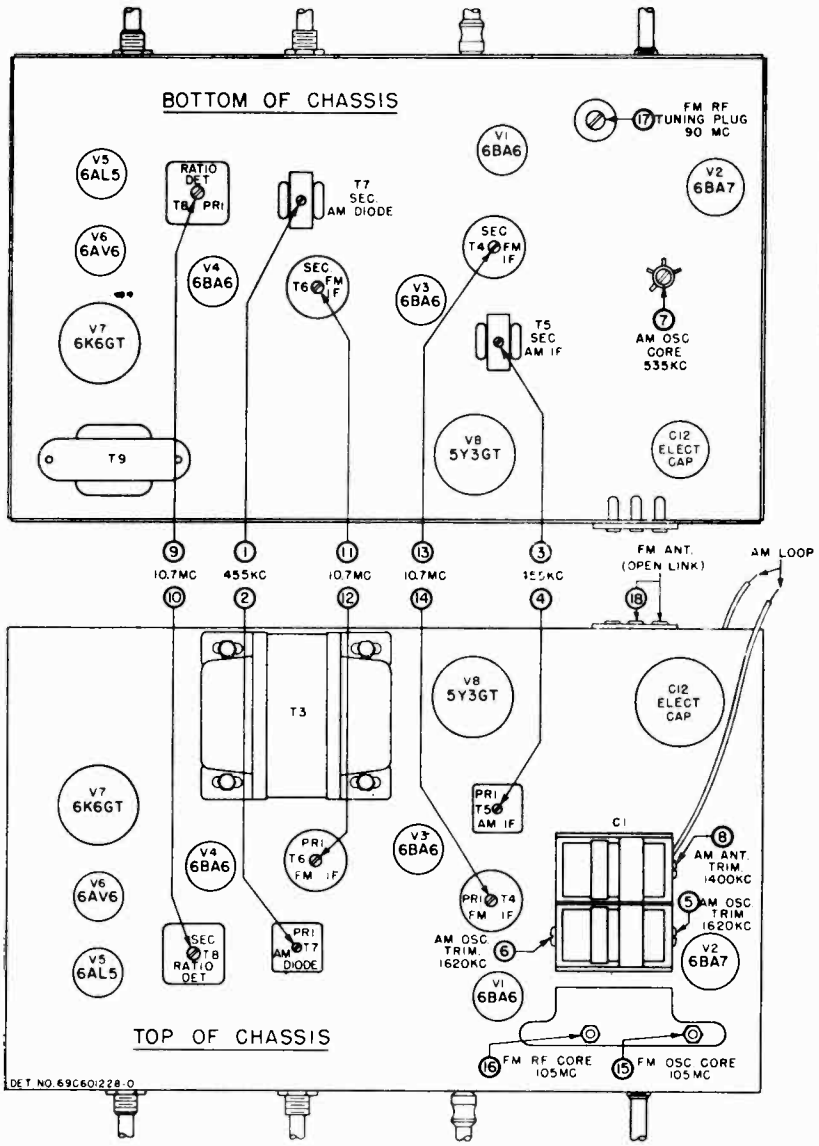


FIGURE 4.
TUBE & TRIMMER LOCATIONS

FM BAND - IF & RF ALIGNMENT (PREFERRED METHOD)

1. The following FM alignment procedure, using an FM signal generator and an oscilloscope, is to be preferred because the actual response pattern may be observed on the scope and adjusted for best symmetry and maximum amplitude.

2. Connect the vertical input terminals of the oscilloscope between the chassis and the junction of resistor R-18 (47K) and capacitor C-23 (1000 mmf).

3. Connect the FM signal generator sync voltage output terminals, through a phase shifting network, to the horizontal input terminals of the scope, as in Figure 5. (Other values of resistance and capacitance may be required, depending upon the scope). The phasing control should be adjusted to give only one trace on the scope. NOTE: If the FM generator has a built-in phase control, the phase shifting network is not necessary.

4. Set the bandswitch to the FM position.

5. Throughout alignment, reduce the generator output to keep the signal just above the noise level, to avoid overloading the receiver.

6. Proceed as shown in the following chart.

CHASSIS HS-261

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	9 (ratio det pri)	Adjust for maximum amplitude of pattern. *
2.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	10 (ratio det sec)	Adjust for symmetrical curve, as shown in Figure 6.
3.	-	-	-	-	-	Repeat steps 1 & 2 for maximum amplitude and best symmetry.
4.	1000 mmf	Grid of 1st IF Amp V-3 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	11 & 12 (2nd IF sec & pri)	Adjust for maximum amplitude of pattern. *
5.	1000 mmf	Grid of conv V-2 (pin 7, 6BA7)	10.7 mc ±100 kc dev	Fully opened	13 & 14 (1st IF sec & pri)	Adjust for maximum amplitude of pattern. *
6.	1000 mmf	Grid of conv V-2 (pin 7, 6BA7)	10.7 mc ±100 kc dev	Fully opened	11, 12, 13 & 14	Readjust for maximum amplitude and best symmetry.
RF ALIGNMENT						
7.	270 ohms	FM terminal 18 on rear of chassis (open link)	105 mc ±22-1/2 kc dev	105 mc on dial	15 (osc core)	Adjust for maximum amplitude of pattern. *
8.	-	-	-	Fully closed	16 (RF core)	Turn counterclockwise until core is at bottom of pipe, then turn four turns clockwise.
9.	270 ohms	FM terminal 18 on rear of chassis	90 mc ±22-1/2 kc dev	Tune in signal	17 (RF tuning plug)	Adjust for maximum amplitude of pattern. *
10.	270 ohms	FM terminal 18 on rear of chassis	105 mc ±22-1/2 kc dev	Tune in signal	16 (RF core)	Adjust for maximum amplitude of pattern. *
11.	-	-	-	-	-	Repeat steps 9 & 10, until no further adjustment is necessary.

* An output meter across the speaker voice coil will also indicate maximum amplitude. It should not be used in place of the scope, however, since it will not show symmetry of the curve.

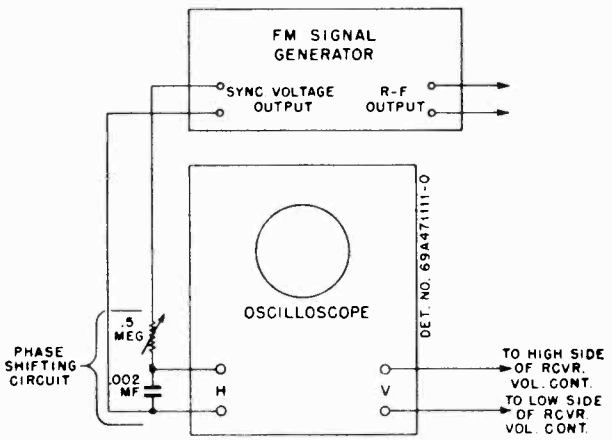


FIGURE 5.
FM SIGNAL GENERATOR AND OSCILLOSCOPE HOOK-UP

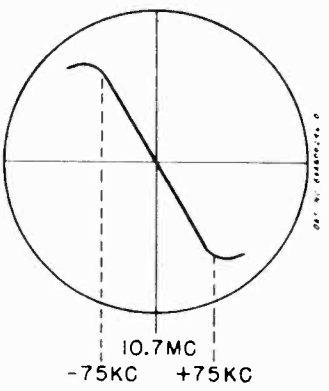


FIGURE 6. RATIO DETECTOR WAVEFORM

FM BAND - IF & RF ALIGNMENT (ALTERNATE METHOD)

1. The following procedure for FM alignment, with an unmodulated carrier generator and a DC electronic voltmeter, is not as desirable as the preceding method; but it may be used if no FM generator is available.
2. Connect the signal generator as in chart below, with no modulation.
3. Set the bandswitch to the FM position.
4. Except in step 2 below, connect the electronic voltmeter across resistor R-19 (33K) in the ratio detector stage.
5. Throughout alignment reduce the signal generator output to a value which produces no more than a 5 volt rise above no signal voltage, to avoid overloading the receiver.
6. In step 2 below, connect two 100K ohm resistors in series across R-19. Connect the electronic voltmeter between the volume control side of resistor R-19 (47K) and the junction of the two 100K resistors, with the low side of the meter at the 100K resistors.
7. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of conv V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	9, 11, 12, 13 & 14 (IF cores)	Adjust for maximum.
2.	1000 mmf	Grid of conv V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	10 (ratio det sec)	Adjust for zero (connect meter as in step 6 above)
RF ALIGNMENT						
3.	270 ohms	FM terminal 18 on rear of chassis (open link)	105 mc	105 mc on dial	15 (osc core)	Adjust for maximum
4.	-	-	-	Fully closed	16 (RF core)	Turn counterclockwise until core is at bottom of pipe, then turn four turns clockwise.
5.	270 ohms	FM terminal 18 on rear of chassis	90 mc	Tune in signal	17 (RF tuning plug)	Adjust for maximum.
6.	270 ohms	FM terminal 18 on rear of chassis	105 mc	Tune in signal	16 (RF core)	Adjust for maximum.
7.	-	-	-	-	-	Repeat steps 5 & 6 until no further adjustment is necessary.

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part No.	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	19B691877	Variable, 2-gang .....
C-2	21B77286	Ceramic: 100 mmf 500V .....
C-3	21K478410	Ceramic: 1000 mmf 500V .....
C-4	21K481377	Ceramic: 500 mmf 500V .....
C-5	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-6	21K77373	Ceramic: 47 mmf 500V .....
C-7	21B77286	Ceramic: 100 mmf 500V.....
C-8	8R9816	Paper: .05 mf 400V .....
C-9	21K77373	Ceramic: 47 mmf 500V .....
C-10	21A690688	Ceramic: 85 mmf 500V .....
C-11	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-12	23B690975	Electrolytic: 40 mf/300V, 40-40 mf/250V, 40 mf/25V .....
C-13	21A470789	Ceramic, disc type: 5000 mmf 450V.
C-14	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-15	21A470789	Ceramic, disc type: 5000 mmf 450V.
C-16	8R9809	Paper: .01 mf 400V .....
C-17	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-18	21K790912	Ceramic; 2000 mmf 500V .....
C-19	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-20	21K478410	Ceramic: 1000 mmf 500V .....
C-21	21B484337	Ceramic: dual; 250-250 mmf/450V....
C-22	23K690543	Electrolytic: 3 mf 50V .....
C-23	21K478410	Ceramic: 1000 mmf 500V .....
C-24	8R9809	Paper: .01 mf 400V .....
C-25	8R490232	Tubular, molded: .047 mf 400V.....
C-26	8R9813	Paper: .005 mf 600V .....
C-27	8R9809	Paper: .01 mf 400V .....
C-28	21B77286	Ceramic: 100 mmf 500V .....
C-29	8R9813	Paper: .005 mf 600V .....
C-30	8R9813	Paper: .005 mmf 600V .....
C-31	8R9847	Paper: .002 mmf 600V .....
C-32	21K482726	Ceramic, disc type: 10,000 mmf 450V
Pilot Light		
I-1,2	65X11854	Bulb, pilot light: #47; 6-8V; .15 amp; clear; bayonet base .....

CHASSIS HS-261

Ref. No.	Part No.	Description
Coils		
L-1	24C690896	AM loop antenna
L-2	24A692148	RF choke
L-3	24A90064	RF choke
L-4	24C690584	Inductor and Capacitor Assembly: FM RF; less tuning core
L-5	24K600519	Inductor and Capacitor Assembly: FM osc; less tuning core
L-6	24A791081	RF choke
Resistors		
		Note: All resistors are insulated carbon type unless otherwise specified.
R-1	6R6004	1 meg 20% 1/2W
R-2	6R5551	120 10% 1/2W
R-3	6R5725	8200 10% 2W
R-4	6R2089	1800 10% 1/2W
R-5	6R6028	22,000 20% 1/2W
R-6	6R6410	33,000 10% 1/2W
R-7	6R6056	47,000 20% 1/2W
R-8	6R2108	47 20% 1/2W
R-9	6R5725	8200 10% 2W
R-10	17A690973	Wire wound: 360 10% 3W; center-tapped
R-11	6R2039	68 10% 1/2W
R-12	6R5725	8200 10% 2W
R-13	6R5551	120 10% 1/2W
R-14	6R6056	47,000 20% 1/2W
R-15	6R3927	2.2 meg 20% 1/2W
R-16	6R6377	470,000 10% 1/2W
R-17	6R5732	15,000 10% 2W
R-18	6R6056	47,000 20% 1/2W
R-19	6R6410	33,000 10% 1/2W
R-20	18A600974	Volume control: 2 meg; tapped at 600,000 ohms; includes on-off sw.
R-21	6R2109	10 meg 20% 1/2W
R-22	6R6074	68,000 10% 1/2W
R-23	6R6032	470,000 20% 1/2W
R-24	18B600683	Tone control: 1 meg; with phono-radio switch
R-25	6R5593	470 10% 1W
R-26	6R6015	220,000 20% 1/2W
Switches		
S-1	40B690538	Bandswitch, AM-FM
Transformers		
T-1	24A690544	FM Antenna Input Transformer
T-2	24K691878	AM Oscillator Transformer: white & red dot
T-3	25B600684	Power Transformer
T-4	24B690540	1st FM IF Transformer (orange dot): 10.7 mc; complete with capacitors and cores; less shield
T-5	24B485553	AM IF Transformer (green dot): 455 kc; complete with capacitors, cores,and shield
T-6	24B690541	2nd FM IF Transformer (yellow dot): 10.7 mc; complete with capacitors and cores; less shield
T-7	24K485555	AM Diode Transformer (pink dot): 455 kc; complete with capacitors, cores, and shield
T-8	24K600893	Ratio Detector Transformer: 10.7 mc; complete with capacitors, cores and shield
T-9	25B600969	Audio Output Transformer

Part Number	Description
CHASSIS PARTS - MECHANICAL	
1X690717	Bracket Assembly, tuning core mtg: includes shoulder rivet and anti-backlash clip
7C690567	Bracket, tuner mtg (gang mtg)
7A600476	Bracket, tuning shaft
43A890397	Bushing, line cord strain relief (use with 43K890398)
43K890398	Bushing, line cord retainer (use with 43A890397)
42K690561	Clip, anti-backlash: single (on core mtg bracket)
42A690560	Clip, anti-backlash: double (on tuner mtg bracket)
42A485548	Clip, coil can mtg (AM IF transformer)
42B482867	Clip, spring: blued finish (holds FM IF transformer)
11M8944	Cord, dial (pointer drive)
11M88137	Cord, dial (core drive)
30K21859	Cord, line: with plug; 9 ft long
46B692164	Core, iron and screw: green dot (FM osc tuning core)
46K692165	Core, iron and screw (FM RF tuning core).
1X600490	Dial Plate and Pulleys Assembly: complete, less dial scale
34C600868	Dial scale: glass
5S7866	Eyelet: .125 x .091 brass; nkl pl (core drive cord retainer)
1X601152	Lead and Plug Assembly, phono pick-up
4S9751	Lockwasher, int-ext: #8; cad pl (pointer drive pulley mtg)
2S7019	Nut, hex: 4-40 x 1/4; cad pl (FM tuning core mtg)
2S7051	Nut, hex palnut: 3/8-32 x 9/16; cad pl (control mtg)
35X691846	Pad, rubber: 1-hole (gang mtg)
35A691845	Pad, rubber: 2-hole (gang mtg)
28K71775	Plug, phono pick-up
52B481704	Pointer, dial
49A23960	Pulley, cord: 1/4" groove (on dial plate assembly)
49A21552	Pulley, cord: 1/2" groove (on dial plate assembly)
49A690562	Pulleys, core drive: brass
1A691015	Pulley, pointer drive: 3-1/2" diameter
9A600040	Receptacle, phono motor: 3-prong; includes shell
9A791031	Receptacle, TV power: 2-prong; includes shell
5S8497	Rivet: .088 x 1/8 stl; nkl pl (anti-backlash clip mtg)
5S7771	Rivet: .088 x 3/16 stl; nkl pl (min socket mtg)
5S7774	Rivet: .088 x 1/4 stl; nkl pl (noval socket mtg)
5S7707	Rivet: .122 x 5/32 stl; nkl pl (term strip mtg)
5S7701	Rivet: .122 x 3/16 stl; nkl pl (ant term strip & output trans mtg)
5S7700	Rivet: .122 x 1/4 stl; nkl pl (octal socket mtg)
5A27675	Rivet, shoulder (cord pulley mtg)
5K13896	Rivet, shoulder (on core mtg brkt)
3S7163	Screw, machine:8-32 x 1/4 plain hex head; cad pl (pointer drive pulley mtg).
3S7205	Screw, machine: 8-32 x 1/4 slotted locking hex head; cad pl (gang mtg)
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (tuner brkt mtg)
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; cad pl (pwr trans & dial plate mtg)
3S7103	Setscrew: 8-32 x 1/8 Allen head; cad pl (core drive pulley mtg)
1X600489	Shaft, tuning: complete with pulley

15A690616	Shell, receptacle (on phono motor receptacle)	9A76209	Socket, tube: octal	31K26235	Strip, terminal: 3 insulated lugs; #1 gnd; 3/8" spacing
15K74443	Shell, receptacle (on TV power receptacle)	41A690598	Spring, coil: 7 turns; cosmoline dipped (FM RF core mtg)	31K4602	Strip, terminal: 5 insulated lugs; #3 gnd; 1/2" spacing
26K485936	Shield, coil (for FM IF transformers)	41K691840	Spring, coil: 8 turns; cop pl (FM osc core mtg)	31A470403	Strip, terminal: 3-screw (antenna input)
26A470013	Shield, pilot light	41A14244	Spring, tension (core & pointer drive cord)	5S5405	Terminal, pin (on speaker leads)
9K600685	Socket, pilot light	37K21114	Strip, channel: rubber; 1" long (dial scale mtg)	4A70015	Washer, "C" (tuning shaft mtg)
9K484167	Socket, tube: miniature; 7-prong	31K37504	Strip, terminal: 1 insulated lug; #1 mtg; 3/8" spacing	4A600767	Washer, dog (AM-FM switch mtg)
9A485495	Socket, tube: noval; 9-prong	31K76184	Strip, terminal: 2 insulated lugs; #1 gnd; 3/8" spacing	4S7555	Washer, flat: 1/4 x .128 x .033 stl; cad pl (output trans mtg)
				4S7582	Washer, flat: 1/2 x .195 x .033 stl; cad pl (pointer drive pulley mtg)

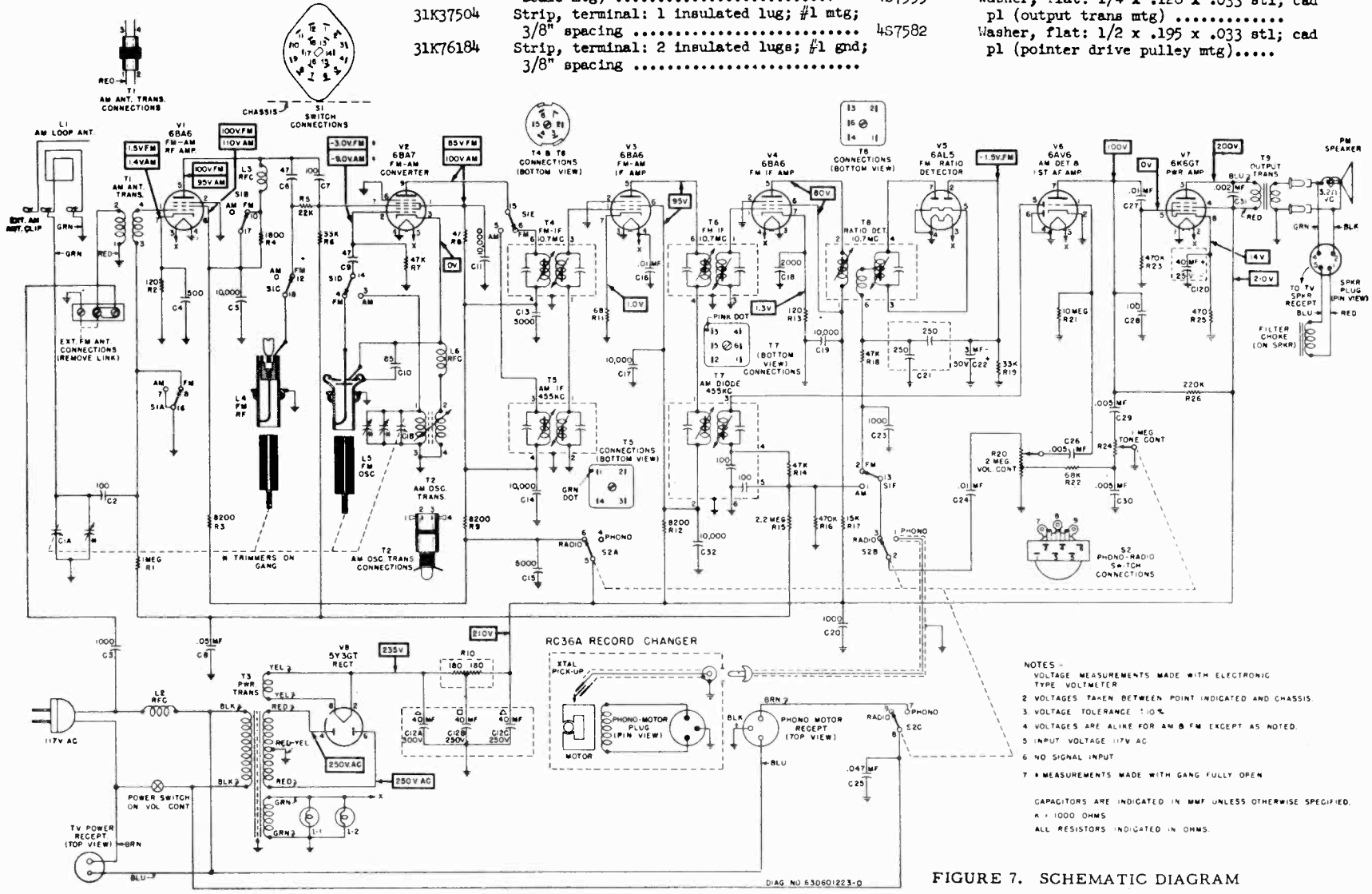


FIGURE 7. SCHEMATIC DIAGRAM

MODEL SROB, Ch. OB, Studebaker

GENERAL INFORMATION

TYPE - Chassis OB is a universal, manually tuned, automotive type, superheterodyne chassis, used in Motorola Models SROB, etc. An external speaker is used.

TUNING RANGE - 540 to 1600 Kc IF - 455 Kc

TUBE COMPLEMENT - 6BA6 - RF Amplifier
6BE6 - Converter
6BA6 - IF Amplifier
6AV6 - Det-AVC & AF Amp
6AS5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 5 amps at 6.3V DC

POWER OUTPUT - 2 watts

NOTE:

This manual contains a complete list of parts for the OB chassis. Replacement parts for specific receivers in which the OB chassis is used, will be found in separate service manuals bearing the appropriate receiver model numbers.

ALIGNMENT

Remove receiver top and bottom housing covers and also the escutcheon to expose all alignment adjustments.

Connect a 6 volt storage battery to BAT terminal and chassis of receiver.

Connect a 3.2 ohm PM speaker to VC terminal and chassis of receiver.

Connect a low range output meter across speaker voice coil and set volume control at maximum. For greatest accuracy, keep output of receiver at approximately 1 watt (1 watt = 1.79 volts on output meter) throughout alignment by reducing signal generator output as stages are brought into alignment. Use a small fibre screwdriver when aligning IF and diode transformers. A special tool, Motorola Part No. 66A76278, is required for adjusting the tuner cores. IMPORTANT: Do not push in on the alignment tool when adjusting the tuner cores; the slightest inward pressure may move tuner carriage and result in inaccurate alignment.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	6BE6 grid (pin #7) & chassis	455 Kc	High frequency end (cores out)	1, 2, 3 & 4	Peak for maximum in order indicated. Check by repeating step.
RF ALIGNMENT						
2.	See Fig. 1	Antenna receptacle through dummy	1610 Kc	High frequency end; cores should project 1-1/8" from cans (Screw out if necessary)	5, 6, & 7	Peak for maximum in order indicated.
3.	"	"	1425 Kc	1425 Kc-per Fig. 1	8, 9 & 10	Peak for maximum in order indicated.

4. When receiver is installed in car, extend antenna fully, set dial to approximately 1400 Kc and repeak antenna trimmer (7) for maximum volume of a weak station or noise between stations.

MODEL 5ROB, Ch. OB, Studebaker

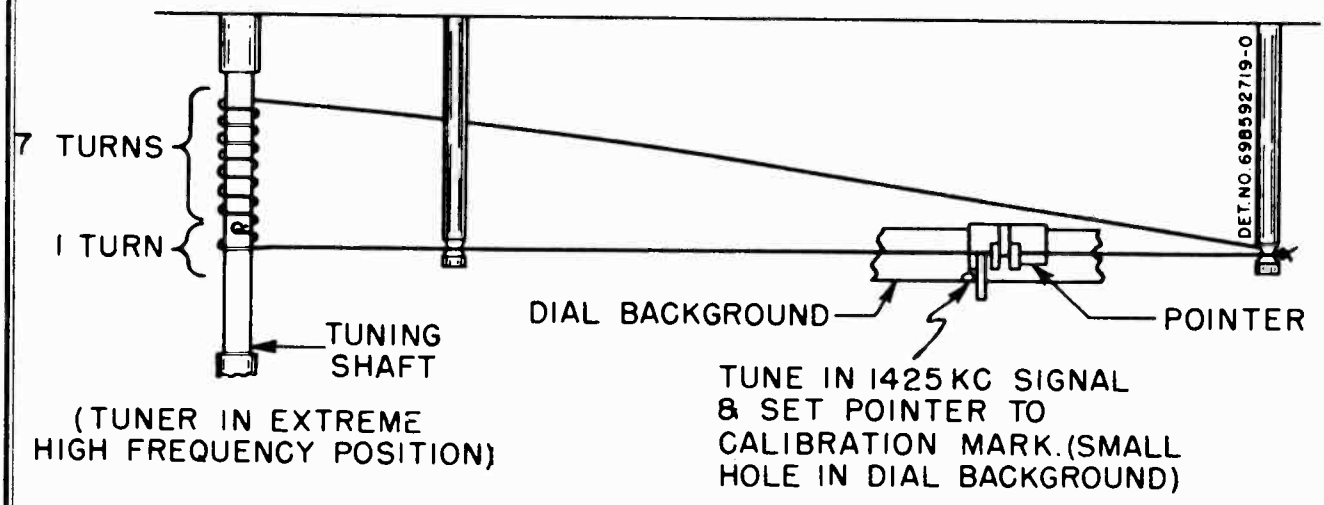


FIGURE 1. RESTRINGING DETAIL

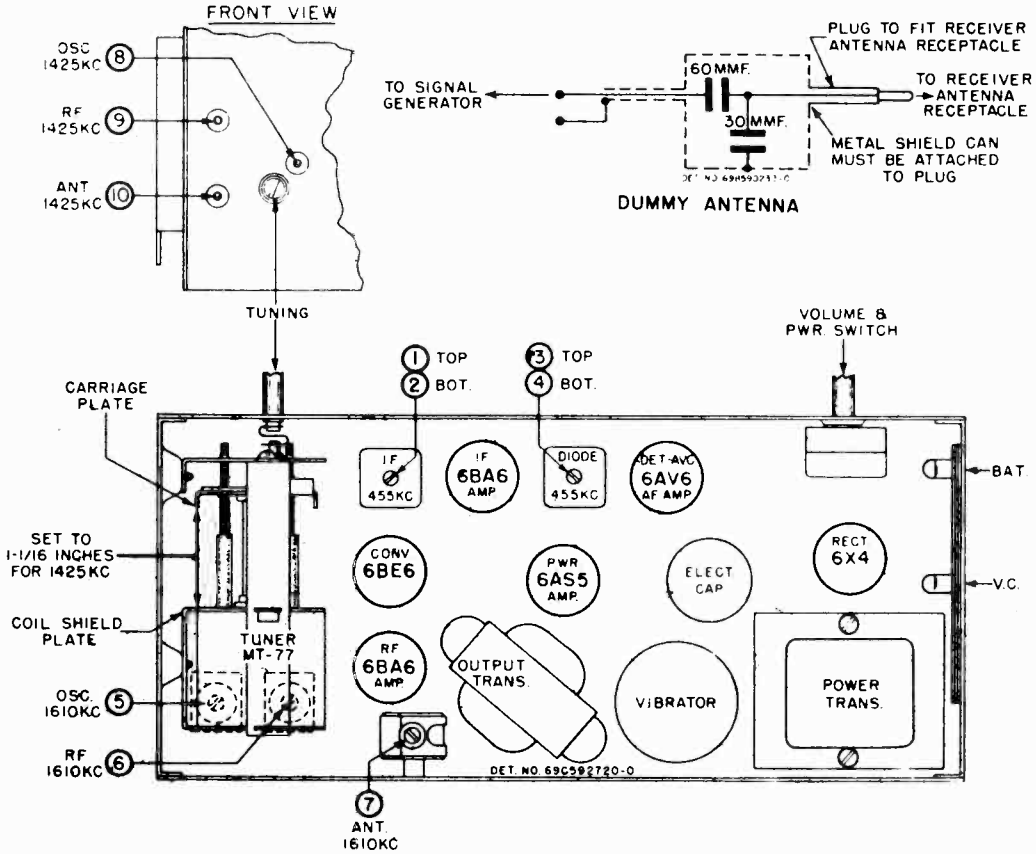
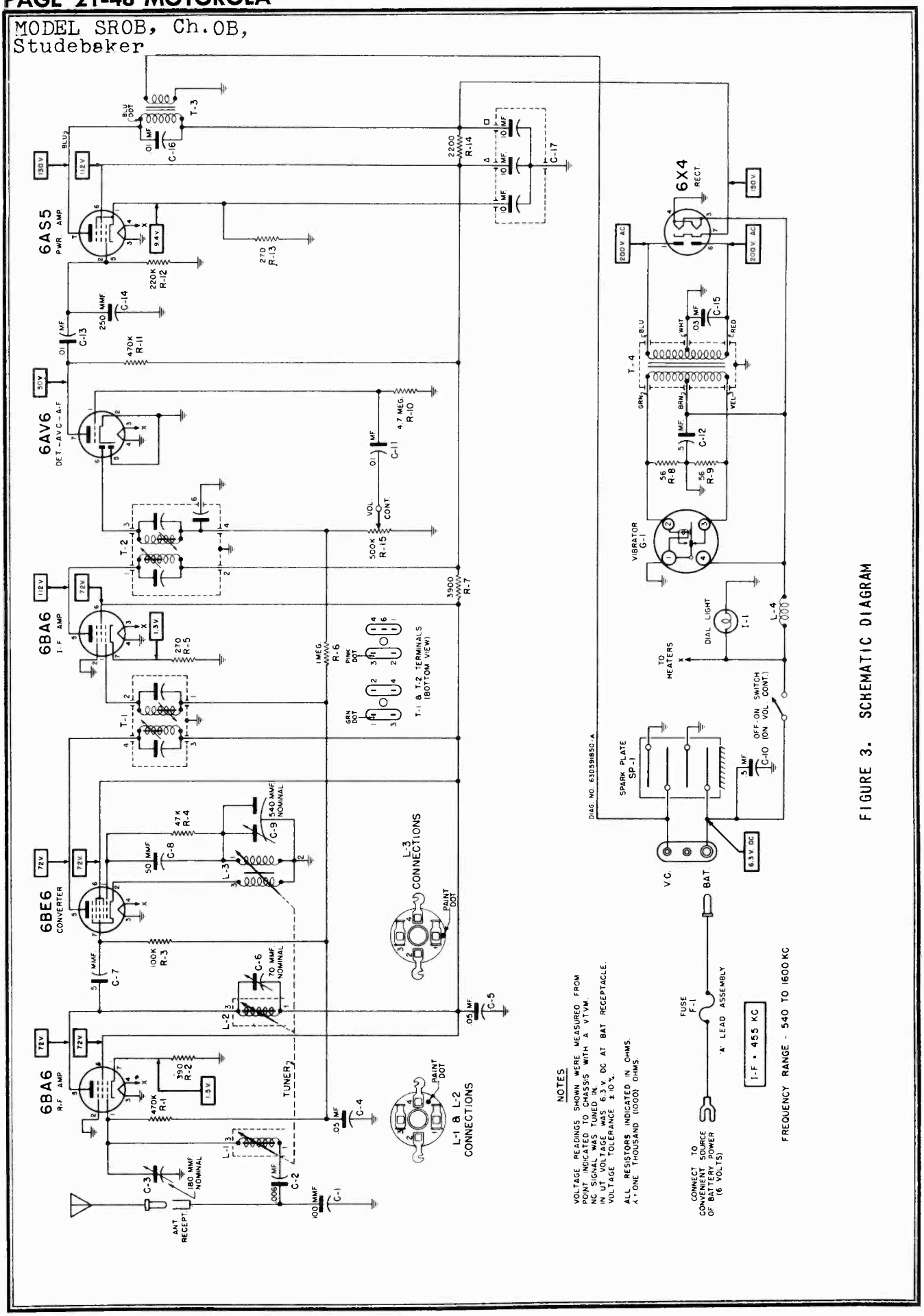


FIGURE 2. TUBE & TRIMMER LOCATIONS AND DUMMY ANTENNA

MODEL SR0B, Ch.0B,
Studebaker



NOTES

VOLTAGE READINGS SHOWN WERE MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM.
NO SIGNAL WAS TUNED IN.
IN UT VOLTAGE WAS 6.3 V DC AT BAT RECEPTACLE.
VOLTAGE TOLERANCE ± 10 %.

ALL RESISTORS INDICATED IN OHMS
K = ONE THOUSAND (1000) OHMS.

FIGURE 3. SCHEMATIC DIAGRAM

MODEL SROB, Ch. OR, Studebaker

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - ELECTRICAL		
CAPACITORS		
C-1	21B77562	Ceramic: 100 mmf 500V
C-2	8A4529	Paper: .006 mf 100V
C-3	20K591969	Trimmer, variable: 180 mmf nominal
C-4	8K13514	Paper: .05 mf 100V
C-5	8R23146	Paper: .05 mf 200V
C-6	20A481526	Trimmer, variable: 70 mmf nominal
C-7	21K70720	Molded: 5 mmf 500V
C-8	21R6513	Mica: 50 mmf 10% 300V
C-9	20A591977	Trimmer, variable: 540 mmf nominal
C-10	8K17028	Paper: .5 mf 100V
C-11	8K472754	Paper: .01 mf 100V
C-12	8K17028	Paper: .5 mf 100V
C-13	8R23690	Paper: .01 mf 400V
C-14	21R6543	Mica: 250 mmf 20% 500V
C-15	8K592154	Paper: .03 mf 600V
C-16	8R23690	Paper: .01 mf 400V
C-17	23A591500	Electrolytic: 10-10/250V; 10-25V.
FUSE		
F-1	65A10266	Fuse: 10 amp (3AG)
PILOT LIGHT		
I-1	65X10867	Bulb: 6.3V; .25 amp; tubular; bayonet base; clear
VIBRATOR		
G-1	48B3333	Vibrator: non-sync; 4-pin
COILS		
L-1,2	24B71881	RF & Antenna Coil (specify color of paint dots on old coil when ordering)
L-3	24B592153	Oscillator Coil (specify color of paint dots on old coil when ordering)
L-4	24A472535	Choke, hash
RESISTORS		
Note:	All resistors are insulated carbon type unless otherwise specified.	
R-1	6R6032	470,000 20% 1/2W
R-2	6R5554	390 10% 1/2W
R-3	6R6075	100,000 20% 1/2W
R-4	6R6056	47,000 20% 1/2W
R-5	6R6432	270 10% 1/2W
R-6	6R6004	1 meg 20% 1/2W
R-7	6R5618	3900 10% 1W
R-8	6R5614	56 10% 1/2W
R-9	6R5614	56 10% 1/2W
R-10	6R2122	4.7 meg 20% 1/2W
R-11	6R6032	470,000 20% 1/2W
R-12	6R6015	220,000 20% 1/2W
R-13	6R6336	270 10% 1W
R-14	6R6006	2200 20% 1W
R-15	18A591978	Volume Control: 500,000 ohms; includes SPST switch
SPARK PLATE		
SP-1	1B592173	Spark Plate Assembly: complete..
TRANSFORMERS		
T-1	24B485553	IF, 455 Kc: complete with tuning cores & padding capacitors but less shield
T-2	24B485554	Diode, 455 Kc: complete with tuning cores & padding capacitors but less shield
T-3	25B70171	Output Transformer
T-4	25B591533	Power Transformer

PART NO.	DESCRIPTION
CHASSIS PARTS - MECHANICAL	
42A485548	Clip, coil can mtg
42A591959	Clip, spring (tuner drive)
42A4215	Clip, vibrator grounding
61A473514	Crystal, transparent green (for dial light)
1X473150	Light Shield & Plug Assembly
4S7666	Lockwasher, ext: #6; cad pl (power trans mtg)
4S7691	Lockwasher, int: 3/8"; cad pl (vol control mtg)
2S7002	Nut, hex: 6-32 x 5/16; cad pl (pwr trans mtg)
2S1376	Nut, hex: 3/8-32 x 1/2; cad pl (vol control mtg)
64A591992	Plate, rear cover
9A472148	Receptacle, antenna contact
5S7706	Rivet: .122 x 1/8; stl; nkl pl (dial light brkt mtg)
5S7707	Rivet: .122 x 5/32; stl; nkl pl (terminal strip mtg)
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg)
5S7701	Rivet: .122 x 3/16; stl; nkl pl (vibrator socket mtg)
5S7700	Rivet: .122 x 1/4; stl; nkl pl (spark plate mtg)
3S7454	Screw, sheet metal: #8 x 1/4; PKZ; plain hex head (tuner mtg, rear cover mtg)
3S8140	Screw, sheet metal: #8 x 3/16; PKZ; plain hex head (tuner mtg)
9A591971	Socket, pilot light & brkt
9A70208	Socket, tube: 4-pin; with grounding lug (vibrator socket)
9A472534	Socket, tube: miniature; 7-prong
9K580218	Socket, tube: miniature; 8-prong
TUNER PARTS - MECHANICAL	
Note:	Electrical parts of the tuner are included in the Electrical Chassis Parts List.
1X592120	Model MT-77 Manual Tuner: complete....
1X592099	Base, Sleeve, Shields & Channels Assembly
1X78034	Carriage Plate, Slug Insulator & Center Guide Rod Assembly
42A70184	Clip, core adjustment
46B591654	Core, iron & screw
14A70876	Insulator, coil sleeve
14B78007	Insulator, slug: bakelite
2A77596	Nut, floating: without ear (on manual lead screw)
2A78005	Nut, floating: with ear (on manual lead screw)
64K592064	Plate, tuner front
5S7770	Rivet: .088 x 5/32; stl; pol nkl (slug insulator mtg)
47A78002	Rod, carriage guide
3S7352	Screw, machine: 8-32 x 2"; slotted round head; stl; cad pl (front plate mtg)
3A591998	Screw, manual lead (tuning shaft)
43A70881	Sleeve, coil: iron
41A77595	Spring, coil slug
41A77592	Spring, compression (on manual lead screw)
4A21577	Washer, 'C' spring (manual lead screw mtg)
4A70873	Washer, coil spacer
4A74571	Washer, fishpaper
4A70956	Washer, slug insulator

MODEL SROB, Ch. OB, Studebaker

GENERAL INFORMATION

TYPE - Manually tuned automotive type superheterodyne receiver specifically designed for installation in 1950 Studebaker cars.

CHASSIS USED - Model OB. Refer to Chassis OB Service Manual for chassis alignment, dial restringing and replacement parts list.

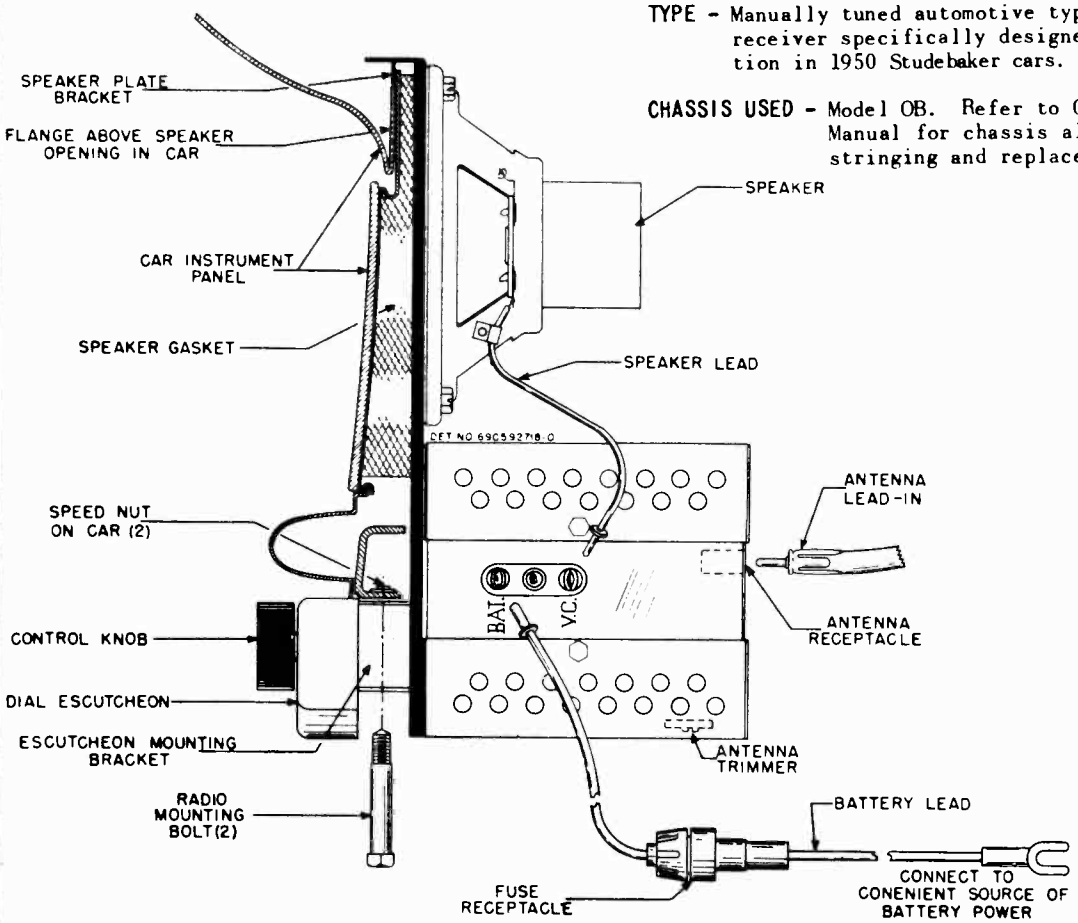


FIGURE 1. RECEIVER INSTALLATION DETAIL

REPLACEMENT PARTS LIST

(For chassis replacement parts, refer to Chassis OB Service Manual)

PART NUMBER	DESCRIPTION
3A592058	Bolt, radio mounting .....
7C592046	Bracket, escutcheon mtg (mounts escutcheon to speaker plate).....
8A4491	Capacitor, noise suppression (generator capacitor) .....
42A591931	Clip, dial scale retaining .....
11M8877	Cord, dial: 20 lb; nylon; black ..
15K592073	Cover, housing (top & bottom) .....
13C592066	Escutcheon, dial: chrome plated....
32C591967	Gasket, speaker: rubber .....
14K590653	Insulator, armite .....
36K591949	Knob, control: tuning & volume .....
1k592062	Pointer & Slider Assembly .....
9B473111	Receptacle, fuse: complete .....
34B592149	Scale, dial: glass .....
3S7370	Screw, machine: 6-32 x 1/4; slotted binderhead; locking type; cad pl (escutcheon mtg) .....
3S7454	Screw, sheet metal: #8 x 1/4; PKZ; plain hex head; cad pl (cover, escutcheon bracket & spkr brkt to chassis mtg) .....
3S8176	Screw, sheet metal: #10 x 3/8 PKZ; plain hex head; cad pl (spkr mtg).
47A592070	Shaft, tuning .....
50B592106 or 50B592479	Speaker, PM: 5 x 7"; 3.2 ohm voice coil .....
1X592189	Speaker Plate & Gasket Assembly: less spkr .....
6A4141	Suppressor, distributor .....
29K5407	Terminal, insulated pin: white (spkr lead) .....
4B592098	Washer, 'C' (tuning shaft retainer)

GENERAL INFORMATION

TYPE - AC table model superheterodyne with self-contained electric clock for controlling automatically the operation of the radio.

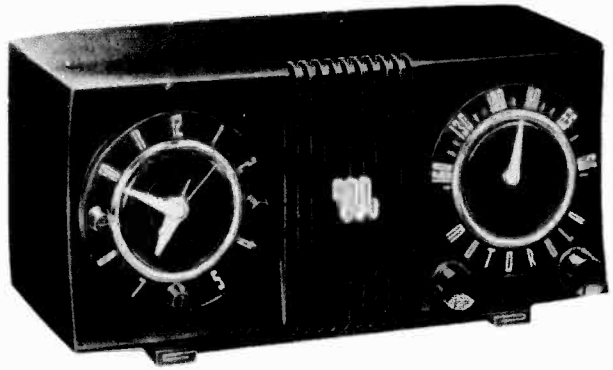
RECEIVER MODELS -

Model	Color	Chassis
5C1	Green	HS-228
5C2	Ivory	HS-258
5C3	Walnut	HS-262

TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

TUBE COMPLEMENT -

12BE6	Converter
12BA6	IF Amplifier
12AT6	Det, AVC & AF Amp
50C5	Power Amplifier
35W4	Rectifier



POWER SUPPLY - Operates from 117 volts, 60 cycle, alternating current only. Power consumption 37 watts.

CLOCK - Telechron self-starting electric clock (Telechron basic movement No. C-57, with Motorola face, hands, and escutcheon).

INSTALLATION & OPERATING INSTRUCTIONS

The locations and functions of the clock and radio controls are shown in Figure 1.

NORMAL RADIO OPERATION

Knob "A" on the clock turns the radio on or off. Select stations with the TUNING knob, and adjust volume with the VOLUME control.

A built-in loop antenna eliminates the need for an outside antenna in most locations. When receiving a weak station, rotate the receiver slightly for best signal strength. If additional pick-up is necessary, connect an external antenna to the radio by following the instructions printed on the rear panel. CAUTION: Never connect the radio chassis to a water pipe, radiator, or other ground.

CLOCK OPERATION

The clock will start as soon as the receiver is plugged into an electrical outlet. To set the hands to the correct time, rotate the TIME SET knob (on the rear of the radio) in a clockwise direction only.

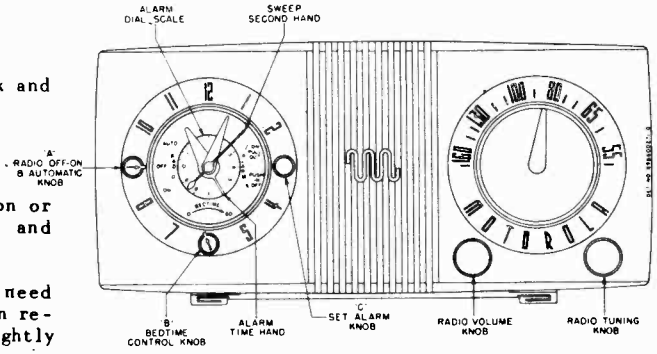


FIGURE 1. OPERATING CONTROLS

BEDTIME CONTROL

The BEDTIME control will turn the radio off after any pre-set interval of time up to one hour.

Turn knob "A" to the "OFF" position and rotate knob "B" to any period of time between 0 and 60 minutes. The radio will be turned off automatically after the proper time has elapsed, and it will remain off until turned on again manually.

AUTOMATIC RADIO OPERATION

The clock controls may be pre-set to turn the radio on automatically at any time up to twelve hours in advance.

Pull out knob "C", rotate it counterclockwise to the desired time on the alarm dial scale, and push the knob back in. Rotate knob "A" first to the "OFF" and then to the "AUTO" position. At the pre-set time, the radio will come on and will continue to play until turned off manually. The alarm will ring also if knob "C" is left pulled out. The radio will come on first and, after an interval of about ten minutes, the alarm will ring.

BEDTIME AND AUTOMATIC OPERATIONS COMBINED

By combining the operations in the two sections above, the radio may be turned off automatically and on again automatically.

When setting the BEDTIME control, rotate knob "A" to the "AUTO" position instead of "OFF". IMPORTANT: It is necessary to turn knob "A" first to the "OFF" position before proceeding to "AUTO", otherwise the radio may not shut off.

ALIGNMENT

NOTE: It is recommended that an isolation transformer be placed between the power line and the receiver to avoid hum and electrical shocks. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator output to a level which produces less than .40 volts (.05 watt) across the voice coil to avoid overloading the receiver.
7. See Figure 2 for adjustment locations and the following chart for procedure.

ALIGNMENT CHART

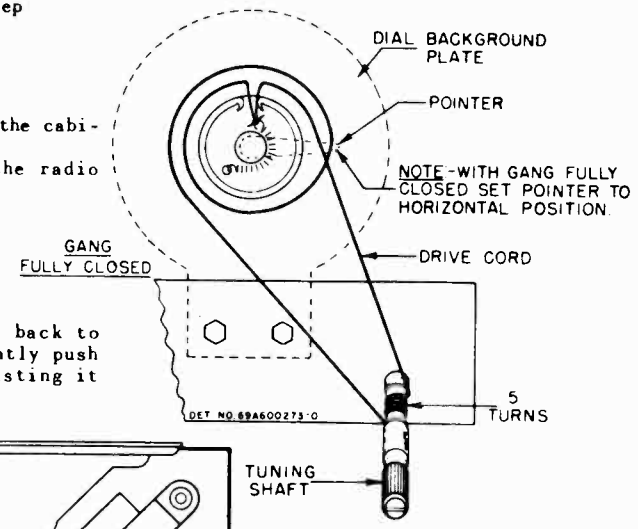
STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. (pin 7, 12BE6)	455 Kc	Fully open	1, 2, 3 & 4 (IF cores)	Adjust for maximum
RF ALIGNMENT						
2.	-	-	-	Fully closed	-	Set pointer to horizontal position
3.	-	Grid of conv. (pin 7, 12BE6)	1620 Kc	Fully open	5 (Osc)	Adjust for maximum
4.	-	Radiation loop*	1400 Kc	Tune for max	6 (Ant)	Adjust for maximum

*Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

ALARM OPERATION

To set the alarm, pull out knob "C" and rotate it in a counterclockwise direction to the desired time on the alarm dial scale. The alarm will ring for one hour, or until knob "C" is pushed in. The alarm function is completely independent of the other controls on the clock.

FIGURE 3. STRING DRIVE DETAIL



SERVICE NOTES

TO REMOVE RADIO CHASSIS FROM CABINET

1. Pull off the two radio control knobs.
2. Remove the split plugs which hold the loop to the cabinet.
3. From the back of the cabinet, remove the two hex head screws at the rear edge of the radio chassis.
4. Slide the radio chassis and loop from the cabinet.
5. Disconnect the two power leads to the radio chassis.

TO REMOVE CLOCK FROM CABINET

1. Remove radio chassis as above.
2. Remove the three nuts and lockwashers holding the shield behind the clock.
3. Slide the shield from the cabinet.
4. Turn the BEDTIME control knob to "60".
5. Pull out the ALARM set knob.
6. Turn the RADIO control knob to "AUTO".
7. While observing the clock from the back to avoid bending or breaking any parts, gently push the clock forward, at the same time twisting it slightly to eliminate binding.

TO REPLACE CLOCK DIAL FACE

1. Remove the clock from the cabinet as above.
2. Pull off the RADIO control and BEDTIME knobs.
3. Turn the ALARM set knob clockwise to remove.
4. Remove the escutcheon and crystal.
5. Carefully pull off the three hands.
6. Remove the alarm dial and the clock face.
7. Turn the radio control shaft to "AUTO" position.
8. Slowly rotate the time set shaft clockwise until the switch contacts behind the radio control shaft close.
9. Reassemble the clock face, alarm dial and three hands. Set all the hands to indicate 12 o'clock. Set Figure 12 on the alarm dial to index with the small pointer on the hour hand.
10. Replace the crystal, the escutcheon, and the knobs.
11. Check the automatic operation to be sure the switch contacts close at the time indicated on the alarm dial.

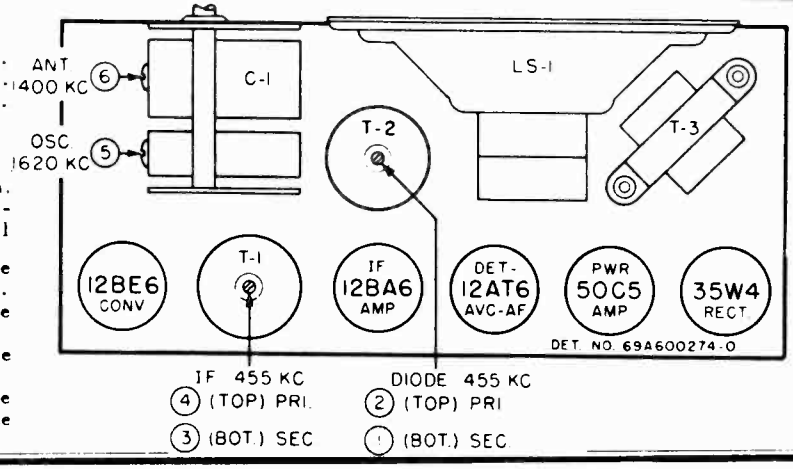


FIGURE 2. TUBE & TRIMMER LOCATIONS

MODELS 5C1, Ch. HS-228; 5C2, Ch. HS-258; 533, Ch. HS-262

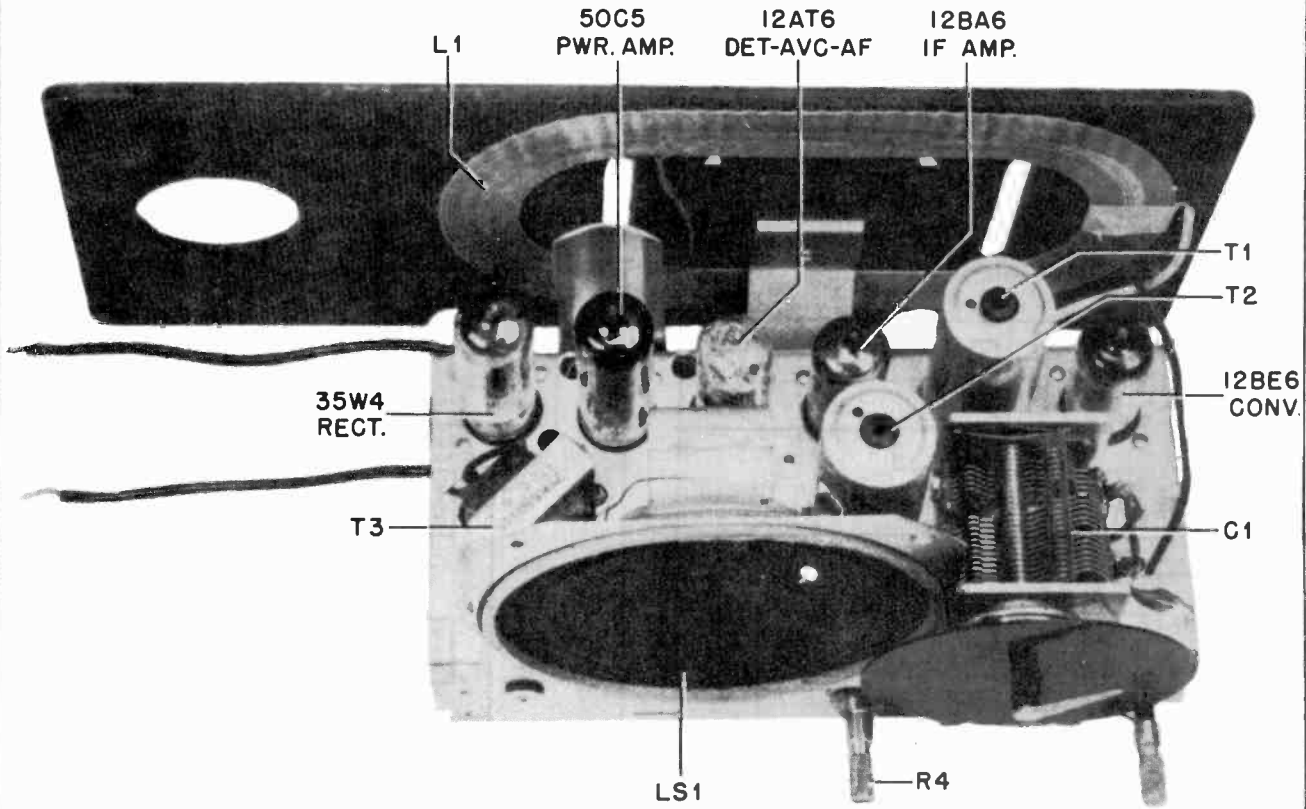


FIGURE 4. TOP VIEW OF CHASSIS

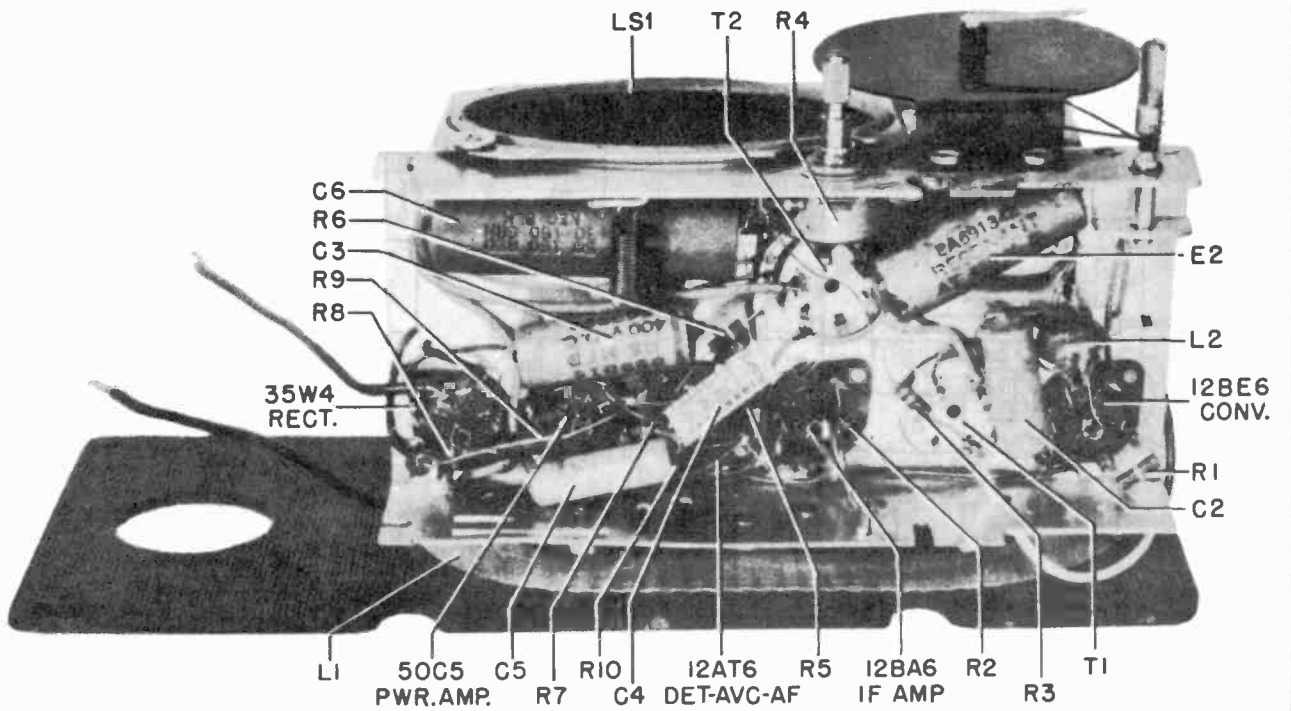


FIGURE 5. BOTTOM VIEW OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR PLATE

MODELS 5C1, Ch. HS-228; 5C2, Ch. HS-258; 533, Ch. HS-262

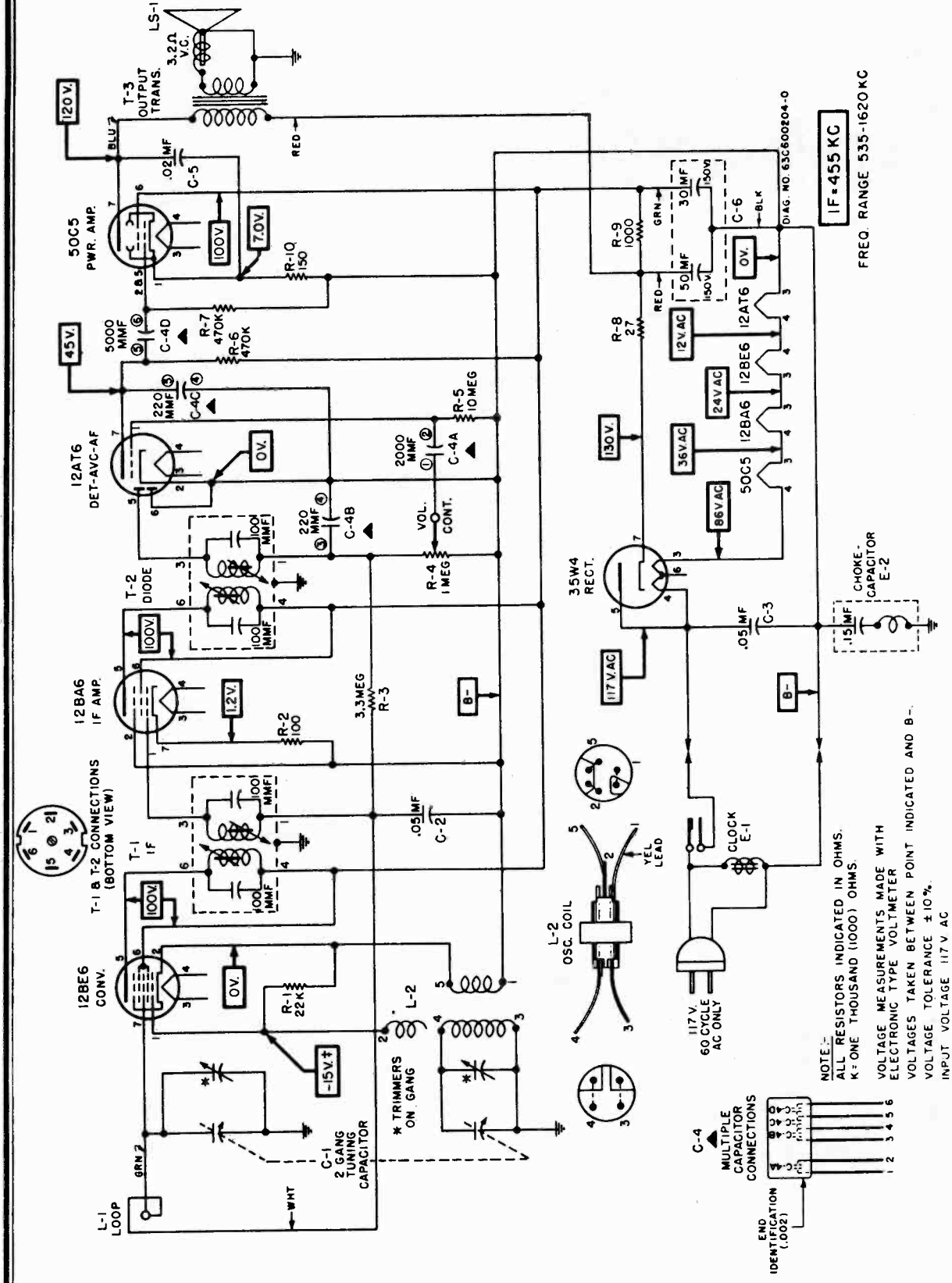
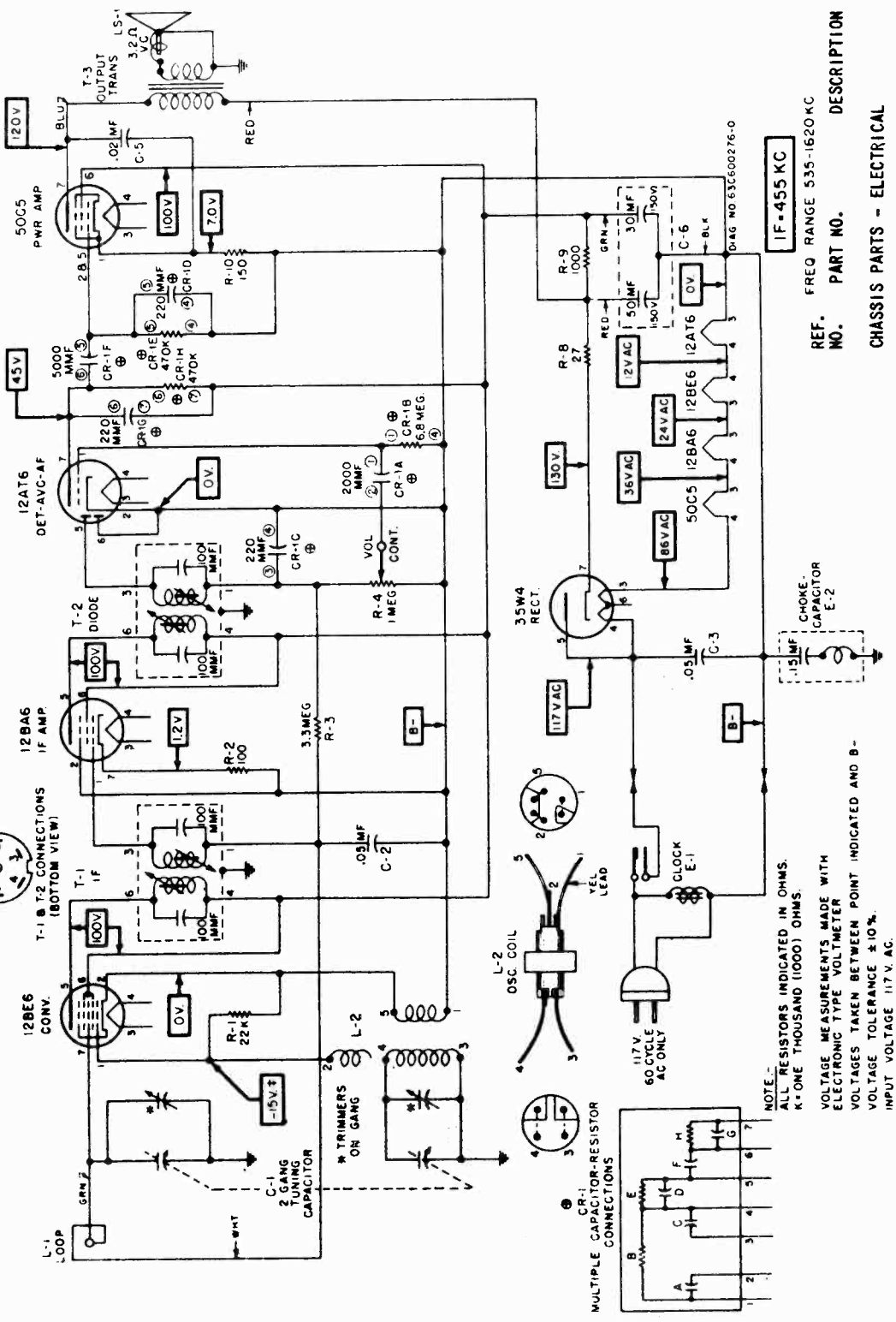


FIGURE 6. SCHEMATIC DIAGRAM OF CHASSIS HS-228, HS-258 & HS-262 USING MULTIPLE CERAMIC CAPACITOR PLATE

MODELS 5C1, Ch. HS-228; 5C2, Ch. HS-258; 533, Ch. HS-262

FIGURE 7. SCHEMATIC DIAGRAM OF CHASSIS HS-228, HS-258 & HS-262 USING MULTIPLE CERAMIC CAPACITOR-RESISTOR PLATE



NOTE:- ALL RESISTORS INDICATED IN OHMS. K = ONE THOUSAND (1000) OHMS.

VOLTAGE MEASUREMENTS MADE WITH ELECTRONIC TYPE VOLTMETER

VOLTAGES TAKEN BETWEEN POINT INDICATED AND B-

VOLTAGE TOLERANCE ±10%.

INPUT VOLTAGE 117 V. AC.

NO SIGNAL INPUT.

‡ MEASUREMENT MADE WITH GANG FULLY OPEN

REPLACEMENT PARTS LIST

IF-455 KC FREQ RANGE 535-1620 KC DIAG NO 63C600276-0

REF. NO.	PART NO.	DESCRIPTION
		CHASSIS PARTS - ELECTRICAL
		CAPACITORS
C-1	19B600021	Variable: 2 gang; with pulley...
C-2	8R9821	Paper: .05 mf 200V .....
C-3	8R9816	Paper: .05 mf 400V .....
C-4	21B482847	Ceramic, multiple: 2000 mmf, 220 mmf, 220 mmf, 5000 mmf .....
C-5	8R9802	Paper: .02 mf 400V .....
C-6	23B600855	Electrolytic: 50-30 mf/150V ...

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

PART NUMBER		DESCRIPTION
CAPACITOR-RESISTOR		
CR-1	21B601007	Capacitor-Resistor: 2000, 220, 220, 5000, 220 mmf; 6.8 meg; 470,000, 470,000 ohms .....
CLOCK		
E-1	59C600007	Electric Clock Assembly: Telechron movement No. C-57, with Motorola face, hands, crystal, escutcheon and knobs (for green cabinet)(5C1) .....
	59K600198	Same as above except color (for ivory cabinet)(5C2) .....
	59K600788	Same as above except color (for walnut cabinet)(5C3) .....
CHOKE & CAPACITOR		
E-2	8A690487	Choke & .15 mf paper capacitor..
COILS		
L-1	24C600029	Antenna Loop and Panel Assembly.
L-2	24B680364	Oscillator coil .....
SPEAKER		
LS-1	50C600017 or 50C600857	Speaker: 4" PM; 3.2 ohm VC .
RESISTORS		Note: All resistors are insulated carbon type unless otherwise specified
R-1	6R6028	22,000 20% ½W .....
R-2	6R6018	100 20% ½W .....
R-3	6R2118	3.3 meg 20% ½W .....
R-4	18A600018	Volume control: 1 meg .....
R-5	6R2109	10 meg 20% ½W .....
R-6	6R6032	470,000 20% ½W .....
R-7	6R6032	470,000 20% ½W .....
R-8	6R5683	27 10% ½W .....
R-9	6R3953	1000 20% 1W .....
R-10	6R3992	150 20% ½W .....
TRANSFORMERS		
T-1	24B482863	IF Transformer (brown dot): 455 Kc: complete with capacitor and cores; less shield .....
T-2	24B482865	Diode Transformer (red dot): 455 Kc: complete with capacitors and cores; less shield .....
T-3	25K680345	Output Transformer .....

CHASSIS PARTS - MECHANICAL

7A478118	Bracket, loop mtg .....
7A77337	Bracket, tuning shaft .....
42B482867	Clip, spring: blued finish (holds IF transformers) .....
11M8944	Cord, dial: 18 lb; black .....
5A484268	Grommet, speaker mtg: rubber .....
14A478119	Insulator, loop brkt mtg: fibre...
4S7691	Lockwasher, internal: 3/8; cad pl (vol control mtg) .....
2A780465	Nut, knurled (vol control mtg).....
64A600025	Plate, dial background: green (HS-228)
64K600193	Plate, dial background: ivory (HS-258)
64K600779	Plate, dial background: walnut (HS-262)
52A600027	Pointer, dial: light green color (HS-228 & HS-262) .....
52K600194	Pointer, dial: dark green color (HS-258)
5S7771	Rivet: .088 x 3/16 stl; nkl pl (tube socket mtg) .....
5S7707	Rivet: .122 x 5/32 stl; nkl pl (output trans mtg) .....
5S7701	Rivet: .122 x 3/16 stl; nkl pl (tuning shaft brkt mtg) .....
5S7703	Rivet: .122 x 7/32 stl; nkl pl (loop bracket & spkr mtg) .....
3S7247	Screw, machine: 6-32 x 3/16 slotted locking hex head; cad pl (gang mtg) .....
3S7506	Screw, sheet metal: #6 x 1/4 PKZ plain hex head; cad pl (dial background plate mtg) .....
3S7467	Screw, sheet metal: #8 x 3/8 PKZ plain hex head; cad pl (loop mtg).....
47A600022	Shaft, tuning .....
26K485936	Shield, coil (for IF transformers)
26A478117	Shield, electrostatic (on rear of chassis) .....
43A600095	Sleeve, paper: black (on pointer shaft)(HS-228, HS-262) .....
43K600195	Sleeve, paper: ivory (on pointer shaft)(HS-258) .....
9A472534	Socket, tube: miniature; 7-prong .
41A73996	Spring, tension (electrolytic mtg).
41A73619	Spring, tension (gang drive cord).
4A70015	Washer, 'C' (tuning shaft mtg)..
4S7633	Washer, flat: 9/16 x 11/64 x .033 stl; cad pl (loop mtg) .....
14A11493	Washer, shoulder: fibre (loop bracket mtg) .....

CABINET PARTS

16E600005	Cabinet, table model: plastic; green (5C1) .....
16K600199	Cabinet, table model: plastic; ivory (5C2) .....
16K600791	Cabinet, table model: plastic; walnut (5C3) .....
28A600064	Connector, wire (connects clock & radio power leads) .....
61A600001	Crystal; plastic (cover over radio dial)
13K600003	Escutcheon, radio dial: green (5C1)...
13K600197	Escutcheon, radio dial: ivory (5C2)...
13K600790	Escutcheon, radio dial: walnut (5C3)..
14A16304	Grommet, fibre (on clock shield).....
36A600065	Knob, radio control: green plastic(5C1)
36K600192	Knob, radio control: ivory plastic(5C2)
36K600787	Knob, radio control: walnut plastic(5C3)
4S7667	Lockwasher: #4 ext: cad pl (clock shield mtg) .....
13A792195	Medallion: brass (on front of speaker grille) .....
2S7019	Nut, hex: 4-40 x 1/4 stl; cad pl (clock shield mtg) .....
38A25507	Plug, split (mounts loop to cabinet) .....
3S476083	Screw, machine: 6-32 x 5/16 slotted locking hex head; cad pl (radio chassis mtg) .....
1X600799	Shield, clock: with grommet (covers rear of clock) .....
2S490840	Speednut: for 1/16" stud (medallion mtg) .....
11M488253	Tape, aluminum foil (inside top of cabinet) .....

CLOCK PARTS

Note: The following Motorola parts are for use with the basic Telechron clock movement No. C-57.

34K600993	Alarm Dial: green color (5C1) .....
34K600994	Alarm Dial: ivory color (5C2) .....
34K600995	Alarm Dial: walnut color (5C3) .....
30K680352	Cord, line: with plug; 6 ft long .....
61A600001	Crystal: plastic (cover over face of clock) .....
34K600990	Dial Face: green color (5C1) .....
34K600991	Dial Face: ivory color (5C2) .....
34K600992	Dial Face: walnut color (5C3) .....
13C600002	Escutcheon, clock: green color(5C1) ..
13K600196	Escutcheon, clock: ivory color (5C2) .
13K600789	Escutcheon, clock: walnut color (5C3).
52K600996	Hand, hour: light green color (5C1 & 5C3) .....
52K600997	Hand, hour: dark green color (5C2)....
52K600998	Hand, minute: light green color (5C1 & 5C3) .....
52K600999	Hand, minute: dark green color (5C2)..
52K601001	Hand, second: brass .....
36K600987	Knob, clock control: plain; green (5C1)
36K600988	Knob, clock control: plain; ivory (5C2)
36K600989	Knob, clock control: plain; walnut(5C3)
36K600984	Knob, clock control: with arrow; green (5C1) .....
36K600985	Knob, clock control: with arrow; ivory (5C2) .....
36K600986	Knob, clock control: with arrow; walnut (5C3) .....
36K601002	Knob, time set .....

GENERAL INFORMATION

TYPE - AC-DC table model superheterodyne receiver with loop antenna.

RECEIVER MODELS -

Model	Color
5H11U	Walnut
5H12U	Ivory
5H13U	Green

TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

TUBE COMPLEMENT - 12BE6 - Converter
12BA6 - IF Amplifier
12AT6 - Det, AVC & 1st AF Amp
50C5 - Power Amplifier
35W4 - Rectifier

POWER SUPPLY - 117 volts AC or DC, 35 watts

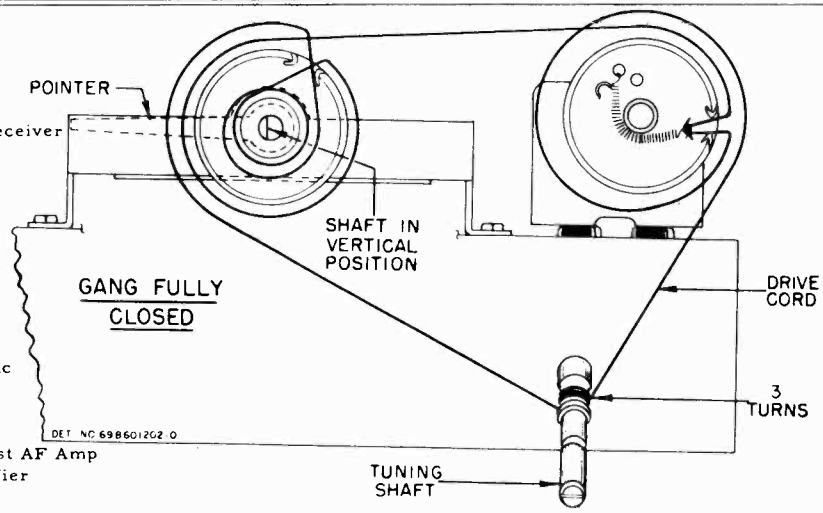
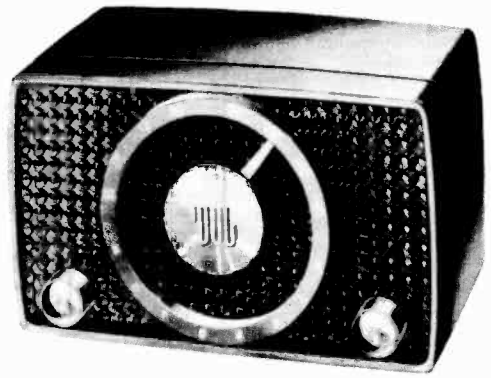


FIGURE 1. STRING DRIVE DETAIL



INSTALLATION & OPERATING INSTRUCTIONS

POWER SWITCH AND VOLUME CONTROL. Operated with the left-hand knob. NOTE: Reverse the line cord plug in the wall outlet if radio does not operate from DC. When operating from AC, reversing the line cord plug in the wall outlet may sometimes improve reception

TUNING. Tune stations with the right-hand knob.

ANTENNA. A built-in loop antenna eliminates the need for an outside antenna in most locations. When receiving a weak station, rotate the receiver slightly for best signal strength. If additional pick-up is necessary, connect an external antenna to the radio by following the instructions printed on the rear panel. CAUTION: Never connect the radio chassis to a water pipe, radiator, or other ground.

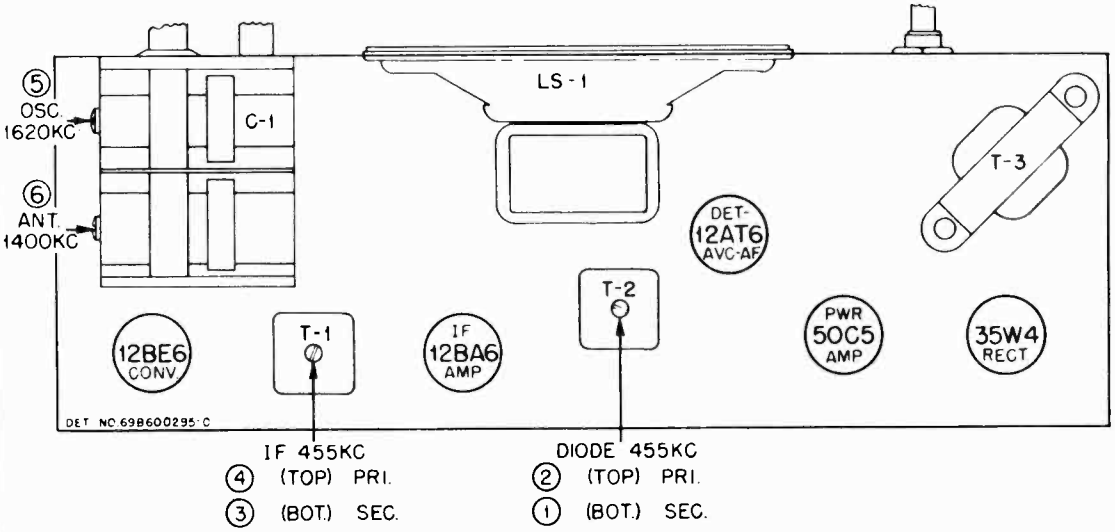


FIGURE 2. TUBE & TRIMMER LOCATIONS

SERVICE NOTES

The chassis of this receiver is isolated from the AC power line circuit by a capacitor to eliminate the shock hazard when handling the receiver. However, as an additional precaution when aligning or servicing the receiver from AC, an isolation transformer should be inserted between the power line and the chassis.

To remove the chassis from the cabinet:

1. Pull off the two radio control knobs.
2. Pull off the brass cover over the pointer.
3. Pull off the pointer.
4. Remove the split plugs which hold the loop to the cabinet.
5. From the back of the cabinet, remove the two hex head screws at the rear edge of the radio chassis.
6. Slide the radio chassis and loop from the cabinet.

MODELS 5H11U, 5H12U,
5H13U, Ch. HS-244

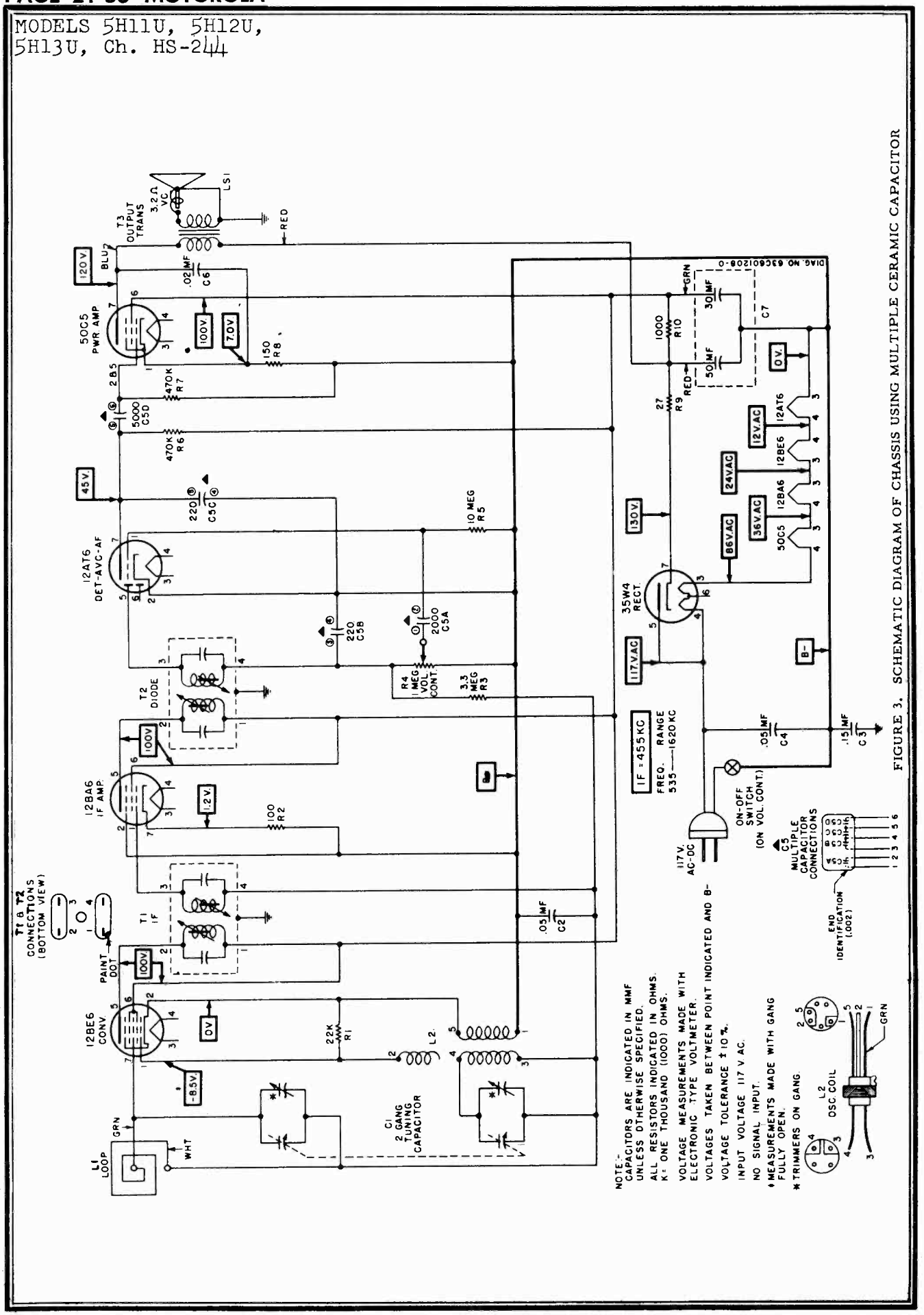


FIGURE 3. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR

MODELS 5H11U, 5H12U,
5H13U, Ch. HS-244

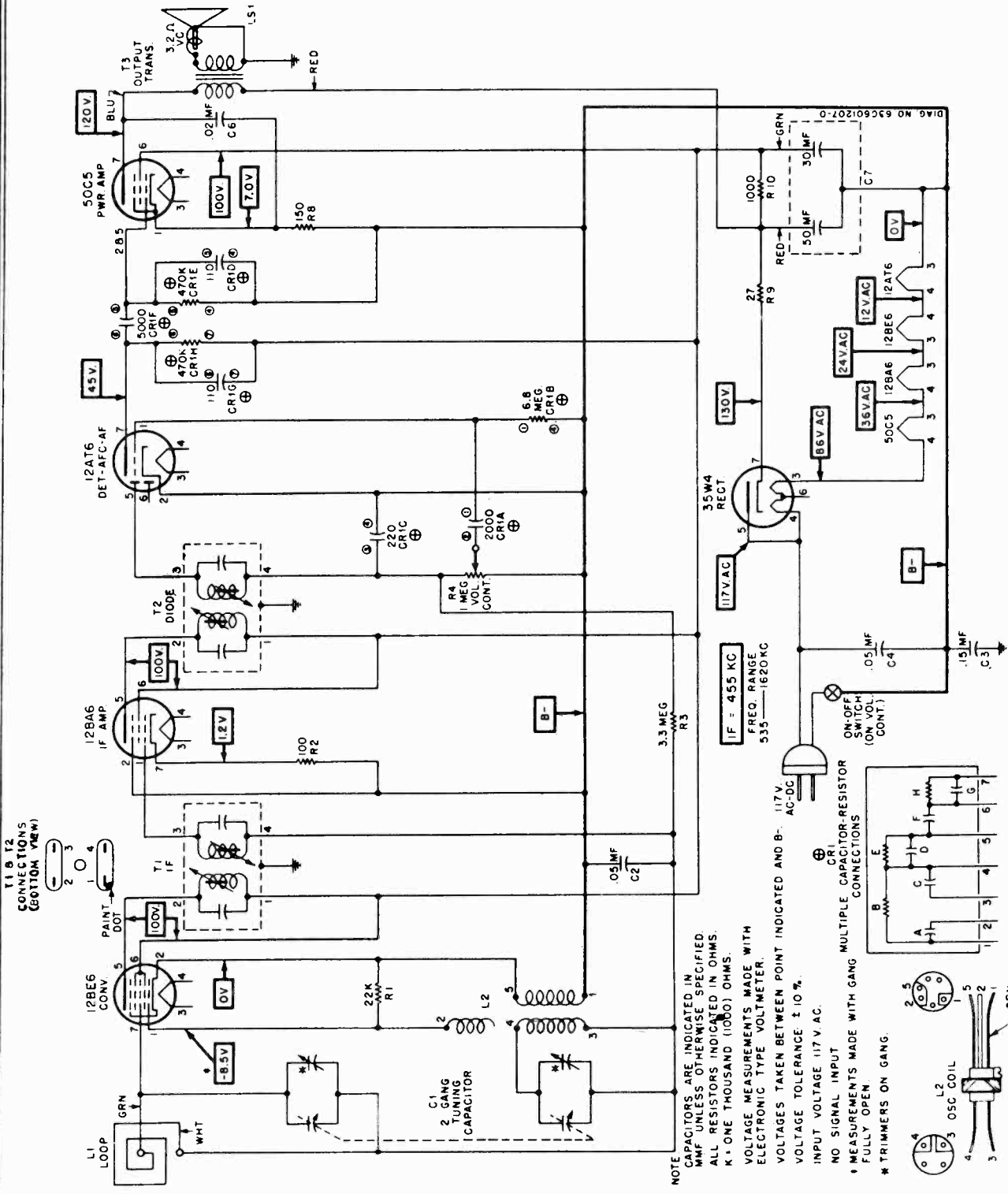


FIGURE 4. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR-RESISTOR

ALIGNMENT

NOTE: It is recommended that an isolation transformer be placed between the power line and the receiver to avoid hum and electrical shocks. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator output to a level which produces less than .40 volts (.05 watt) across the voice coil to avoid overloading the receiver.
7. See Figure 2 for adjustment locations and the following chart for procedure.

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. (pin 7, 12BE6)	455 Kc	Fully open	1, 2, 3 & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	-	Grid of conv. (pin 7, 12BE6)	1620 Kc	Fully open	5 (Osc)	Adjust for maximum.
3.	-	Radiation loop*	1400 Kc	Tune for max	6 (Ant)	Adjust for maximum.

*Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

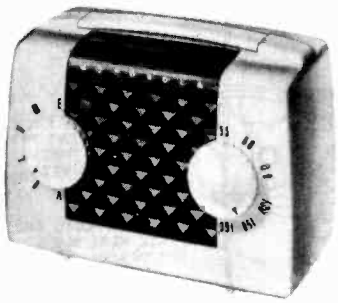
REPLACEMENT PARTS LIST

NOTE: When ordering parts specify model number of set in addition to part number and description of part.

Ref. No.	Part Number	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	19B600483	Variable, 2 gang: with pulley .....
C-2	8R9821	Paper: .05 mf 200V .....
C-3	8R9816	Paper: .05 mf 400V .....
C-4	8R9843	Paper: .15 mf 200V .....
C-5	21B482847	Ceramic, multiple: 2000,220,220, 5000 mmf .....
C-6	8R9802	Paper: .02 mf 400V .....
C-7	23B600855	Electrolytic: 50-30 mf/150V .....
Capacitor-Resistor		
CR-1	21B601007	2000,110,110,5000 mmf; 6.8 meg; 470,000, 470,000 ohms .....
Coils		
L-1	24C600518	Loop Antenna Assembly: includes back panel .....
L-2	24K600812	BC Oscillator .....
Speaker		
LS-1	50C691401	Speaker, PM: 4"; 3.2 ohm VC ...
Resistors		
		Note: All resistors are insulated carbon type unless otherwise specified.
R-1	6R6028	22,000 20% 1/2W .....
R-2	6R6018	100 20% 1/2W .....
R-3	6R2118	3.3 meg 20% 1/2W .....
R-4	18K600473	Volume control: 1 meg; includes on-off switch .....
R-5	6R2109	10 meg 20% 1/2W .....
R-6	6R6032	470,000 20% 1/2W .....
R-7	6R6032	470,000 20% 1/2W .....
R-8	6R3992	150 20% 1/2W .....
R-9	6R5683	27 10% 1/2W .....
R-10	6R3953	1000 20% 1W .....
Transformers		
T-1,2	24B485553	IF and Diode, 455 Kc: complete; including padding capacitors and tuning cores .....
T-3	25K485973	Output .....

Part Number	Description
CHASSIS PARTS - MECHANICAL	
7K485971	Bracket, loop back mtg .....
7A600476	Bracket, tuning shaft mtg .....
1X600606	Bracket and Bushing Assembly, pointer
42A485548	Clip, coil can mtg .....
11M8944	Cord, dial: 18 lb black .....
30A470651	Cord, line and plug: 6 ft long .....
5A19658	Eyelet, spacer (gang mtg) .....
5A70404	Grommet, rubber (gang mtg) .....
14A482844	Insulator, cord outlet .....
29R3010	Lug, soldering .....
2S7051	Nut, hex: Palnut (volume control mtg)
1X600590	Pulley and Bushing Assembly, pointer drive
5S7771	Rivet: .088 x 3/16 stl; nkl pl (tube socket mtg) .....
5S7707	Rivet: .122 x 5/32 stl; nkl pl (tube shield mtg, output transformer mtg and tuning shaft bracket mtg) ....
3S2294	Screw, machine: 6-32 x 1/2; lockscrew; plain hex head; stl; cad pl (gang mtg) .....
3S7477	Screw, machine: 8-32 x 1/4; type #1; plain hex head; stl; cad pl (back mtg) .....
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; stl; cad pl (pointer bracket mtg) .....
3S3398	Screw, sheet metal: #6 x 3/8 PKZ plain hex head; stl; cad pl (loop bracket mtg) .....
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; stl; cad pl (speaker mtg)
3S7148	Setscrew: 6-32 x 1/8; Allen head; stl; cad pl (pointer drive pulley retainer).
47K600598	Shaft, pointer: brass .....
1K600594	Shaft and Pulley Assembly, tuning ....
26A481521	Shield, spring (for 12BA6 tube) .....
9A472534	Socket, tube: 7-prong .....
9K580218	Socket, tube: 8-prong .....
41A73996	Spring, tension (electrolytic mtg) ...
41A14244	Spring, tension (drive cord) .....
4K692188	Washer, "C" (tuning shaft retainer and pointer shaft retainer) .....
4S7633	Washer, flat: 9/16 x 11/64 x .033 thick; stl; cad pl (loop back mtg) .....
4K482859	Washer, insulated shoulder .....
CABINET PARTS	
16E600461	Cabinet, table model: walnut (5H11U) .
16K600463	Cabinet, table model: ivory (5H12U) ..
16K600465	Cabinet, table model: green (5H13U) ..
15B600569	Cover, pointer .....
36B600566	Knob, control: walnut (5H11U) .....
36K600567	Knob, control: ivory (5H12U) .....
36K600568	Knob, control: green (5H13U) .....
38A25507	Plug, split (back mtg) .....
52B600537	Pointer, dial .....
3S3371	Screw, sheet metal: #8 x 3/8 PKF plain hex head; stl; cad pl (chassis mtg) ...

MODELS 5J1, 5L1, Ch. HS-250; 5J1U, 5L1U, Ch. HS-224



5L1 SERIES

5J1 SERIES

GENERAL INFORMATION

TYPE - A three-power (AC/DC, Battery) portable receiver. Four miniature type tubes and a selenium rectifier are used in a superheterodyne circuit.

MODEL	COLOR	CHASSIS
5L1	Tan	HS-250
5L1U	Tan	HS-224
5J1	Black	HS-250
5J1U	Black	HS-224

TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

TUBE COMPLEMENT - 1R5 - Converter
1U4 - IF Amplifier
1U5 - Det, AVC & 1st AF Amp
3S4 - Power Amplifier
Rectifier - Selenium type (for AC/DC operation)

POWER SUPPLY - Operates from 117V AC/DC (15 watts) or from the following batteries:

2 - 1½V flashlight cells (Eveready #950 or equivalent)

1 - 67½V "B" battery (Eveready #467 or equivalent)

OPERATING INSTRUCTIONS

TO OPEN FRONT COVER (5J1 & 5J1U ONLY). The front covers of the models 5J1 and 5J1U contain the loop antenna. They may be opened simply by lifting them upward with the fingers. A special hinge holds the covers in either the closed, half-opened, or fully open position.

VOLUME CONTROL & OFF-ON SWITCH. The "off-on" switch and volume control are combined and are operated with the left-hand knob.

TUNING CONTROL. Stations are tuned in with the right-hand knob.

TO TURN OFF. Turn the receiver "off" by rotating the volume knob to the left until a click is heard.

TO OPEN BACK COVER. The back cover may be opened by inserting the fingertips into the slots in the cover and pulling it open. When closing the cover be careful not to pinch the power line cord or other leads between the cover and the cabinet.

117 VOLT AC OR DC OPERATION. The power cord is located inside the cabinet and may be reached by opening the back cover. Pass the line cord through the slot on the side of the receiver, and plug it into any 117 volt AC or DC power outlet. If the receiver does not operate from DC power, reverse the plug in the power outlet. When operating from AC power, reception may sometimes be improved by reversing the power plug in the outlet. It is not necessary that batteries be installed if the receiver is to be operated only from house power lines.

BATTERY OPERATION. Open the back cover and install the batteries, following the instructions on the label inside the back cover (or see Figure 1). Insert the line cord plug into the receptacle on the chassis, or the receiver will not play from batteries. If the receiver is to be operated for a long period of time from 117 volts AC or DC, or is to be placed in storage, remove the batteries and store in a cool place. IMPORTANT: Never leave low or run-down batteries in the receiver, as they will leak or swell and damage it.

ANTENNA. A loop antenna is built into the front cover of models 5J1 and 5J1U and into the rear cover of models 5L1 and 5L1U. Because of the slightly directional characteristics of the loop antenna, reception from some stations may be improved by rotating the entire receiver. In extremely noisy locations, rotate the receiver until minimum noise and maximum signal pickup are obtained.

BATTERY REPLACEMENT. If low volume or fuzzy tone is noticed when operating from batteries, replace the flashlight cells. Normally, the 67½V "B" battery will last for 3 or 4 changes of the flashlight cells. The condition of the batteries will not affect the operation of the receiver from 117 volts AC or DC. Complete battery replacement instructions will be found inside the cabinet back cover (or see Figure 1).

MODELS 5J1, 5L1,
Ch. HS-250: 5J1U.
5L1U, Ch. HS-224

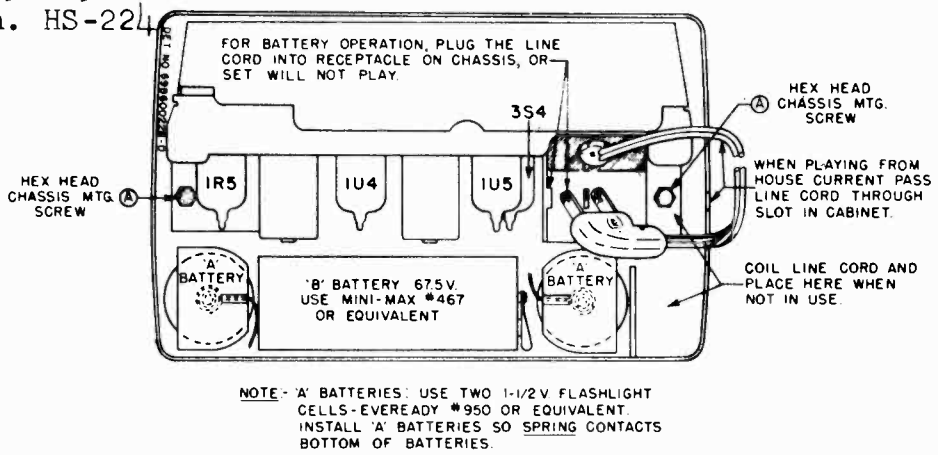


FIGURE 1. BATTERY INSTALLATION & CHASSIS REMOVAL INSTRUCTIONS

ALIGNMENT

NOTE: The receiver may be operated either from a battery or from the commercial power lines during alignment. If AC power is used, it is recommended that an isolation transformer be placed between the power line and the receiver. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator input to keep the output of the receiver at approximately .05 watt (.05 watt = .40 volts on the output meter) to avoid overloading the receiver.
7. See Figure 2 for adjustment locations and the following chart for procedure.

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. (pin 6, 1R5)*	455 Kc	Fully open	1, 2 & 3	Adjust for maximum.
RF ALIGNMENT						
2.	-	Grid of conv. (pin 6, 1R5)*	1620 Kc	Fully open	4	Adjust for maximum.
3.	-	-	-	-	-	Install chassis in cabinet, leaving output meter connected to speaker. NOTE: Batteries should be in cabinet.
4.	-	Radiation loop**	1400 Kc	Tune for maximum	5	Adjust for maximum. Trimmer is reached through hole under plug button on side of cabinet.

*On chassis HS-250 return the grid of the converter tube to AVC either through the loop or through a 4.7 meg resistor (as in chassis HS-224).

**Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

MODELS 5J1, 5L1, Ch. HS-250; 5J1U, 5L1U, Ch. HS-224

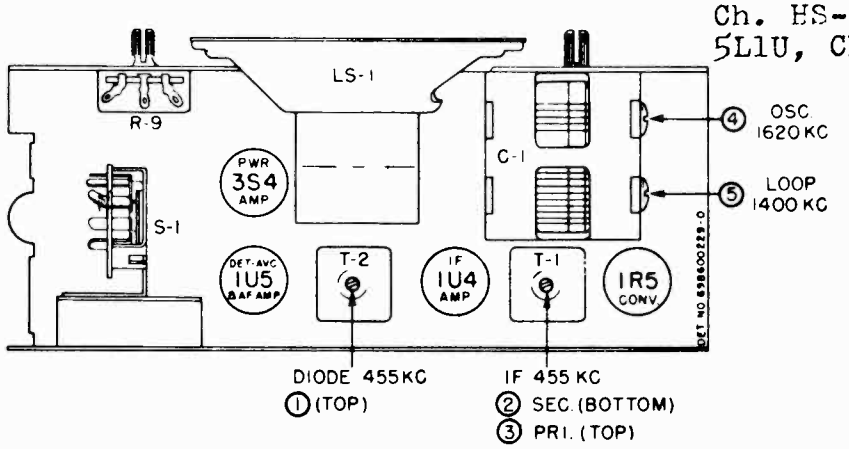


FIGURE 2. TUBE & TRIMMER LOCATIONS

SERVICE NOTES

The chassis of this receiver is isolated from the AC power line circuit by a capacitor-choke assembly to eliminate the shock hazard when handling the receiver. However, as an additional precaution when aligning or servicing the receiver from AC, an isolation transformer should be inserted between the power line and the chassis.

The tubes are exposed when the rear cover is opened. It is not necessary to remove the chassis to replace tubes.

To remove the chassis from the cabinet:

1. Pull off the two control knobs on the front of the cabinet.
2. Open the rear cover and remove the batteries.
3. Disconnect the two loop antenna leads from the chassis.
4. Remove the two hex head screws holding the chassis to the cabinet ("A" - "A" in Figure 1).
5. Slide the chassis out of the cabinet.

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - ELECTRICAL		
CAPACITORS		
C-1	19K692008	Variable, 2-gang .....
C-2	21K481377	Ceramic: 500 mmf 500V .....
C-3	21K482726	Ceramic, disc type: 10,000 mmf 450V .....
C-4	21K482726	Ceramic, disc type: 10,000 mmf 450V .....
C-5	21K77373	Ceramic: 47 mmf 500V .....
C-6	8K71213	Paper: .05 mf 100V .....
C-7	8K71213	Paper: .05 mf 100V .....
C-8	8K471635	Paper: .05 mf 400V .....
C-9	23B691995	Electrolytic: 40-40 mf 150V/ 250 mf 10V .....
C-10A, B,C,D	21K691992	Ceramic, multiple: 2000 mmf, 100 mmf, 100 mmf, 5000 mmf .....
C-11	21K482726	Ceramic, disc type: 10,000 mmf 450V .....
C-12	21A470789	Ceramic, disc type: 5000 mmf 450V
CHOKE & CAPACITOR		
E-2	24K691986	Choke & .05 mf 200V paper capacitor .....
RECTIFIER		
E-1	48B791092	Selenium rectifier: half-wave...
COILS		
L-1	1X692056	Antenna Loop & Leads Assembly (5L1 & 5L1U) .....
	1X692139	Antenna Loop & Front Cover Assembly: complete; black plastic (5J1 & 5J1U).....
	1X692141	Antenna Loop, Panel & Hinge Assembly: less front coverr black plastic(5J1 & 5J1U).....
	24B691936	Antenna Loop & Panel Assembly: less hinges; black plastic (5J1 & 5J1U) .....
L-2	24B691987	Oscillator coil (red code) (HS-224 only) .....
	24K600154	Oscillator coil (white code) (HS-250 only) .....

REF. NO.	PART NO.	DESCRIPTION
SPEAKER		
LS-1	50B692037	Speaker: 3½" PM; 3.2 ohm VC.
or	50B692038	Speaker: 3½" PM; 3.2 ohm VC.
RESISTORS		
	Note:	All resistors are insulated, carbon type unless otherwise specified.
R-1	6R2122	4.7 meg 20% ½W .....
R-2	6R6031	100,000 10% ½W .....
R-3	6R6397	22,000 10% ½W .....
R-4	6R2109	10 meg 20% ½W .....
R-5	6R5683	27 10% ½W .....
R-6	6R2118	3.3 meg 20% ½W .....
R-7	17K692009	Wire wound: 2150 5% 10W; tapped
R-8	6R5581	3300 10% ½W .....
R-9	18A692018	Volume control: 1 meg; with on-off switch .....
R-10	6R5554	390 10% ½W .....
R-11	6R2109	10 meg 20% ½W .....
R-12	6R6004	1 meg 20% ½W .....
R-13	6R2122	4.7 meg 20% ½W .....
R-14	6R2118	3.3 meg 20% ½W .....
R-15	6R6432	270 10% ½W .....
R-16	6R6040	680 10% ½W .....
R-17	6R6269	820 10% ½W .....
R-18	6R6015	220,000 20% ½W .....
SWITCHES		
S-1	40B471927	Rotary switch, 5PDT (AC/DC, battery selector)(HS-224 only) .....
	40K600156	Rotary switch, 4PDT (AC/DC, battery selector)(HS-250 only).
S-2		On-off switch (on volume control)
TRANSFORMERS		
T-1	24B692014	IF Transformer, 455 Kc: complete with capacitors, less shield...
T-2	24B692015	Diode Transformer, 455 Kc: complete with capacitors, less shield .....
T-3	25K692006	Output Transformer .....

MODELS 5J1, 5L1, Ch. HS-250; 5J1U, 5L1U, Ch. HS-224

PART NUMBER	DESCRIPTION
CHASSIS PARTS - MECHANICAL	
43A692012	Bushing, strain relief: line cord (use with 43K692013)
42K75826	Clip, electrolytic mtg
42A485548	Clip, IF coil mtg
30B691994	Cord, line: with plug; 6 ft long (HS-224 only)
30K600125	Cord, line: with plug; 6 ft long (HS-250 only)
4S7650	Lockwasher, internal: #6; cad pl.
29R5294	Lug, soldering (holds battery leads)
29R5239	Lug, soldering: #8 hole (holds line cord)(HS-224 only)
29R3020	Lug, soldering: battery contact (in 'A' battery retainer)
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (R-7 & selenium rect mtg)
2S7051	Nut, hex: palnut; 3/8-32 x 9/16; pl (vol control mtg)
9A691988	Receptacle, 2-pin (ant lead recep)
15B481896	Retainer, 'A' battery; plastic
43K692013	Retainer, strain relief (on line cord bushing)(use with 43A692012)
5S7771	Rivet: .088 x 3/16 stl; nkl pl (tube socket mtg)
5S7706	Rivet: .122 x 1/8 stl; nkl pl (term strip & switch mtg)
5S7791	Rivet: .122 x 3/8 stl; nkl pl (ant receptacle mtg)
3S490828	Screw, machine: 6-32 x 3/16 plain hex head lockscrew; cad pl (gang mtg)
3S7363	Screw, machine: 6-32 x 1" slotted binder head; cad pl (selenium rect mtg)
3S1451	Screw, machine: 6-32 x 2" slotted round head; cad pl (R-7 mtg)
3S7205	Screw, machine: 8-32 x 1/4 slotted hex head lockscrew; cad pl (spkr mtg)
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (bottom shield mtg)
3S7462	Screw, thread-cutting: 6-32 x 3/16 plain hex head; cad pl (S-1 mtg)
26K600155	Shield, back: aluminum (on rear of chassis)(HS-250 only)
26C691983	Shield, bottom: black (over chassis bottom)(HS-224 only)
26A692005	Shield, heat (around R-7)
26K691997	Shield, switch: cad pl (over AC/DC, Batt. switch)
9A690129	Socket, tube: miniature; 7-prong
41K680029	Spring, battery contact (in 'A' battery retainer)
31K691985	Strip, 'B' battery terminal: with leads
31K37504	Strip, terminal: 1 insulated lug; #1 mtg; 3/8" spacing
31K470746	Strip, terminal: 3 insulated lugs; #2 mtg; 3/8" spacing
4K470939	Washer, fibre (ant receptacle mtg)
4K470939	Washer, fibre (R-7 mtg)
CABINET PARTS (5L1 & 5L1U)	
7B600059	Bracket, chassis support: cad pl (on sides of chassis)
38K692051	Button, plug: tan
16E691902	Cabinet & Grille Assembly, front section; complete, less carrying handle; tan plastic
16K691903	Cabinet, front section: less grille & carrying handle; tan plastic
16D691905	Cover, cabinet back: tan plastic; less latch spring
5S7855	Eyelet: .156 x .484 (on loop leads)doz
16K691904	Grille, speaker: brown plastic
1X600082	Handle Assembly, complete: tan
36B691906	Knob, tuning: tan plastic
29A690089	Lug, crimping (on cover stop cord).doz
3S8175	Screw, sheet metal: #4 x 3/16 PKZ pl hex head; cad pl (chassis support bracket mtg) ....per/c
3S490390	Screw, thread-cutting: #4 x 3/8; type 25 Phillips round head; cad pl (spkr grille mtg)
3S488009	Screw, thread cutting: #6 x 3/8; type 25 plain hex head; cad pl (mounts chassis to cabinet)
2S7089	Speednut: for .187 stud; black parkerized finish (loop mtg)
41A480094	Spring, hinge (rear cover)
55B692068	Spring, rear cover latch
4K19943	Washer, paper: 11/16 x 17/64 x 1/32 (loop mtg)
CABINET PARTS (5J1 & 5J1U)	
7A600078	Bracket, chassis support: cad pl (on sides of chassis)
7A692061	Bracket, hinge mtg: black nickel finish (inside cabinet front)
38K692052	Button, plug: black
16E691798	Cabinet, front section: less grille, loop & front cover; black plastic
42K692143	Clip, cabinet locking (on front section of cabinet)
42A480078	Clip, cabinet locking (on rear cover)
13A691938	Cloth, grille
15D691799	Cover, cabinet back: black plastic
15D691894	Cover, cabinet front: less medallion and loop; black plastic
55A692058	Cover, handle mtg: brass plated (over ends of handle)
7A691932	Frame, grille: satin brass finish (around top of spkr grille)
7K691934	Frame, grille: satin brass finish (around bottom of spkr grille)
13C691896	Grille, speaker: green plastic
55A691944	Handle, carrying: black plastic; less spring
1X692142	Hinge Assembly, front cover: complete.
36B691923	Knob, control: green plastic
1X692137	Lead and Eyelet Assembly: white (loop lead)
1X692138	Lead and Eyelet Assembly: green (loop lead)
4S7695	Lockwasher, internal: #5; cad pl
29A690089	Lug, crimping (on cover stop cord)
29R3037	Lug, soldering: #6 hole (loop lead connector-on loop panel)
13A691927	Medallion: brass plated (on front cover)
64A692191	Plate, handle mtg: cad pl (under ends of handle)
64A600044	Plate, loop panel support (under loop hinges-on loop panel)
5S6833	Rivet: .122 x 3/16 stl; blk nkl (mounts hinge to loop panel)
3S7327	Screw, machine: 5-40 x 3/8 plain hex head; cad pl (handle mtg)
3S7155	Screw, machine: 6-32 x 3/16 plain hex head; cad pl (holds hinge to hinge mtg brkt)
3S490018	Screw, sheet metal: #2 x 1/4 PKZ Phillips flat head; blk nkl (mounts loop to front cover)
3S8136	Screw, sheet metal: #4 x 1/4 PKZ Phillips round head; blk nkl (chassis support brkt mtg)
3S400036	Screw, thread-cutting: #6 x 1/4 PKF slotted binderhead; cad pl (holds hinge mtg brkt)
3S488009	Screw, thread-cutting: #6 x 3/8; type 25 plain hex head; cad pl (mounts chassis to cabinet)
2S490840	Speednut: for 1/16 stud; black parkerized finish (medallion mtg)
2S7092	Speednut: for .125 stud; black parkerized finish (spkr grille mtg)
2S490842	Speednut: for .271 stud; black parkerized finish (holds cover stop cord)
41A692060	Spring, handle (inside plastic handle)
4S1719	Washer, flat; 3/8 x .140 x .030 stl; cad pl (handle mtg)
4B600136	Washer, paper: 3/4 x 5/16 x .020 (holds cover stop cord)

MODELS 5J1U,
5L1U, Ch. HS-224

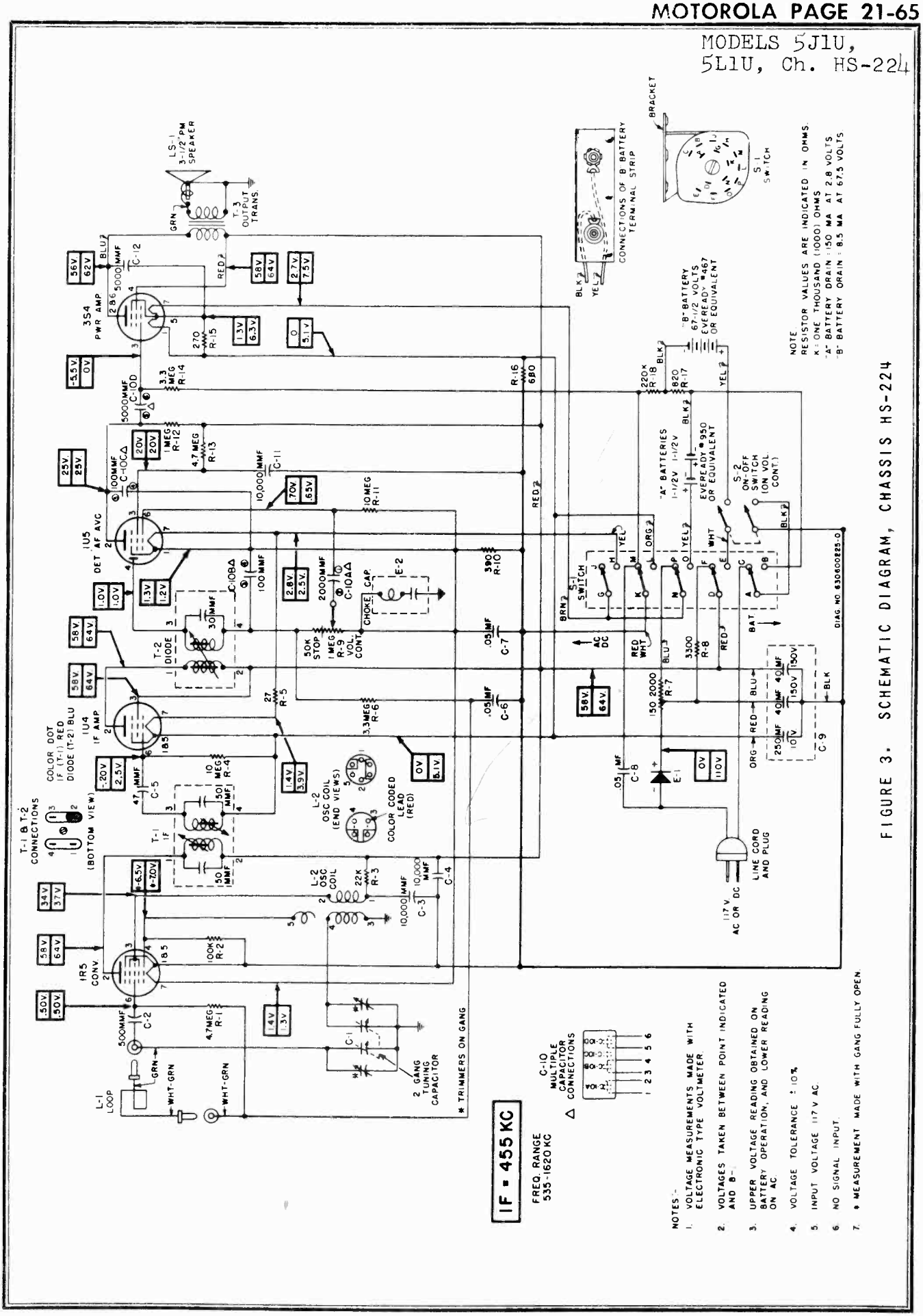


FIGURE 3. SCHEMATIC DIAGRAM, CHASSIS HS-224

MODELS 5J1,
5L1, Ch. HS-250

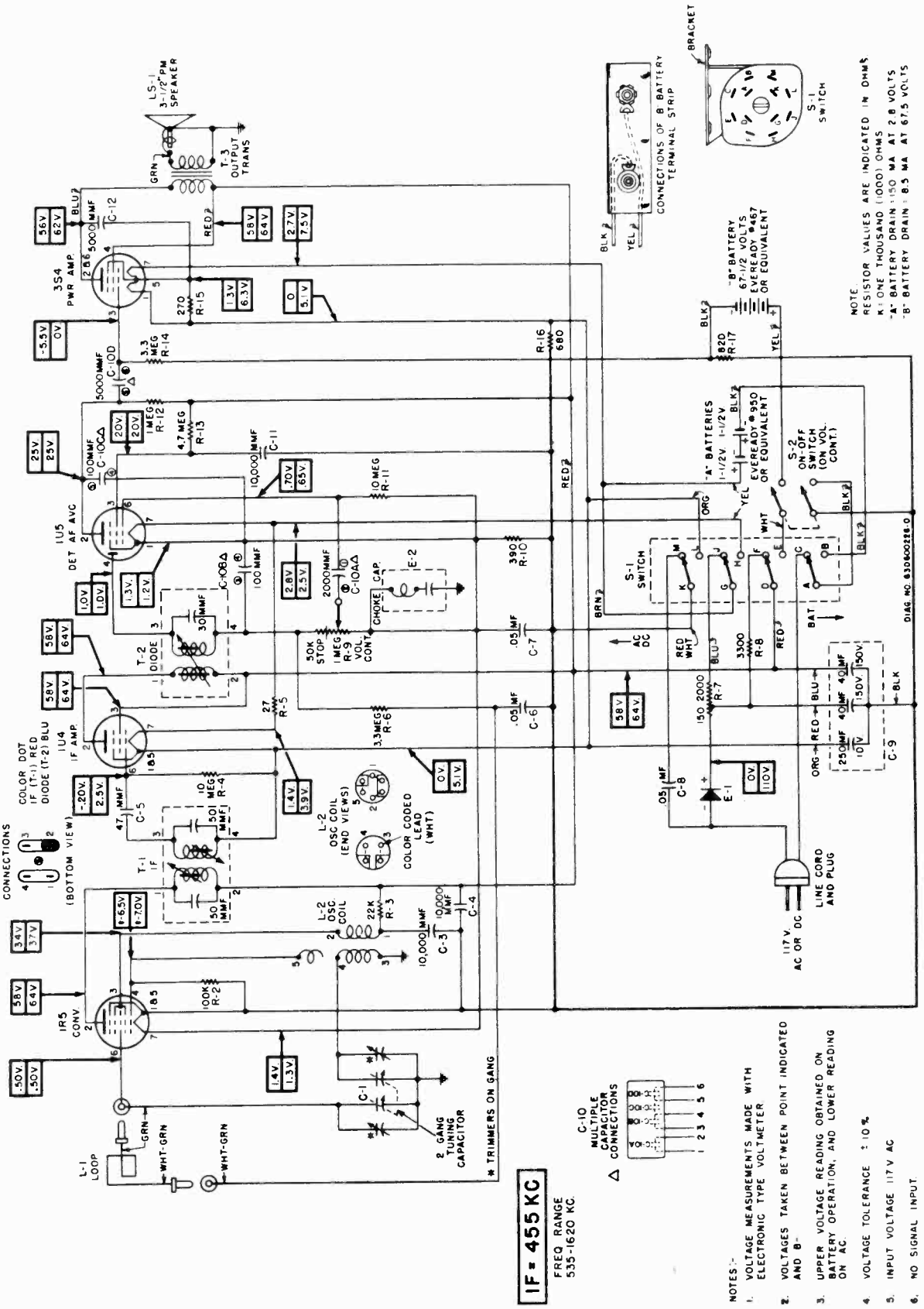
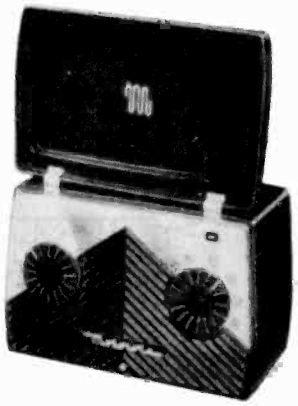


FIGURE 4. SCHEMATIC DIAGRAM, CHASSIS HS-250

NOTES:-
1. VOLTAGE MEASUREMENTS MADE WITH ELECTRONIC TYPE VOLTMETER
2. VOLTAGES TAKEN BETWEEN POINT INDICATED AND B-
3. UPPER VOLTAGE READING OBTAINED ON BATTERY OPERATION, AND LOWER READING ON AC
4. VOLTAGE TOLERANCE ± 10%
5. INPUT VOLTAGE 117 V AC
6. NO SIGNAL INPUT
7. * MEASUREMENT MADE WITH GANG FULLY OPEN

MODELS 5M1, 5M2, Ch. HS-249; 5M1U, 5M2U, Ch. HS-223

GENERAL INFORMATION



5M1 & 5M2 SERIES

TYPE - Three-power (AC/DC, Battery) portable radio receiver. Four miniature type tubes and a selenium rectifier are used in a superheterodyne circuit.

MODEL	COLOR	CHASSIS
5M1	Green	HS-249
5M1U	Green	HS-223
5M2	Maroon	HS-249
5M2U	Maroon	HS-223

TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

TUBE COMPLEMENT - 1R5 - Converter
1R4 - IF Amplifier
1U5 - Det, AVC & 1st AF Amp
3S4 - Power Amplifier
Rectifier - Selenium type - for AC/DC operation

POWER SUPPLY - Operates from 117V AC/DC (15 watts) or from the following batteries:

2 - 1½V flashlight cells (Eveready #950 or equivalent)

1 - 67½V "B" battery (Eveready #467 or equivalent)

OPERATING INSTRUCTIONS

TO OPEN FRONT COVER. The front cover is opened by pushing upward on the "M" bar located in the center of the cover. The receiver is automatically turned on when the front cover is opened and raised to a vertical position.

TO OPEN BACK COVER. The back cover may be opened by gently pulling it at the top. When closing the cover, be careful not to pinch the power line cord or other leads between the cover and the cabinet.

117 VOLT AC OR DC OPERATION. The power cord is located inside the cabinet and may be reached by opening the back cover. Pass the line cord through the slot on the side of the receiver, and plug it into any 117 volt AC or DC power outlet. If the receiver does not operate from DC power, reverse the plug in the power outlet. When operating from AC power, reception may sometimes be improved by reversing the power plug in the outlet. It is not necessary that batteries be installed if the receiver is to be operated only from house power lines.

BATTERY OPERATION. Open the back cover and install the batteries, following the instructions on the label inside the back cover (or see Figure 1). Insert the line cord plug into the receptacle on the chassis, or the receiver will not play from batteries. If the receiver is to be operated for a long period of time from 117 volts AC or DC, or is to be placed in storage, remove the batteries and store them in a cool place. IMPORTANT: Never leave low or run-down batteries in the receiver, as they will leak or swell and damage it.

TUNING CONTROL. Stations are tuned in with the right-hand knob. The markings around the tuning knob may be read in kilocycles by adding one zero to the figures.

VOLUME CONTROL. The left-hand knob controls volume.

TO TURN OFF. Closing the front cover will automatically turn off the receiver.

ANTENNA. A loop antenna is built into the front cover. Because of the slightly directional characteristics of the loop antenna, reception from some stations may be improved by rotating the entire receiver. In extremely noisy locations, rotate the receiver until minimum noise and maximum signal pickup are obtained.

BATTERY REPLACEMENT. If low volume or fuzzy tone is noticed when operating from batteries, replace the flashlight cells. Normally, the 67½V "B" battery will last for 3 or 4 changes of the flashlight cells. The condition of the batteries will not affect the operation of the receiver from 117 volts AC or DC. Complete battery replacement instructions will be found inside the cabinet back cover (or See Figure 1).

SERVICE NOTES

The chassis of this receiver is isolated from the AC power line circuit by a capacitor-choke assembly to eliminate the shock hazard when handling the receiver. However, as an additional precaution when aligning or servicing the receiver from AC, an isolation transformer should be inserted between the power line and the chassis.

The tubes are exposed when the rear cover is opened. It is not necessary to remove the chassis to replace tubes.

To remove the chassis from the cabinet:

1. Pull off the two control knobs on the front of the cabinet.
2. Open the rear cover and remove the batteries.
3. Remove the two Phillips head screws holding the chassis to the cabinet ("A" - "A" in Figure 1).
4. Slide the chassis out of the cabinet.
5. Disconnect the two leads from the chassis to the loop antenna hinges.

MODELS 5M1, 5 M2, Ch. HS-249; 5M1U, 5M2U, Ch. HS-223

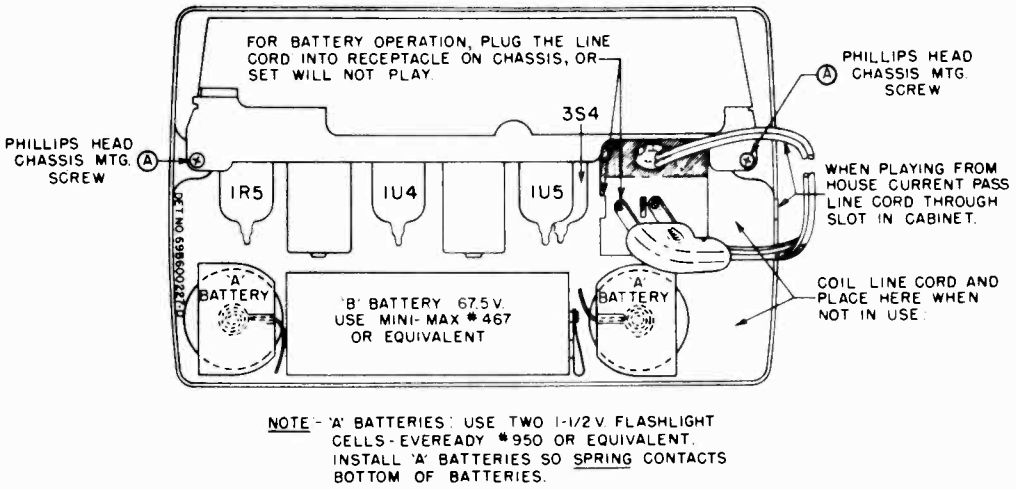


FIGURE 1. BATTERY INSTALLATION & CHASSIS REMOVAL INSTRUCTIONS

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv (pin 6, 1R5)*	455 Kc	Fully open	1, 2 & 3	Adjust for maximum.
RF ALIGNMENT						
2.	-	Grid of conv (pin 6, 1R5)*	1620 Kc	Fully open	4	Adjust for maximum.
3.	-	-	-	-	-	Install chassis in cabinet, leaving output meter connected to speaker.
4.	-	Radiation loop**	1400 Kc	Tune for maximum	5	Adjust for maximum. Trimmer is reached through hole under plug button on side of cabinet.

* On chassis HS-249 return the grid of the converter tube to AVC either through the loop or through a 4.7 meg resistor (as in chassis HS-223).

**Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

ALIGNMENT

NOTE: The receiver may be operated either from a battery or from the commercial power lines during alignment. If AC power is used, it is recommended that an isolation transformer be placed between the power line and the receiver. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator input to keep the output of the receiver at approximately .05 watt (.05 watt = .40 volts on the output meter) to avoid overloading the receiver.
7. See Figure 2 for adjustment locations and the following chart for procedure.

MODELS 5M1, 5M2, Ch. HS-249; 5M1U, 5M2U, Ch. HS-223

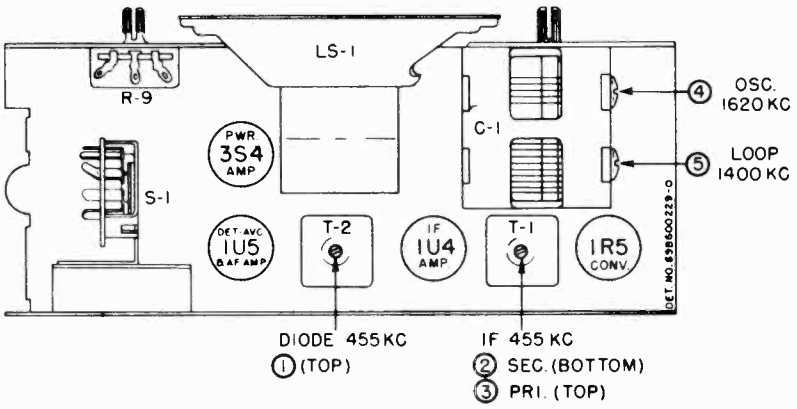


FIGURE 2. TUBE & TRIMMER LOCATIONS

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - ELECTRICAL		
CAPACITORS		
C-1	19K692007	Variable, 2-gang
C-2	21K481377	Ceramic: 500 mmf 500V
C-3	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-4	21K482726	Ceramic, disc type: 10,000 mmf
C-5	21K77373	Ceramic: 47 mmf 500V
C-6	8K71213	Paper: .05 mf 100V
C-7	8K71213	Paper: .05 mf 100V
C-8	8K471635	Paper: .05 mf 400V
C-9	23B691995	Electrolytic: 40-40 mf 150V/ 250 mf 10V
C-10A, B, C, D	21K691992	Ceramic, multiple: 2000 mmf, 100 mmf, 100 mmf, 5000 mmf
C-11	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-12	21A470789	Ceramic, disc type: 5000 mmf 450V
CHOKE & CAPACITOR		
E-2	24K691986	Choke & .05 mf 200V paper capacitor
RECTIFIER		
E-1	48B791092	Selenium Rectifier: half-wave
COILS		
L-1	1X692159	Antenna Loop & Front Cover Assembly: complete; green plastic (5M1 & 5M1U)
	1X692160	Antenna Loop, Panel & Hinge Assembly: less front cover; green plastic (5M1 & 5M1U)
	24B692200	Antenna Loop & Panel Assembly: less hinges; green plastic (5M1 & 5M1U)
	1X600129	Antenna Loop & Front Cover Assembly: complete; maroon plastic (5M2 & 5M2U)
	1X600130	Antenna Loop, Panel & Hinge Assembly: less front cover; maroon plastic (5M2 & 5M2U)
	24K600132	Antenna Loop & Panel Assembly: less hinges; maroon plastic (5M2 & 5M2U)
L-2	24K600097	Oscillator Coil (yellow code)
SPEAKER		
LS-1	50K600142	Speaker: 3½" PM; 3.2 ohm VC.
or	50K600141	Speaker: 3½" PM; 3.2 ohm VC.
RESISTORS		
		Note: All resistors are insulated, carbon type unless otherwise specified.
R-1	6R2122	4.7 meg 20% ½W
R-2	6R6031	100,000 10% ½W
R-3	6R6397	22,000 10% ½W
R-4	6R2109	10 meg 20% ½W
R-5	6R5683	27 10% ½W
R-6	6R2118	3.3 meg 20% ½W
R-7	17K692009	Wire wound: 2150 5% 10W; tapped
R-8	6R5581	3300 10% ½W
R-9	18A691993	Volume control: 1 megohm
R-10	6R5554	390 10% ½W
R-11	6R2109	10 meg 20% ½W
R-12	6R6004	1 meg 20% ½W
R-13	6R2122	4.7 meg 20% ½W
R-14	6R2118	3.3 meg 20% ½W
R-15	6R6432	270 10% ½W
R-16	6R6040	680 10% ½W
R-17	6R6269	820 10% ½W
R-18	6R6015	220,000 20% ½W
SWITCHES		
S-1	40B471927	Rotary switch, 5PDT (AC/DC, battery selector)
S-2	40A691999	Slide switch (on-off)
TRANSFORMERS		
T-1	24B692014	IF Transformer, 455 kc: complete with capacitors, less shield
T-2	24B692015	Diode Transformer, 455 kc; complete with capacitors, less shield
T-3	25K692006	Output Transformer

PART NUMBER	DESCRIPTION
CHASSIS PARTS - MECHANICAL	
43A692011	Bushing, insulator: fibre (on rear edge of chassis)
43A692012	Bushing, strain relief: line cord (use with 43K692013)
42K75826	Clip, electrolytic mtg
42A485548	Clip, IF transformer mtg
30B691994	Cord, line: with plug; 6 ft long (HS-223 only)
30K600125	Cord, line: with plug; 6 ft long (HS-249 only)
4S7650	Lockwasher, internal: #6; cad pl.
29R5294	Lug, soldering (holds battery leads)
29R5239	Lug, soldering: #8 hole (holds line cord) (HS-223 only)
29R3020	Lug, soldering: battery contact (in 'A' battery retainer)
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (R-7 & selenium rect mtg)
2S7051	Nut, hex: palnut; 3/8-32 x 9/16; cad pl (volume control mtg)
9A470980	Receptacle, loop (on lead to loop).
15B481896	Retainer, 'A' battery: plastic
43K692013	Retainer, strain relief (on line cord bushing) (use with 43A692012)
5S7771	Rivet: .088 x 3/16 stl; nkl pl (tube socket mtg)
5S7706	Rivet: .122 x 1/8 stl; nkl pl (term strip & switch mtg)
3S490828	Screw, machine: 6-32 x 3/16; plain hex head lockscrew; cad pl (gang mtg)
3S7363	Screw, machine: 6-32 x 1 slotted binderhead; cad pl (selenium rect mtg)
3S1451	Screw, machine: 6-32 x 2 slotted round head; cad pl (R-7 mtg)
3S7205	Screw, machine: 8-32 x 1/4 slotted hex head lockscrew; cad pl (spkr mtg).
3S2695	Screw, sheet metal: #6 x 3/16 PKZ pl hex head; cad pl (rear shield mtg)
3S7462	Screw, thread-cutting: 6-32 x 3/16 plain hex head; cad pl (S-1 mtg)
26K692003	Shield, back (on rear of chassis).
26A692005	Shield, heat (around R-7)
26K691997	Shield, switch (over AC/DC, Batt. sw)
9A690129	Socket, tube: miniature; 7-prong
41K680029	Spring, battery contact (in 'A' battery retainer)
31K470880	Strip, 'B' battery terminal: with leads
31K37504	Strip, terminal: 1 insulated lug; #1 mtg; 3/8" spacing
31K470746	Strip, terminal: 3 insulated lugs; #2 mtg; 3/8" spacing
4K470939	Washer, fibre (R-7 mtg)
CABINET PARTS	
7A600092	Bracket, escutcheon support: cad pl (cabinet front support)(5M1U & 5M2U)
38K692050	Button, plug: green finish (5M1 & 5M1U)
38K600106	Button, plug: maroon finish (5M2 & 5M2U)
1X692156	Cabinet: complete, less handle, grille and front cover; green finish (5M1 & 5M1U)
1X600126	Cabinet: complete, less handle, grille and front cover; maroon finish (5M2 & 5M2U)
42A600094	Clip, grille retainer (holds front grille to cabinet)
55A692058	Cover, handle mtg: brass plated (over ends of handle)
13D691949	Escutcheon, dial & volume (on front of cabinet)
55A27113	Foot, cabinet bottom: felt
1X692162	Front Cover Assembly: complete, less loop; green plastic (5M1 & 5M1U)
1X600131	Front Cover Assembly: complete, less loop; maroon plastic (5M2 & 5M2U)
1X692158	Grille Assembly: complete with escutcheon; green plastic (5M1 & 5M1U)
1X600128	Grille Assembly: complete with escutcheon; maroon plastic (5M2 & 5M2U)
55K692166	Handle, carrying: green plastic; less spring (5M1 & 5M1U)
55K600107	Handle, carrying: maroon plastic; less spring (5M2 & 5M2U)
55C692202	Hinge, front cover; complete; left-hand
55K600087	Hinge, front cover: complete; right-hand
55K30198	Hinge, rear cover
36B691899	Knob, control: green plastic (5M1 & 5M1U)
36K600105	Knob, control: maroon plastic (5M2 & 5M2U)
1X692163	Latch and Plate Assembly (inside front cover)
4S8406	Lockwasher, internal: #2; cad pl.
4S7683	Lockwasher, internal: #4; cad pl.
29R5399	Lug, soldering (under front hinge, for loop connection)
13B691901	Medallion (on front cover)
28A692198	Pin, loop connector (on front hinge)
64A692191	Plate, handle mtg: cad pl (under ends of handle)
5S8487	Rivet: .088 x 3/32 stl; blk nkl (rear cover hinges)
5S8490	Rivet: .088 x 5/32 stl; blk nkl (front hinge mtg)(5M1 & 5M1U)
5S2827	Rivet: .088 x 5/32 stl; statuary bronze (front hinge mtg)(5M2 & 5M2U)
3S490849	Screw, machine: 4-40 x 11/32 Phillips round head; cad pl (mounts front hinges to cabinet)
3S2995	Screw, machine: 5-40 x 5/16 plain hex head; cad pl (handle mtg)
3S490018	Screw, sheet metal: #2 x 1/4 PKZ Phillips flat head; blk nkl (mounts loop to front cover)(5M1 & 5M1U)
3S3389	Screw, sheet metal: #2 x 1/4 PKZ Phillips flat head; statuary bronze (mounts loop to front cover) (5M2 & 5M2U)
3S490739	Screw, sheet metal: #4 x 1/4 PKZ Phillips binderhead; cad pl (chassis mtg)
41A470909	Spring, door latch (inside front cover)
41K692167	Spring, handle (inside plastic handle)
41A692069	Spring, rear cover latch
42A692189	Strap, door latch retainer (inside front cover)
46A692151	Stud, latch retainer (front cover latch, on grille)
46K690079	Stud, trimount: blk nkl (on loop panel for operating on-off switch)(5M1 & 5M1U)
46K680035	Stud, trimount: statuary bronze (on loop panel, for operating on-off switch)(5M2 & 5M2U)
4S1719	Washer, flat: 3/8 x .140 x .030 stl; cad pl (handle mtg)

MODELS 5M1, 5M2, Ch. HS-249; 5M1U, 5M2U, Ch. HS-223

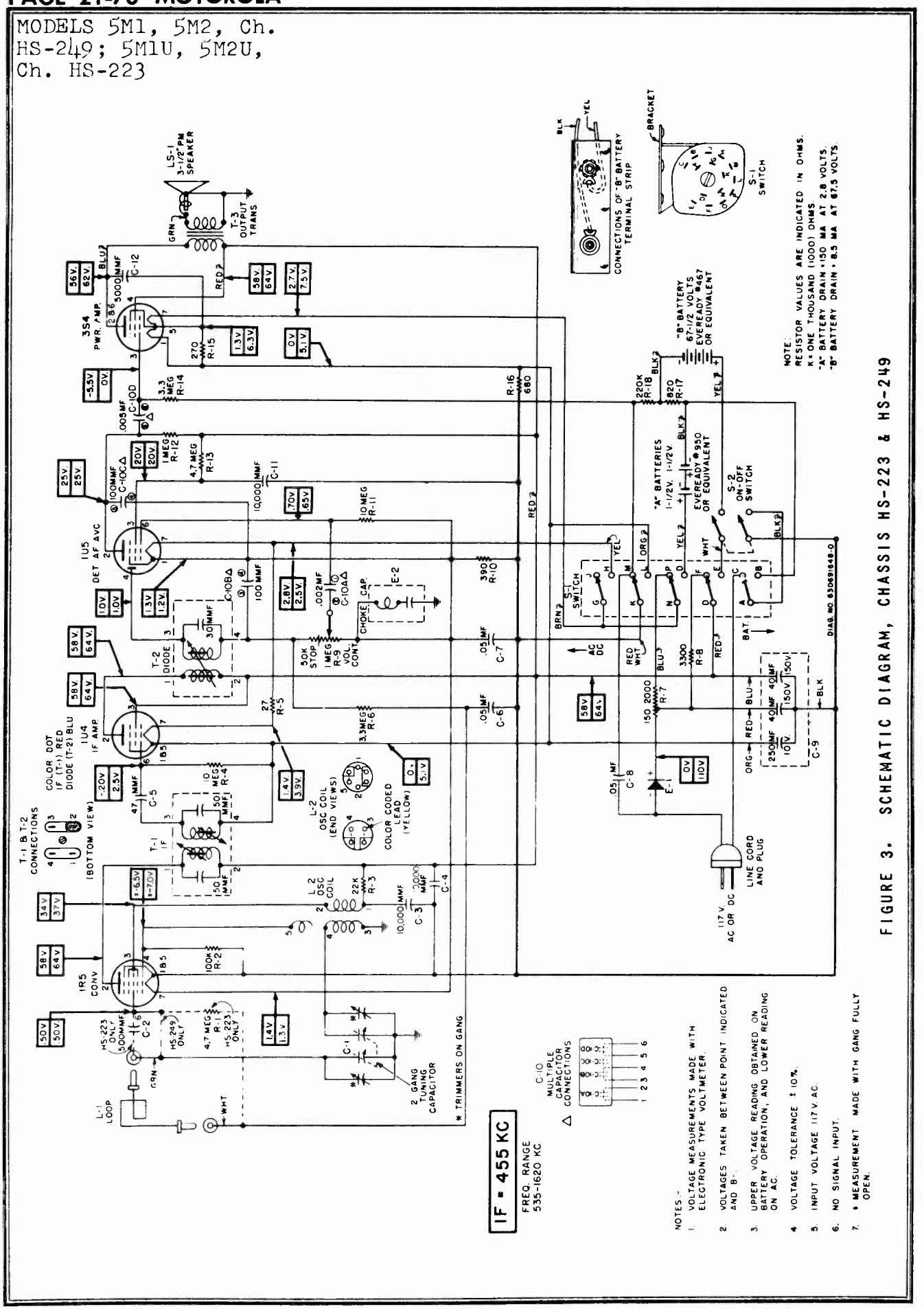


FIGURE 3. SCHEMATIC DIAGRAM, CHASSIS HS-223 & HS-249

NOTES:-

1. VOLTAGE MEASUREMENTS MADE WITH ELECTRONIC TYPE VOLTMETER.
2. VOLTAGES TAKEN BETWEEN POINT INDICATED AND B-.
3. UPPER VOLTAGE READING OBTAINED ON BATTERY OPERATION, AND LOWER READING ON AC.
4. VOLTAGE TOLERANCE ± 10%.
5. INPUT VOLTAGE 117 V AC.
6. NO SIGNAL INPUT.
7. ♦ MEASUREMENT MADE WITH GANG FULLY OPEN.

MODELS 5R11U, 5R12U, 5R13U, 5R14U, 5R15U, 5R16U, Ch. HS-242

GENERAL INFORMATION

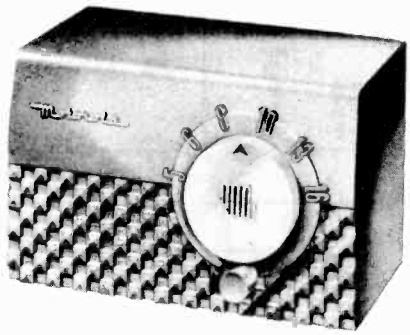
TYPE - AC-DC table model superheterodyne receiver with loop antenna.

RECEIVER MODELS -

Model	Color
5R11U	Walnut-Mahogany
5R12U	Ivory
5R13U	Maroon
5R14U	Gray
5R15U	Green
5R16U	Yellow

TUBE COMPLEMENT -

12BE6	Converter
12BA6	IF Amplifier
12AT6	Det, AVC & AF Amp
50C5	Power Amplifier
35W4	Rectifier



TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

POWER SUPPLY - 117 volts AC or DC; 35 watts

ALIGNMENT

NOTE: It is recommended that an isolation transformer be placed between the power line and the receiver to avoid hum and electrical shocks. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator output to a level which produces less than .40 volts (.05 watt) across the voice coil to avoid overloading the receiver.
7. See Figure 1 for adjustment locations and the following chart for procedure.

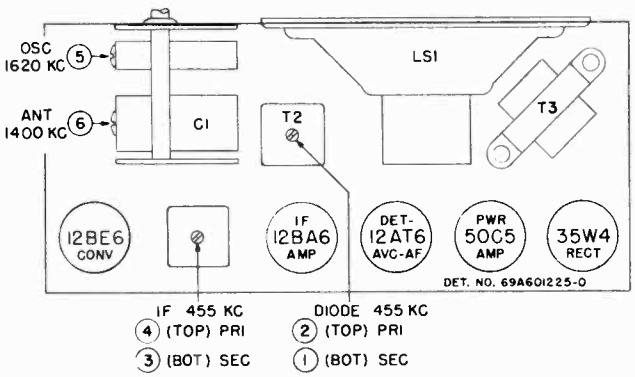
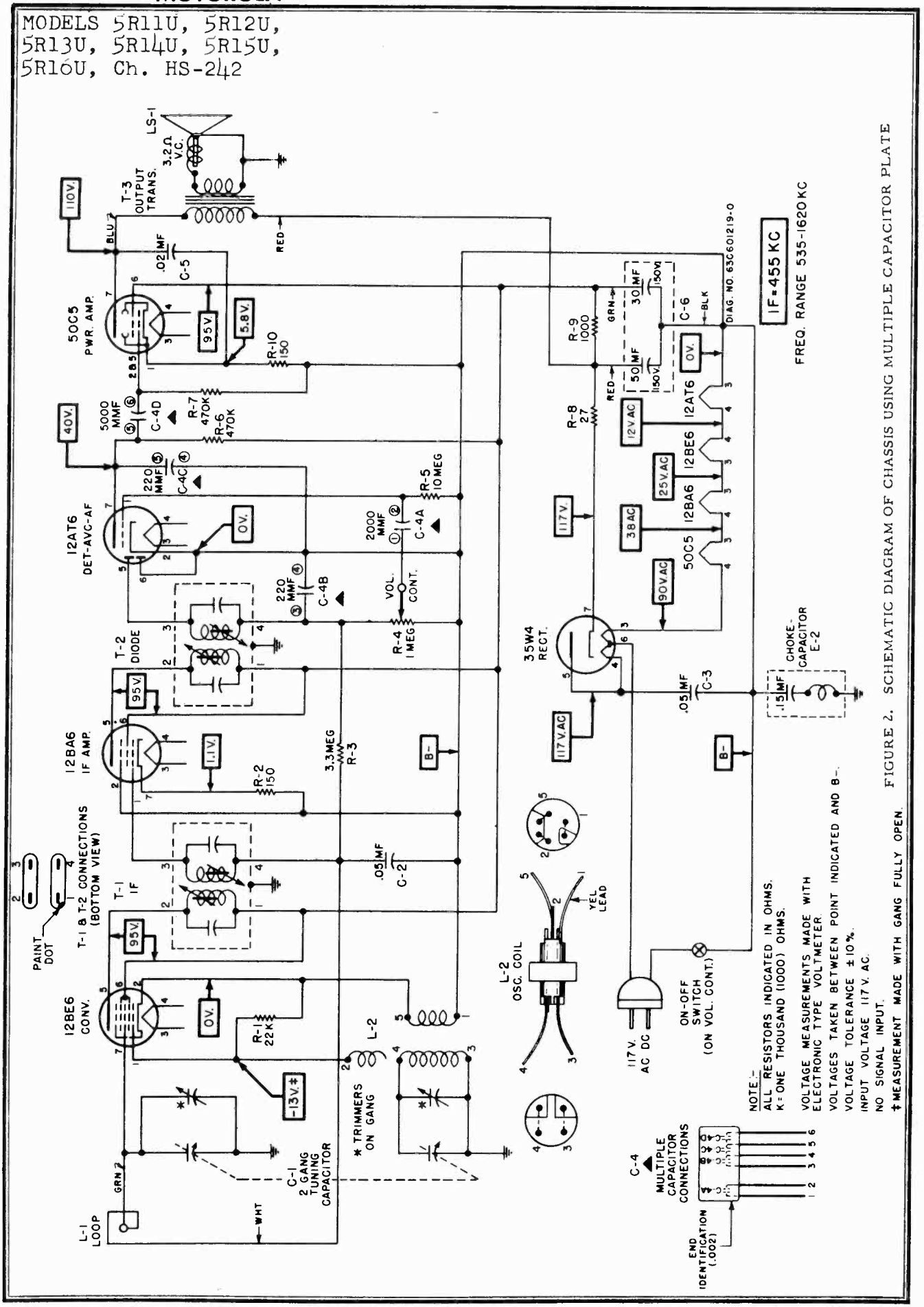


FIGURE 1. TUBE AND TRIMMER LOCATIONS

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. (pin 7, 12BE6)	455 Kc	Fully open	1, 2, 3 & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	-	Grid of conv. (pin 7, 12BE6)	1620 Kc	Fully open	5 (Osc)	Adjust for maximum.
3.	-	Radiation loop*	1400 Kc	Tune for max	6 (Ant)	Adjust for maximum

*Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

MODELS 5R11U, 5R12U,
5R13U, 5R14U, 5R15U,
5R16U, Ch. HS-242



NOTE:-
ALL RESISTORS INDICATED IN OHMS.
K = ONE THOUSAND (1000) OHMS.

VOLTAGE MEASUREMENTS MADE WITH ELECTRONIC TYPE VOLTMETER
VOLTAGES TAKEN BETWEEN POINT INDICATED AND B-.
VOLTAGE TOLERANCE ±10%.
INPUT VOLTAGE 117 V. AC.
NO SIGNAL INPUT.
‡MEASUREMENT MADE WITH GANG FULLY OPEN.

FIGURE 2. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CAPACITOR PLATE

MODELS 5R11U, 5R12U, 5R13U, 5R14U, 5R15U, 5R16U, Ch. HS-242

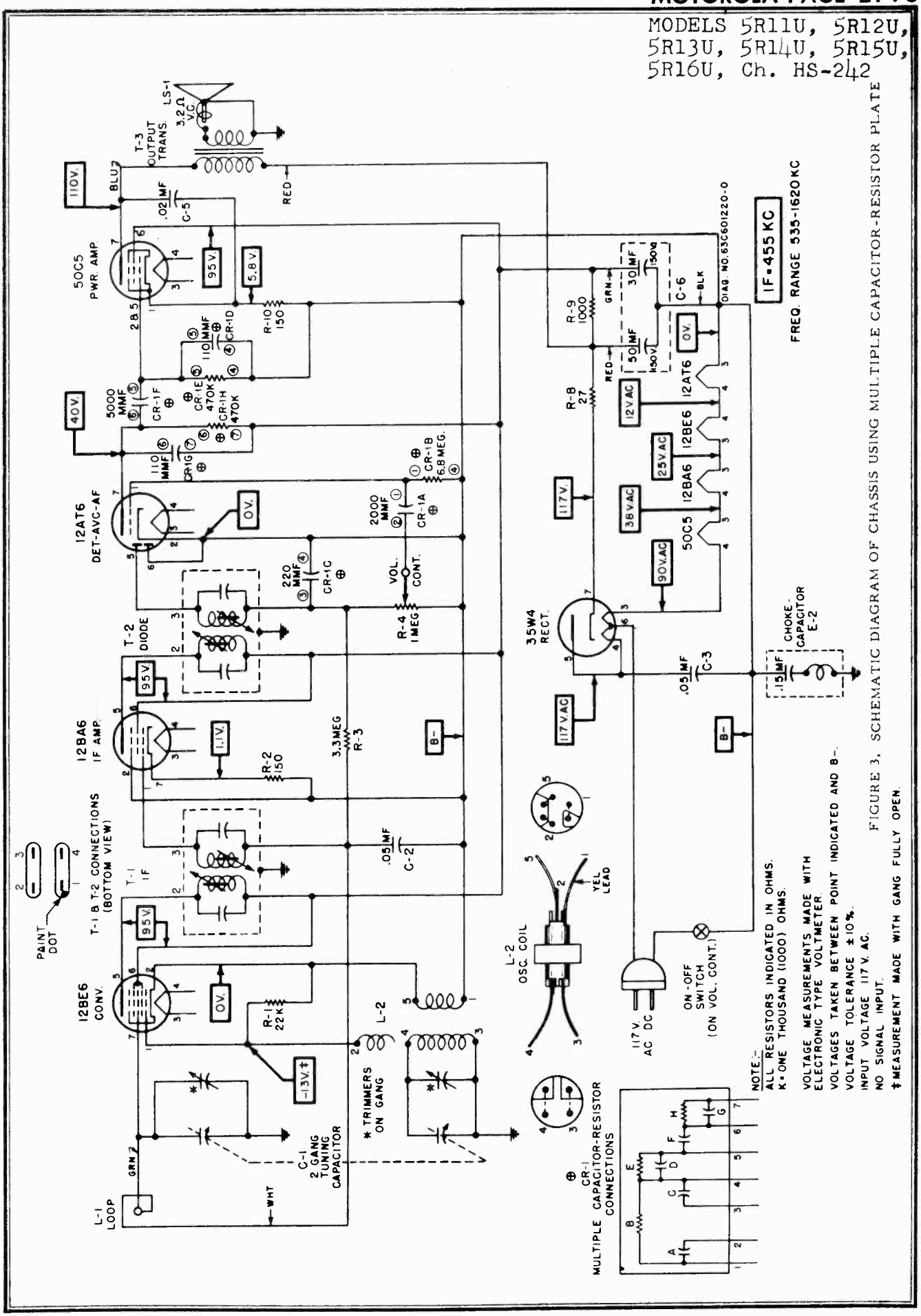


FIGURE 3. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CAPACITOR-RESISTOR PLATE

MODELS 5R11U, 5R12U, 5R13U, 5R14U, 5R15U, 5R16U, Ch. HS-242

INSTALLATION & OPERATING INSTRUCTIONS

POWER SWITCH & VOLUME CONTROL. Operated with small lower knob. NOTE: Reverse the line plug in the electrical outlet if the radio does not operate from DC. When operating from AC, reversing the line cord plug in wall outlet may sometimes improve reception.

TUNING. Tune in station with large upper knob.

ANTENNA. A built-in loop antenna eliminates the need for an outside antenna in most locations. When receiving a a weak station, rotate the receiver slightly for best signal strength. If additional pick-up is necessary, connect an external antenna to the radio by following the instructions printed on the rear panel. CAUTION: Never connect the radio chassis to a water pipe, radiator, or other ground.

SERVICE NOTES

To remove chassis from cabinet:

1. Pull off the two control knobs from the front of the receiver.
2. Remove the two split plugs which hold the loop to the cabinet.
3. Remove the two hex head screws at the rear edge of the chassis.
4. Slide the chassis from the cabinet.

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

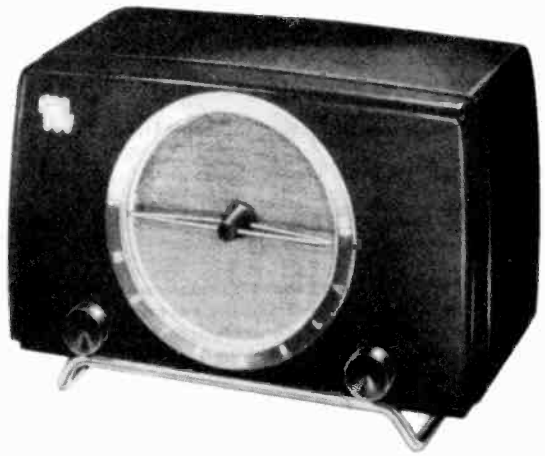
Ref. No.	Part No.	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	19B600458	Variable: 2 gang; with pulley....
C-2	8R9821	Paper: .05 mf 200V.....
C-3	8R9816	Paper: .05 mf 400V.....
C-4	21B482847	Ceramic, multiple: 2000 mmf, 220 mmf, 220 mmf, 5000 mmf.....
C-5	8R9802	Paper: .02 mf 400V.....
C-6	23B600855	Electrolytic: 50-30 mf/150V.....
Capacitor-Resistor		
CR-1	21B601007	Capacitor-Resistor: 7-lead; 2000, 220, 5000, 110, 110mmf, 6.8 meg, 470,000, 470,000 ohms.....
Choke & Capacitor		
E-1	8A690487	Choke & .15 mf paper capacitor...
Coils		
L-1	24C600543	Antenna Loop and Panel Assembly..
L-2	24B680364	Oscillator coil.....
Speaker		
LS-1	50B690661	Speaker: 4" PM; 3.2 ohm VC....
Resistors		Note: All resistors are insulated carbon type unless otherwise specified
R-1	6R6028	22,000 20% 1/2W.....
R-2	6R3992	150 20% 1/2W.....
R-3	6R2118	3.3 meg 20% 1/2W.....
R-4	18K600449	Volume control: 1 meg; with switch
R-5	6R2109	10 meg 20% 1/2W.....
R-6	6R6032	470,000 20% 1/2W.....
R-7	6R6032	470,000 20% 1/2W.....
R-8	6R5683	27 10% 1/2W.....
R-9	6R3953	1000 20% 1W.....
R-10	6R3992	150 20% 1/2W.....
Transformers		
T-1,2	24B485553	IF and Diode, 455 Kc: complete with capacitors, cores, and shield..
T-3	25K680345	Output Transformer.....

Part No.	Description
CHASSIS PARTS - MECHANICAL	
7A478118	Bracket, loop mtg.....
43A692012	Bushing, strain relief (line cord)....
42A485548	Clip, coil can mtg (for T-1 & T-2)....
30K680352	Cord, line and plug: 6 feet long.....
5A484268	Grommet, rubber (speaker mtg).....
14A478119	Insulator, fibre (loop bracket mtg)..
2S7051	Nut, hex: 3/8-32 x 9/16; stl; cad pl (volume control mtg).....
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg).....
5S7707	Rivet: .122 x 5/32; stl; nkl pl (output trans and shield mtg).....
5S7703	Rivet: .122 x 7/32; stl; nkl pl (loop bracket and speaker mtg).....
3S7247	Screw, machine: 6-32 x 3/16 slotted hex head; locking type; stl; cad pl (gang mtg).....
26A478117	Shield, electrostatic (on rear of chassis).....
9A472534	Socket, tube: 7 prong.....
41A73996	Spring, tension (electrolytic mtg)....
46A478145	Stud, tri-mount (back mtg to chassis).
14A11493	Washer, shoulder: fibre (loop bracket mtg).....
CABINET PARTS	
16K600181	Cabinet, table model: molded; walnut-mahogany finish (5R11U).....
16E600157	Cabinet, table model: molded; ivory finish (5R12U).....
16K600183	Cabinet, table model: molded, maroon finish (5R13U).....
16K600184	Cabinet, table model: molded; gray finish (5R14U).....
16K600185	Cabinet, table model: molded; green finish (5R15U).....
16K600186	Cabinet, table model: molded; yellow finish (5R16U).....
36B600485	Knob, tuning: ivory (5R11U, 5R13U, 5R14U, and 5R15U).....
36K600486	Knob, tuning: red (5R12U).....
36K600487	Knob, tuning: blue (5R16U).....
36B600544	Knob, volume control: walnut (5R11U)...
36K600545	Knob, volume control: ivory (5R12U)....
36K600546	Knob, volume control: maroon (5R13U)...
36K600547	Knob, volume control: gray (5R14U)....
36K600548	Knob, volume control: green (5R15U)..
36K600549	Knob, volume control: yellow (5R16U)..
3S476083	Screw, machine: 6-32 x 5/16; slotted hex head; stl; cad pl; locking type (chassis mtg).....
38A25507	Plug, split (back mtg to cabinet)....
11M488253	Tape; aluminum foil: 2 1/2" wide

MODELS 5X11U, 5X12U, 5X13U, Ch. HS-243

GENERAL INFORMATION

TYPE - AC-DC table model superheterodyne receiver with loop antenna.



RECEIVER MODELS -

Model	Color
5X11U	Walnut-mahogany
5X12U	Ivory
5X13U	Ebony

TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

TUBE COMPLEMENT - 12BE6 - Converter
12BA6 - IF Amplifier
12AT6 - Det, AVC & 1st AF Amp
50C5 - Power Amplifier
35W4 - Rectifier

POWER SUPPLY - 117 volts AC or DC, 35 watts

INSTALLATION & OPERATING INSTRUCTIONS

POWER SWITCH AND VOLUME CONTROL. Operated with the left-hand knob. NOTE: Reverse the line cord plug in the wall outlet if radio does not operate from DC. When operating from AC, reversing the line cord plug in the wall outlet may sometimes improve reception.

TUNING. Tune stations with the right-hand knob.

ANTENNA. A built-in loop antenna eliminates the need for an outside antenna in most locations. When receiving a weak station, rotate the receiver slightly for best signal strength. If additional pick-up is necessary, connect an external antenna to the radio by following the instructions printed on the rear panel. CAUTION: Never connect the radio chassis to a water pipe, radiator, or other ground.

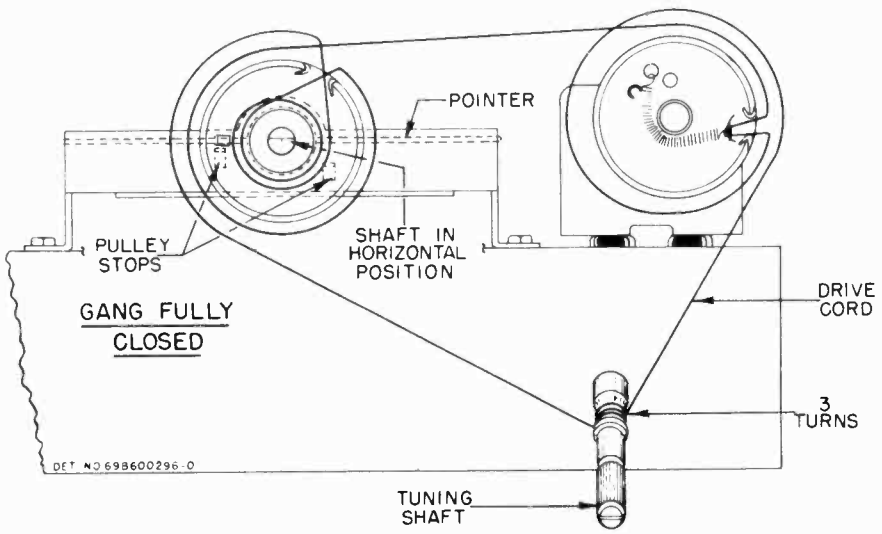


FIGURE 1. STRING DRIVE DETAIL

MODELS 5X11U, 5X12U,
5X13U, Ch. HS-243

SERVICE NOTES

The chassis of this receiver is isolated from the AC power line circuit by a capacitor to eliminate the shock hazard when handling the receiver. However, as an additional precaution when aligning or servicing the receiver from AC, an isolation transformer should be inserted between the power line and the chassis.

To remove the chassis from the cabinet:

1. Pull off the two radio control knobs.
2. Pull off the pointer.
3. Remove the split plugs which hold the loop to the cabinet.
4. From the back of the cabinet, remove the two hex head screws at the rear edge of the radio chassis.
5. Slide the radio chassis and loop from the cabinet.

ALIGNMENT

NOTE: It is recommended that an isolation transformer be placed between the power line and the receiver to avoid hum and electrical shocks. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator output to a level which produces less than .40 volts (.05 watt) across the voice coil to avoid overloading the receiver.
7. See Figure 2 for adjustment locations and the following chart for procedure.

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. (pin 7, 12BE6)	455 Kc	Fully open	1, 2, 3 & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	-	Grid of conv. (pin 7, 12BE6)	1620 Kc	Fully open	5 (Osc)	Adjust for maximum.
3.	-	Radiation loop*	1400 Kc	Tune for max	6 (Ant)	Adjust for maximum.

*Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

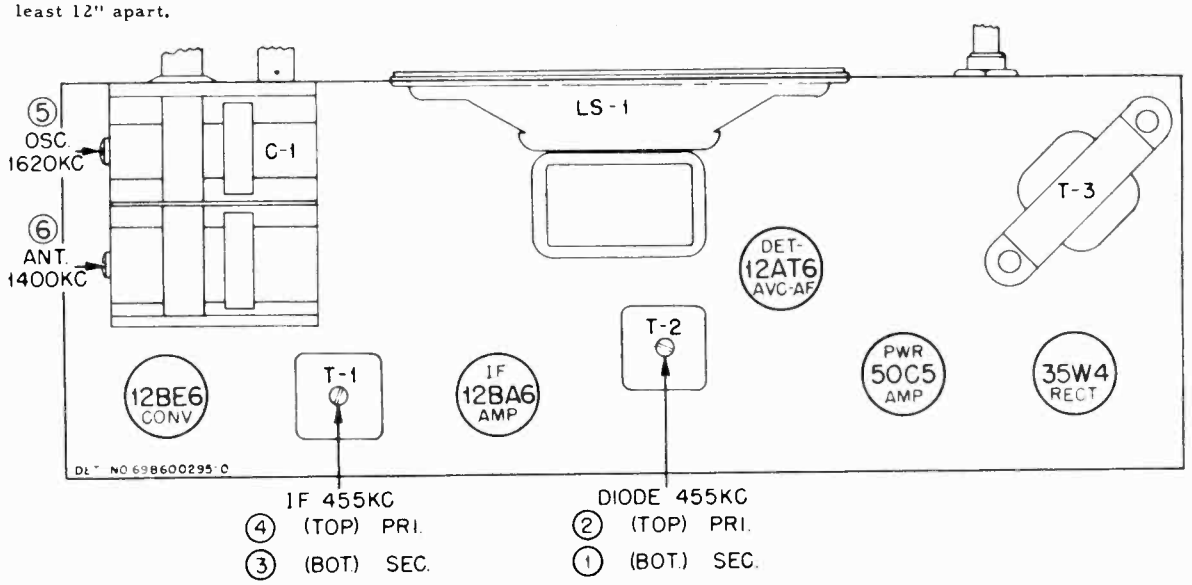


FIGURE 2. TUBE & TRIMMER LOCATIONS

MODELS 5X11U, 5X12U,
5X13U, Ch. HS-243

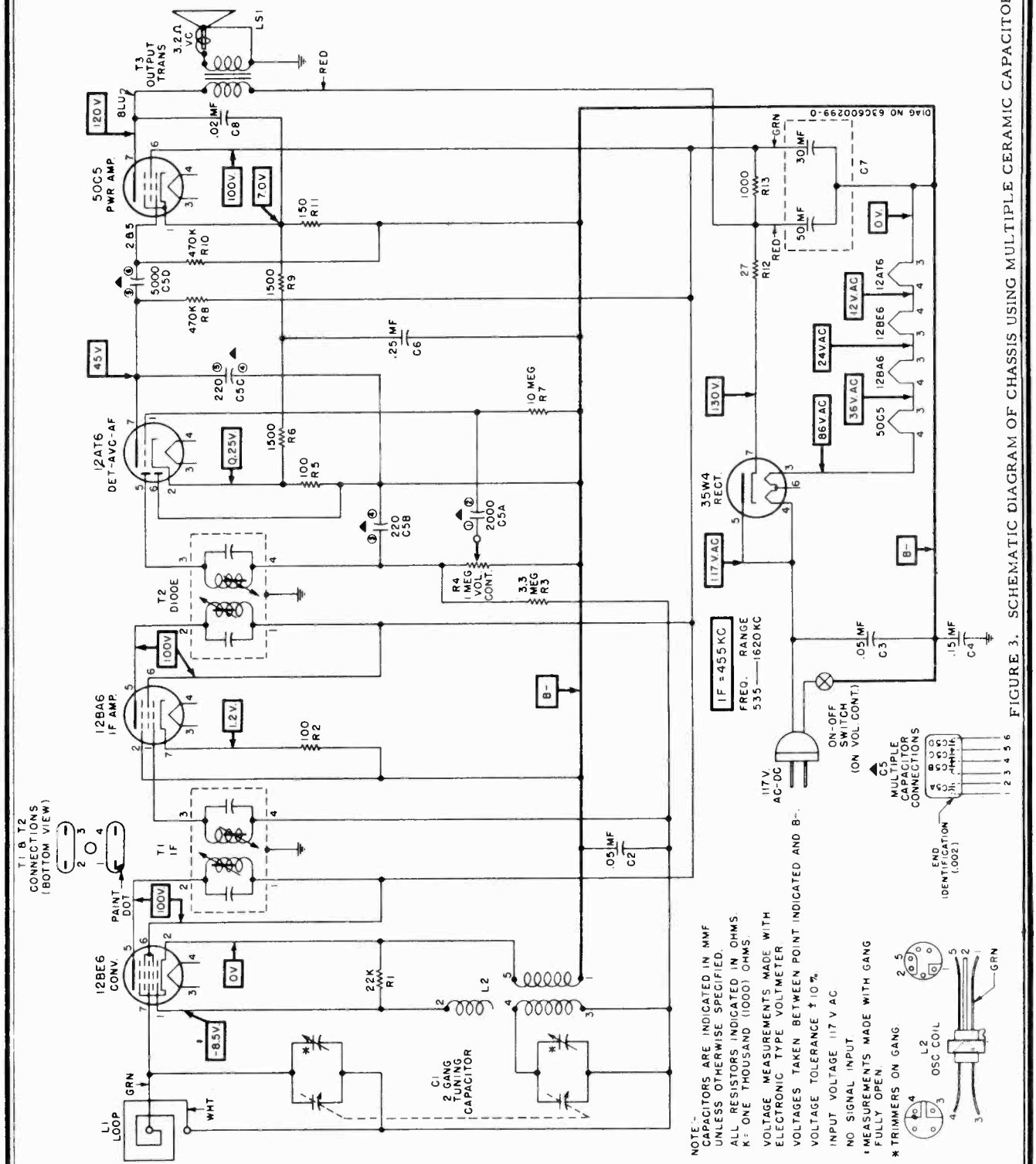


FIGURE 3. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR

MODELS 5X11U, 5X12U,
5X13U, Ch. HS-243

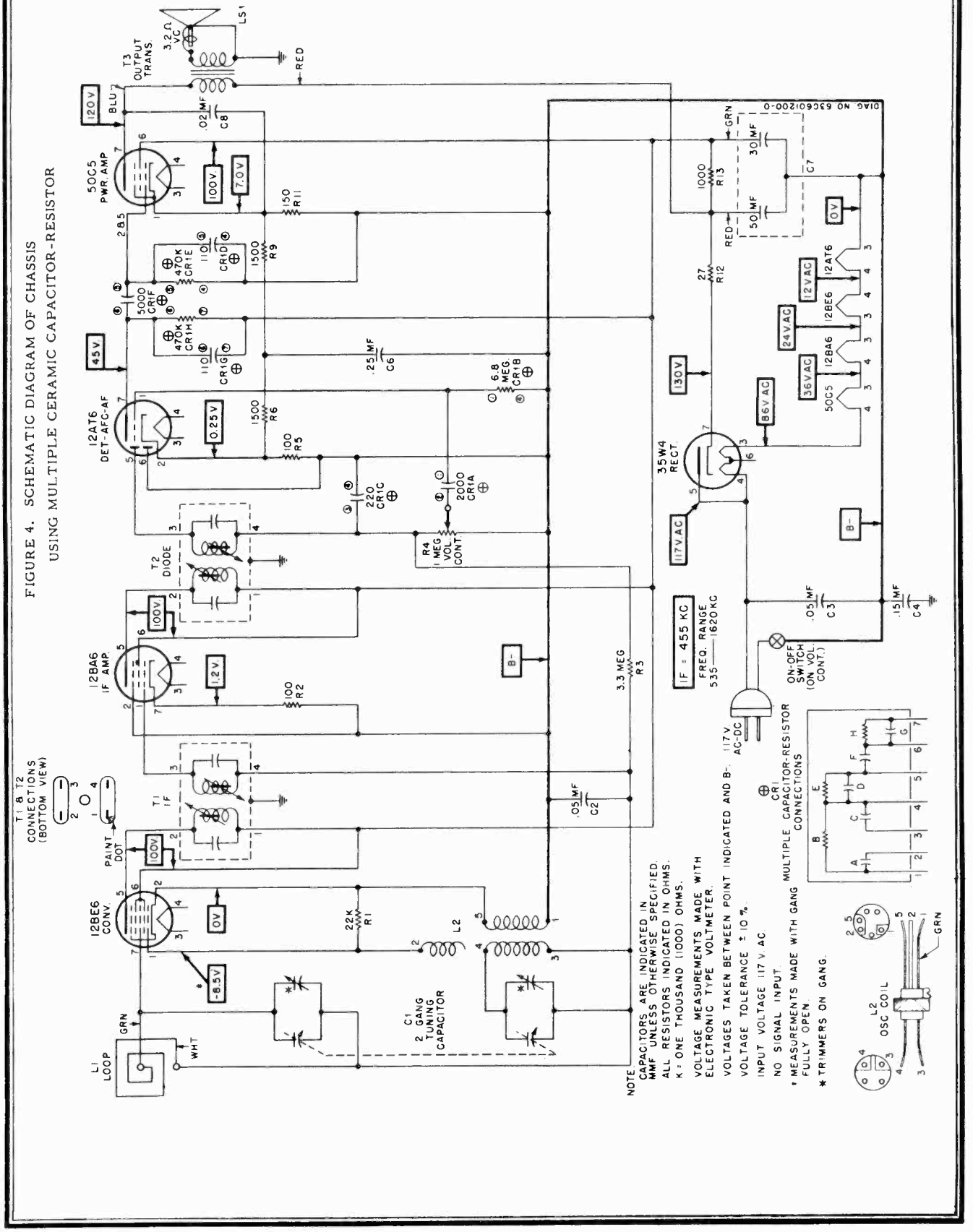


FIGURE 4. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR-RESISTOR

MODELS 5X11U, 5X12U, 5X13U, Ch. HS-243

REPLACEMENT PARTS LIST

NOTE: When ordering parts specify model number of set in addition to part number and description of part.

Ref. No.	Part Number	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	19B600483	Variable, 2 gang: with pulley .....
C-2	8R9821	Paper: .05 mf 200V .....
C-3	8R9816	Paper: .05 mf 400V .....
C-4	8R9843	Paper: .15 mf 200V .....
C-5	21B482847	Ceramic, multiple: 2000,220,220, 5000 mmf .....
C-6	8A470504	Paper: .25 mf 50V .....
C-7	23B600855	Electrolytic: 50-30 mf/150V .....
C-8	8R9802	Paper: .02 mf 400V .....
Capacitor-Resistor		
CR-1	21B601007	2000,110,110,5000 mmf; 6.8 meg, 470,000, 470,000 ohms .....
Coils		
L-1	24C600517	Loop Antenna Assembly: includes back panel .....
L-2	24K600812	BC Oscillator .....
Speaker		
LS-1	50C691401	Speaker, PM: 4"; 3.2 ohm VC ...
Resistors		
Note: All resistors are insulated carbon type unless otherwise specified.		
R-1	6R6028	22,000 20% 1/2W .....
R-2	6R6018	100 20% 1/2W .....
R-3	6R2118	3.3 meg 20% 1/2W .....
R-4	18K600474	Volume control: 1 meg; includes on-off switch .....
R-5	6R6326	100 10% 1/2W .....
R-6	6R6038	1500 10% 1/2W .....
R-7	6R2109	10 meg 20% 1/2W .....
R-8	6R6032	470,000 20% 1/2W .....
R-9	6R6038	1500 10% 1/2W .....
R-10	6R6032	470,000 20% 1/2W .....
R-11	6R3992	150 20% 1/2W .....
R-12	6R5683	27 10% 1/2W .....
R-13	6R3953	1000 20% 1W .....
Transformers		
T-1,2	24B485553	IF and Diode, 455 Kc: complete including padding capacitors and tuning cores .....
T-3	25K485973	Output .....

Part Number	Description
CHASSIS PARTS - MECHANICAL	
7K485971	Bracket, loop back mtg .....
7A600476	Bracket, tuning shaft mtg .....
1X600589	Bracket and Bushing Assembly, pointer.
42A485548	Clip, coil can mtg .....
11M8944	Cord, dial: 18 lb black .....
30A470651	Cord, line and plug: 6 ft lg .....
5A19658	Eyelet, spacer (gang mtg) .....
5A70404	Grommet, rubber (gang mtg) .....
14A482844	Insulator, cord outlet .....
29R3010	Lug, soldering .....
2S7051	Nut, hex: Palnut (volume control mtg)
1X600590	Pulley and Bushing Assembly, pointer drive .....
5S7771	Rivet: .088 x 3/16 stl; nkl pl (tube socket mtg) .....
5S7707	Rivet: .122 x 5/32 stl; nkl pl (tube shield mtg, output transformer mtg and tuning shaft bracket mtg).....
3S2294	Screw, machine: 6-32 x 1/2; lockscrew; plain hex head; stl; cad pl (gang mtg) .....
3S7477	Screw, machine: 8-32 x 1/4; type #1; plain hex head; stl; cad pl (back mtg) .....
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; stl; cad pl (pointer bracket mtg) .....
3S3398	Screw, sheet metal: #6 x 3/8 PKZ plain hex head; stl; cad pl (loop bracket mtg) .....
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; stl; cad pl (spkr mtg) ..
3S7148	Setscrew: 6-32 x 1/8; Allen head; stl; cad pl (pointer drive pulley retainer)
47K600506	Shaft, pointer: brass .....
1K600484	Shaft and Pulley Assembly, tuning ....
26A481521	Shield, spring (for 12BA6 tube) .....
9A472534	Socket, tube: 7-prong .....
9K580218	Socket, tube: 8-prong .....
41A73996	Spring, tension (electrolytic mtg) ...
41A14244	Spring, tension (drive cord) .....
4K692188	Washer, "C" (tuning shaft retainer and pointer shaft retainer) .....
4S7633	Washer, flat: 9/16 x 11/64 x .033 thick; stl; cad pl (loop back mtg) .....
4K482859	Washer, insulated shoulder .....
CABINET PARTS	
16E600187	Cabinet, table model: walnut-mahogany finish (5X11U) .....
16K600191	Cabinet, table model: ivory finish (5X12U)
16K600189	Cabinet, table model: ebony finish(5X13U)
13C600416	Bezel, dial (5X11U) .....
13K600417	Bezel, dial (5X12U) .....
13K600418	Bezel, dial (5X13U) .....
13B600573	Grille, cabinet (5X11U and 5X12U) ....
13K600575	Grille, cabinet (5X13U) .....
36B600570	Knob, pointer: walnut(5X11U) .....
36K600571	Knob, pointer: ivory (5X12U) .....
36K600572	Knob, pointer: black (5X13U) .....
36B600455	Knob, tuning: walnut (5X11U) .....
36K600456	Knob, tuning: ivory (5X12U) .....
36K600457	Knob, tuning: black (5X13U) .....
38A25507	Plug, split (back mtg) .....
52A600451	Pointer, dial: brass (5X11U and 5X12U)
52K600453	Pointer, dial: steel (5X13U) .....
3S3371	Screw, sheet metal: #8 x 3/8 PKF plain hex head; stl; cad pl (chassis mtg)
7C600814	Support, cabinet: brass (5X11U, 5X12U)
7K600816	Support, cabinet: aluminum (5X13U)....

MODELS 5X21U, 5X22U, 5X23U, Ch. HS-259

GENERAL INFORMATION

TYPE - A combination standard broadcast and shortwave table model receiver.

RECEIVER MODELS

Model	Color
5X21U	Walnut-Mahogany
5X22U	Ivory
5X23U	Ebony

TUBE COMPLEMENT -

12BE6 - Converter
12BA6 - IF Amplifier
12AT6 - Detector, AVC & 1st Audio Amp
50C5 - Power Amplifier
35W4 - Rectifier

POWER SUPPLY - 117V AC/DC 35 watts

TUNING RANGE - Standard Broadcast - 535 to 1620 Kc
Shortwave - 5.85 Mc to 18.1 Mc

IF - 455 Kc

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNAS

For shortwave reception, it is necessary to connect a length of wire (at least 10 feet long) to the screw terminal located on the radio rear panel. A commercial shortwave antenna is recommended for best results.

No outside antenna is normally required for standard broadcast station reception. A loop antenna for receiving broadcast stations is built into the radio. If the radio is located at a considerable distance from broadcast stations, it may be necessary to secure additional signal pick-up by using an external antenna. The shortwave antenna wire may by used for additional pick-up of standard broadcast stations; leave the wire connected to the shortwave terminal screw and wind two turns of the wire in the slots located at the top of the radio rear panel.

CAUTION: Do not connect antenna or chassis to water pipe, radiator or other ground.

CONTROLS

POWER SWITCH & VOLUME CONTROL. The power switch and volume control are combined and operated with the left-hand knob. If the radio does not operate from a DC power line after being turned on for a few minutes, reverse the power cord plug in the power outlet. When operating from AC power lines, reception can sometimes be improved by reversing the power cord in the power outlet.

BANDSWITCH. The small (inner) right-hand knob selects standard broadcast or shortwave reception, as desired. Rotate this knob to the left for standard broadcast or to the right for shortwave reception.

TUNING. The large (outer) right-hand knob is used for tuning both standard broadcast and shortwave stations.

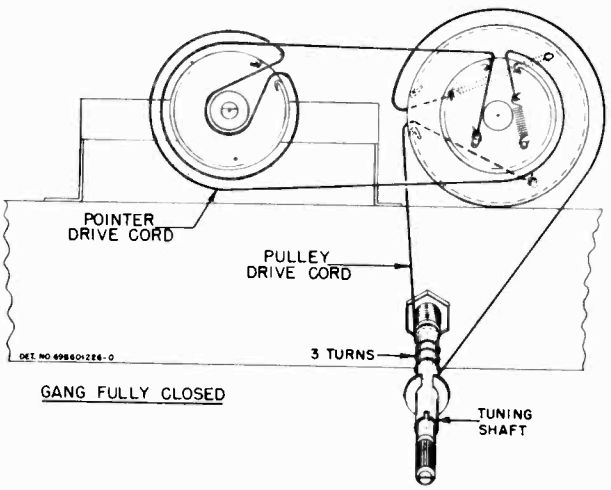


FIGURE 1. STRING DRIVE DETAIL

SERVICE NOTES

TO REMOVE CHASSIS FROM CABINET:

1. Remove the control knobs, pointer knob and pointer; these parts pull off.
2. Remove the two split plugs which hold the top of the loop panel to the cabinet.
3. Remove the two chassis mounting screws, accessible through the slots in the loop panel and slide the chassis from the cabinet.

MODELS 5X21U, 5X22U, 5X23U, Ch. HS-259

ALIGNMENT

NOTE: It is recommended that an isolation transformer be placed between the power line and the receiver to avoid hum and electrical shocks. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator output to a level which produces less than .40 volts (.05 watt) across the voice coil to avoid overloading the receiver.
7. See Figure 2 for adjustment locations and the following chart for procedure.

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	BAND SWITCH	GANG SET TO	ADJUST	REMARKS
IF ALIGNMENT							
1.	.1 mf	Rear stator of tuning capacitor	455 Kc	-	Gang opened	1, 2, 3 & 4	Adjust for maximum.
SW BAND RF ALIGNMENT							
2.	400 ohms	SW Ant terminal	18.1 mc	SW	Fully opened	5 & 6	Adjust for maximum.
BC BAND RF ALIGNMENT							
3.	.1 mf	Rear stator of tuning capacitor	1620 Kc	BC	Fully opened	7	Adjust for maximum.
4.	None	Radiation loop*	1400 Kc	BC	Tune for maximum	8	Adjust for maximum.

* Connect generator output to 5" diameter, 3 turn loop and couple to receiver loop. Keep loops at least 12" apart.

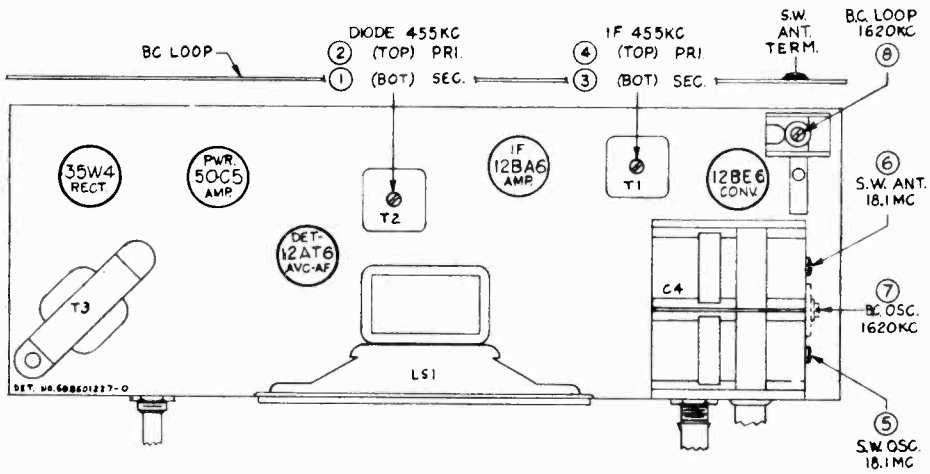


FIGURE 2. TUBE & TRIMMER LOCATIONS

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part No.	Description
		CHASSIS PARTS - ELECTRICAL
		Capacitors
C-1	21K77373	Ceramic: 47 mmf 500V .....
C-2	21K891154	Mica: 613 mmf 3% 500V .....

MODELS 5X21U, 5X22U,
5X23U, Ch. HS-259

C-3	20A600917	Mica, variable: 3 to 20 mmf; includes bracket
C-4	19B600922	Variable, 2 gang: includes pulley
C-5	21KT7373	Ceramic: 47 mmf 500V
C-6	20A680362	Mica, variable: 10 to 50 mmf
C-7	8R9807	Paper: .1 mf 400V
C-8	8R9821	Paper: .05 mf 200V
C-9	8R9816	Paper: .05 mf 400V
C-10	8R9843	Paper: .15 mf 200V
C-11	21B482847	Ceramic, multiple: .002 mf, 220 mmf, 220 mmf & .005 mf 400V
C-12	8A470504	Paper: .25 mf 50V
C-13	8R9802	Paper: .02 mf 400V
C-14	23K600927	Electrolytic: 40-20-20 mf/150V

Capacitor-Resistor

CR-1	21B601007	Capacitor-Resistor: 2000 mmf, 220 mmf, 5000 mmf, 110 mmf, 110 mmf, 6.8 meg, 470,000 ohms & 470,000 ohms

Coils

L-1	24K600687	Loop Antenna Assembly: includes back panel
L-2	24B600925	Coil, shortwave antenna
L-3	24B600924	Coil, shortwave oscillator
L-4	24A600926	Coil, BC oscillator

Speaker

LS-1	50C691401	Speaker, PM: 4"; 3.2 ohm VC

Resistors

Note: All resistors are insulated carbon type unless otherwise specified.

R-1	6R6075	100,000 20% 1/2W
R-2	6R2108	47 20% 1/2W
R-3	6R6028	22,000 20% 1/2W
R-4	6R6018	100 20% 1/2W
R-5	6R2118	3.3 meg 20% 1/2W
R-6	18K600474	Volume control: 1 meg; includes on-off switch
R-7	6R6326	100 10% 1/2W
R-8	6R6038	1500 10% 1/2W
R-9	6R2109	10 meg 20% 1/2W
R-10	6R6032	470,000 20% 1/2W
R-11	6R5683	27 10% 1/2W
R-12	6R6032	470,000 20% 1/2W
R-13	6R6038	1500 10% 1/2W
R-14	6R3992	150 20% 1/2W
R-15	6R3953	1000 20% 1W
R-16	6R6290	2200 20% 1/2W

Switch

S-1	40K600919	Switch, band: 2-position

Transformers

T-1,2	24B485553	IF and Diode: complete with tuning cores, padding capacitors and shield
T-3	25K485973	Output Transformer

CHASSIS PARTS - MECHANICAL

7K485971	Bracket, loop mtg
1X600589	Bracket and Bushing Assembly, pointer shaft
42A485548	Clip, coil can mtg (for T-1 & T-2)
11M8944	Cord, dial: 18# black
30A470651	Cord, line and plug; 6 ft long
5A19658	Eyelet, spacer (gang mtg)
5A70404	Grommet, rubber (gang mtg)

Part Number	Description
14A482844	Insulator, cord outlet
29R3010	Lug, soldering
2S7051	Nut, hex: Palnut; 3/8-32 x 9/16; stl; cad pl (volume control and bandswitch mtg)
1X600590	Pulley and Bushing Assembly, pointer drive
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg)
5S7706	Rivet: .122 x 1/8; stl; nkl pl (variable capacitor mtg)
5S7707	Rivet: .122 x 5/32; stl; nkl pl (spring tube shield, output transformer and variable capacitor & bracket assembly mtg)
3S2294	Screw, machine: 6-32 x 1/2 plain hex head; locking type; stl; cad pl (gang mtg)
3S7477	Screw, machine: 8-32 x 1/4 plain hex head; stl; cad pl (loop back mtg)
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; stl; cad pl (coils and pointer bracket mtg)
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; stl; cad pl (speaker mtg)
3S3398	Screw, sheet metal: #6 x 3/8 PKZ plain hex head; stl; cad pl (loop bracket & insulator mtg)
3S7148	Setscrew: 6-32 x 1/8; Allen head; stl; cad pl (pointer pulley assembly retainer)
47K600506	Shaft, pointer: brass
47K600928	Shaft, tuning
26A481521	Shield, spring (for 12AT6 tube)
9A472534	Socket, tube: 7-prong
9K580218	Socket, tube: 8-prong
41A73996	Spring, tension (electrolytic mtg)
41A14111	Spring, tension (dial cord -long)
41A21332	Spring, tension (dial cord -short)
4K692188	Washer, "C" (pointer shaft retainer)
4A73639	Washer, "C" (tuning shaft retainer)
4S7633	Washer, flat: 9/16 x 11/64 x .033 thick; stl; cad pl (loop back mtg)
4K482859	Washer, insulated shoulder (loop bracket & insulator mtg)

CABINET PARTS

13C600935	Bezel, dial (5X21U)
13K600936	Bezel, dial (5X22U)
13K600937	Bezel, dial (5X23U)
16E600187	Cabinet, table model: molded; walnut-mahogany finish (5X21U)
16K600191	Cabinet, table model: molded; ivory finish (5X22U)
16K600189	Cabinet, table model: molded; ebony finish (5X23U)
13B600573	Grille, cabinet (5X21U and 5X22U)
13K600575	Grille, cabinet (5X23U)
36K482767	Knob, band control (5X21U)
36K482788	Knob, band control (5X22U)
36K600939	Knob, band control (5X23U)
36K600570	Knob, pointer retainer (5X21U)
36K600571	Knob, pointer retainer (5X22U)
36K600572	Knob, pointer retainer (5X23U)
36K690668	Knob, tuning control (5X21U)
36K690669	Knob, tuning control (5X22U)
36K600943	Knob, tuning control (5X23U)
36B690664	Knob, volume and on-off control (5X21U)
36K690665	Knob, volume and on-off control (5X22U)
36K600945	Knob, volume and on-off control (5X23U)
38A25507	Plug, split (loop back mtg to cabinet)
52A600451	Pointer, dial (5X21U and 5X22U)
52K600453	Pointer, dial (5X23U)
3S3371	Screw, machine: 8-32 x 3/8 PKF plain hex head; stl; cad pl (chassis mtg to cabinet)
7C600814	Support, cabinet (5X21U and 5X22U)
7K600816	Support, cabinet (5X23U)

MODELS 5X21U, 5X22U,
5X23U, Ch. HS-259

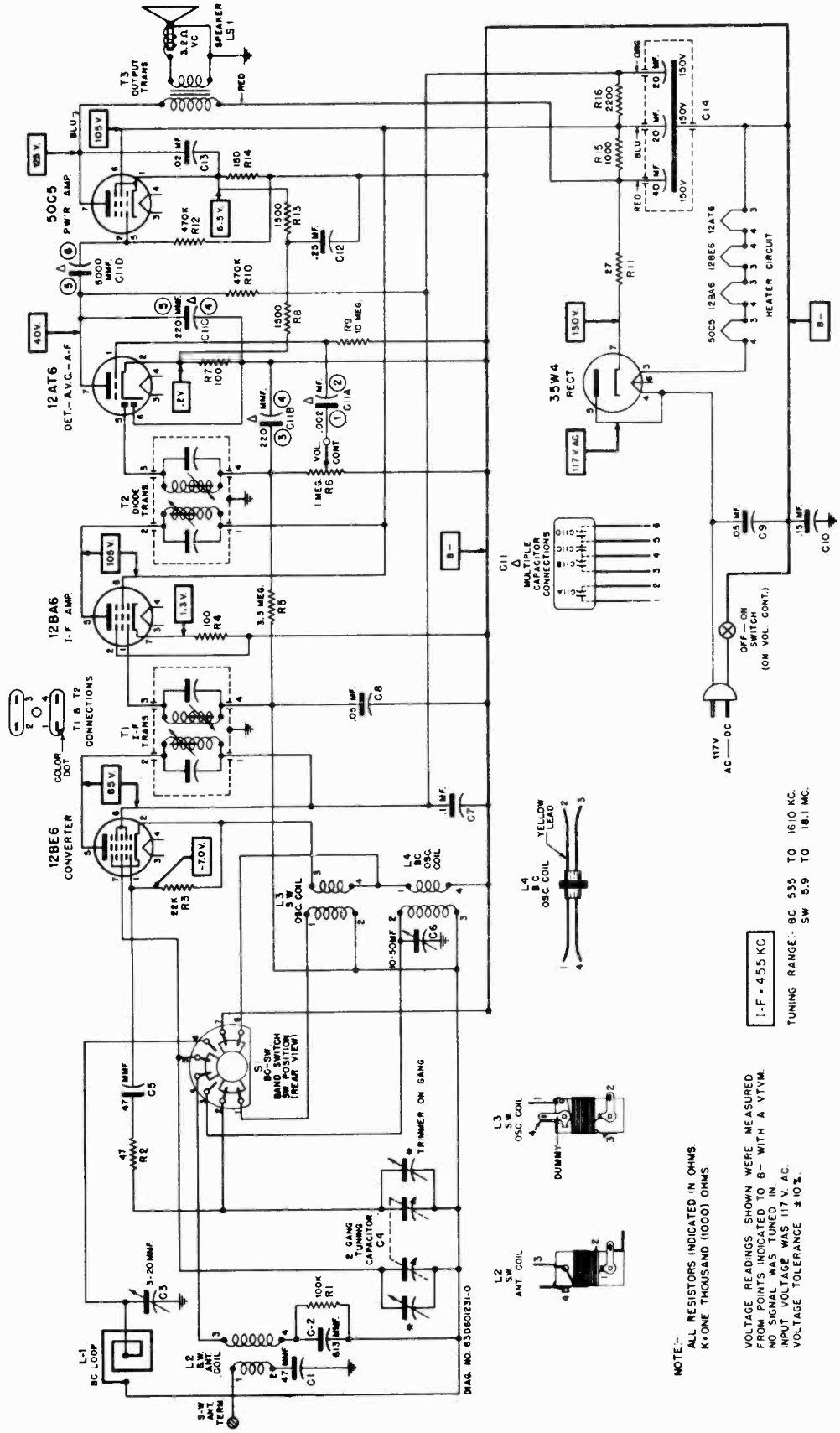


FIGURE 3. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR

MODELS 5X21U, 5X22U,
5X23U, Ch. HS-259

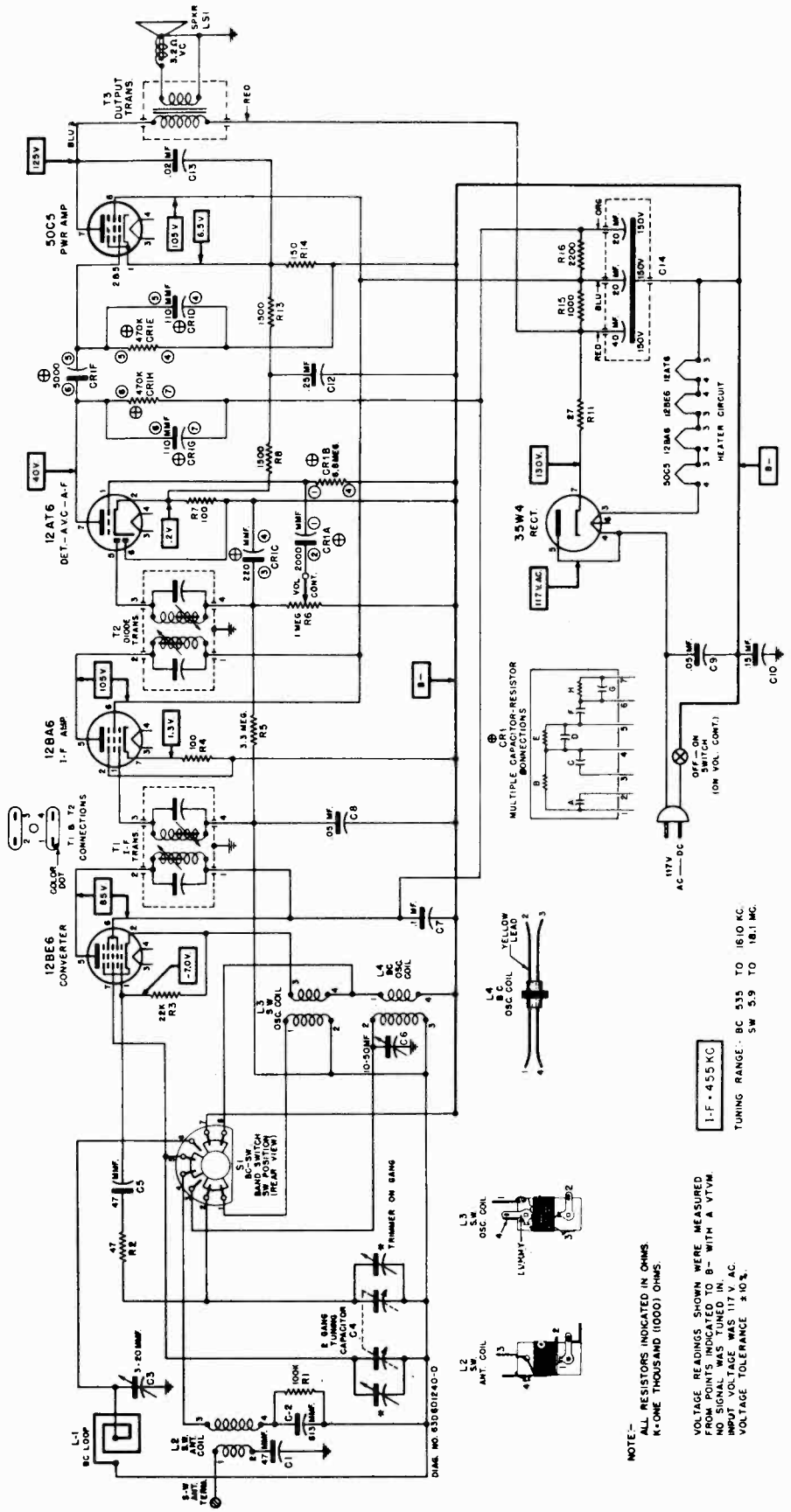


FIGURE 4. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR-RESISTOR

MODELS 6F11, 6F11B,
Ch. HS-264

GENERAL INFORMATION

TYPE - AM Radio-Phonograph Combination

RECEIVER MODELS -

Model	Color
6F11	Red-brown mahogany
6F11B	Blonde

TUBE COMPLEMENT -

TUNING RANGE - 535 to 1620 Kc	6BA6	RF Amplifier
	6BE6	Converter
	6BA6	IF Amplifier
IF FREQUENCY - 455 Kc	6AV6	Detector & 1st Audio Amp
	6K6GT	Power Amplifier
	5Y3GT	Rectifier

POWER SUPPLY - 117 volts, 60 cycle AC only; 80 watts, including phono motor

PHONOGRAPH - Model RC-37, three-speed: 33, 45 & 78 RPM. Refer to the RC-37 Service Manual for record changer service information.

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNA

No outside antenna or ground is normally required for radio reception, as a loop antenna is located inside the cabinet. Two wires from the chassis connect to the loop.

In locations where additional pick-up is desired, an external antenna may be connected to the clip marked "EXT BC ANT" on the loop.

CONTROLS

Refer to Figure 1 for the locations of the radio operating controls.

Power for both the radio and the record changer is controlled by the VOL-ON-OFF knob. The phonograph motor will not operate, however, until the PHONO-RADIO knob is rotated to "PHONO".

FIGURE 1. OPERATING CONTROLS

SERVICE NOTES

TO REMOVE CHASSIS FROM CABINET:

1. Remove the screws from the cabinet back.
2. Disconnect the phono power lead, the phono pick-up lead, the speaker leads, the line cord, and the antenna loop leads.
3. Remove the pointer escutcheon by pulling it downward.
4. Turn the tuning knob counterclockwise until the pointer reaches the extreme low frequency end of the dial scale.
5. From the back of the cabinet, loosen the pointer adjustment setscrew (see Figure 2), and pull the pointer and shaft assembly from the chassis. CAUTION: Do not remove the nut from the front of the pointer, as the detent ball and spring will fall out and may become lost.
6. Pull off the control knobs.
7. Remove the three chassis mounting screws, from beneath the chassis.
8. Slide the chassis from the cabinet.

TO CALIBRATE DIAL:

1. Turn the tuning knob counterclockwise until the end of its travel is reached.
2. From the back of the cabinet, loosen the pointer adjustment setscrew (see Figure 2). CAUTION: Do not remove the nut from the front of the pointer.
3. Move the pointer until it is in a horizontal position (at the low frequency end of the dial scale).
4. Tighten the adjustment setscrew.

NOTE: If the pointer is moved by hand accidentally, it will be released from a detent in the pointer collar, and no damage to the tuning mechanism will result. To reset the pointer, move it back and forth until it again engages in the detent.

MODELS 6F11, 6F11B,
Ch. HS-264

ALIGNMENT

1. Connect a low range output meter across the speaker voice coil.
2. Connect an AM signal generator as in chart below.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Rotate the PHONO-RADIO switch to the "RADIO" position.
5. Turn the receiver volume control to maximum.
6. Use a small fibre screwdriver for aligning the IF and diode transformers.
7. As stages are brought into alignment, reduce the signal generator output to a level which produces less than 1.27 volts (.5 watt) across the voice coil, to avoid overloading the receiver.
8. See Figure 3 for adjustment locations, and the following chart for procedure.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv V-2 (pin 7, 6BE6)	455 Kc	Fully opened	1, 2, 3 & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv V-2 (pin 7, 6BE6)	1620 Kc	Fully opened	5 (Osc)	Adjust for maximum. *
3.	-	-	-	-	-	Connect BC loop to chassis.
4.	-	Across radiation loop**	1400 Kc	Tune in signal	8 (Ant)	Adjust for maximum.

5. If, after the receiver has been aligned as above, it is found to be badly off calibration, it will be necessary to adjust oscillator core (7) as follows: connect the generator to the grid of the converter tube and, with the gang fully closed, adjust core (7) at 535 kc. It is advisable to repeat the oscillator adjustments at 1620 kc and 535 kc several times until the tuning range is correct. Core (7) has been pre-set at the factory and normally should require no retuning.

* If difficulty is encountered in tuning trimmer (5), adjust trimmer (6) to 1/2 turn from tight.

**Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

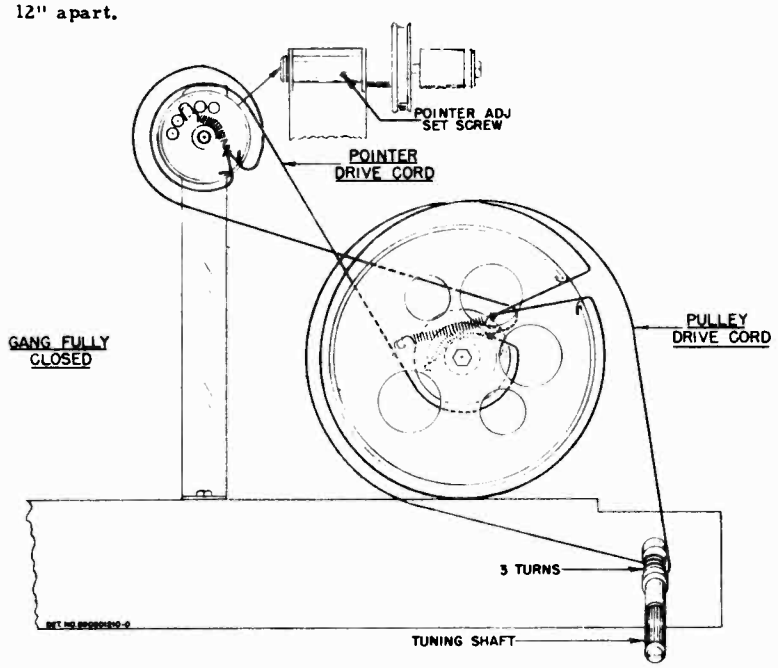


FIGURE 2.
DIAL RESTRINGING DETAIL

MODELS 6F11, 6F11B,
Ch. HS-264

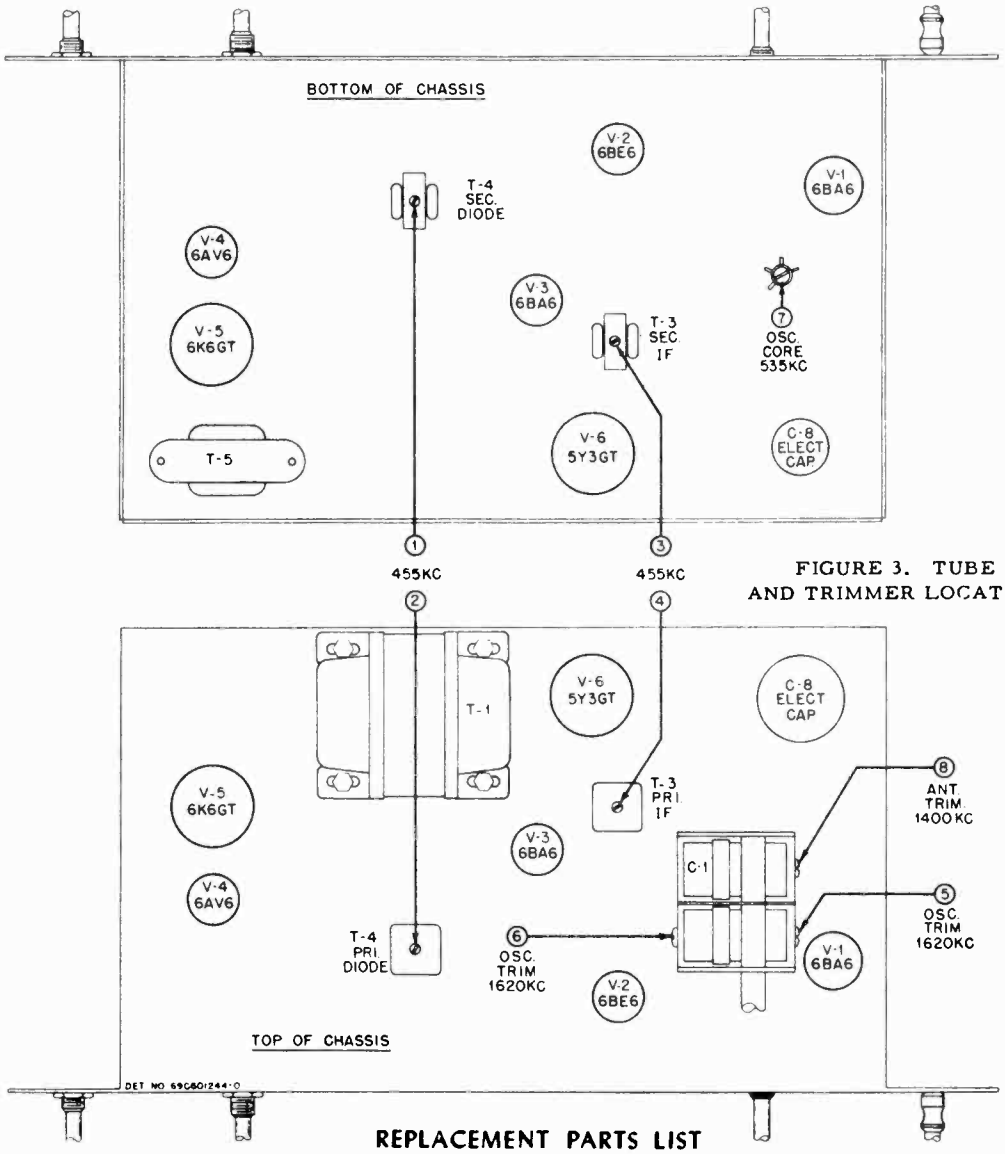


FIGURE 3. TUBE AND TRIMMER LOCATIONS

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part No.	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	19B691877	Variable: 2- gang.....
C-2	21B77286	Ceramic: 100 mmf 500V.....
C-3	8R9816	Paper: .05 mf 400V.....
C-4	21K482726	Ceramic, disc type: 10,000 mmf 450V.....
C-5	21B77286	Ceramic: 100 mmf 500V.....
C-6	21K77373	Ceramic: 47 mmf 500V.....
C-7	21K482726	Ceramic; disc type: 10,000 mmf 450V.....
C-8	23B690975	Electrolytic: 40 mf/300V, 40-40 mf/250V, 40 mf/25V.....
C-9	21K482726	Ceramic; disc type: 10,000 mmf 450V.....
C-10	21K482726	Ceramic, disc type: 10,000 mmf 450V.....
C-11	8R9809	Paper: .01 mf 400V.....
C-12	8R9813	Paper: .005 mf 600V.....
C-13	8R9809	Paper: .01 mf 400V.....
C-14	8R9813	Paper: .005 mf 600V.....
C-15	8R9813	Paper: .005 mf 600V.....
C-16	8R490232	Tubular, molded: .047 mf 400V....
C-17	21B77286	Ceramic: 100 mmf 500V.....
C-18	8R9847	Paper: .002 mf 600V.....
Pilot Light		
I-1,2	65X10867	Bulb, pilot light: #44; 6-8V; .25 amp; clear; bayonet base....
Coils		
L-1	24C690896	Loop Antenna.....
Speaker		
LS-1	50C601038	Speaker: 8" PM; 3.2 ohm V.C...
Resistors		

NOTE: All resistors are insulated, carbon type unless otherwise specified.

MODELS 6F11, 6F11B, Ch. HS-264

Ref. No.	Part No.	Description
R-1	6R6004	1 meg 20% 1/2W
R-2	6R5551	120 10% 1/2W
R-3	6R5766	12,000 10% 2W
R-4	6R6069	2200 10% 1/2W
R-5	6R6012	33,000 20% 1/2W
R-6	6R6056	47,000 20% 1/2W
R-7	6R5766	12,000 10% 2W
R-8	17A690973	Wire wound: 360 10% 3W; centic tapped
R-9	6R6270	220 10% 1/2W
R-10	6R6056	47,000 20% 1/2W
R-11	6R6056	47,000 20% 1/2W
R-12	6R3927	2.2 meg 20% 1/2W
R-13	6R2109	10 meg 20% 1/2W
R-14	6R6032	470,000 20% 1/2W
R-15	18A600974	Volume control: 2 meg; tapped at 600,000 ohms; includes ON-OFF switch
R-16	6R6074	68,000 10% 1/2W
R-17	18R77399	Tone Control: 1 meg
R-18	6R6032	470,000 20% 1/2W
R-19	6R6015	220,000 20% 1/2W
R-20	6R5593	470 10% 1W

Switches

S-1	40B601065	Switch, PHONO-RADIO

Transformers

T-1	25B600684	Power Transformer
T-2	24K691878	Oscillator Transformer: white & red dot
T-3	24B485553	IF Transformer (green dot): 455 Kc; complete with capacitors, cores, and shield
T-4	24K485555	Diode Transformer (pink dot): 455 Kc; complete with capacitors, cores, and shield
T-5	25B600969	Audio Output Transformer

CHASSIS PARTS - MECHANICAL

7C690567	Bracket, gang mtg
7A600965	Bracket, pilot light mtg
7B600801	Bracket, pointer mtg
7A77337	Bracket, tuning shaft
43A890397	Bushing, tire cord strain relief (use with 43K890398)
43K890398	Bushing, tire and retainer (use with (43A890397)
42A485548	Clip, coil can mtg (IF transformers).
11M8944	Cord, dial (pointer drive)
30K21859	Cord, line: with plug; 9 ft long
15A600877	Cover, volume control: with insulator
1X600495	Lead and Plug Assembly, phono pick-up.
4S9751	Lockwasher int-ext: #8; cad pl pointer & gang drive pulleys mtg)
2S7051	Nut, hex palnut: 3/8-32 x 9/16; cad pl (control mtg)
28K71775	Plug, phono pick-up
49A690559	Pulley, gang drive: 3 1/2" diameter
49A690558	Pulley, pointer drive: 1 1/4" diameter
9A600040	Receptacle, phono motor: 3 prong; includes shell
5S7771	Rivet: .088 x 3/16 stl; nkl pl (min socket mtg)
5S7707	Rivet: .122 x 5/32 stl; nkl pl (term strip mtg)
5S7701	Rivet: .122 x 3/16 stl; nkl pl (output trans mtg)
5S7700	Rivet: .122 x 1/4 stl; nkl pl (octal socket mtg)
3S7326	Screw, machine: 8-32 x 3/16 plain locking hex head; cad pl (gang mtg)
3S7163	Screw, machine: 8-32 x 1/4 plain hex head; cad pl (pointer & gang drive pulleys mtg)
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (holds gang mtg brkt)
3S7506	Screw, sheet metal: #6 x 1/4 PKZ plain hex head; cad pl (holds pointer mtg brkt)
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; cad pl (pilot light brkt mtg)
3S7475	Screw, sheet metal: #8 x 1/4 PKZ slotted acron head; cad pl (power trans mtg)
3S7103	Setscrew: 8-32 x 1/8 allen head; cad pl (pointer mtg)
1K601085	Shaft and Pulleys Assembly, pointer mtg.
1X600489	Shaft, tuning: complete with pulley
15A690616	Shell, receptacle (on phono motor receptacle)
9K600968	Socket, pilot light
9K484167	Socket, tube: miniature; 7-prong
9A76209	Socket, tube: octal
41A14244	Spring, tension (pointer drive cord).
31K37494	Strip, terminal: 4 insulated lugs, #3 gnd; 3/8" spacing
31K90046	Strip, terminal: 5 insulated lugs, #4 gnd; 3/8" spacing
29K5405	Terminal pin (on speaker leads)
4A70015	Washer, "C" (tuning shaft mtg)
4A21941	Washer, "C" (holds pointer mtg shaft & pulley)
4S7555	Washer, flat: 1/4 x .128 x .033 stl; cad pl (output trans mtg)
4S7582	Washer, flat: 1/2 x .195 x .033 stl; cad pl (pointer & gang drive pulleys mtg)
4A691006	Washer, flat: double "D" (pointer & gang drive pulleys mtg)

MODEL 6F11 CABINET PARTS

43A4326	Ball, steel: 1/8" dia (pointer detent)
38K691915	Button, plug (on record changer)
16F600649	Cabinet, console: red-brown mahogany; complete less pointer escutcheon and dial scale
13K600651	Cloth, grille: 17 1/2" x 18 1/4"; mahogany
15C600874	Cover, cabinet back
34K601066	Dial scale
34K600817	Escutcheon, pointer
5S7870	Eyelet: brass (on R. C. drawer panel-holds extra spindle)
5A71081	Eyelet, chassis mtg: plain; 9/32" long
5A600963	Eyelet, chassis mtg: pierced; 1/8" long
5A71092	Grommet, chassis mtg: rubber
36K601052	Knob, control (VOL-ON-OF): walnut-mahogany
36K601053	Knob, control (PHONO-RADIO): walnut-mahogany
36K601054	Knob, control (TONE): walnut-mahogany.
36K601055	Knob, control (TUNING) walnut-mahogany
4S7657	Lockwasher ext: #8; cad pl (spkr mtg)
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (pointer mtg)
2S7003	Nut, hex: 8-32 x 5/16;cad pl (spkr mtg)
62K70581	Overlay, logotype: "Motorola"; gold lacquer finish
1X600851	Pointer and Collar Assembly (less shaft and sleeve)
55K600653	Pull, record changer drawer: satin brass
3K600655	Screw, machine: 8-32 x 1/2 cross slot head; statuary bronze finish (R.C. drawer pull mtg)
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acron head; antique copper finish (back cover mtg)

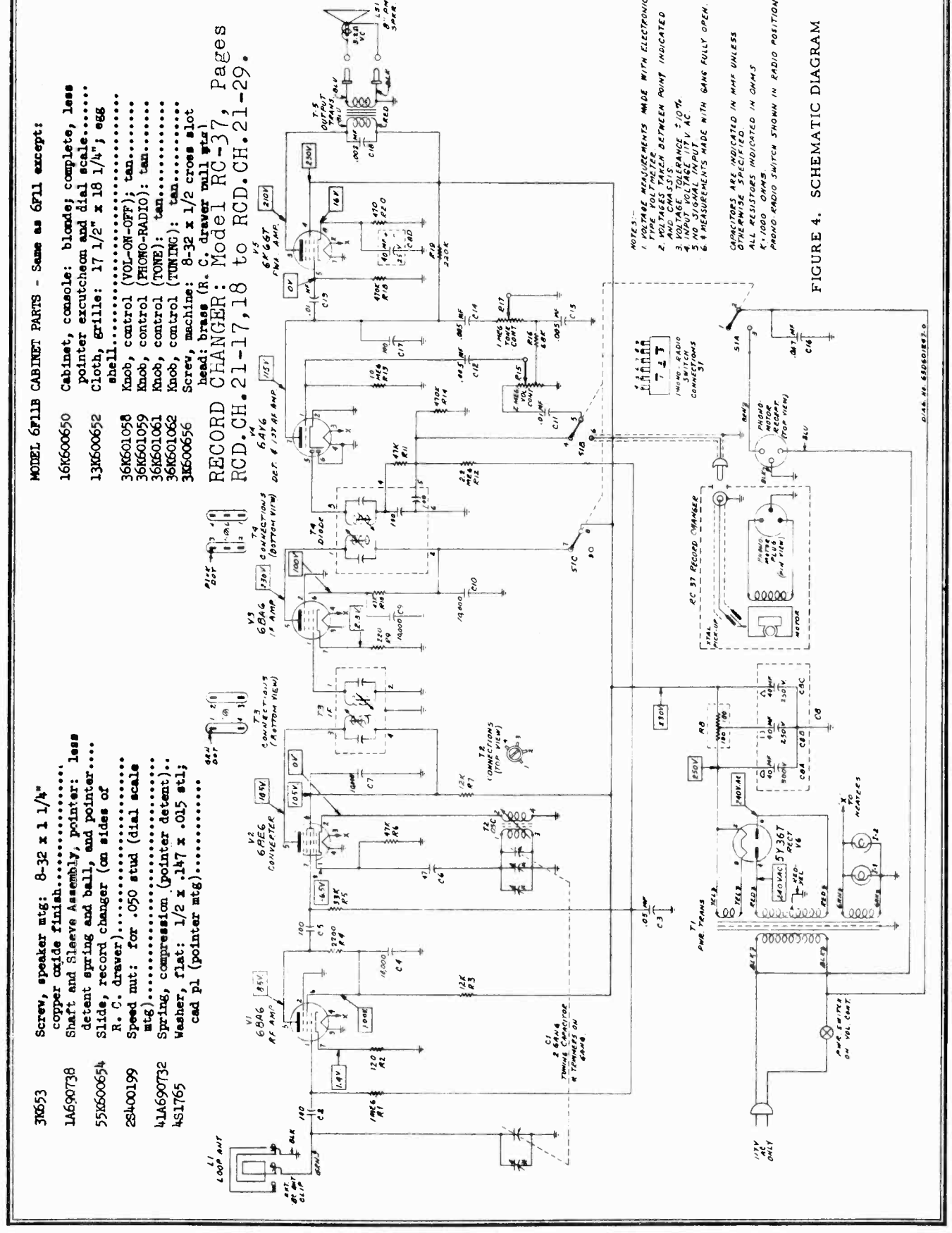
MODELS 6F11, 6F11B,
Ch. HS-264

MODEL 6F11B CABINET PARTS - Same as 6F11 except:

16K6000650	Cabinet, console: blonde; complete, less pointer escutcheon and dial scale.....
13K6000652	Cloth, grille: 17 1/2" x 18 1/4"; egg shell.....
36K6001058	Knob, control (VOL-ON-OFF): tan.....
36K6001059	Knob, control (PHONO-RADIO): tan.....
36K6001061	Knob, control (TONE): tan.....
36K6001062	Knob, control (TUNING): tan.....
3K6000656	Screw, machine: 8-32 x 1/2 cross slot head; brass (R. C. drawer mtg)

3K653	Screw, speaker mtg: 8-32 x 1 1/4" copper oxide finish.....
1A690738	Shaft and Sleeve Assembly, pointer: less detent spring and ball, and pointer....
55K6000654	Slide, record changer (on sides of R. C. drawer).....
28400199	Speed nut: for .050 stud (dial scale mtg).....
41A690732	Spring, compression (pointer detent)..
4S1765	Washer, flat: 1/2 x .147 x .015 stl; cad pl (pointer mtg).....

RECORD CHANGER: Model RC-37, Pages RCD.CH.21-17,18 to RCD.CH.21-29.



MODELS 6L1, 6L2,
Ch. HS-226

GENERAL INFORMATION

TYPE - Five-tube, three-power (AC/DC, Battery) portable, with a selenium rectifier. A loop antenna is housed in the back cover.

TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

TUBE COMPLEMENT - 1U4 - RF Amplifier
1R5 - Converter
1U4 - IF Amplifier
1U5 - Det, AVC & 1st AF Amp
3V4 - Power Amplifier
Rectifier - Selenium type

POWER SUPPLY - Operates from 117 volts AC or DC (15 watts), or self-contained battery pack. Use an Eveready #753 or a General #60A-6F6-5 battery pack.

OPERATING INSTRUCTIONS

CONTROLS. The volume control and power switch are combined and are operated with the left-hand knob. Select stations with the right-hand knob.

TO OPEN BACK COVER. Insert a coin or similar object into the slots on either side of the cabinet, and twist until the two sections of the cabinet separate. To close, merely snap together.

CAUTION: When closing the cover, be careful not to pinch the line cord or other leads.

HOUSE CURRENT OPERATION. The power cord is located inside the cabinet and can be reached by opening the back cover. Pass the cord through the slot in the side of the cabinet before closing the cover. Insert the power plug into any 117 volt AC or DC outlet. If the receiver does not operate from DC power, reverse the line cord plug in the power outlet.

BATTERY OPERATION. Open the back cover and install the battery pack, following the instructions in Figure 1. Insert the line cord plug into the receptacle on the receiver chassis or the receiver will not operate from its battery. If the receiver is to be operated for a long period of time from AC or DC, or is to be placed in storage, remove the battery and store it in a cool place. Replace the battery when low volume or fuzzy tone is noticed. The condition of the battery will not affect the operation of the receiver from AC or DC. Never leave a low or run-down battery in the receiver because it will leak or swell and damage the receiver.

ANTENNA. A loop antenna is built into the rear cover of this receiver. Because of the slightly directional characteristics of the loop antenna, reception from some stations may be improved by rotating the receiver. In extremely noisy locations, rotate the entire receiver until minimum noise and maximum signal pickup are obtained.

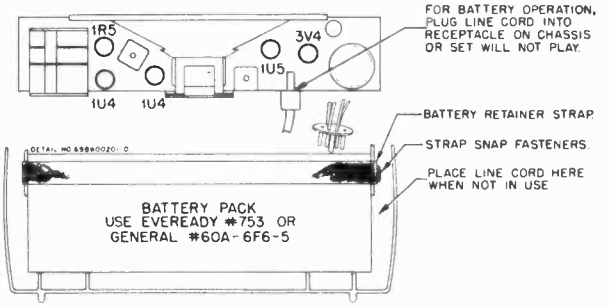


FIGURE 1. BATTERY & TUBE LOCATIONS

ALIGNMENT

NOTE: The receiver may be operated either from a battery or from the commercial power lines during alignment. If AC power is used, it is recommended that an isolation transformer be placed between the power line and the receiver. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

PROCEDURE:-

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator input to keep the output of the receiver at approximately .05 watts (.05 watt = .40 volts on the output meter) to avoid overloading the receiver.
7. See Figure 2 for adjustment locations and the following chart for procedure.

MODELS 6L1, 6L2,
Ch. HS-226

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. (pin 6, 1R5)	455 Kc	Fully open	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT						
2.	-	-	-	Fully closed	Pointer	Set pointer as shown in Figure 3.
3.	.1 mf	Grid of RF Amp (pin 6, 1U4)	1620 Kc	Fully open	5	Adjust for maximum
4.	.1 mf	"	1400 Kc	Tune for maximum	6	Adjust for maximum
5.	-	Radiation loop*	"	"	7	With chassis installed in cabinet and output meter connected to speaker, open rear cover slightly and adjust for maximum. NOTE: Battery pack should be in cabinet.

*Connect generator output across 5" diameter, 5-turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

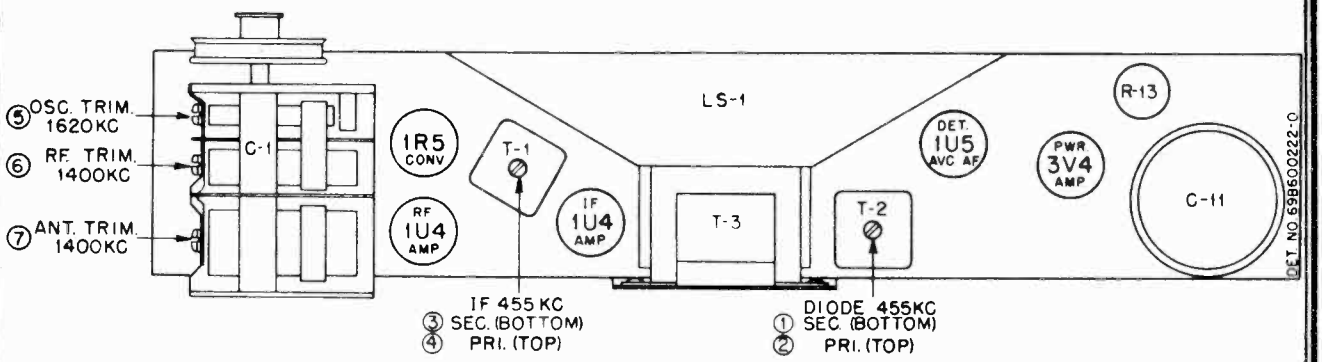


FIGURE 2. TUBE & TRIMMER LOCATIONS

SERVICE NOTES

The chassis of this receiver is isolated from the AC power line circuit by a capacitor to eliminate the shock hazard when handling the receiver. However, as an additional precaution when aligning or servicing the receiver from AC, an isolation transformer should be inserted between the power line and the chassis.

The tubes are exposed when the rear cover is opened. It is not necessary to remove the chassis to replace tubes.

To remove the chassis from the cabinet:

1. Open the rear cover and remove the battery pack.
2. Disconnect the two leads from the chassis to the loop antenna.
3. Pull off the two control knobs on the front of the cabinet.
4. Remove the two hex head screws located under the knobs.
5. Slide the chassis out of the cabinet.

MODELS 6L1, 6L2,
Ch. HS-226

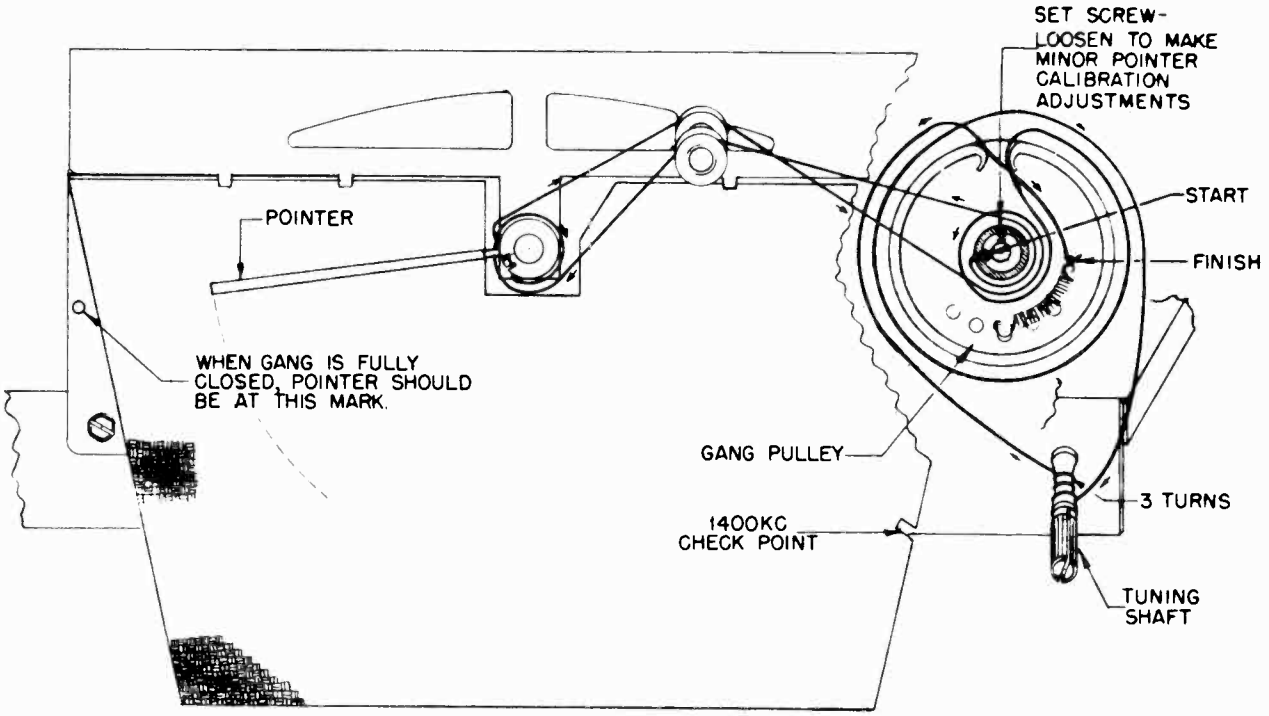


FIGURE 3. STRING DRIVE

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
		CHASSIS PARTS - ELECTRICAL
		CAPACITORS
C-1	19B692045	Variable: 3-gang .....
C-2	8K71213	Paper: .05 mf 100V .....
C-3	21B77286	Ceramic: 100 mmf 500V .....
C-4	21K482726	Ceramic, disc type: 10,000 mmf 450V .....
C-5	21K482726	Ceramic, disc type: 10,000 mmf 450V .....
C-6	21K482726	Ceramic, disc type: 10,000 mmf 450V .....
C-7	8K471635	Paper: .05 mf 400V .....
C-8A, B,C,D	21B482847	Ceramic, multiple: 2000 mmf, 220 mmf, 220 mmf, 5000 mmf .....
C-9	21K482726	Ceramic, disc type: 10,000 mmf 450V .....
C-10	8K71213	Paper: .05 mf 100V .....
C-11	23K76985	Electrolytic: 40-40-20 mf/150V, 80 mf/25V; includes cover ....
C-12	8R490210	Molded: .01 mf (100,000 mmf) 200V
C-13	21A470789	Ceramic, disc type: 5000 mmf 450V .....
		RECTIFIER
E-1	48K692077	Selenium Rectifier: half-wave; 75 ma .....
		COILS
L-1	24C692074	Loop Antenna Assembly: includes panel .....
L-2	24B692115	RF Coil .....
L-3	24B692114	Oscillator Coil .....
		SPEAKER
LS-1	50C692044	Speaker: 4" x 6" PM; 3.2 ohm VC.
		RESISTORS

Note: All resistors are insulated carbon type unless otherwise specified.

REF. NO.	PART NO.	DESCRIPTION
R-1	6R3927	2.2 meg 20% 1/2W .....
R-2	6R3988	5.6 meg 10% 1/2W .....
R-3	6R2118	3.3 meg 20% 1/2W .....
R-4	6R3927	2.2 meg 20% 1/2W .....
R-5	6R6301	1000 20% 1/2W .....
R-6	6R6075	100,000 20% 1/2W .....
R-7	6R6012	33,000 20% 1/2W .....
R-8	6R5585	8.2 meg 10% 1/2W .....
R-9	6R6004	1 meg 20% 1/2W .....
R-10	17A76986	Wire wound: 150 10% 2-1/2W...
R-11	18K480039	Volume control: 1 meg; with sw.
R-12	6R2109	10 meg 20% 1/2W .....
R-13	17B692047	Wire wound: 2000; center-tapped
R-14	6R6269	820 10% 1/2W .....
R-15	6R2118	3.3 meg 20% 1/2W .....
R-16	6R6004	1 meg 20% 1/2W .....
R-17	6R2118	3.3 meg 20% 1/2W .....
R-18	6R3933	220 20% 1/2W .....
R-19	6R3949	470 10% 1/2W .....
R-20	6R6010	330 20% 1/2W .....

MODELS 6L1, 6L2,
Ch. HS-226

SWITCHES

S-1	40A27114	Slider Switch: 3PDT .....
S-2	-	Power Switch: on volume control.

TRANSFORMERS

T-1, 2	24K600013	IF & Diode Transformer, 455 Kc: includes capacitors; less shield
T-3	25B692076	Output Transformer .....

PART NUMBER	DESCRIPTION

CHASSIS PARTS - MECHANICAL

16K692102	Baffle, speaker: includes cloth .....
1X692121	Bottom Cover Assembly: includes brackets & battery strap .....
43A692012	Bushing, line cord strain relief (use with 43K692013) .....
1X692118	Cable Assembly, battery: includes 9-pin plug .....
42A485548	Clip, coil can mtg (IF coils) ...
11M8944	Cord, dial: 18#; black .....
30K692049	Cord, line: with plug; 6 ft long
5A19658	Eyelet, spacer (gang mtg) .....
5A70404	Grommet, rubber (gang mtg) .....
9A22056	Insulator, electrolytic mtg .....
4S7666	Lockwasher, external: #6; cad pl.
4S7650	Lockwasher, internal: #6; cad pl.
29R3013	Lug, soldering (on gang mtg screw).
29R5235	Lug, soldering: #6 (on battery strap bracket) .....
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (selenium rectifier mtg).....
2S7051	Nut, hex (Palnut): 3/8-32 x 9/16; cad pl (vol cont mtg) .....
29K5401	Pin, loop lead .....
64A692072	Plate, output trans mtg .....
28K77272	Plug, 9-pin (on battery cable).....
52A692091	Pointer, dial: red .....
49A21741	Pulley, cord .....
49A692078	Pulley, pointer drive .....
1A692119	Pulley Assembly (on gang) .....
1X692120	Pulley and Plate Assembly: pointer drive; includes mtg plate and 3 pullies .....
43K692013	Retainer, strain relief bushing (use with 43A692012) .....
5S7771	Rivet: .088 x 3/16 stl; nkl pl (tube socket mtg) .....
5S7707	Rivet: .122 x 5/32 stl; nkl pl (terminal strip & output trans mtg).
5S7701	Rivet: .122 x 3/16; stl; nkl pl (electrolytic insulator mtg) ...
5K74560	Rivet, shoulder (drive cord pulley mtg) .....
5A692104	Rivet, shoulder (pointer drive pulley mtg) .....
3S7350	Screw, machine: 6-32 x 1/4 slotted hex head lockscrew; cad pl (spkr mtg) .....
3S490354	Screw, machine: 6-32 x 5/8 slotted hex head; cad pl (gang mtg) .....
3S2977	Screw, machine: 6-32x1-1/8 pl hex hd; stl; cad pl (rec mtg).....
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (switch mtg) .....
3S7506	Screw, sheet metal: #6 x 1/4 PKZplain hex head; cad pl (R-13 & T-3 mtg) .....
3S9700	Setscrew: 6-32 x 3/16 Allen head; cad pl (gang pulley mtg) .....
47A692106	Shaft, tuning .....
9A690129	Socket, tube: miniature; 7-prong .
41A14244	Spring, tension (dial drive)
35K692125	Strap, battery: with button .....
31K692075	Strip, terminal: 1 insulated lug; end mtg; 3/8" spacing .....
46A600011	Stud, chassis mtg (on front of chassis) .....
4A70015	Washer, 'C' (on tuning shaft)...
4S7551	Washer, flat: 9/32 x .120 x .025; brass (battery strap mtg) .....
4S8221	Washer, flat: 3/8 x .144 x .032; brass (spkr baffle mtg) .....
4S8253	Washer, flat: 5/8 x .390 x .020 brass (vol cont mtg) .....
4K71133	Washer, spring (on tuning shaft).

CABINET PARTS

16E691796	Cabinet, front section: green plastic; less grille, handle and hardware (6L1)
16K600109	Cabinet, front section: brown plastic; less grille, handle and hardware (6L2)
16D691797	Cabinet, rear section: green plastic; less antenna loop and hardware (6L1).
16K600110	Cabinet, rear section: brown plastic; less antenna loop and hardware (6L2).
35A692073	Channel, rubber (inside cabinet front)
42K891863	Clip, cabinet locking (inside cabinet front) .....
42A480078	Clip, cabinet locking (inside cabinet back) .....
42A600010	Clip, retainer (speaker grille).....
55A692127	Cover, handle mtg (over ends of carrying handle) .....
13B691958	Grille, speaker: plastic .....
55A691943	Handle, carrying: black plastic; less spring (6L1) .....
55K600111	Handle, carrying: brown plastic; less spring (6L2) .....
14A600096	Insulator: fibre (on carrying handle) .....
36B691956	Knob, control: green plastic (6L1) ..
36K600112	Knob, control: brown plastic (6L2) ..
13K691929	Medallion (on front of cabinet) .....
64A692129	Plate, handle mtg: cad pl (under ends of carrying handle) .....
64A691941	Plate, medallion (under medallion)...
3S2949	Screw, machine: 6-32 x 5/16 plain hex head; cad pl (handle mtg).....
3S476083	Screw, machine: 6-32 x 5/16 slotted locking hex head; cad pl (chassis mtg) .....
3S488008	Screw, sheet metal: #4 x 1/4 Phillips round head; cad pl (cabinet locking clip mtg) .....
2S490840	Speednut: for 1/16" stud (medallion mtg) .....
2S476112	Speednut: for .156" stud (spkr grille and ant loop mtg) .....
41A692126	Spring, handle (inside carrying handle)
41A691939	Spring, hinge (on bottom of cabinet) .....
4K780040	Washer, felt (under knobs) .....
4S7610	Washer, flat: 3/8 x 5/32 x .015 stl; cad pl (chassis mtg) .....
4S490841	Washer, flat: 3/4 x .156 x .032; pl (handle mtg) .....

MODELS 6L1, 6L2,
Ch. HS-226

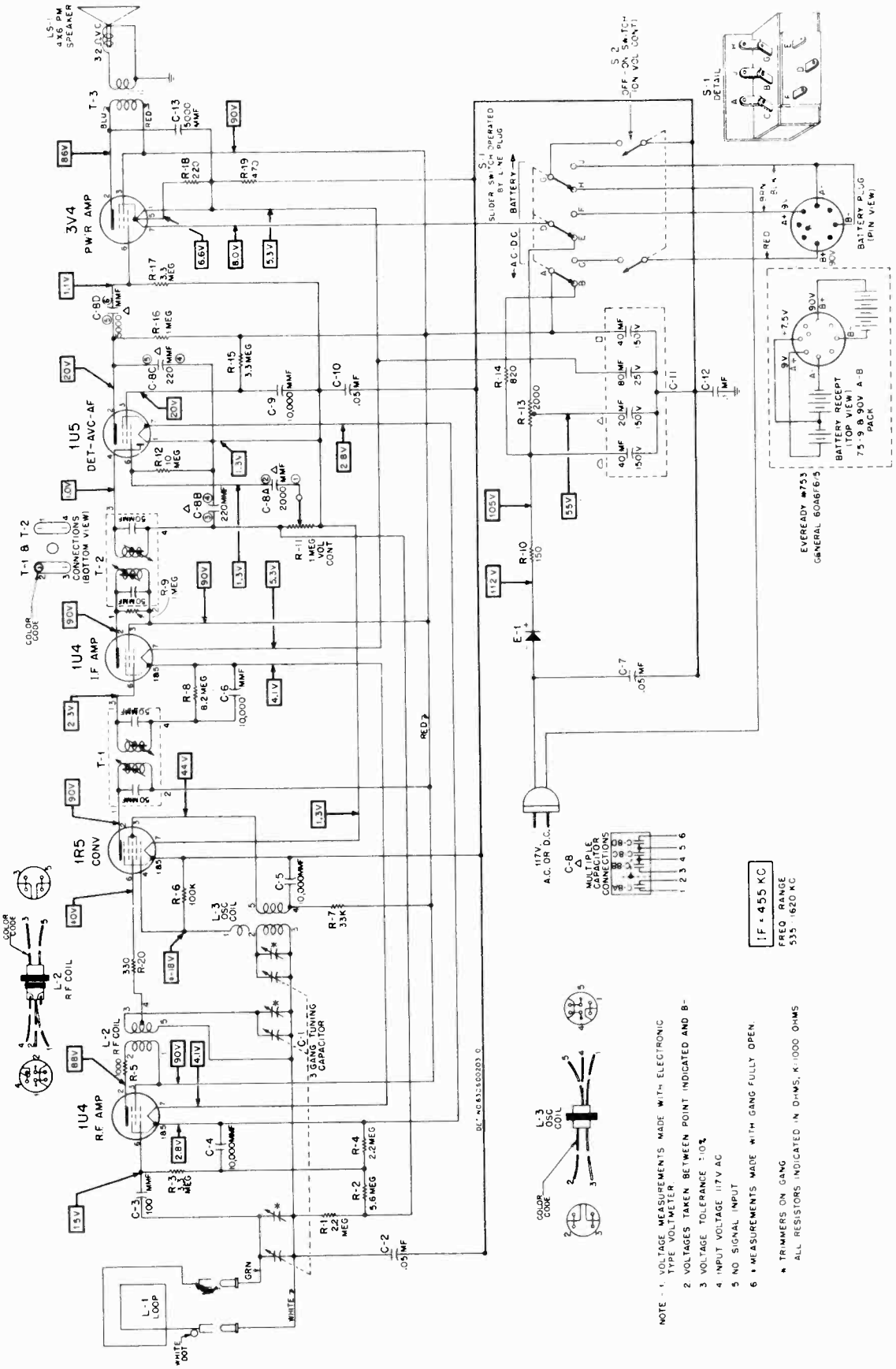
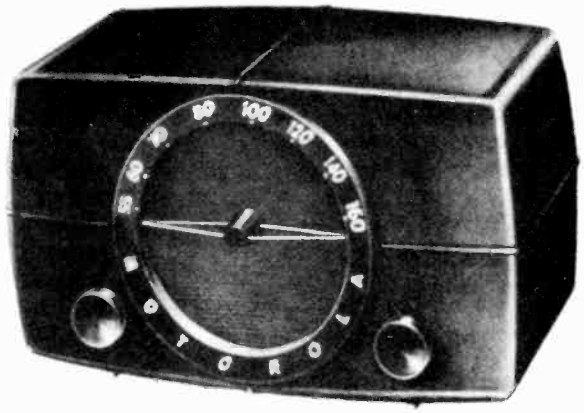


FIGURE 4. SCHEMATIC DIAGRAM

MODELS 6X11U,
6X12U, Ch. HS-245



GENERAL INFORMATION

TYPE - AC-DC operated table model superheterodyne receiver with loop antenna.

RECEIVER MODELS -

Model	Color
6X11U	Walnut
6X12U	Ivory

TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

TUBE COMPLEMENT - 12BA6 - RF Amplifier
12BE6 - Converter
12BA6 - IF Amplifier
12AT6 - Det, AVC & 1st AF Amp
35C5 - Power Amplifier
35W4 - Rectifier

POWER SUPPLY - 117 volts AC or DC, 35 watts

INSTALLATION & OPERATING INSTRUCTIONS

POWER SWITCH AND VOLUME CONTROL. Operated with left-hand knob. NOTE: Reverse line plug in electrical outlet if radio does not operate from DC. When operating from AC, reversing the line cord plug in wall outlet, may sometimes improve reception.

TUNING. Tune stations with right-hand knob.

ANTENNA. A built-in loop antenna eliminates the need for an outside antenna in most locations. When receiving a weak station, rotate the receiver slightly for best signal strength. If additional pick-up is necessary, connect an external antenna to the radio by following the instructions printed on the rear panel. CAUTION: Never connect the radio chassis to a water pipe, radiator, or other ground.

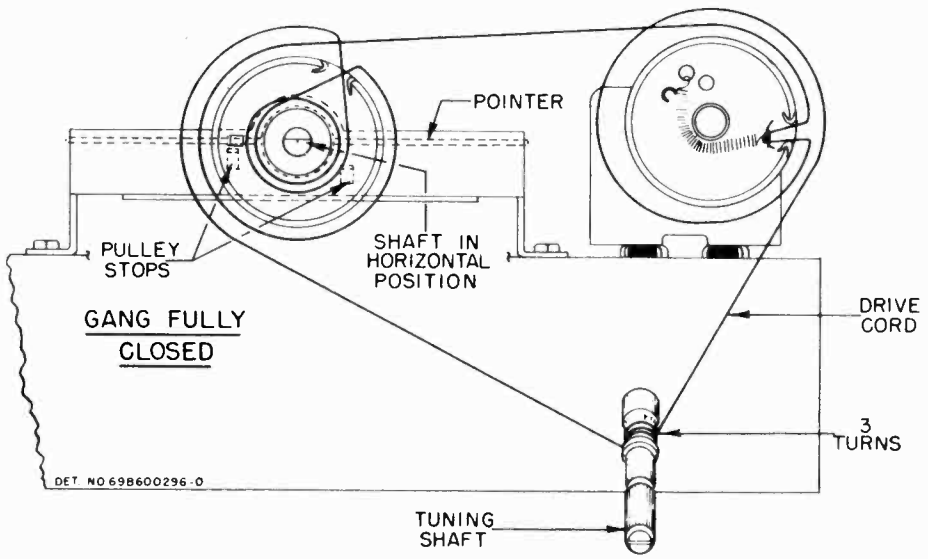


FIGURE 1. STRING DRIVE DETAIL

MODELS 6X11U,
6X12U, Ch. HS-245

SERVICE NOTES*

The chassis of this receiver is isolated from the AC power line circuit by a capacitor to eliminate the shock hazard when handling the receiver. However, as an additional precaution when aligning or servicing the receiver from AC, an isolation transformer should be inserted between the power line and the chassis.

To remove the chassis from the cabinet:

1. Pull off the two radio control knobs.
2. Pull off the pointer.
3. Remove the split plugs which hold the loop to the cabinet.
4. From the back of the cabinet, remove the two hex head screws at the rear edge of the radio chassis.
5. Slide the radio chassis and loop from the cabinet.

ALIGNMENT

NOTE: It is recommended that an isolation transformer be placed between the power line and the receiver to avoid hum and electrical shocks. If an isolation transformer is not available, connect the low side of the signal generator to B- through a .1 mf capacitor.

1. Connect a low range output meter across the speaker voice coil.
2. Connect the low side of the signal generator to B-.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Turn the receiver volume control to maximum.
5. Use a small fibre screwdriver for aligning the IF and diode transformers.
6. As stages are brought into alignment, reduce the signal generator output to a level which produces less than .40 volts (.05 watt) across the voice coil to avoid overloading the receiver.
7. See Figure 2 for adjustment locations and the following chart for procedure.

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Rear stator of tuning capacitor	455 Kc	Fully open	1, 2, 3 & 4 (IF cores)	Adjust for maximum.
WAVETRAP						
2.	.1 mf	Rear stator of tuning capacitor	455 Kc	Fully open	5 (Wavetrap)	Adjust for minimum.
RF ALIGNMENT						
3.	.1 mf	Rear stator of tuning capacitor	1620 Kc	Fully open	6 (Osc)	Adjust for maximum.
4.	-	Radiation loop*	1400 Kc	Tune for max	7 (Ant)	Adjust for maximum.

*Connect generator output to 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

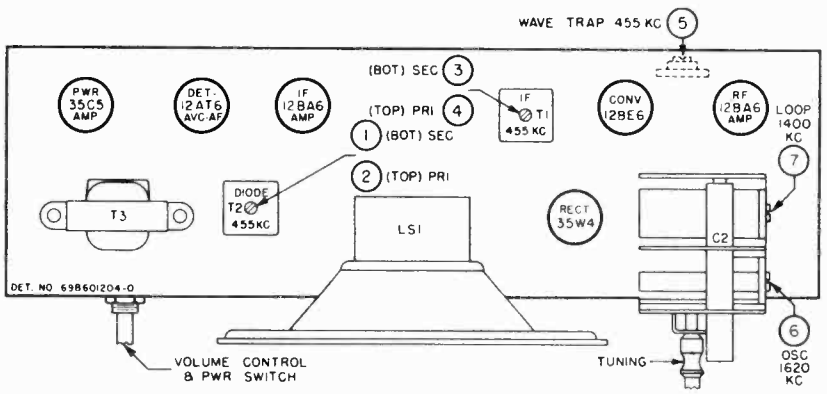


FIGURE 2. TUBE & TRIMMER LOCATIONS

MODELS 6X11U,
6X12U, Ch. HS-245

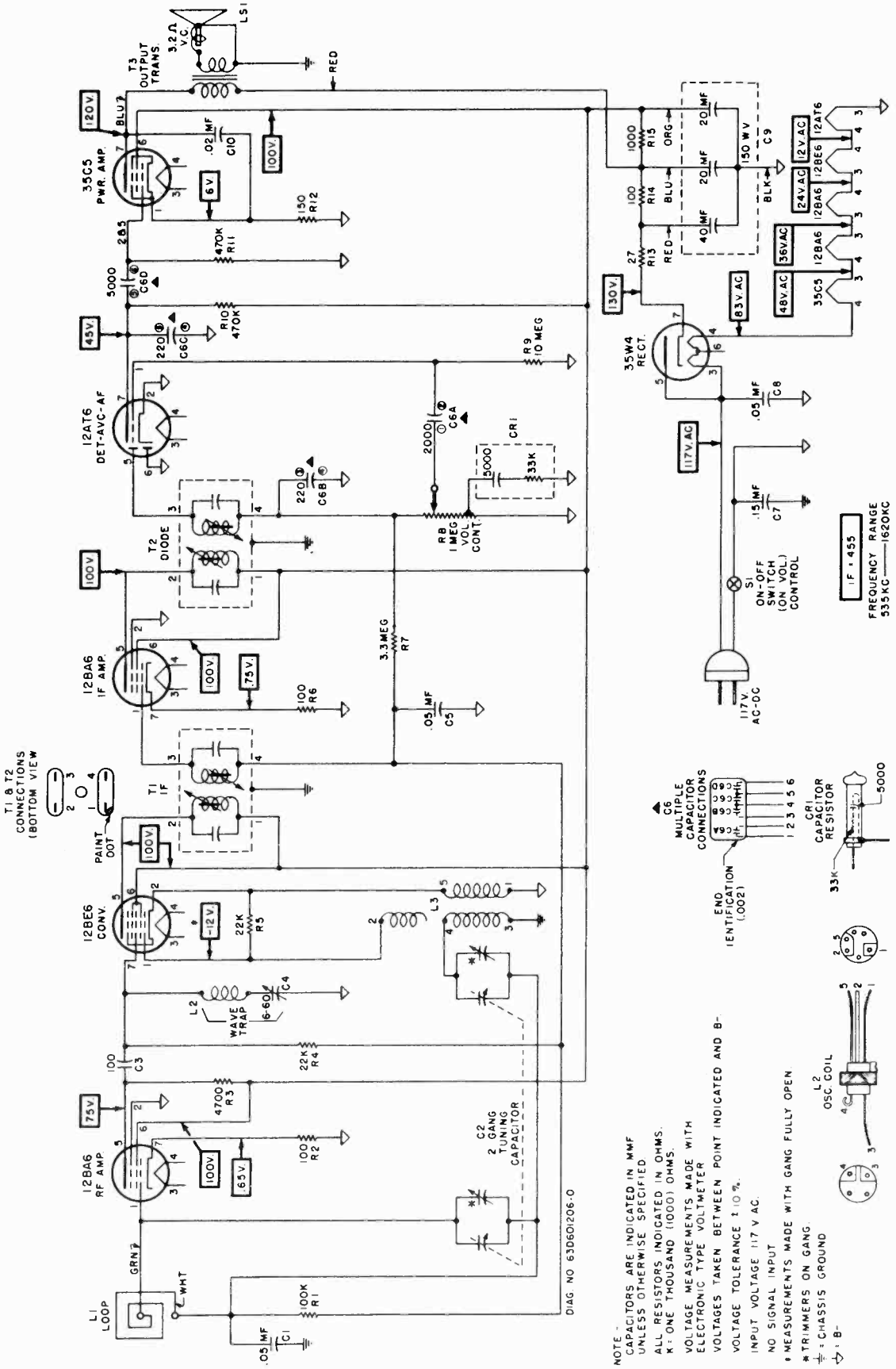


FIGURE 3. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR

MODELS 6X11U,
6X12U, Ch. HS-245

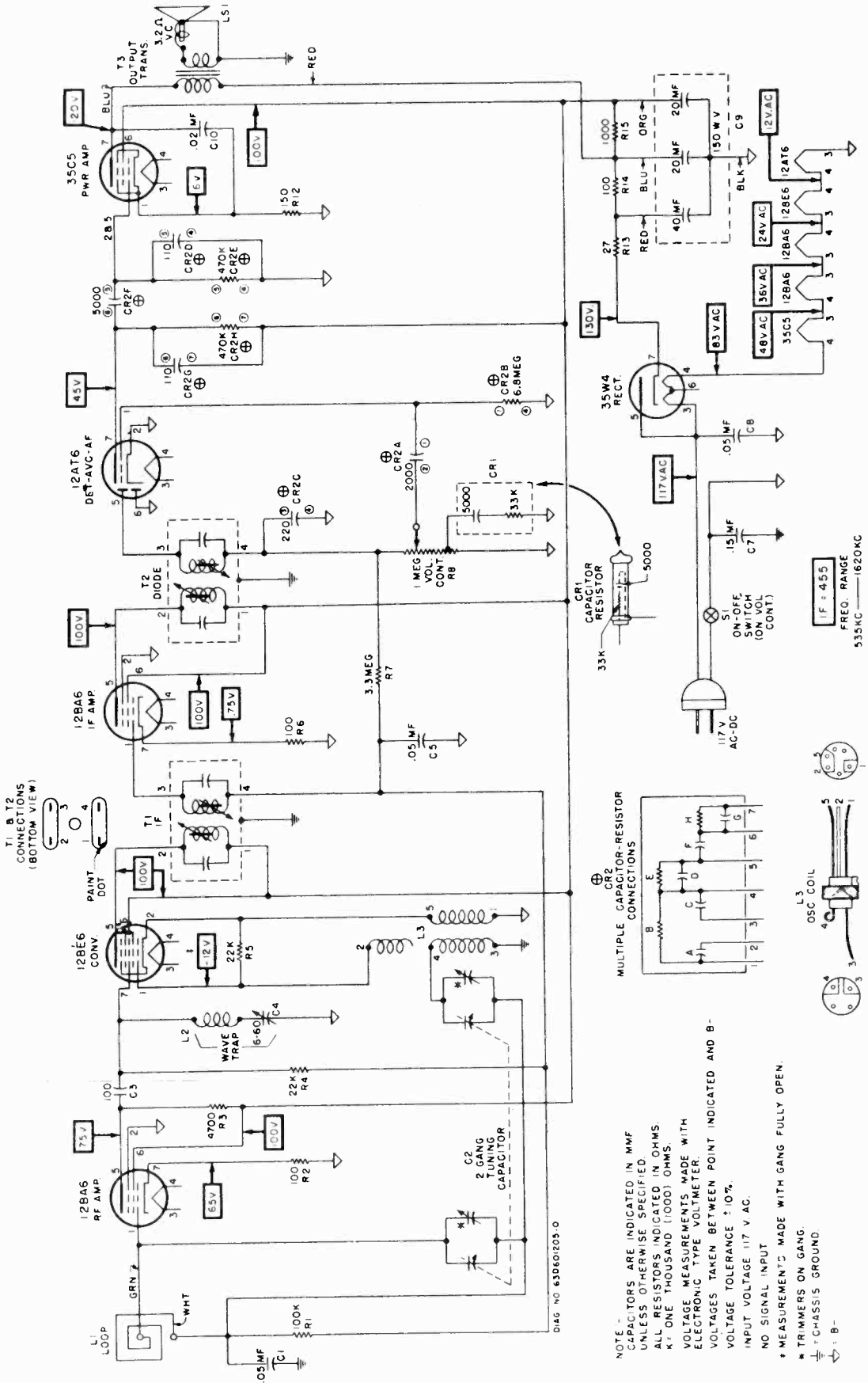


FIGURE 4. SCHEMATIC DIAGRAM OF CHASSIS USING MULTIPLE CERAMIC CAPACITOR-RESISTOR

MODELS 6X11U, 6X12U. Ch. HS-245

REPLACEMENT PARTS LIST

NOTE: When ordering parts specify model number of set in addition to part number and description of part.

Ref. No.	Part Number	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	8R9821	Paper: .05 mf 200V
C-2	19B600483	Variable, 2-gang: includes pulley
C-3	21R6641	Mica: 100 mmf 500V
C-4	20A26941	Mica, variable: 6 mmf-60 mmf; includes bracket
C-5	8R9821	Paper: .05 mf 200V
C-6	21B482847	Ceramic, multiple: 2000 mmf, 220 mmf, 220 mmf, 5000 mmf
C-7	8R9843	Paper: .15 mf 200V
C-8	8R9816	Paper: .05 mf 400V
C-9	23K484234	Electrolytic: 40-20-20 mf/150V
C-10	8R9802	Paper: .02 mf 400V
Capacitor-Resistor		
CR-1	21B484227	Capacitor-Resistor: 2 lead; 33,000 ohms, 5000 mmf
CR-2	21B601007	Capacitor-Resistor: 7 lead; 2000 mmf, 220 mmf, 5000 mmf, 110 mmf, 110 mmf, 6.8 meg, 470,000 ohms, 470,000 ohms
Coils		
L-1	24C600539	Loop and Panel Assembly
L-2	24A77336	Wavetrap
L-3	24K600813	BC Oscillator Coil
Speaker		
LS-1	50K600538	Speaker, PM: 5-1/4"; 3.2 ohm VC.
Resistors		
		Note: All resistors are insulated carbon type unless otherwise specified.
R-1	6R6075	100,000 20% 1/2W
R-2	6R6018	100 20% 1/2W
R-3	6R6039	4700 20% 1/2W
R-4	6R6028	22,000 20% 1/2W
R-5	6R6028	22,000 20% 1/2W
R-6	6R6018	100 20% 1/2W
R-7	6R2118	3.3 meg 20% 1/2W
R-8	18K485925	Volume Control: 1 meg
R-9	6R2109	10 meg 20% 1/2W
R-10	6R6032	470,000 20% 1/2W
R-11	6R6032	470,000 20% 1/2W
R-12	6R3992	150 20% 1/2W
R-13	6R5683	27 10% 1/2W
R-14	6R488025	100 20% 1W
R-15	6R3953	1000 20% 1W
Transformers		
T-1,2	24B485553	IF and Diode, 455 Kc: complete; including padding capacitors and tuning cores
T-3	25B482858	Output

Part Number	Description
CHASSIS PARTS - MECHANICAL	
26A473002	Base, tube shield mtg
1X600627	Bracket and Bushing Assembly, pointer shaft
7K600579	Bracket, loop mtg
7A600476	Bracket, tuning shaft mtg
42A485548	Clip, coil can mtg
42A75825	Clip, electrolytic mtg
30A470651	Cord, line and plug: 6 ft long
5A19658	Eyelet, spacer (gang mtg)
5A70404	Grommet, rubber (gang mtg)
14A482844	Insulator, cord outlet
29R3010	Lug, soldering
2S7051	Nut, hex: 3/8-32 x 9/16; Palnut; stl; pl (volume control mtg)
1X600590	Pulley and Bushing Assembly, pointer drive
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg and shield base mtg)
5S7707	Rivet: .125 x 5/32; stl; nkl pl (tuning shaft bracket mtg, output transformer mtg, variable capacitor mtg, electrolytic clip mtg, and tube spring shield mtg)
3S2294	Screw, machine: 6-32 x 1/2; plain hex head; locking type; stl; cad pl (gang mtg)
3S7477	Screw, machine: 8-32 x 1/4; type #1; plain hex head; stl; cad pl (loop back mtg)
3S7316	Screw, machine: 8-32 x 3/8; slotted hex head; locking type; stl; cad pl (speaker mtg)
3S2965	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; stl; cad pl (pointer shaft bracket mtg)
3S3398	Screw, sheet metal: #6 x 3/8 PKZ plain hex head; stl; cad pl (loop bracket mtg)
3S7148	Setscrew: 6-32 x 1/8; Allen head; stl; cad pl (pointer drive pulley & bushing retainer)
1K600595	Shaft and Pulley Assembly, tuning
47K600509	Shaft, pointer: brass
26A481521	Shield, spring (for 12BE6 tube)
26A90301	Shield, tube (for 12AT6 tube)
9A472534	Socket, tube: 7-prong
9K580218	Socket, tube: 8-prong
4K692188	Washer, "C" (tuning shaft retainer and pointer shaft retainer)
4S7614	Washer, flat: 11/16 x 11/64 x .036 thick; stl; cad pl (loop back mtg)
4K482859	Washer, insulated shoulder (loop bracket mtg)
CABINET PARTS	
16E600169	Cabinet, table model: molded; walnut (6X11U)
16K600175	Cabinet, table model; molded; ivory (6X12U)
13B600535	Grille, cabinet
36B600570	Knob, pointer (6X11U)
36K600571	Knob, pointer (6X12U)
36B600455	Knob, tuning (6X11U)
36K600456	Knob, tuning (6X12U)
38A25507	Plug, split (back mtg)
52A600451	Pointer, dial: brass
3S3371	Screw, sheet metal: #8 x 3/8 PKZ plain hex head; stl; cad pl (chassis mtg)

MODELS 7F11, 7F11B,
Ch. HS-265

GENERAL INFORMATION

TYPE - AM Radio-Phonograph Combination

RECEIVER MODELS -

Model	Color
7F11	Red-brown mahogany
7F11B	Blonde

TUBE COMPLEMENT -

6BA6	RF Amplifier
6BE6	Converter
6BA6	IF Amplifier
6AV6	Detector & 1st Audio Amp
6V6GT	Power Amplifier
6V6GT	Power Amplifier
7Z4	Rectifier

TUNING RANGE - 535 to 1620 Kc

IF FREQUENCY - 455 Kc

POWER SUPPLY - 117 volts, 60 cycle AC only; 85 watts including phono motor.

ANTENNA

No outside antenna or ground is normally required for radio reception, as a loop antenna is located inside the cabinet. Two wires from the chassis connect to the loop.

In locations where additional pick-up is desired, an external antenna may be connected to the clip marked "EXT BC ANT" on the loop.

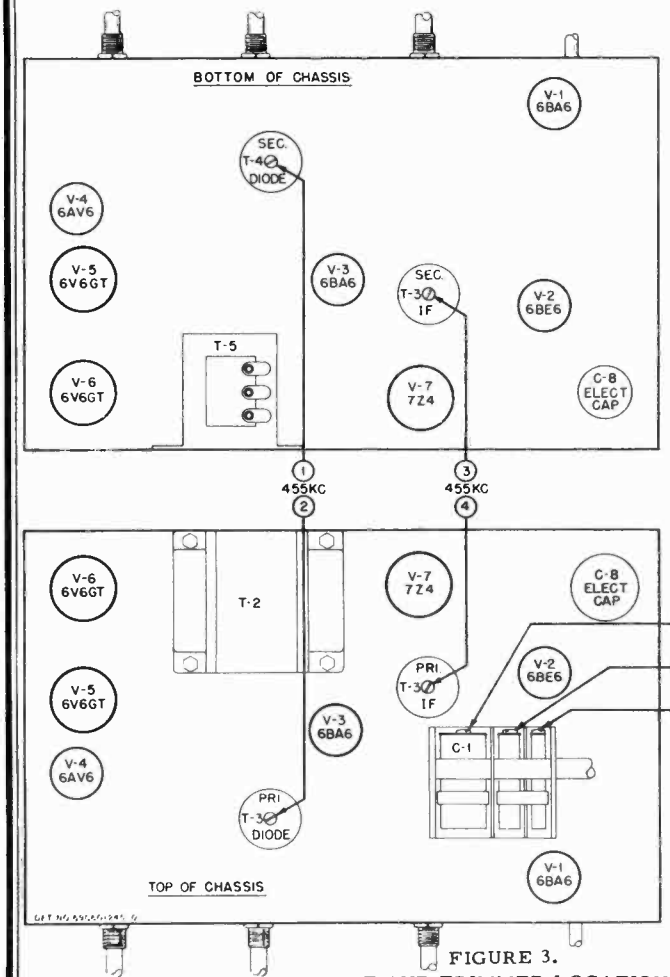


FIGURE 3.
TUBE AND TRIMMER LOCATIONS

INSTALLATION & OPERATING INSTRUCTIONS

CONTROLS

Refer to Figure 1 for the locations of the radio operating controls.

Power for both the radio and the record changer is controlled by the VOL-ON-OFF knob. The phonograph motor will not operate, however, until the PHONO-RADIO knob is rotated to "PHONO".

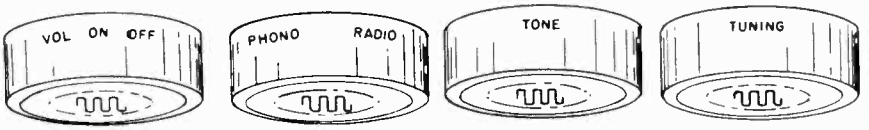


FIGURE 1. OPERATING CONTROLS

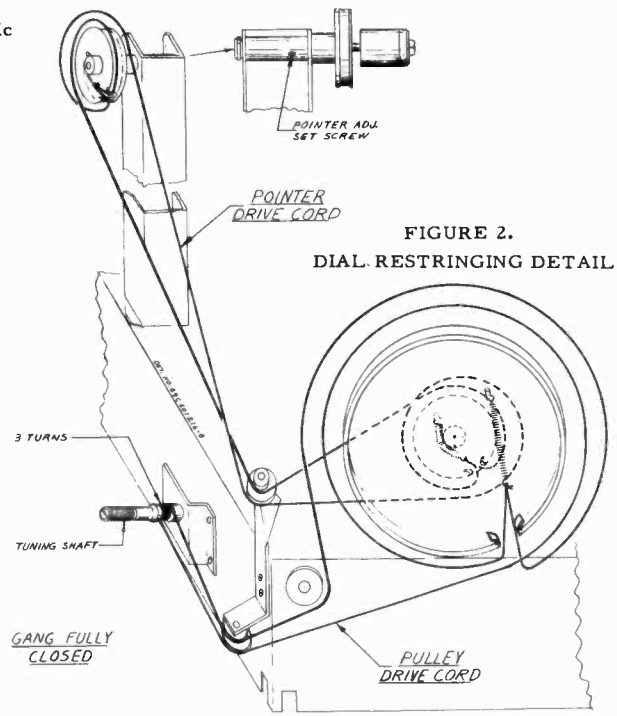


FIGURE 2.
DIAL RESTRINGING DETAIL

PHONOGRAPH - Model RC-37, three-speed: 33, 45 & 78 RPM. Refer to the RC-37 Service Manual for record changer service information.

MODELS 7F11, 7F11B,
Ch. HS-265

SERVICE NOTES

TO REMOVE CHASSIS FROM CABINET:

1. Remove the screws from the cabinet back.
2. Disconnect the phono power lead, the phono pick-up lead, the speaker leads, the line cord, and the antenna loop leads.
3. Remove the pointer escutcheon by pulling it downward.
4. Turn the tuning knob counterclockwise until the pointer reaches the extreme low frequency end of the dial scale.
5. From the back of the cabinet, loosen the pointer adjustment setscrew (see Figure 2), and pull the pointer and shaft assembly from the chassis. CAUTION: Do not remove the nut from the front of the pointer, as the detent ball and spring will fall out and may become lost.
6. Pull off the control knobs.
7. Remove the three chassis mounting screws, from beneath the chassis.
8. Slide the chassis from the cabinet.

TO CALIBRATE DIAL:

1. Turn the tuning knob counterclockwise until the end of its travel is reached.
2. From the back of the cabinet, loosen the pointer adjustment setscrew (see Figure 2). CAUTION: Do not remove the nut from the front of the pointer.
3. Move the pointer until it is in a horizontal position (at the low frequency end of the dial scale.)
4. Tighten the adjustment setscrew.

NOTE: If the pointer is moved by hand accidentally, it will be released from a detent in the pointer collar, and no damage to the tuning mechanism will result. To reset the pointer, move it back and forth until it again engages in the detent.

ALIGNMENT

1. Connect a low range output meter across the speaker voice coil.
2. Connect an AM signal generator as in chart below.
3. Set the signal generator for 400 cycle, 30% modulation.
4. Rotate the PHONO-RADIO switch to the "RADIO" position.
5. Turn the receiver volume control to maximum.
6. Use a small fibre screwdriver for aligning the IF and diode transformers.
7. As stages are brought into alignment, reduce the signal generator output to a level which produces less than 1.27 volts (.5 watt) across the voice coil, to avoid overloading the receiver.
8. See Figure 3 for adjustment locations, and the following chart for procedure.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. V-2 (pin 7, 6BE6)	455 Kc	Fully opened	1, 2, 3, & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv. V-2 (pin 7, 6BE6)	1620 Kc	Fully opened	5 (Osc)	Adjust for maximum.
3.	.1 mf	Grid of conv. V-2 (pin 7, 6BE6)	1400 Kc	Tune in signal	6 (RF)	Adjust for maximum.
4.	-	-	-	-	-	Connect BC loop to chassis.
5.	-	Across radiation loop*	1400 Kc	Tune in signal	7 (Ant)	Adjust for maximum.

* Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

MODELS 7F11,
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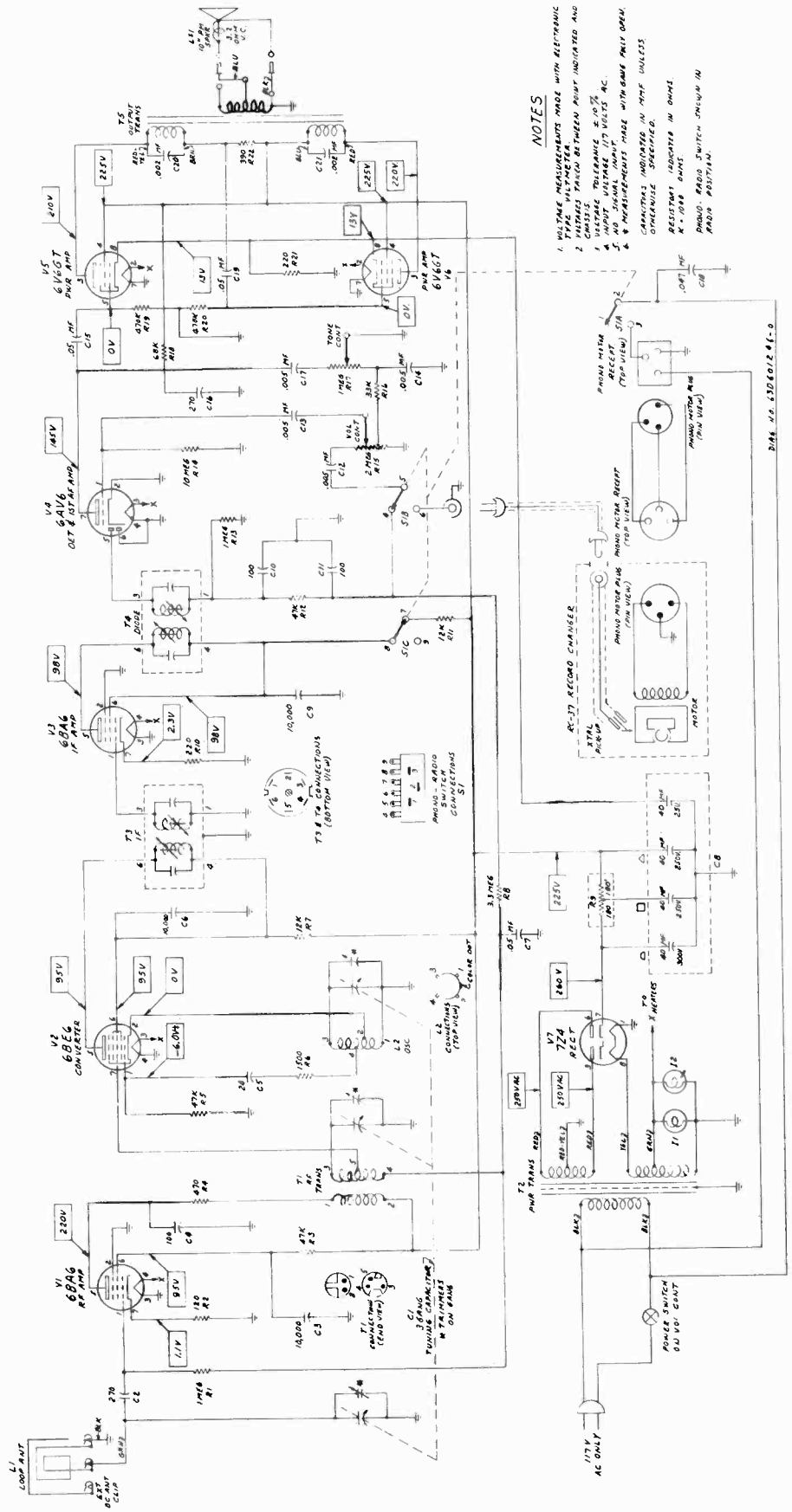

RECORD CHANGER: Model RC-37, Pages RCD.CH.21-17,18 through RCD.CH.21-29.

FIGURE 4. SCHEMATIC DIAGRAM

MODELS 7F11, 7F11B,
Ch. HS-265

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part No.	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	19B690978	Variable, 3-gang .....
C-2	21K400037	Ceramic: 270 mmf 500V .....
C-3	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-4	21B77286	Ceramic: 100 mmf 500V .....
C-5	21R28816	Ceramic: 24 mmf 500V .....
C-6	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-7	8R9816	Paper: .05 mf 400V .....
C-8	23B690975	Electrolytic: 40 mf/300V; 40-40 mf/ 250V; 40 mf/25V.....
C-9	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-10	21B77286	Ceramic: 100 mmf 500V .....
C-11	21B77286	Ceramic: 100 mmf 500V .....
C-12	8R9813	Paper: .005 mf 600V .....
C-13	8R9813	Paper: .005 mf 600V .....
C-14	8R9813	Paper: .005 mf 600V .....
C-15	8R9816	Paper: .05 mf 400V .....
C-16	21K400037	Ceramic: 270 mmf 500V.....
C-17	8R9813	Paper: .005 mf 600V .....
C-18	8R490232	Tubular, molded: .047 mf 400V.....
C-19	8R9816	Paper: .05 mf 400V .....
C-20	8R9824	Paper: .002 mf 400V .....
C-21	8R9824	Paper: .002 mf 400V .....
Pilot Light		
I-1,2	65X10867	Bulb, pilot light: #44; 6-8V; .25 amp; clear; bayonet base .....
Coils		
L-1	24C690896	Loop antenna .....
L-2	24B690976	Oscillator coil .....
Speaker		
LS-1	50C601037	Speaker: 10" PM; 3.2 ohm VC ....
Resistors		
		Note: All resistors are insulated, carbon type unless otherwise specified.
R-1	6R6004	1 meg 20% 1/2W .....
R-2	6R5551	120 10% 1/2W .....
R-3	6R6056	47,000 20% 1/2W .....
R-4	6R3949	470 20% 1/2W .....
R-5	6R6056	47,000 20% 1/2W .....
R-6	6R6038	1500 10% 1/2W .....
R-7	6R5766	12,000 10% 2W .....
R-8	6R6497	3.3 meg 10% 1/2W .....
R-9	17A690973	Wire wound: 360 10% 3W; center-tapped .....
R-10	6R6270	220 10% 1/2W .....
R-11	6R5766	12,000 10% 2W .....
R-12	6R6056	47,000 20% 1/2W .....
R-13	6R6004	1 meg 20% 1/2W .....
R-14	6R2109	10 meg 20% 1/2W .....
R-15	18A600974	Volume control: 2 meg; tapped at 600,000 ohms; includes on-off sw
R-16	6R6410	33,000 10% 1/2W .....
R-17	18K77399	Tone control: 1 meg .....
R-18	6R6001	68,000 20% 1/2W .....
R-19	6R6032	470,000 20% 1/2W .....
R-20	6R6032	470,000 20% 1/2W .....
R-21	6R6389	220 10% 1W.....
R-22	6R5598	390 10% 1W .....
Switch		
S-1	40B601065	Switch, PHONO-RADIO .....

Ref. No.	Part No.	Description
Transformers		
T-1	24B690899	RF Transformer .....
T-2	25B691035	Power Transformer .....
T-3	24B482863	IF Transformer (brown dot): 455 kc; complete with capacitors and cores; less shield .....
T-4	24B482865	Diode Transformer (red dot): 455 kc; complete with capacitors and cores; less shield .....
T-5	25B690898	Audio Output Transformer .....
CHASSIS PARTS - MECHANICAL		
7C690567		Bracket, gang mtg .....
7A600965		Bracket, pilot light mtg .....
7B600801		Bracket, pointer mtg .....
1X600827		Bracket & Pulleys Assembly: includes four pulleys and shoulder rivets (cord guides on chassis front) .....
7A77337		Bracket, tuning shaft .....
43A890397		Bushing, line cord strain relief (use with 43K890398) .....
43K890398		Bushing, line cord retainer (use with 43A890397) .....
42B482867		Clip, spring: blued finish (holds IF transformers) .....
11M8944		Cord, dial (pointer drive) .....
30K21859		Cord, line: with plug; 9 ft long .....
4S9751		Lockwasher, int-ext: #8; cad pl (pointer and gang drive pulley mtg).....
2S7051		Nut, hex palnut: 3/8-32 x 9/16; cad pl (control mtg) .....
49A23960		Pulley, cord: 1/4" groove (on pulley bracket) .....
49A21741		Pulley, cord: 3/8" groove (on pulley bracket) .....
49A73807		Pulley, cord: 1/2" groove (on chassis side and on pulley bracket) .....
49A26433		Pulley, cord: 21/32" groove (on pulley bracket) .....
49A690559		Pulley, gang drive: 3-1/2" diameter ...
49A690558		Pulley, pointer drive: 1-1/4" diameter.
9K592170		Receptacle, phono pick-up: 1-prong ....
9A27674		Receptacle, phono power: 3-prong .....
5S7771		Rivet: .088 x 3/16 stl; nkl pl (min and midget tube socket mtg).....
5S7707		Rivet: .122 x 5/32 stl; nkl pl (loctal tube socket, terminal strip, output trans mtg) .....
5S7701		Rivet: .122 x 3/16 stl; nkl pl (power receptacle and tuning shaft brkt mtg) .....
5S7700		Rivet: .122 x 1/4 stl; nkl pl (octal tube socket mtg) .....
5K71735		Rivet, shoulder (mounts 21/32" and 3/8" pulleys to bracket) .....
5K13896		Rivet, shoulder (mounts 1/2" and 1/4" pulleys to bracket) .....
3S7326		Screw, machine: 8-32 x 3/16 plain locking hex head; cad pl (gang mtg).....
3S7163		Screw, machine: 8-32 x 1/4 plain hex head; cad pl (pointer & gang drive pulleys mtg) .....
3S2695		Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (holds gang mtg brkt) .....
3S7506		Screw, sheet metal: #6 x 1/4 PKZ plain hex head; cad pl (holds pointer mtg brkt) .....
3S7454		Screw, sheet metal: #8 x 1/4 PKZ plain hex head; cad pl (pilot light brkt mtg) .....
3S7475		Screw, sheet metal: #8 x 1/4 PKZ slotted acorn head; cad pl (power trans mtg) .....

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Part Number	Description
3S7462	Screw, thread cutting: 6-32 x 3/16 plain hex head; cad pl (electrostatic shield mtg)
3S7103	Setscrew: 8-32 x 1/8 Allen head; cad pl (pointer mtg)
1K601085	Shaft and Pulley Assembly, pointer mtg...
1X691134	Shaft, tuning: complete with pulley.....
26K485936	Shield, coil (for IF transformers).....
26K690984	Shield, electrostatic (gang shield).....
26A692080	Shield, tube (for V-7): includes 41K692081 spring
9K600968	Socket, pilot light
9K484167	Socket, tube: miniature; 7-prong.....
9A76209	Socket, tube: octal
9A690129	Socket, tube: midget; 7-prong (for V-1)
9A72519	Socket, tube: loctal
41A14244	Spring, tension (pointer drive cord)..
41K692081	Spring, tube shield retaining (for V-7 shield)
31K37504	Strip, terminal: 1 insulated lug, #1 mtg; 3/8" spacing
31K51511	Strip, terminal: 3 insulated lugs, #3 gnd; 3/8" spacing
31K90046	Strip, terminal: 5 insulated lugs, #4 gnd; 3/8" spacing
29A76280	Terminal, pin (on speaker leads).....
4A70015	Washer, "C" (tuning shaft retainer)
4A21941	Washer, "C" (holds pointer mtg shaft & pulley)
4S7582	Washer, flat: 1/2 x .195 x .033 stl; cad pl (pointer & gang drive pulleys mtg)
4A691006	Washer, flat: double "D" (pointer & gang drive pulleys mtg)
MODEL 7F11 CABINET PARTS	
43A4326	Ball, steel: 1/8" dia (pointer detent)
38K691915	Button, plug (on record changer).....
16F600641	Cabinet, console: red-brown mahogany; complete, less pointer escutcheon and dial scale.....
55K482159	Catch, bullet: statuary bronze finish (door latch on cabinet).....
42A470832	Clamp, cable: plastic (holds line cord).....
42K600645	Clip, pointer escutcheon.....
43K600637	Cloth, grille: 13 3/8 x 15 1/2 ; mahogany.....
15D600648	Cover, cabinet back.....
34K601066	Dial, scale.....
34K600817	Escutcheon, pointer.....
5S7870	Eyelet: brass (on R. C. drawer panel-holds extra spindle).....
5A71081	Eyelet, chassis mtg: plain; 9/32" long
5A600963	Eyelet, chassis mtg: pierced; 1/8" long.....
5A71092	Grommet, chassis mtg: rubber.....
55K600643	Handle, door: polished brass.....
55K600646	Hinge, door: bronze finish (lower hinges pair
55K600639	Hinge, door (stop type): bronze finish (upper hinges).....pair
14K791482	Insulator, fibre (clamps phono leads).
36C601041	Knob control (VOL-ON-OFF): walnut-mahogany.....
36K601043	Knob, control (TONE): walnut-mahogany
1X600852	Lead and Plugs Assembly, phono-pick-up (shielded lead with two phono pick-up plugs).....
4S7657	Lockwasher, ext: #8; cad pl (spkr mtg).....

Part Number	Description
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (pointer mtg).....
2S7003	Nut, hex: 8-32 x 5/16; cad pl (spkr mtg).....
36K601042	Knob, control (PHONO-RADIO): walnut mahogany.....
36K601045	Knob, control (TUNING): walnut-mahogany.....
62K70581	Overlay, logotype: "Motorola"; gold lacquer finish.....
35K691051	Pad, felt: 1/2" diameter (door stop)
64K600867	Panel, record changer bottom: chipboard.
1X600851	Pointer and Collar Assembly (less shaft and sleeve).....
28A27573	Plug, phono motor: 3-pin; includes shell (on phono motor lead).....
28K71775	Plug, phono pick-up.....
9A600040	Receptacle, phono motor: 3- prong; includes sheel (on phono motor lead)...
3K489169	Screw, machine: 8-32 x 1 cross slot head; statuary bronze finish (door handle mtg).....
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acron head; antique copper finish (back cover mtg).....
3S3387	Screw, sheet metal: #6 x 1/2 PKA plain hex head; statuary bronze finish (cable clamp mtg).....
3K653	Screw, speaker mtg) 3-32 x 1-1/4"; copper oxide finish.....
3S1334	Screw, wood: #6 x 1 flat head statuary bronze finish (door hinge mtg).....
1A690738	Shaft and Sleeve Assembly, pointer less detent spring and ball, and pointer...
15A690616	Shell, receptacle (on phono motor receptacle).....
15K74442	Shell, receptacle (on phono motor plug)
55K600171	Slide, record changer: left-hand (on side of RC drawer).....
55K600172	Slide, record changer: right-hand (on side of RC drawer).....
2S400199	Speednut: for .050 stud (dial scale mtg).....
41A690732	Spring, compression (pointer detent)..
55K482160	Strike & nail: statuary bronze finish (door latch - on door).....
4S1765	Washer, flat: 1/2 x .147 x .015 stl; cad pl (pointer mtg).....
4S7629	Washer, flat: 1/2 x 3/16 x .048 stl; cad pl (spkr mtg).....
4S8214	Washer, flat: 7/8 x .203 x .067 stl; cad pl.....
4A690729	Washer, spring (pointer mtg).....
MODEL 7F11B CABINET PARTS - Same as 7F11 except:	
16K600642	Cabinet, console: blonde; complete less pointer escutcheon and dial scale.....
55K482794	Catch, bullet: brass (door latch on cabinet).....
43K600638	Cloth, grille: 13 3/8 x 15 1/2; eggshell & brown.....
55K600647	Hinge, door: brushed brass finish (lower hinges).....pair
55K600644	Hinge, door (stop type): brushed brass finish (upper hinges).....pair
36K601046	Knob, control (VOL-ON-OFF): tan.....
36K601048	Knob, control (TONE): tan.....
36K601047	Knob, control (PHONO-RADIO): tan.....
36K601051	Knob, control (TUNING): tan.....
3K489170	Screw, machine: 8-32 x 1 cross slot head; brass (door handle mtg).....
55K482795	Strike & Nail: brass (door latch on door)

MODELS 8FM21,
8FM21B, Ch. HS-247

GENERAL INFORMATION

TYPE - FM-AM Radio Phonograph Combination

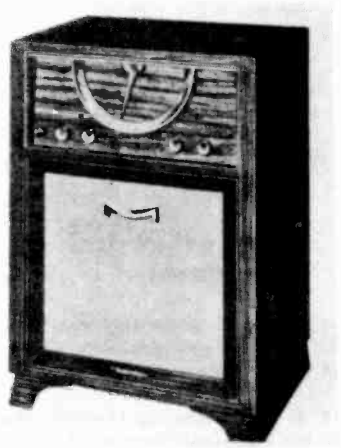
RECEIVER MODELS -

Model	Color
8FM21	Red-brown mahogany
8FM21B	Blonde

TUNING RANGE - AM 535 to 1620 Kc AM IF - 455 Kc
FM 88 to 108 Mc FM IF - 10.7 Mc

TUBE COMPLEMENT - 6BA6 - FM-AM RF Amplifier
6BA7 - FM-AM Converter
6BA6 - FM-AM IF Amplifier
6BA6 - FM IF Amplifier
6AL5 - FM Ratio Detector
6AV6 - AM Det & 1st Audio Amp
6K6GT - Power Amplifier
5Y3GT - Rectifier

POWER SUPPLY - 117 volts, 60 cycles AC only; 85 watts, including phono motor



PHONOGRAPH - Model RC-37, three-speed: 33, 45 & 78 RPM. Refer to the RC-37 Service Manual for record changer service information.

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNAS

No outside antenna or ground is normally required for standard broadcast (AM) reception, as a loop antenna is located inside the cabinet. Antenna connections are shown in Figure 1. In locations where additional pick-up is desired, an external antenna may be connected to the clip marked "EXT BC ANT" on the loop antenna.

An FM antenna, built into the power cord, eliminates the need for an external FM antenna when the receiver is used in normal FM service areas, such as are found in and for a few miles around metropolitan areas. In "fringe" or weak signal areas, improved FM reception can be obtained by using an outside FM antenna. The external antenna should be connected through a 300 ohm twin transmission line to the 1st and 2nd screws on the terminal strip on the chassis, as in Figure 1. The link between the 2nd and 3rd screws should be opened. Orient the antenna to obtain maximum volume of the FM stations.

For best FM reception from the built-in power line cord antenna, it is important to stretch the cord to its full length. Changing the direction or position of the line cord, or reversing the plug in the wall outlet, will often improve reception from weak stations. Connect the link between the 2nd and 3rd screws on the terminal strip on the chassis when the built-in antenna is used.

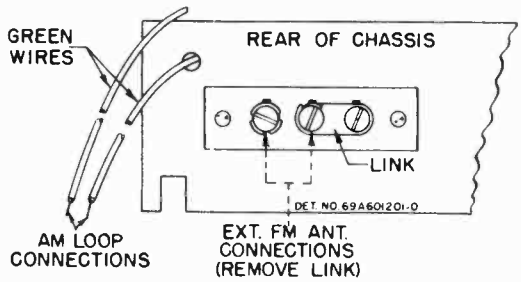


FIGURE 1. ANTENNA CONNECTIONS

CONTROLS

Refer to Figure 2 for the locations of the radio operating controls.

Power for both the radio and the record changer is controlled by the VOL-ON-OFF knob.

The phonograph motor will not operate, however, until the PHONO-TONE-RADIO knob is rotated also to "PHONO".

Tuning of FM stations should be done very carefully, for best sound reproduction, not necessarily for the strongest volume received.

FIGURE 2. OPERATING CONTROLS

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ALIGNMENT

GENERAL INFORMATION

1. Maximum performance can be obtained only if extreme care is exercised during alignment.
2. Use a small fibre screwdriver for aligning the IF transformers.
3. Refer to Figure 4 for the location of all alignment trimmers and cores.
4. As the stages are brought into alignment, reduce the signal generator output to a low value to avoid overloading the receiver.

ORDER OF ALIGNMENT AND EQUIPMENT REQUIRED

1. AM Broadcast Band IF & RF Alignment
   a. 455 to 1620 Kc AM signal generator
   b. Low range output meter.

2(A) FM Band IF & RF Alignment (preferred method)
   a. 10.7 to 108 Mc FM signal generator
   b. Oscilloscope

(B) FM Band IF & RF Alignment (alternate method)
   a. 10.7 to 108 Mc signal generator (unmodulated)
   b. Low range DC electronic voltmeter

AM BROADCAST BAND - IF&RF ALIGNMENT

1. Connect the AM signal generator as in chart below, with 400 cycle, 30% modulation.
2. Connect the output meter across the speaker voice coil. Throughout alignment, reduce the generator output to a level which produces less than 1.27 volts (.5 watt) across the voice coil to avoid overloading the receiver.
3. Set the bandswitch to the AM position.
4. Turn the receiver volume control to maximum.
5. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	455 Kc	Fully opened	1, 2, 3 & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv. V-2(pin 7, 6BA7)	1620 Kc	Fully opened	5 (AM Osc)	Adjust for maximum. *
3.	-	-	-	-	-	Connect AM loop to chassis.
4.	-	Across radiation loop**	1400 Kc	Tune in signal	8 (AM Ant)	Adjust for maximum.

5. If, after the receiver has been aligned as above, it is found to be badly off calibration, it will be necessary to adjust oscillator core (7) as follows: connect the generator to the grid of the converter tube and, with the gang fully closed, adjust core (7) at 535 kc. It is advisable to repeat the oscillator adjustments at 1620 kc and 535 kc several times until the tuning range is correct. Core (7) has been pre-set at the factory and normally should require no retuning.

* If difficulty is encountered in tuning trimmer (5), adjust trimmer (6) to 1/2 turn from tight.

** Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

FM BAND - IF & RF ALIGNMENT (PREFERRED METHOD)

1. The following FM alignment procedure, using an FM signal generator and an oscilloscope, is to be preferred because the actual response pattern may be observed on the scope and adjusted for best symmetry and maximum amplitude.
2. Connect the vertical input terminals of the oscilloscope between the chassis and the junction of resistor R-18 (47K) and capacitor C-23 (1000 mmf).
3. Connect the FM signal generator sync voltage output terminals, through a phase shifting network, to the horizontal input terminals of the scope, as in Figure 5. (Other values of resistance and capacitance may be required, depending upon the scope). The phasing control should be adjusted to give only one trace on the scope. NOTE: If the FM generator has a built-in phase control, the phase shifting network is not necessary.
4. Set the bandswitch to the FM position.
5. Throughout alignment, reduce the generator output to keep the signal just above the noise level, to avoid

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SERVICE NOTES

TO REMOVE CHASSIS FROM CABINET:

1. Remove the screws from the cabinet back.
2. Disconnect the phono power lead, the phono pick-up lead, the speaker leads, the line cord, and the antenna loop leads.
3. Remove the pointer escutcheon by pulling it downward.
4. Turn the tuning knob counterclockwise until the pointer reaches the extreme low frequency end of the dial scale.
5. From the back of the cabinet, loosen the pointer adjustment setscrew (see Figure 3) and pull the pointer and shaft assembly from the chassis. CAUTION: Do not remove the nut from the front of the pointer, as the detent ball and spring will fall out, and may become lost.
6. Pull off the control knobs.
7. Remove the three chassis mounting screws, from beneath the chassis.
8. Slide the chassis from the cabinet.

TO CALIBRATE DIAL:

1. Turn the tuning knob counterclockwise until the end of its travel is reached.
2. From the back of the cabinet, loosen the pointer adjustment setscrew (see Figure 3). CAUTION: Do not remove the nut from the front of the pointer.
3. Move the pointer until it is in a horizontal position (at the low frequency end of the dial scale).
4. Tighten the adjustment setscrew.

NOTE: If the pointer is moved by hand accidentally, it will be released from a detent in the pointer collar, and no damage to the tuning mechanism will result. To reset the pointer, move it back and forth until it again engages in the detent.

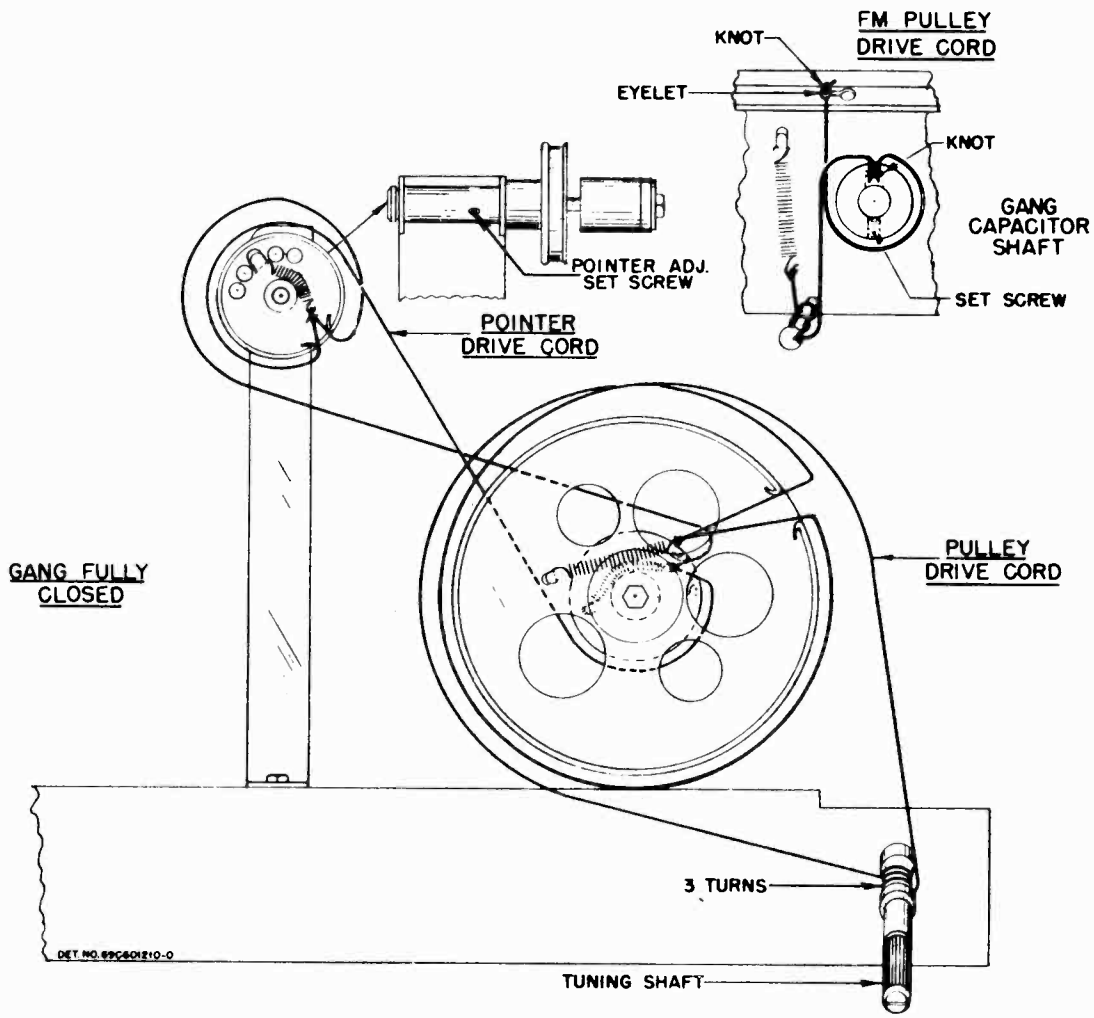

FIGURE 3. POINTER AND DRIVE CORD RESTRINGING DETAIL

MODELS 8FM21,
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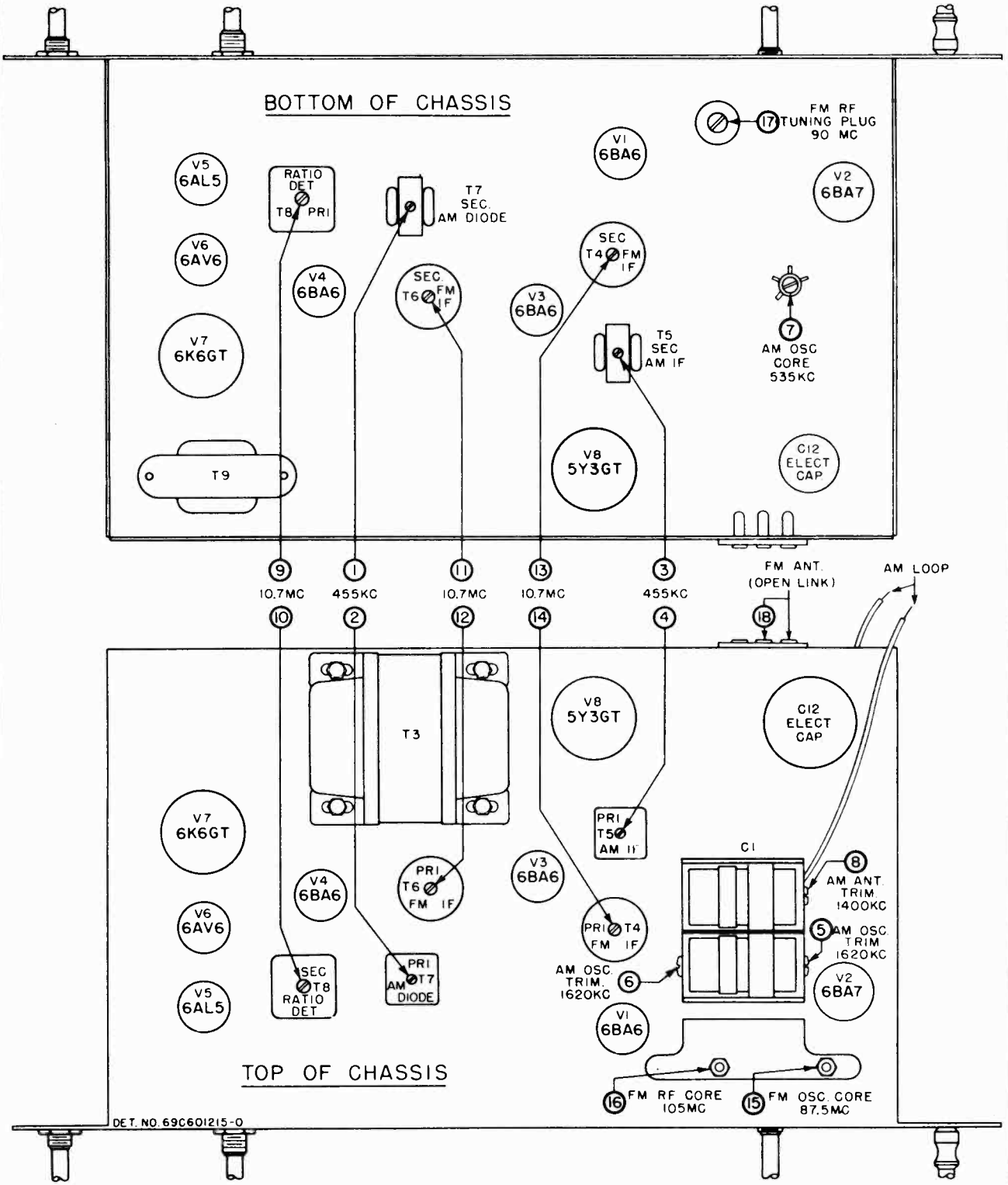

FIGURE 4. TUBE AND TRIMMER LOCATIONS

MODELS 8FM21, 8FM21B, Ch. HS-247

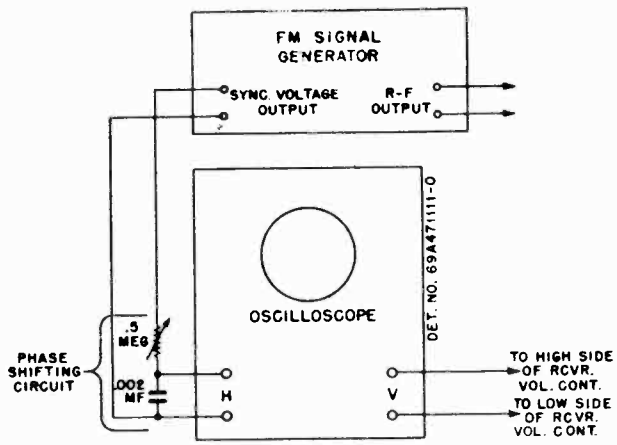

FIGURE 5.
FM SIGNAL GENERATOR & OSCILLOSCOPE HOOK-UP

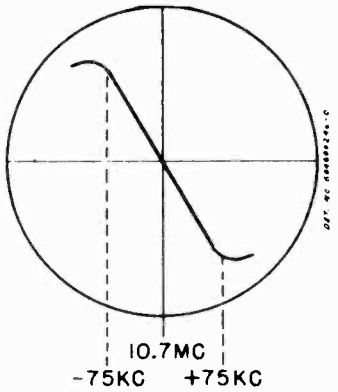

FIGURE 6. RATIO DETECTOR WAVEFORM

overloading the receiver.

6. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	9 (ratio det pri)	Adjust for maximum amplitude of pattern. *
2.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	10 (ratio det sec)	Adjust for symmetrical curve, as shown in Figure 6.
3.	-	-	-	-	-	Repeat steps 1 & 2 for maximum amplitude and best symmetry.
4.	1000 mmf	Grid of 1st IF Amp V-3 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	11 & 12 (2nd IF sec & pri)	Adjust for maximum amplitude of pattern. *
5.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc ±100 kc dev	Fully opened	13 & 14 (1st IF sec & pri)	Adjust for maximum amplitude of pattern. *
6.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc ±100 kc dev	Fully opened	11, 12, 13 & 14	Readjust for maximum amplitude and best symmetry.
RF ALIGNMENT						
7.	270 ohms	FM terminal 18 on rear of chassis (open link)	87.5 mc ±22-1/2 kc dev	Fully closed	15 (osc core)	Adjust for maximum amplitude of pattern. *
8.	-	-	-	Fully closed	16 (RF core)	Turn counterclockwise until core is at bottom of pipe, then turn four turns clockwise.
9.	270 ohms	FM terminal 18 on rear of chassis	90 mc ±22-1/2 kc dev	Tune in signal	17 (RF tuning plug)	Adjust for maximum amplitude of pattern. *
10.	270 ohms	FM terminal 18 on rear of chassis	105 mc ±22-1/2 kc dev	Tune in signal	16 (RF core)	Adjust for maximum amplitude of pattern. *
11.	-	-	-	-	-	Repeat steps 9 & 10, until no further adjustment is necessary.

* An output meter across the speaker voice coil will also indicate maximum amplitude. It should not be used in place of the scope, however, since it will not show symmetry of the curve.

FM BAND - IF & RF ALIGNMENT (ALTERNATE METHOD)

1. The following procedure for FM alignment, with an unmodulated carrier generator and a DC electronic voltmeter, is not as desirable as the preceding method; but it may be used if no FM generator is available.

2. Connect the signal generator as in chart below, with no modulation.

3. Set the bandswitch to the FM position.

4. Except in step 2 below, connect the electronic voltmeter across resistor R-19 (33K) in the ratio detector stage.

5. Throughout alignment reduce the signal generator output to a value which produces no more than a 5 volt rise above no signal voltage, to avoid overloading the receiver.

6. In step 2 below, connect two 100K ohm resistors in series across R-19. Connect the electronic voltmeter between the volume control side of resistor R-18 (47K) and the junction of the two 100K resistors, with the low side of the meter at the 100K resistors.

7. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	9, 11, 12, 13 & 14 (IF cores)	Adjust for maximum.
2.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	10 (ratio det sec)	Adjust for zero (connect meter as in step 6 above.)
RF ALIGNMENT						
3.	270 ohms	FM terminal 18 on rear of chassis (open link)	87.5 mc	Fully closed	15 (osc core)	Adjust for maximum.
4.	-	-	-	Fully closed	16 (RF core)	Turn counterclockwise until core is at bottom of pipe, then turn four turns clockwise.
5.	270 ohms	FM terminal 18 on rear of chassis	90 mc	Tune in signal	17 (RF tuning plug)	Adjust for maximum.
6.	270 ohms	FM terminal 18 on rear of chassis	105 mc	Tune in signal	16 (RF core)	Adjust for maximum.
7.	-	-	-	-	-	Repeat steps 5 & 6 until no further adjustment is necessary.

MODELS 8FM21,
8FM21B, Ch. HS-247

RECORD CHANGER: Model RC-37, Pages RCD.CH.21-17,18 through RCD.CH.21-29.

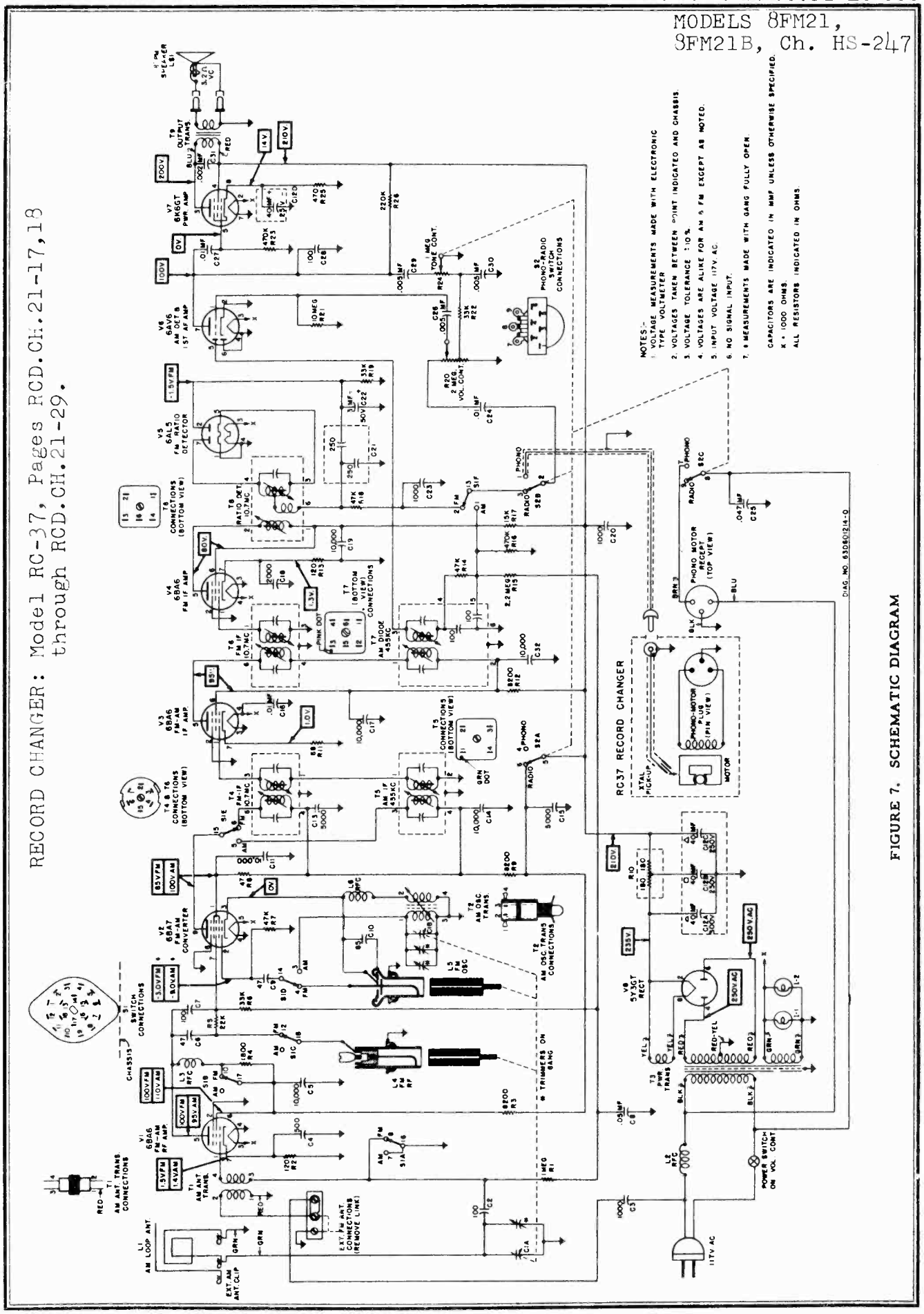

FIGURE 7. SCHEMATIC DIAGRAM

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8FM21B, Ch. HS-247

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part No.	Description
		CHASSIS PARTS - ELECTRICAL
		Capacitors
C-1	19B691877	Variable, 2-gang .....
C-2	21B77286	Ceramic: 100 mmf 500V .....
C-3	21K478410	Ceramic: 1000 mmf 500V .....
C-4	21K481377	Ceramic: 500 mmf 500V .....
C-5	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-6	21K77373	Ceramic: 47 mmf 500V .....
C-7	21B77286	Ceramic: 100 mmf 500V .....
C-8	8R9816	Paper: .05 mf 400V .....
C-9	21K77373	Ceramic: 47 mmf 500V .....
C-10	21A690688	Ceramic: 85 mmf 500V .....
C-11	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-12	23B690975	Electrolytic: 40 mf/300V, 40-40 mf/ 250V, 40 mf/25V .....
C-13	21A470789	Ceramic, disc type: 5000 mmf 450V.
C-14	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-15	21A470789	Ceramic, disc type: 5000 mmf 450V..
C-16	8R9809	Paper: .01 mf 400V .....
C-17	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-18	21K790912	Ceramic: 2000 mmf 500V .....
C-19	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-20	21K478410	Ceramic: 1000 mmf 500V .....
C-21	21B484337	Ceramic: dual; 250-250 mmf/450V.....
C-22	23K690543	Electrolytic: 3 mf 50V .....
C-23	21K478410	Ceramic: 1000 mmf 500V .....
C-24	8R9809	Paper: .01 mf 400V .....
C-25	8R490232	Tubular, molded: .047 mf 400V.....
C-26	8R9813	Paper: .005 mf 600V .....
C-27	8R9809	Paper: .01 mf 400V .....
C-28	21B77286	Ceramic: 100 mmf 500V .....
C-29	8R9813	Paper: .005 mf 600V .....
C-30	8R9813	Paper: .005 mf 600V .....
C-31	8R9847	Paper: .002 mmf 600V .....
C-32	21K482726	Ceramic, disc type: 10,000 mmf 450V
		Pilot Light
I-1,2	65X10867	Bulb, pilot light: #44; 6-8V; .25 amp; clear; bayonet base .....
		Coils
L-1	24C690896	AM Loop Antenna .....
L-2	24A692148	RF Choke .....
L-3	24A90064	RF Choke .....
L-4	24C690584	Inductor and Capacitor Assembly: FM RF; less tuning core .....
L-5	24K600519	Inductor and Capacitor Assembly: FM osc; less tuning core .....
L-6	24A791081	RF Choke .....
		Speaker
LS-1	50C601038	Speaker: 8" PM; 3.2 ohm VC ..... exch
		Resistors
		Note: All resistors are insulated carbon type unless otherwise specified.
R-1	6R6004	1 meg 20% 1/2W .....
R-2	6R5551	120 10% 1/2W .....
R-3	6R5725	8200 10% 2W .....
R-4	6R2089	1800 10% 1/2W .....
R-5	6R6028	22,000 20% 1/2W.....
R-6	6R6410	33,000 10% 1/2W.....
R-7	6R6056	47,000 20% 1/2W .....
R-8	6R2108	47 20% 1/2W .....
R-9	6R5725	8200 10% 2W .....
R-10	17A690973	Wire wound: 360 10% 3W; center-tapped .....
R-11	6R2039	68 10% 1/2W .....
R-12	6R5725	8200 10% 2W .....
R-13	6R5551	120 10% 1/2W .....
R-14	6R6056	47,000 20% 1/2W .....
R-15	6R3927	2.2 meg 20% 1/2W .....
R-16	6R6377	470,000 10% 1/2W .....
R-17	6R5732	15,000 10% 2W .....
R-18	6R6056	47,000 20% 1/2W .....
R-19	6R6410	33,000 10% 1/2W.....
R-20	18A600974	Volume control: 2 meg; tapped at 600,000 ohms; includes on-off sw
R-21	6R2109	10 meg 20% 1/2W .....
R-22	6R6410	33,000 10% 1/2W .....
R-23	6R6032	470,000 20% 1/2W .....
R-24	18B600683	Tone control: 1 meg; with phono-radio switch .....
R-25	6R5593	470 10% 1W .....
R-26	6R6015	220,000 20% 1/2W .....
		Switches
S-1	40B690538	Bandswitch, AM-FM .....
S-2	-	Phono-radio switch (on tone control)
		Transformers
T-1	24A690544	FM Antenna Input Transformer .....
T-2	24K691878	AM Oscillator Transformer: white & red dot .....
T-3	25B600684	Power Transformer .....
T-4	24B690540	1st FM IF Transformer (orange dot): 10.7 mc; complete with capacitors and cores; less shield .....
T-5	24B485553	AM IF Transformer (green dot): 455 kc; complete with capacitors, cores, and shield .....
T-6	24B690541	2nd FM IF Transformer (yellow dot): 10.7 mc; complete with capacitors and cores; less shield .....
T-7	24K485555	AM Diode Transformer (pink dot): 455 kc; complete with capacitors, cores, and shield .....
T-8	24K600893	Ratio Detector Transformer: 10.7 mc; complete with capacitors, cores and shield .....
T-9	25B600969	Audio Output Transformer .....

Part Number	Description
	CHASSIS PARTS - MECHANICAL
1K690717	Bracket Assembly, tuning core mtg: includes shoulder rivet and anti-backlash clip...
7A600965	Bracket, pilot light mtg .....
7B600801	Bracket, pointer mtg .....
7C690567	Bracket, tuner mtg (gang mtg) .....
7A77337	Bracket, tuning shaft .....
43A890397	Bushing, line cord strain relief (use with 43K890398) .....
43K890398	Bushing, line cord retainer (use with 43A890397) .....
42K690561	Clip, anti-backlash: single (on core mtg bracket) .....
42A690560	Clip, anti-backlash: double (on tuner mtg brkt) .....

MODELS 8FM21, 8FM21B, Ch. HS-247

Part Number	Description
42A485548	Clip, coil can mtg (AM IF transformer)
42B482867	Clip, spring: blued finish (holds FM IF transformer)
11M8944	Cord, dial (pointer drive)
11M488137	Cord, dial (core drive)
30K21859	Cord, line: with plug; 9 ft long
46B692164	Core, iron and screw: green dot (FM osc tuning core)
46K692165	Core, iron and screw (FM RF tuning core)
15A600877	Cover, volume control: with insulator...
5S7866	Eyelet: .125 x .091 brass; nkl pl (core drive cord retainer)
1X600495	Lead and Plug Assembly, phono pick-up...
4S9751	Lockwasher, int-ext: #8; cad pl (pointer drive pulley mtg)
2S7019	Nut, hex: 4-40 x 1/4; cad pl (FM tuning core mtg)
2S7051	Nut, hex palnut: 3/8-32 x 9/16; cad pl (control mtg)
35K691846	Pad, rubber: 1-hole (gang mtg)
35A691845	Pad, rubber: 2-hole (gang mtg)
28K71775	Plug, phono pick-up
1X600828	Pulley Assembly, pointer & gang drive (includes 3-1/2" & 1-1/4" pulleys)...
49A690562	Pulley, core drive: brass
9A600040	Receptacle, phono motor: 3-prong; includes shell
5S8497	Rivet: .088 x 1/8 stl; nkl pl (anti-backlash clip mtg)
5S7771	Rivet: .088 x 3/16 stl; nkl pl (min socket mtg)
5S7774	Rivet: .088 x 1/4 stl; nkl pl (noval socket mtg)
5S7707	Rivet: .122 x 5/32 stl; nkl pl (term strip mtg)
5S7701	Rivet: .122 x 3/16 stl; nkl pl (ant term strip mtg)
5S7700	Rivet: .122 x 1/4 stl; nkl pl (octal socket mtg)
5K13896	Rivet, shoulder (on core mtg brkt)....
3S7163	Screw, machine: 8-32 x 1/4 plain hex head; cad pl (pointer drive pulley mtg).
3S7205	Screw, machine: 8-32 x 1/4 slotted locking hex head; cad pl (gang mtg)
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (tuner brkt mtg)..
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; cad pl (pwr trans & pointer brkt mtg)
3S7103	Setscrew: 8-32 x 1/8 Allen head; cad pl (core drive pulley & pointer mtg).....
1K601085	Shaft and Pulley Assembly, pointer mtg...
1X600489	Shaft, tuning: complete with pulley.....
15A690616	Shell, receptacle (on phono motor receptacle)
26K485936	Shield, coil (for FM IF transformers)....
9K600968	Socket, pilot light
9K484167	Socket, tube: miniature; 7-prong.....
9A485495	Socket, tube: noval; 9-prong
9A76209	Socket, tube: octal
41A690598	Spring, coil: 7 turns; cosmoline dipped (FM RF core mtg)
41K691840	Spring, coil: 8 turns; cop pl (FM osc core mtg)
41A14244	Spring, tension (core & pointer drive cord)
31K37504	Strip, terminal: 1 insulated lug; #1 mtg 3/8" spacing
31K76184	Strip, terminal: 2 insulated lugs; #1 gnd; 3/8" spacing
31K26235	Strip, terminal: 3 insulated lugs; #1 gnd; 3/8" spacing
31K26658	Strip, terminal: 5 insulated lugs; #3 gnd; 3/8" spacing
31A470403	Strip, terminal: 3-screw (antenna input).
5S5405	Terminal, pin (on speaker leads)...
4A70015	Washer, "C" (tuning shaft mtg).....
4A21941	Washer, "C" (holds pointer mtg shaft & pulley)
4A600676	Washer, dog (AM-FM switch mtg).....
4S7582	Washer, flat: 1/2 x .195 x .033 stl; cad pl (pointer drive pulley mtg).....

MODEL 8FM21 CABINET PARTS

43A4326	Ball, steel: 1/8" diameter (pointer detent)
38K691915	Button, plug (on record changer).....
16F600649	Cabinet, console: red-brown mahogany; complete less pointer escutcheon and dial scale
13K600651	Cloth, grille: 17-1/2" x 18-1/4"; mahogany
15C600874	Cover, cabinet back
34D600819	Dial scale
34K600817	Escutcheon, pointer
5S7870	Eyelet: brass (on RC drawer panel-holds extra spindle)
5A71081	Eyelet, chassis mtg: plain; 9/32" long.
5A600963	Eyelet, chassis mtg: pierced; 1/8" long
5A71092	Grommet, chassis mtg: rubber
36K601052	Knob, control (Vol-On-Off): walnut-mahog.
36K601056	Knob, control (Phono-Tone-Radio): walnut-manogany
36K601057	Knob, control (AM-FM): walnut-mahogany...
36K601055	Knob, control (Tuning): walnut-mahogany..
4S7657	Lockwasher, ext: #8; cad pl (spkr mtg)
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (pointer mtg)
2S7003	Nut, hex: 8-32 x 5/16; cad pl (spkr mtg)
62K70581	Overlay, logotype: "Motorola"; gold lacquer finish
1X600851	Pointer and Collar Assembly (less shaft and sleeve)
55K600653	Pull, record changer drawer: satin brass.
3K600655	Screw, machine: 8-32 x 1/2 cross slot head; statuary bronze finish (RC drawer pull mtg)
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; antique copper finish (back cover mtg)
3K653	Screw, speaker mtg: 8-32 x 1-1/4"; copper oxide finish
1A690738	Shaft and Sleeve Assembly, pointer: less detent spring and ball,and pointer.....
55K600654	Slide, record changer (on sides of RC drawer)
2B400199	Speednut: for .050 stud (dial scale mtg)
41A690732	Spring, compression (pointer detent)..
4S1765	Washer, flat: 1/2 x .147 x .015 stl; cad pl (pointer mtg)
4S7629	Washer, flat: 1/2 x 3/16 x .048 stl; cad pl (spkr mtg)
4A690729	Washer, spring (pointer mtg)

MODEL 8FM21B CABINET PARTS -Same as 8FM21 except:

16K600650	Cabinet, console: blonde; complete, less pointer escutcheon and dial scale.....
13K600652	Cloth, grille: 17-1/2" x 18-1/4"; eggshell
36K601058	Knob, control (Vol-On-Off): tan
36K601063	Knob, control (Phono-Tone-Radio): tan....
36K601064	Knob, control (AM-FM): tan
36K601062	Knob, control (Tuning): tan
3K600656	Screw, machine: 8-32 x 1/2 cross slot head; brass (RC drawer pull mtg).....

MODELS 9FM21,
9FM21B, Ch. HS-246

GENERAL INFORMATION

TYPE – FM-AM Radio Phonograph Combination

RECEIVER MODELS-

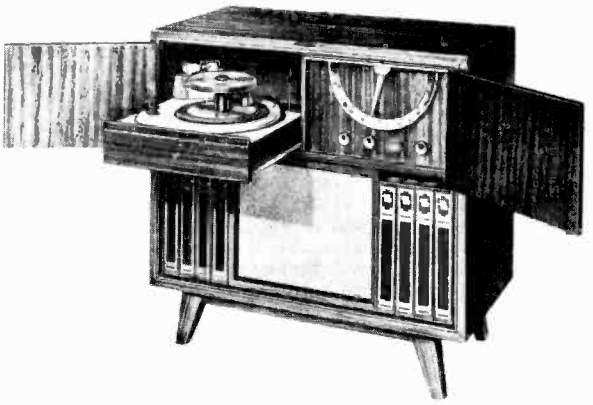
Model	Color
9FM21	Red-brown mahogany
9FM21B	Blonde

TUNING RANGE -AM 535 to 1620 Kc AM IF - 455 Kc
FM 88 to 108 Mc FM IF - 10.7 Mc

TUBE COMPLEMENT -

6AU6	FM-AM RF Amplifier
6BA7	FM-AM Converter
6BA6	FM-AM IF Amplifier
6AU6	FM IF Amplifier
6AL5	FM Ratio Detector
6AV6	AM Det & 1st Audio Amp
6V6GT	Power Amplifier
6V6GT	Power Amplifier
7Z4	Rectifier

POWER SUPPLY - 117 volts, 60 cycle AC only; 100 watts, including phono motor



PHONOGRAPH - Model RC-37, three-speed: 33, 45 & 78 RPM. Refer to the RC-37 Service Manual for record changer service information.

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNAS

No outside antenna or ground is normally required for standard broadcast (AM) reception, as a loop antenna is located inside the cabinet. Antenna connections are shown in Figure 1. In locations where additional pick-up is desired, an external antenna may be connected to the clip marked "EXT BC ANT" on the loop antenna.

An FM loop antenna, mounted inside the cabinet, eliminates the need for an external FM antenna when the receiver is used in normal FM service areas such as are found in and for a few miles around metropolitan areas.

In "fringe" or weak signal areas, improved FM reception can be obtained by using an outside FM antenna. The loop connections should be removed from the terminal strip on the rear of the chassis and the outside antenna should be connected, through a 300 ohm twin transmission line, to the terminal strip, as shown in Figure 1. Orient the antenna to obtain maximum volume of the FM stations.

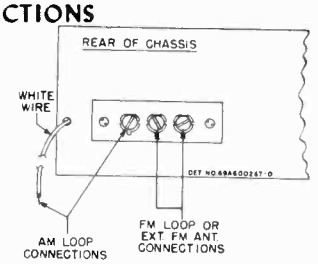


FIGURE 1. ANTENNA CONNECTIONS

CONTROLS

Refer to Figure 2 for the locations of the radio operating controls.

Power for both the radio and the record changer is controlled by the VOL-ON-OFF knob. The phonograph motor will not operate, however, until the PHONO-FM-AM knob is rotated to "PHONO"

Tuning of FM stations should be done very carefully, for best sound reproduction, not necessarily for the strongest volume received.

FIGURE 2. OPERATING CONTROLS

SERVICE NOTES

TO REMOVE CHASSIS FROM CABINET:

1. Remove the screws from the cabinet back.
2. Disconnect the phono power lead, the phono pick-up lead, the speaker leads, the line cord, and the antenna loop leads.
3. Remove the pointer escutcheon by pulling it downward.
4. Turn the tuning knob counterclockwise until the pointer reaches the extreme low frequency end of the the dial scale.
5. From the back of the cabinet, loosen the pointer adjustment setscrew (see Figure 3), and pull the pointer shaft assembly from the chassis. CAUTION: Do not remove the nut from the front of the pointer, as the detent ball and spring will fall out and may become lost.
6. Pull off the control knobs.
7. Remove the three chassis mounting screws, from beneath the chassis.
8. Slide the chassis from the cabinet.

TO CALIBRATE DIAL:

1. Turn the tuning knob counterclockwise until the end of its travel is reached.

2. From the back of the cabinet, loosen the pointer adjustment setscrew (see Figure 3). CAUTION: Do not remove the nut from the front of the pointer.

3. Move the pointer until it is in a horizontal position (at the low frequency end of the dial scale.

4. Tighten the adjustment setscrew.

NOTE: If the pointer is moved by hand accidentally, it will be released from a detent in the pointer collar, and no damage to the tuning mechanism will result. To reset the pointer, move it back and forth until it again engages in the detent.

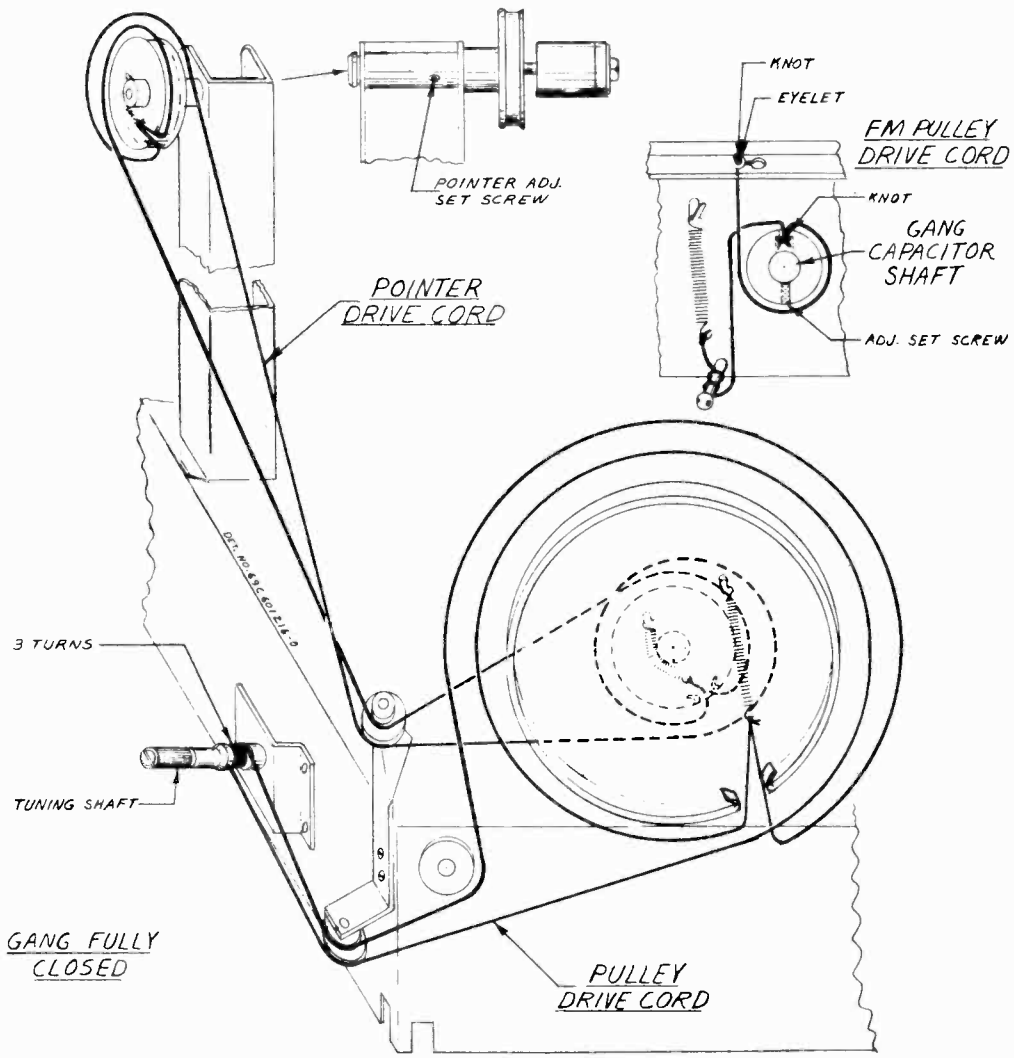


FIGURE 3. POINTER & DRIVE CORD RESTRINGING DETAIL

ALIGNMENT

GENERAL INFORMATION

1. Maximum performance can be obtained only if extreme care is exercised during alignment.

2. Use a small fibre screwdriver for aligning the IF transformers.

3. Refer to Figure 4 for the location of all alignment trimmers and cores.

4. As the stages are brought into alignment, reduce the signal generator output to a low value to avoid overloading the receiver.

MODELS 9FM21,
9FM215, Ch. HS-246

AM BROADCAST BAND - IF & RF ALIGNMENT

1. Connect the AM signal generator as in chart below, with 400 cycle, 30% modulation.
2. Connect the output meter across the speaker voice coil. Throughout alignment reduce the generator output to a level which produces less than 1.27 volts (.5 watt) across the voice coil, to avoid overloading the receiver.
3. Set the bandswitch to the AM position.
4. Turn the receiver volume control to maximum.
5. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	455 Kc	Fully opened	1, 2, 3, & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	1620 Kc	Fully opened	5 (AM osc)	Adjust for maximum.
3.	.1 mf	Grid of conv. V-2 (pin 7, 6BA7)	1400 Kc	Tune in signal	6 (AM RF)	Adjust for maximum.
4.		-	-	-	-	Connect AM loop to chassis.
5.	-	Across radiation loop*	1400 Kc	Tune in signal	7 (AM ant)	Adjust for maximum.

* Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

ORDER OF ALIGNMENT AND EQUIPMENT REQUIRED

1. AM Broadcast Band IF & RF Alignment
   a. 455 to 1620 Kc AM Signal Generator
   b. Low range output meter

2(A) FM Band IF & RF Alignment (preferred method)
   a. 10.7 to 108 Mc FM signal generator
   b. Oscilloscope.

(B) FM Band IF & RF Alignment (alternate method)
   a. 10.7 to 108 Mc signal generator (unmodulated)
   b. Low range DC electronic voltmeter

FM BAND - IF & RF ALIGNMENT (PREFERRED METHOD)

1. The following FM alignment procedure, using an FM signal generator and an oscilloscope, is to be preferred because the actual response pattern may be observed on the scope and adjusted for best symmetry and maximum amplitude.
2. Connect the vertical input terminals of the oscilloscope between the chassis and the junction of resistor R-19 (47K) and capacitor C-24 (1000 mmf).
3. Connect the FM signal generator sync voltage output terminals, through a phase shifting network, to the horizontal input terminals of the scope, as in Figure 5. (Other values of resistance and capacitance may be required, depending upon the scope). The phasing control should be adjusted to give only one trace on the scope. NOTE: If the FM generator has a built-in phase control, the phase shifting network is not necessary.
4. Set the bandswitch to the FM position.
5. Throughout alignment, reduce the generator output

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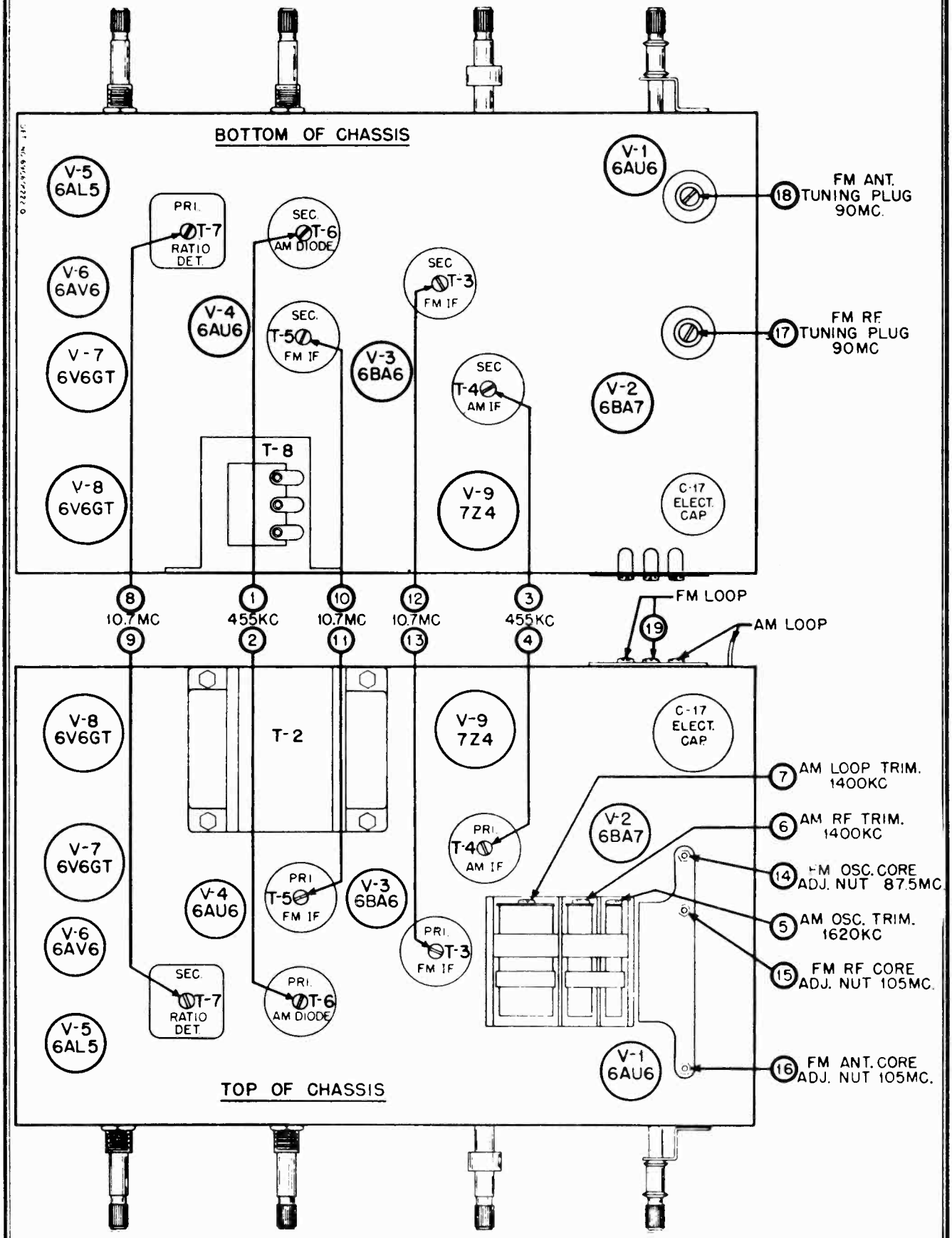

FIGURE 4. TUBE AND TRIMMER LOCATIONS

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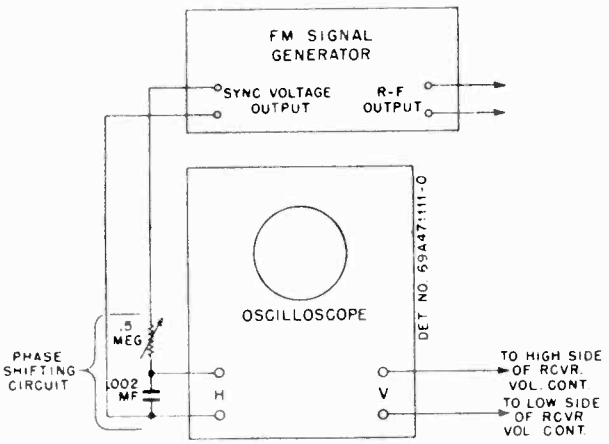

FIGURE 5.
FM SIGNAL GENERATOR & OSCILLOSCOPE HOOK-UP

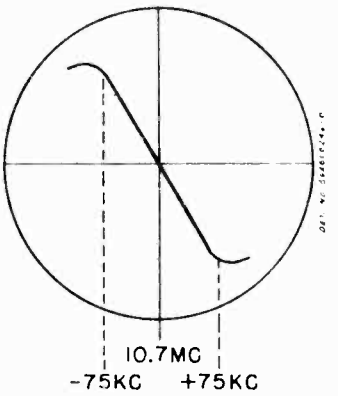

FIGURE 6. RATIO DETECTOR WAVEFORM

to keep the signal just above the noise level, to avoid overloading the receiver.

6. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6AU6)	10.7 mc ±100 kc dev	Fully opened	8 (ratio det pri)	Adjust for maximum amplitude of pattern. *
2.	1000 mmf	Grid of 2nd IF Amp V-4 (pin 1, 6AU6)	10.7 mc ±100 kc dev	Fully opened	9 (ratio det sec)	Adjust for symmetrical curve, as shown in Figure 6.
3.	-	-	-	-	-	Repeat steps 1 & 2 for maximum amplitude and best symmetry.
4.	1000 mmf	Grid of 1st IF Amp V-3 (pin 1, 6BA6)	10.7 mc ±100 kc dev	Fully opened	10 & 11 (2nd IF sec & pri)	Adjust for maximum amplitude of pattern. *
5.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc ±100 kc dev	Fully opened	12 & 13 (1st IF sec & pri)	Adjust for maximum amplitude of pattern. *
6.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc ±100 kc dev	Fully opened	10, 11 12 & 13	Readjust for maximum amplitude and best symmetry.
RF ALIGNMENT						
7.	270 ohms	FM terminal 19 on rear of chassis	87.5 mc ±22-1/2 kc dev	Fully closed	14 (osc core)	Adjust for maximum amplitude of pattern. *
8.	-	-	-	Fully closed	15 & 16 (RF & ant cores)	Turn counterclockwise until cores are at bottom of pipe, then turn two turns clockwise.
9.	270 ohms	FM terminal 19 on rear of chassis	90 mc ±22-1/2 kc dev	Tune in signal	17 & 18 (RF & ant tuning plugs)	Adjust for maximum amplitude of pattern. *
10.	270 ohms	FM terminal 19 on rear of chassis	105 mc ±22-1/2 kc dev	Tune in signal	15 & 16 (RF & ant cores)	Adjust for maximum amplitude of pattern. *
11.	-	-	-	-	-	Repeat steps 9 & 10 until no further adjustment is necessary.

* An output meter across the speaker voice coil will also indicate maximum amplitude. It should not be used in place of the scope, however, since it will not show symmetry of the curve.

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FM BAND - IF & RF ALIGNMENT (ALTERNATE METHOD)

1. The following procedure for FM alignment, with an unmodulated carrier generator and a DC electronic voltmeter, is not as desirable as the preceding method; but it may be used if no FM generator is available.
2. Connect the signal generator as in chart below, with no modulation.
3. Set the bandswitch to the FM position.
4. Except in step 2 below, connect the electronic voltmeter across resistor R-23 (33K) in the ratio detector stage.
5. Throughout alignment reduce the signal generator output to a value which produces no more than a 5 volt rise above no signal voltage, to avoid overloading the receiver.
6. In step 2 below, connect two 100K ohm resistors in series across R-23. Connect the electronic voltmeter between the volume control side of resistor R-19 (47K) and the junction of the two 100K resistors, with the low side of the meter at the 100K resistors.
7. Proceed as shown in the following chart.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	8, 10, 11, 12 & 13 (IF cores)	Adjust for maximum.
2.	1000 mmf	Grid of conv. V-2 (pin 7, 6BA7)	10.7 mc	Fully opened	9 (ratio det sec)	Adjust for zero. (Connect meter as in step 6 above).
RF ALIGNMENT						
3.	270 ohms	FM terminal 19 on rear of chassis	87.5 mc	Fully closed	14 (osc core)	Adjust for maximum.
4.	-	-	-	Fully closed	15 & 16 (RF & ant cores)	Turn counterclockwise until cores are at bottom of pipe, ther turn two turns clockwise.
5.	270 ohms	FM terminal 19 on rear of chassis	90 mc	Tune in signal	17 & 18 (RF & ant tuning plugs)	Adjust for maximum.
6.	270 ohms	FM terminal 19 on rear of chassis	105 mc	Tune in signal	15 & 16 (RF & ant cores)	Adjust for maximum.
7.	-	-	-	-	-	Repeat steps 5 & 6 until no further adjustment is necessary.

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part No.	Description
CHASSIS PARTS - ELECTRICAL		
Capacitors		
C-1	19B690978	Variable, 3-gang .....
C-2	21K77375	Ceramic: 220 mmf 500V .....
C-3	21K70720	Ceramic: 5 mmf 500V .....
C-4	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-5	21B77286	Ceramic: 100 mmf 500V .....
C-6	21B77296	Ceramic: 100 mmf 500V .....
C-7	21B77286	Ceramic: 100 mmf 500V.....
C-8	21R6554	Mica: 100 mmf 10% 500V .....
C-9	21K28816	Ceramic: 24 mmf 500V .....
C-10	21K478410	Ceramic: 1000 mmf 500V .....
C-11	21K691203	Ceramic: 85 mmf 500V.....
C-12	8R9821	Paper: .05 mf 200V .....
C-13	21B77286	Ceramic: 100 mmf 500V.....
C-14	8R9809	Paper: .01 mf 400V .....
C-15	8R9809	Paper: .01 mf 400V .....
C-16	8R9813	Paper: .005 mf 600V .....
C-17	23B690975	Electrolytic: 40 mf/300V, 40-40 mf/250V, 40 mf/25V .....
C-18	21K482726	Ceramic, disc type: 10,000 mmf 450V
C-19	21K77373	Ceramic: 47 mmf 500V .....
C-20	21K77373	Ceramic: 47 mmf 500V .....
C-21	21K478410	Ceramic: 1000 mmf 500V .....
C-22	8R9824	Paper: .002 mf 400V .....
C-23	8K470606	Paper: .05 mf 400V .....
C-24	21K478410	Ceramic: 1000 mmf 500V .....
C-25	21B484337	Ceramic: dual; 250-250 mmf/450V...
C-26	8K470606	Paper: .05 mf 400V .....
C-27	8R9813	Paper: .005 mf 600V .....
C-28	8R9813	Paper: .005 mf 600V .....
C-29	8R9813	Paper: .005 mf 600V .....
C-30	8R9821	Paper: .05 mf 200V .....
C-31	23K690543	Electrolytic: 3 mf 50V .....
C-32	8R9809	Paper: .01 mf 400V .....
C-33	21A470789	Ceramic, disc type: 5000 mmf 450V
C-34	21K77375	Ceramic: 220 mmf 500V .....

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Ref. No.	Part No.	Description
Dial Light		
I-1,2	65X10867	Bulb, dial light: #44; 6-8V; .25 amp; clear; bayonet base .....
Coils		
L-1	24K690985	FM loop antenna: with lead .....
L-2	24C690896	AM loop antenna .....
L-3	24C690584	Inductor and Capacitor Assembly: FM antenna: less tuning core.....
L-4	24A484025	RF choke .....
L-5	24C690584	Inductor and Capacitor Assembly: FM RF; less tuning core .....
L-6	24K690996	Inductor and Capacitor Assembly: FM oscillator; less tuning core...
L-7	24K780128	RF choke: insulated .....
L-8	24B690976	AM oscillator coil .....
Speaker		
LS-1	50C601037	Speaker: 10" PM; 3.2 ohm VC....
Resistors		
		Note: All resistors are insulated carbon type unless otherwise specified.
R-1	6R6046	1 meg 10% 1/2W .....
R-2	6R5551	120 10% 1/2W .....
R-3	6R6048	47,000 10% 1/2W .....
R-4	6R3949	470 20% 1/2W .....
R-5	6R490131	3.3 10% 1/2W .....
R-6	6R6028	22,000 20% 1/2W .....
R-7	6R5585	8.2 meg 10% 1/2W .....
R-8	6R6048	47,000 10% 1/2W .....
R-9	6R6038	1500 10% 1/2W .....
R-10	6R5725	8200 10% 2W .....
R-11	6R6497	3.3 meg 10% 1/2W .....
R-12	6R2039	68 10% 1/2W.....
R-13	6R5725	8200 10% 2W .....
R-14	6R6046	1 meg 10% 1/2W .....
R-15	17A690973	Wirewound: 360 10% 3W; center tapped .....
R-16	6R6056	47,000 20% 1/2W .....
R-17	6R3992	150 20% 1/2W .....
R-18	6R6431	15,000 10% 1W .....
R-19	6R6056	47,000 20% 1/2W .....
R-20	6R6032	470,000 20% 1/2W .....
R-21	6R6032	470,000 20% 1/2W .....
R-22	6R6389	220 10% 1W .....
R-23	6R6410	33,000 10% 1/2W .....
R-24	6R5598	390 10% 1W .....
R-25	6R6012	33,000 20% 1/2W .....
R-26	18A600974	Volume control: 2 meg; tapped at 600,000 ohms; includes on-off sw
R-27	18K77399	Tone Control: 1 meg .....
R-28	6R2109	10 meg 20% 1/2W .....
R-29	6R6001	68,000 20% 1/2W .....
Switches		
S-1	40B690977	Band Switch: AM-FM-Phono .....
S-2	-	On-Off Switch (on volume control)..
S-3	40A691922	Phono-Radio-Switch; SPST .....
Transformers		
T-1	24B690899	AM RF Transformer .....
T-2	25B691035	Power Transformer .....
T-3	24B690540	1st FM IF Transformer (orange dot): 10.7 mc; complete with capacitor and cores; less shield .....
T-4	24B482863	AM IF Transformer (brown dot): 455 Kc: complete with capacitors and cores; less shield .....
T-5	24B690541	2nd FM IF Transformer (yellow dot): 10.7 mc; complete with capacitor and cores: less shield .....
T-6	24B482865	AM Diode Transformer (red dot): 455 Kc: complete with capacitors and cores; less shield.....
T-7	24B690542	Ratio Detector Transformer: 10.7 mc; complete with capacitors, cores and shield .....
T-8	25B690898	Audio Output Transformer .....

Part Number	Description
CHASSIS PARTS - MECHANICAL	
1X690717	Bracket Assembly, tuning core mtg: includes shoulder rivet and single anti-backlash clip .....
1X600827	Bracket & Pulleys Assembly: includes four pulleys and shoulder rivets (cord guides on chassis front) .....
7A600965	Bracket, pilot light mtg .....
7B600801	Bracket, pointer mtg .....
7C690567	Bracket, tuner mtg (gang mtg) .....
7A77337	Bracket, tuning shaft .....
43K890398	Bushing, line cord retainer (use with 43A890397) .....
43A890397	Bushing, line cord strain relief (use with 43K890398) .....
42A690560	Clip, anti-backlash: double (on tuner mounting brkt) .....
42K690561	Clip, anti-backlash: single (on core mtg brkt) .....
42B482867	Clip, spring: blued finish (holds IF transformer) .....
11M488137	Cord, dial (core drive) .....
11M8944	Cord, dial (pointer drive) .....
30K21859	Cord, line: with plug: 9 ft long .....
46B692164	Core, iron and screw: green dot (FM osc tuning core) .....
46K692165	Core, iron and screw (FM RF and ant tuning core) .....
5S7866	Eyelet: .125 x .091; brass; nkl pl (core drive cord retainer) .....
1X600081	Link Assembly, bandswitch actuating: complete with bushings; less setscrews..
4S9751	Lockwasher, int-ext: #8; cad pl (pointer drive pulley mtg) .....
2S7019	Nut, hex: 4-40 x 1/4; cad pl (FM tuning core mtg) .....
2S7051	Nut, hex palnut: 3/8-32 x 9/16; cad pl (bandswitch, tone and volume control mtg) .....
1X600828	Pulley Assembly, pointer & gang drive (includes 3-1/2" & 1-1/4" pulleys)...
49A23960	Pulley, cord: 1/4" groove (on pulley bracket) .....
49A21741	Pulley, cord: 3/8" groove (on pulley bracket) .....
49A73807	Pulley, cord: 1/2" groove (on chassis side and on pulley bracket).....
49A26433	Pulley, cord: 21/32" groove (on pulley bracket) .....
49A690562	Pulley, core drive: brass .....
9K592170	Receptacle, phono pick-up: 1-prong .....
9A27674	Receptacle, phono power: 3-prong .....
5S8497	Rivet: .088 x 1/8 stl; nkl pl (single anti-backlash clip mtg) .....
5S7771	Rivet: .088 x 3/16; stl; nkl pl (min and midget tube socket mtg) .....
5S7707	Rivet: .122 x 5/32; stl; nkl pl (loctal tube socket, terminal strip, output transformer mtg) .....
5S7701	Rivet: .122 x 3/16 stl; nkl pl (power receptacle, ant term strip, and tuning shaft bracket mtg) .....
5S7700	Rivet: .122 x 1/4; stl; nkl pl (octal tube socket mtg) .....
5K13896	Rivet, shoulder (tuning core cord guide and mounts 1/2" and 3/8" pulleys to bracket) .....
5K71246	Rivet, shoulder (pulley mtg on side of chassis) .....
5K71735	Rivet, shoulder (mounts 21/32" and 3/8" pulleys to bracket) .....

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Part Number	Description
3S7462	Screw, machine: 6-32 x 3/16 plain hex head; cad pl (electrostatic shield mtg) .....
3S7326	Screw, machine: 8-32 x 3/16 plain locking hex head; cad pl (gang mtg).....
3S7163	Screw, machine: 8-32 x 1/4 plain hex head; cad pl (pointer drive pulley mtg)..
3S2695	Screw, sheet metal: #6 x 3/16 PKZ plain hex head; cad pl (tuner brkt mtg)..
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; cad pl (pointer bracket mtg) .....
3S7475	Screw, sheet metal: #8 x 1/4 PKZ slotted acorn head; cad pl (power trans mtg)
3S7103	Setscrew: 8-32 x 1/8 Allen head; cad pl (core drive pulley & pointer mtg).....
3S7113	Setscrew: 8-32 x 1/4 slab head; cad pl (bandswitch link assembly mtg).....
1K601085	Shaft and Pulley Assembly, pointer mtg...
1X691134	Shaft, tuning: complete with pulley.....
26K485936	Shield, coil: for IF transformers.....
26K690984	Shield, electrostatic (gang shield).....
26K690981	Shield, tube: spring type .....
26A692080	Shield, tube (for V-9): includes 41K692081 spring .....
9K600968	Socket, pilot light .....
9A72519	Socket, tube: loctal .....
9A690129	Socket, tube: midget; 7-prong(for V-1)...
9K484167	Socket, tube: miniature; 7-prong.....
9A485495	Socket, tube: noval; 9-prong .....
9A76209	Socket, tube: octal .....
41A690598	Spring, coil: 7 turns; cosmoline dipped (FM RF & ant core mtg).....
41K691840	Spring, coil: 8 turns; copper plated (FM osc core mtg) .....
41A14244	Spring, tension (core & pointer drive cord) .....
41K692081	Spring, tube shield retaining (for V-9 shield) .....
31K51251	Strip, terminal: 1 insulated lug, #1 gnd; 3/8" spacing .....
•31K76184	Strip, terminal: 2 insulated lugs; #1 gnd; 3/8" spacing .....
31K471565	Strip, terminal: 3 insulated lugs, #4 gnd; 3/8" spacing .....
31A690974	Strip, terminal: 7 insulated lugs, #4 & 9 gnd; 3/8" spacing .....
31K471498	Strip, terminal: 3-screw (antenna input).
29K5412	Terminal, plain pin (on speaker leads)
4A70015	Washer, "C" (tuning shaft retainer)
4A21941	Washer, "C" (holds pointer mtg shaft & pulley) .....
4S7582	Washer, flat: 1/2 x .195 x .033 stl; cad pl (pointer drive pulley mtg).....
MODEL 9FM21 CABINET PARTS	
43A4326	Ball, steel: 1/8" diameter (pointer detent) .....
38K691915	Button, plug (on record changer).....
16F600641	Cabinet, console: red-brn mahogany; complete, less pointer escutcheon and dial scale .....
55K482159	Catch, bullet: statuary bronze finish (door latch - on cabinet) .....
42A470832	Clamp, cable: plastic (holds line cord)..
42K600645	Clip, pointer escutcheon .....
43K600637	Cloth, grille: 13-3/8 x 15-1/2; mahogany.
15D600648	Cover, cabinet back .....
34D600819	Dial scale .....
34K600817	Escutcheon, pointer .....
5S7870	Eyelet: brass (on RC drawer panel -holds extra spindle) .....
5A71081	Eyelet, chassis mtg: plain; 9/32"long.
5A600963	Eyelet, chassis mtg:pierced ; 1/8" lg.
5A71092	Grommet, chassis mtg: rubber .....
55K600643	Handle, door: polished brass .....
55K600646	Hinge, door: bronze finish (lower hinges) .....
55K600639	Hinge, door (stop type): bronze finish (upper hinges) .....
14K791482	Insulator, fibre (clamps phono leads).
36C601041	Knob, control (VOL-ON-OFF): walnut-mahogany
36K601043	Knob, control (TONE): walnut-mahogany ...
36K601044	Knob, control (PHONO-FM-AM): walnut-mahogany .....
36K601045	Knob, control (TUNING): walnut-mahogany..
1X600852	Lead and Plugs Assembly, phono-pick-up (shielded lead with two phono pick-up plugs) .....
4S7657	Lockwasher, ext: #8; cad pl (spkr mtg) .....
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (pointer mtg) .....
2S7003	Nut, hex: 8-32 x 5/16; cad pl (spkr mtg) .....
62K70581	Overlay, logotype: "Motorola"; gold lacquer finish .....
35K691051	Pad, felt: 1/2" diameter (door stop)..
64K600867	Panel, record changer bottom: chipboard.
1X600851	Pointer and Collar Assembly (less shaft and sleeve) .....
28A27573	Plug, phono motor: 3-pin; includes shell (on phono motor lead) .....
28K71775	Plug, phono pick-up .....
9A600040	Receptacle, phono motor: 3-prong; includes shell (on phono motor lead) .....
3K489169	Screw, machine: 8-32 x 1 cross slot head; statuary bronze finish (door handle mtg) .....
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; antique copper finish (back cover mtg) .....
3S3387	Screw, sheet metal: #6 x 1/2 PKA plain hex head; statuary bronze finish (cable clamp mtg) .....
3K653	Screw, speaker mtg: 8-32 x 1-1/4"; copper oxide finish .....
3S1334	Screw, wood: #6 x 1 flat head; statuary bronze finish (door hinge mtg).....
1A690738	Shaft and Sleeve Assembly, pointer: less detent spring and ball, and pointer....
15A690616	Shell, receptacle (on phono motor receptacle) .....
15K74442	Shell, receptacle (on phono motor plug)
55K600171	Slide, record changer: left-hand (on side of RC drawer) .....
55K600172	Slide, record changer: right-hand (on side of RC drawer) .....
2S400199	Speednut: for .050 stud (dial scale mtg) .....
41A690732	Spring, compression (pointer detent)..
55K482160	Strike & nail: statuary bronze finish (door latch - on door) .....
4S1765	Washer, flat: 1/2 x .147 x .015 stl; pl (pointer mtg) .....
4S7629	Washer, flat: 1/2 x 3/16 x .048 stl; pl (spkr mtg) .....
4S8214	Washer, flat: 7/8 x .203 x .067 stl; pl .....
4A690729	Washer, spring (pointer mtg) .....
MODEL 9FM21B CABINET PARTS - Same as 9FM21 except:	
16K600642	Cabinet, console: blonde; complete, less pointer escutcheon and dial scale.....
55K482794	Catch, bullet: brass (door latch - on cabinet) .....
43K600638	Cloth, grille: 13-3/8 x 15-1/2; eggshell & brown .....
55K600647	Hinge, door: brushed brass finish (lower hinges) .....pr
55K600644	Hinge, door (stop type): brushed brass finish (upper hinges) .....pr
36K601046	Knob, control (VOL-ON-OFF): tan .....
36K601048	Knob, control (TONE): tan .....
36K601049	Knob, control (PHONO-FM-AM): tan .....
36K601051	Knob, control (TUNING): tan .....
3K489170	Screw, machine: 8-32 x 1 cross slot head; brass (door handle mtg) .....
55K482795	Strike & nail: brass (door latch - on door)

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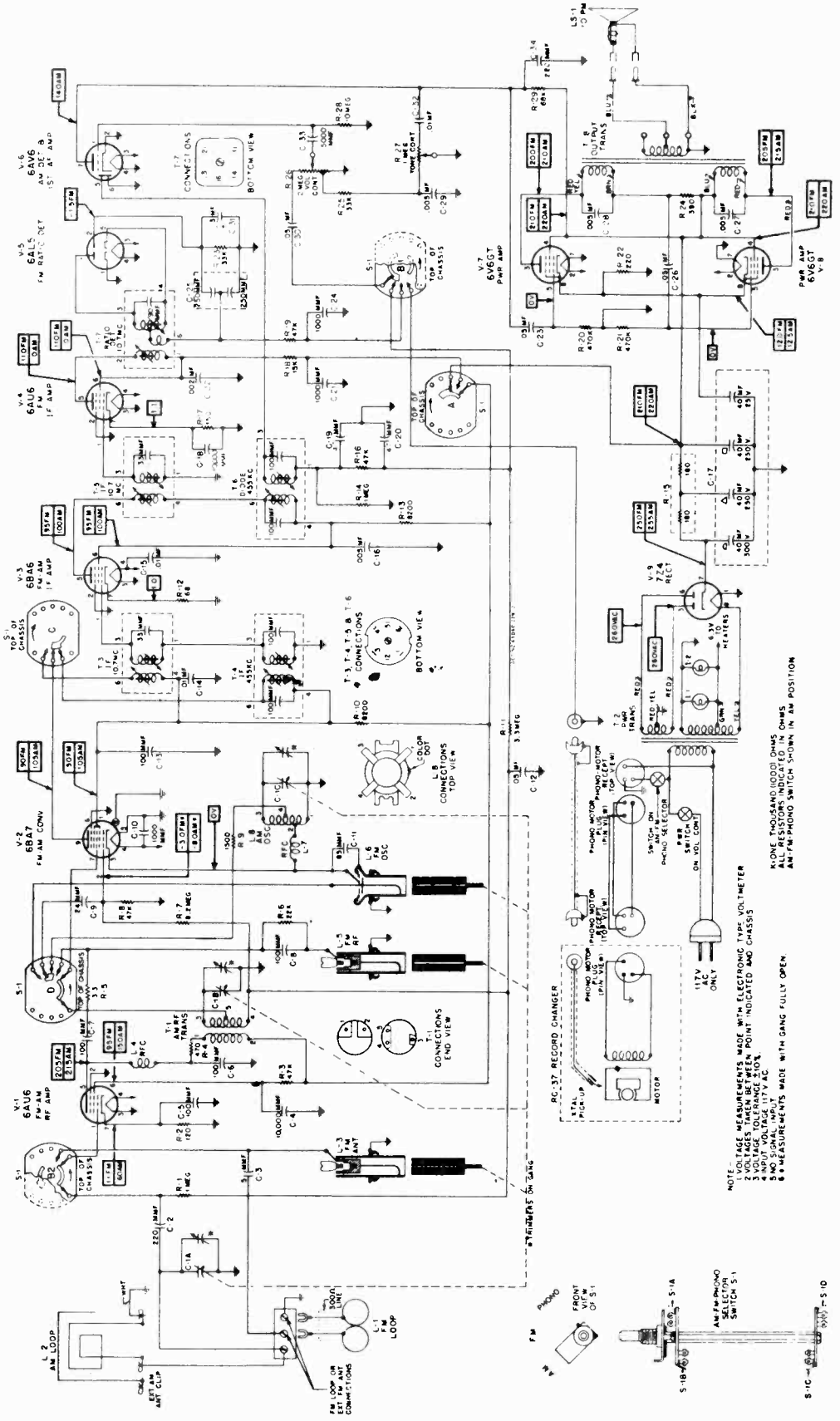


FIGURE 7. SCHEMATIC DIAGRAM

GENERAL INFORMATION

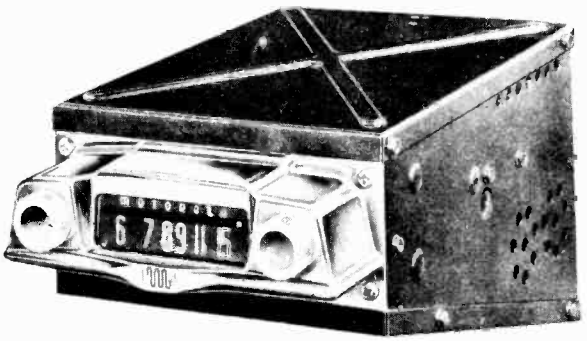
TYPE - Universal automotive type superheterodyne receiver with self-contained speaker. Designed for under-dash mounting.

TUNING RANGE - 535 to 1600 kc IF - 455 kc

TUBE COMPLEMENT - 6BA6 - RF Amplifier
6BE6 - Converter
6BA6 - IF Amplifier
6AV6 - Detector-AVC-AF Amplifier
6AS5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 6.3 volts DC at 6 amperes

POWER OUTPUT - 2 watts



REPLACEMENT PARTS LIST

CHASSIS PARTS - ELECTRICAL

REF. NO.	PART NO.	DESCRIPTION
CAPACITORS		
C-1	21K591682	Ceramic: 90 mmf 500V
C-2	8A4529	Paper: .006 mf 100V
C-3	20A485652	Trimmer, mica: 50 to 280 mmf 500V
C-4	8K472035	Paper: .1 mf 100V
C-5	8K14791	Paper: .05 mf 400V
C-6	20A481526	Trimmer, mica: 20 to 180 mmf 500V
C-7	21K70720	Molded: 5 mmf 500V
C-8	21K74661	Ceramic: 50 mmf 300V
C-9	20A580113	Trimmer, mica: 240 to 300 mmf 500V
C-10	8K13514	Paper: .05 mf 100V
C-11	8K17028	Paper: .5 mf 100V
C-12	8K592154	Paper: .03 mf 600V
C-13	8K472754	Paper: .01 mf 100V
C-14	8K23690	Paper: .01 mf 400V
C-15	21R6543	Mica: 250 mmf 500V
C-16	8K71909	Paper: .004 mf 400V
C-17	23A591500	Electrolytic: 15-10-20 mfd/ 350-350-25V
FUSE		
F-1	65A10266	Fuse: 10 amp
VIBRATOR		
G-1	48B3333	Vibrator: 4-pin; non-sync
DIAL LIGHT		
I-1	65X10867	Bulb: 6.3V; .25A; tubular; bayonet base; #44
COILS		
L-1	24B580570	Coil, antenna
L-2	24K580571	Coil, RF
L-3	24B592036	Coil, oscillator
L-4	24K580706	Choke, RF
L-5	24A472535	Choke, hash

REF. NO.	PART NO.	DESCRIPTION
SPEAKER		
LS-1	50B591189 or 50B580759 or 50B590079	Speaker: PM; 5-1/4"; 3.2 ohm voice coil
RESISTORS		
	Note:	All resistors are carbon insulated type unless otherwise specified.
R-1	6R6032	470,000 20% 1/2W
R-2	6R6075	100,000 20% 1/2W
R-3	6R6056	47,000 20% 1/2W
R-4	6R5614	56 10% 1/2W
R-5	6R5614	56 10% 1/2W
R-6	6R6022	330 10% 1/2W
R-7	6R6006	2200 20% 1W N.I.
R-8	18K592021	Volume Control: .5 meg; includes on-off switch
R-9	6R6004	1 meg 20% 1/2W
R-10	6R2122	4.7 meg 20% 1/2W
R-11	6R6032	470,000 20% 1/2W
R-12	6R6015	220,000 20% 1/2W
R-13	6R6390	180 10% 1W
R-14	6R6004	2200 20% 1W N.I.
SPARK PLATE		
SP-1	1A485606	Spark Plate Assembly
TRANSFORMERS		
T-1	24B485553	IF, 455 Kc; complete
T-2	24K485554	Diode: 455 Kc; complete
T-3	25C591740	Power Transformer
T-4	25B70171	Output Transformer

MODEL 400

PART NUMBER	DESCRIPTION
CHASSIS PARTS - MECHANICAL	
42A485548	Clip, coil can mtg (T-1 & T-2 mtg)
42A4215	Clip, vibrator grounding .....
9K14906	Insulator, electrolytic mtg: armite .....
9K580705	Lead, fuse: complete with 10 amp fuse.
4S7666	Lockwasher, ext: #6; stl; cad pl (power trans mtg).....
4S8406	Lockwasher, int: #2; stl; cad pl (pointer plate mtg) .....
4S7650	Lockwasher, int: #6; stl; cad pl (dial light mtg) .....
2A78005	Nut, floating: with ear (on tuning shaft) .....
2A77596	Nut, floating: without ear (on tuning shaft) .....
2S7005	Nut, hex: 6-32 x 1/4; stl; cad pl (power trans mtg) .....
2S7051	Nut, hex: 3/8-32 x 9/16; Palnut; stl; cad pl (vol. cont mtg) .....
1X592056	Plate and Stud Assembly (pointer adj plate) .....
1X592054	Pointer Plate and Sleeving Assembly...
9A472148	Receptacle, antenna contact .....
5S7771	Rivet: .088 x 5/16; stl; nkl pl (tube socket mtg) .....
5S7707	Rivet: .122 x 5/32; stl; nkl pl (output trans mtg) .....
5S7701	Rivet: .122 x 3/16; stl; nkl pl (vibrator socket, dial light and spark plate assem mtg) .....
5S7703	Rivet: .122 x 7/32; stl; nkl pl (electrolytic wafer mtg) .....
3S1921	Screw, machine: 2-56 x 1/8; slotted binder head; stl; cad pl (pointer plate mtg and pointer adjustment screw) .....
3S7454	Screw, sheet metal: #8 x 1/4; plain hex head; stl; cad pl (tuner mtg)
47K592016	Shaft, drive (tuning shaft) .....
60K25753	Shield, light .....
9K580609	Socket, dial light: includes mtg brkt.
9A472534	Socket, tube: miniature .....
9A70208	Socket, tube: 4 prong (for vibrator)..
41A77592	Spring, compression (tuning shaft).
41A472659	Spring, torsion (pointer assembly..
46A485622	Stud, drive plate mtg .....
46A592015	Stud, pointer mtg .....
9A12705	Wafer, electrolytic mtg: bakelite..
4K24124	Washer, 'C' (drive shaft retainer).
4A11291	Washer, 'C' (pointer mtg and carriage plate stop) .....
4S488235	Washer, flat: 3/8 x 3/32 x .010; thick; stl; cad pl (pointer plate mtg) .....
4S1719	Washer, flat: 3/8 x 9/64 x .030; thick; stl; cad pl (pointer mtg)
4K592045	Washer, spring (drive shaft play takeup) .....
39A26068	Wiper, grounding: spring brass (grounds chassis to top cover)..
HOUSING PARTS	
15K592028	Cover, bottom: less speaker .....
15K592026	Cover, top .....
13D592010	Escutcheon, dial .....
7A485674	Frame, dial scale retainer .....
36K591957	Knob, control .....
4S7657	Lockwasher, ext: #8; stl; cad pl (speaker mtg) .....
2S7003	Nut, hex: 8-32 x 5/16 stl; cad pl (speaker mtg) .....
2S7988	Speednut (dial scale mtg) .....
34K591929	Scale, dial: glass .....
3S8114	Screw, sheet metal: #8 x 1/4 slotted acorn head; antique copper finish (housing screws) .....
3S490733	Screw, sheet metal: #8 x 1/4 PkZ Phillips binder head; chrome pl (escutcheon mtg) .....
MOUNTING PARTS AND ACCESSORIES	
7B590654	Bracket, receiver mtg (on escutcheon).
7A72256	Bracket, receiver mtg (on housing)....
7A484424	Bracket and Stud Assembly (receiver mtg)
8A4491	Capacitor, noise suppression (generator cap) .....
4S7688	Lockwasher, int-ext: 1/4; stl; cad pl (receiver mtg) .....d
2S7022	Nut, hex: 1/4-20 x 7/16; stl; cad pl (receiver mtg) .....
3S8109	Screw, sheet metal: #8 x 3/8; PKZ; slotted acorn head; stl; cad pl (receiver mtg) .....
3S7295	Screw, machine: 1/4-20 x 3/4; plain hex head; stl; cad pl (receiver mtg strap) .....
3S9694	Screw, machine: 1/4-20 x 1-1/2; plain hex head; stl; cad pl (receiver mtg to car firewall) .....
42A485718	Strap, receiver mtg .....
6A4141	Suppressor, noise (distributor) ..
TUNER PARTS - MECHANICAL	
Note:	Coils and trimmers are included in the Electrical Chassis Parts list. Drive shaft parts are included in the Mechanical Chassis Parts List.
1X580162	Carriage Plate Assembly: includes bakelite core insulator & slider spring..
46K489214	Core, iron and screw (specify color coding on old core when ordering)...
42A70184	Clip, core adjustment .....
5K580503	Grommet, rubber (Ant & RF coil mtg)..
5K580504	Grommet, rubber (oscillator coil mtg)
14A485602	Insulator, core: bakelite; 2-11/16 x 1-1/8 .....
5S8497	Rivet: .088 x 1/8; stl; nkl pl (terminal strip and slider mtg).....
5S6819	Rivet: .122 x 1/8; stl; nkl pl (shield mtg) .....
26A580546	Shield, coil .....
41A485649	Spring, core .....
41A580079	Spring, slider .....
31A485605	Strip, terminal: 2 insulated lugs, #2 mtg .....
4A70956	Washer, core insulator: 1/4 dia; bakelite .....

MODEL 400

ALIGNMENT

Connect a low range output meter across speaker voice coil and set volume control at maximum. For greatest accuracy, keep output of receiver at approximately 1 watt (1 watt = 1.79 volts on output meter) throughout alignment by reducing signal generator output as stages are brought into alignment. Use a small fibre screwdriver when aligning IF and diode transformers. A special tool, Motorola Part No. 66A76278, is required for adjusting the tuner cores. IMPORTANT: Do not push in on the alignment tool when adjusting the tuner cores; the slightest inward pressure may move tuner carriage and result in inaccurate alignment. Remove receiver top and bottom covers and the escutcheon and dial scale assembly to expose all adjustments.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	6BE6 Grid (pin #7)	455 Kc	High frequency end (cores out)	1, 2, 3 & 4	Peak for maximum in order indicated. Check by repeating procedure.
RF ALIGNMENT						
2.	See Fig. 1.	Antenna receptacle through dummy.	1605 Kc	High frequency end; cores should project 1-1/4" from cans. (Screw out)	5, 6 & 7	Peak for maximum in order indicated.
3.	"	"	1300 Kc	1300 Kc per Fig. 2	8, 9 & 10	"
POINTER ADJUSTMENT						
4.	"	"	600 Kc	Tune for maximum	-	Replace dial scale & set pointer to 600 Kc by means of pointer adjustment screw.

5. With receiver installed in car, the antenna fully extended and dial set to approximately 1400 Kc, adjust antenna trimmer (7) for maximum volume of a weak station or noise between stations.

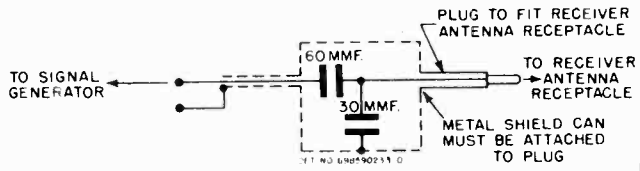
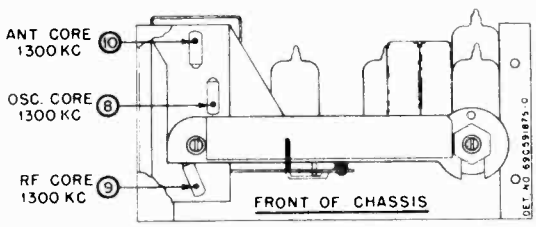


FIGURE 1. DUMMY ANTENNA



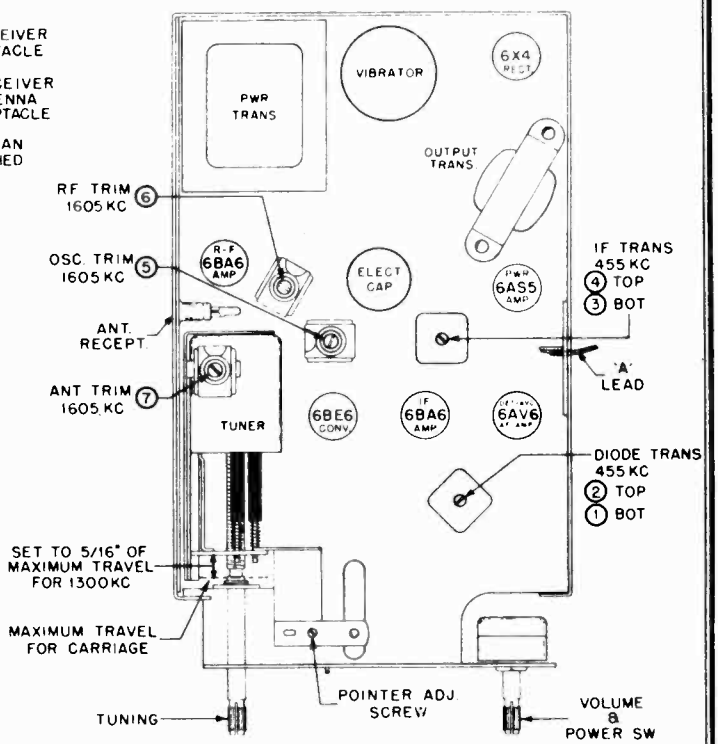


FIGURE 2. TUBE & TRIMMER LOCATIONS

MODEL 400

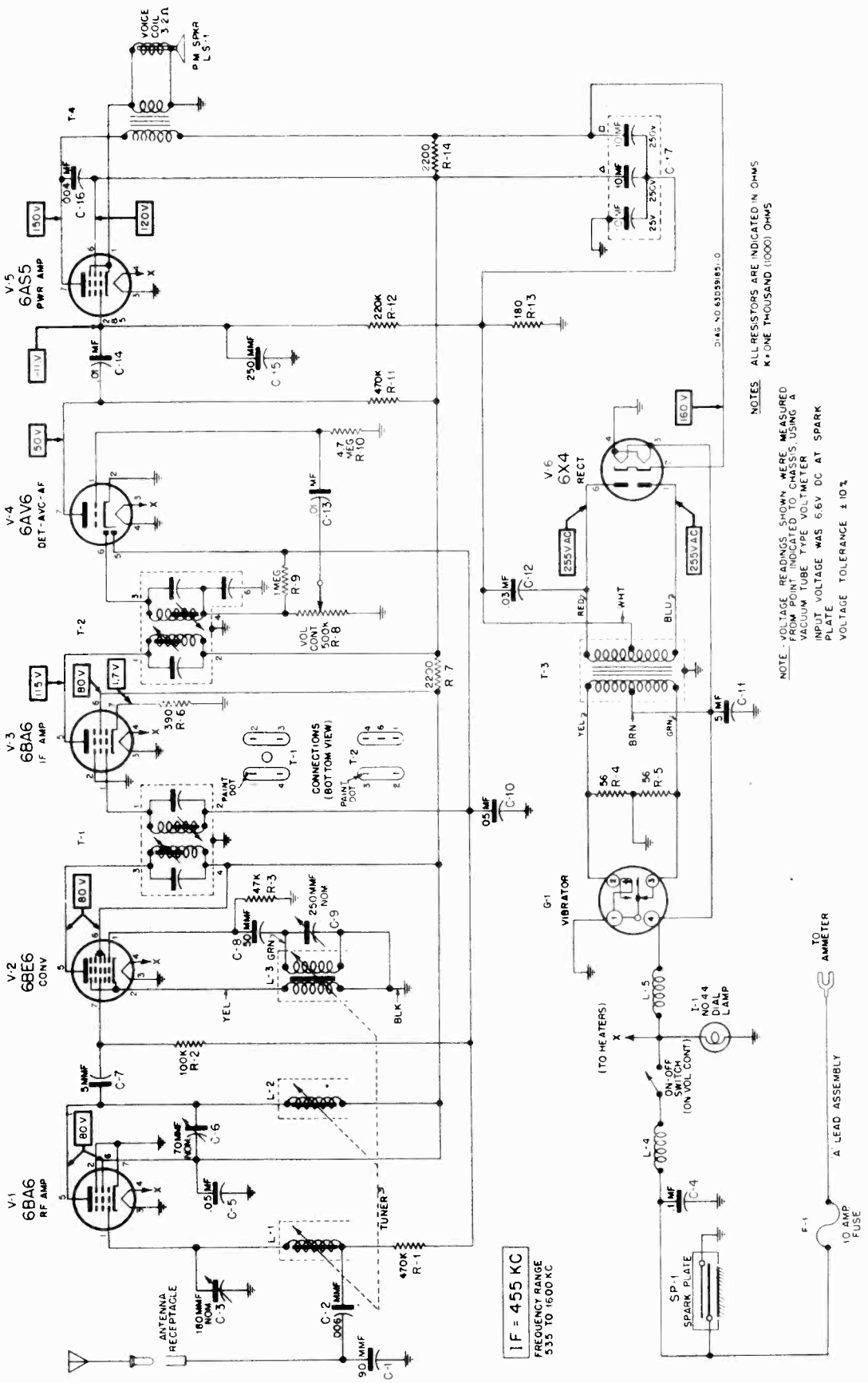


FIGURE 3. SCHEMATIC DIAGRAM

GENERAL INFORMATION

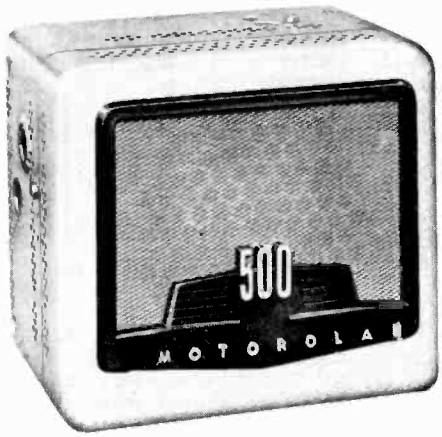
TYPE - Compact automotive type superheterodyne receiver with self-contained speaker. Receiver is designed for installation in any car when used with appropriate Motorola control head.

TUNING RANGE - 535 to 1600 Kc IF - 455 Kc

TUBE COMPLEMENT - 6BA6 - RF Amplifier
6BE6 - Converter
6BA6 - IF Amplifier
6AT6 - Det, AVC & AF Amp
6AQ5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 6.8 amps at 6.3 volts

POWER OUTPUT - 3.5 watts (max)



REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - ELECTRICAL		
CAPACITORS		
C-1	21A591682	Ceramic: 90 mmf 500V.....
C-2	8C4529	Paper: .006 mf 100V .....
C-3	20K592078	Trimmer, variable: 50 to 280 mmf; on same bracket as C-5 and C-8 (sold only as assembly).....
C-4	8R13166	Paper: .1 mf 400V .....
C-5	20K592078	Trimmer, variable: 20 to 180 mmf; on same bracket as C-3 and C-8 (sold only as assembly).....
C-6	21K70720	Molded: 5 mmf 500V .....
C-7	21R6513	Mica: 50 mmf 10% 300V .....
C-8	20K592078	Trimmer, variable: 500 to 580 mmf; on same bracket as C-3 and C-5 (sold only as assembly) .....
C-9	8K17028	Paper: .5 mf 100V .....
C-10	8R13514	Paper: .05 mf 100V .....
C-11	8R13514	Paper: .05 mf 100V .....
C-12	21B77562	Ceramic: 100 mmf 500V .....
C-13	21B77562	Ceramic: 100 mmf 500V .....
C-14	21K70720	Molded: 5 mmf 500V .....
C-15	8K17028	Paper: .5 mf 100V .....
C-16	8R490449	Paper: .02 mf 1000V .....
C-17	21K478410	Ceramic: 1000 mmf 500V .....
C-18	8R71911	Paper: .03 mf 400V .....
C-19	8R23690	Paper: .01 mf 400V .....
C-20	23A485677	Electrolytic: 15-10-20 mf/350-350-25V .....

REF. NO.	PART NO.	DESCRIPTION
FUSE		
F-1	65A10266	10 Amp (3AG) .....
VIBRATOR		
G-1	48B3333	Non-sync: 4-pin .....
COILS		
L-1,2	24B591664	RF & Antenna Coil (specify color of paint dots on old coil when ordering) .....
L-3	24B592153	Oscillator Coil (specify color of paint dots on old coil when ordering) .....
L-4,5	24K78026	Choke, RF .....
L-6	24A472535	Choke, hash .....
RESISTORS		
Note: All resistors are insulated carbon type, 20% unless otherwise specified.		
R-1	6R6032	470,000 1/2W .....
R-2	6R6432	270 10% 1/2W .....
R-3	6R6075	100,000 1/2W .....
R-4	6R6056	47,000 1/2W .....
R-5	6R6090	470 10% 1/2W .....
R-6	6R6287	6800 1W N.I. .....
R-7	6R6004	1 meg 1/2W .....
R-8	1A472531	Volume Control: 500,000 ohms; includes SPST switch .....

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REF. NO.	PART NO.	DESCRIPTION
R-9	6R6056	47,000 1/2W
R-10	6R6004	1 meg 1/2W
R-11	6R5614	56 10% 1/2W
R-12	6R5614	56 10% 1/2W
R-13	6R5577	2700 10% 1/2W
R-14	6R2118	3.3 meg 1/2W
R-15	6R6032	470,000 1/2W
R-16	6R6015	220,000 1/2W
R-17	6R6336	270 10% 1W
R-18	6R6184	1000 1W N.I.
SPARK PLATE		
SP-1	1X592328	Spark Plate Assembly: complete.
TRANSFORMERS		
T-1,2	24B485670	Diode or IF, 455 Kc: complete with tuning cores and padding capacitors but less shield...
T-3	25B70171	Output Transformer
T-4	25B472533	Power Transformer

PART NUMBER	DESCRIPTION
CHASSIS PARTS - MECHANICAL	
42A13177	Clip, center post grounding
42A4215	Clip, vibrator grounding
4S7695	Lockwasher, int: #5; stl; cad pl (terminal strip mtg)
4S7671	Lockwasher, split: #8; stl; cad pl (spark plate mtg)
9A472148	Receptacle, antenna
5S7771	Rivet: .088 x 3/16 stl; nkl pl (tube socket mtg)
5S7706	Rivet: .122 x 1/8; stl; nkl pl (sensitivity control and center post ground clip mtg)
5S7707	Rivet: .122 x 5/32; stl; nkl pl (terminal strip and output transformer mtg)
5S7701	Rivet: .122 x 3/16; steel; nkl pl (vibrator grounding clip and output transformer mtg)
3S8140	Screw, sheet metal: #8 x 3/16 PKZ plain hex head; cad pl (tuner mtg)
3S7454	Screw, sheet metal: #8 x 1/4 plain hex head; stl; cad pl (capacitor bracket assembly and spark plate mtg)
3S3397	Screw, sheet metal: #8 x 5/16 PKZ plain hex head; cad pl (power transformer mtg)
26K485936	Shield (for T-1 & T-2)
9A70208	Socket, tube: 4-pin; with grounding lug (vibrator socket)
9A472534	Socket, tube: miniature; 7-prong
9K580218	Socket, tube: miniature; 8-prong
31C4079	Strip, terminal: 1 insulated lug, end mtg
31A472573	Strip, terminal: 2 insulated lugs, #2 mtg
31K16330	Strip, terminal: 3 insulated lugs, #3 mtg

PART NUMBER	DESCRIPTION
HOUSING PARTS	
42A472033	Clip, chassis retainer
13B592105	Cloth, speaker escutcheon
13C592107	Escutcheon, speaker
1X592332	Housing and Bushing Assembly, rear
1X592334	Housing, front: includes escutcheon...
3S7456	Screw, sheet metal: #8 x 1/4 PKA slotted acorn head; antique copper finish (housing screws)
ACCESSORIES	
65X4151	Bulb, pilot light: 6-8V; clear bayonet base
8A4491	Capacitor, generator
9B473111	Lead Assembly, fuse: complete with 10 amp fuse
1X74340	Lead Assembly, dial light: complete with bulb
4S7653	Lockwasher, int-ext: 5/16; stl; cad pl (receiver mtg)
4S7657	Lockwasher, ext: #8; stl; cad pl (speaker mtg)
2S7003	Nut, hex: #8 x 5/16; stl; cad pl (speaker mtg)
2S2863	Nut, hex: 5/16-18 x 9/16; stl; cad pl (receiver mtg)
1K75148	Shaft, flexible: with housing 24" long
50B472012 or 50C580519 or 50K591140	Speaker, PM: 5-1/4; 3.2 ohm VC
3A77542	Stud, receiver mtg
6X4141	Suppressor, distributor
TUNER PARTS - MECHANICAL	
Note:	Electrical parts of the tuner are included in the Electrical Chassis Parts List.
1X592301	Manual Tuner MT-75
1X592099	Base, Sleeve, Shields and Channels Assembly
1X78034	Carriage Plate, Slug Insulator and Center Guide Rod Assembly
42A70184	Clip, core adjustment
46K592080	Core, iron and screw
58K78012	Coupling, manual lead screw
14B78007	Insulator, slug: bakelite
2A77596	Nut, floating: without ear (on manual lead screw)
2A78005	Nut, floating: with ear (on manual lead screw)
64A77593	Plate, tuner front
5S7770	Rivet: .088 x 5/32; stl; nkl pl (slug insulator mtg)
47A78002	Rod, carriage guide
3S7352	Screw, machine: #8-32 x 2 slotted round head; stl; cad pl (front plate mtg)
43A70881	Sleeve, coil (iron)
41A77595	Spring, coil slug
41A77592	Spring, compression
42A21577	Washer, 'C': spring (manual lead screw mtg)
4A70873	Washer, coil spacer
4A74571	Washer, fishpaper
4A70956	Washer, slug insulator
4K485653	Washer, spring (manual lead screw mtg)

MODEL 500

ALIGNMENT

Remove receiver front and rear housings to expose all adjustments.

Connect a 6 volt battery to BAT terminal and chassis.

Connect a low range output meter across speaker voice coil and set volume control at maximum. For greatest accuracy, keep output of receiver at approximately 1 watt (1 watt = 1.79 volts on output meter) throughout alignment by reducing signal generator output as stages are brought into alignment. Use a small fibre screwdriver when aligning IF and diode transformers. A special tool, Motorola Part No. 66A76278, is required for adjusting the tuner cores. IMPORTANT: Do not push in on the alignment tool when adjusting the tuner cores; the slightest inward pressure may move tuner carriage and result in inaccurate alignment.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	6BE6 grid (pin #7) & chassis	455 Kc	High frequency end (cores out)	1, 2 3 & 4	Peak for maximum in order indicated. Check by repeating step.
RF ALIGNMENT						
2.	See Fig. 1	Antenna receptacle through dummy	1610 Kc	High frequency end; cores should project 1-1/8" from cans. (Screw out if necessary)	5, 6 & 7	Peak for maximum in order indicated.
3.	"	"	1425 Kc	1425 Kc per Fig. 1	8, 9 & 10	Peak for maximum in order indicated.

4. When receiver is installed in car, extend antenna fully, set dial to approximately 1400 Kc and repeak antenna trimmer (7) for maximum volume of a weak station or noise between stations.

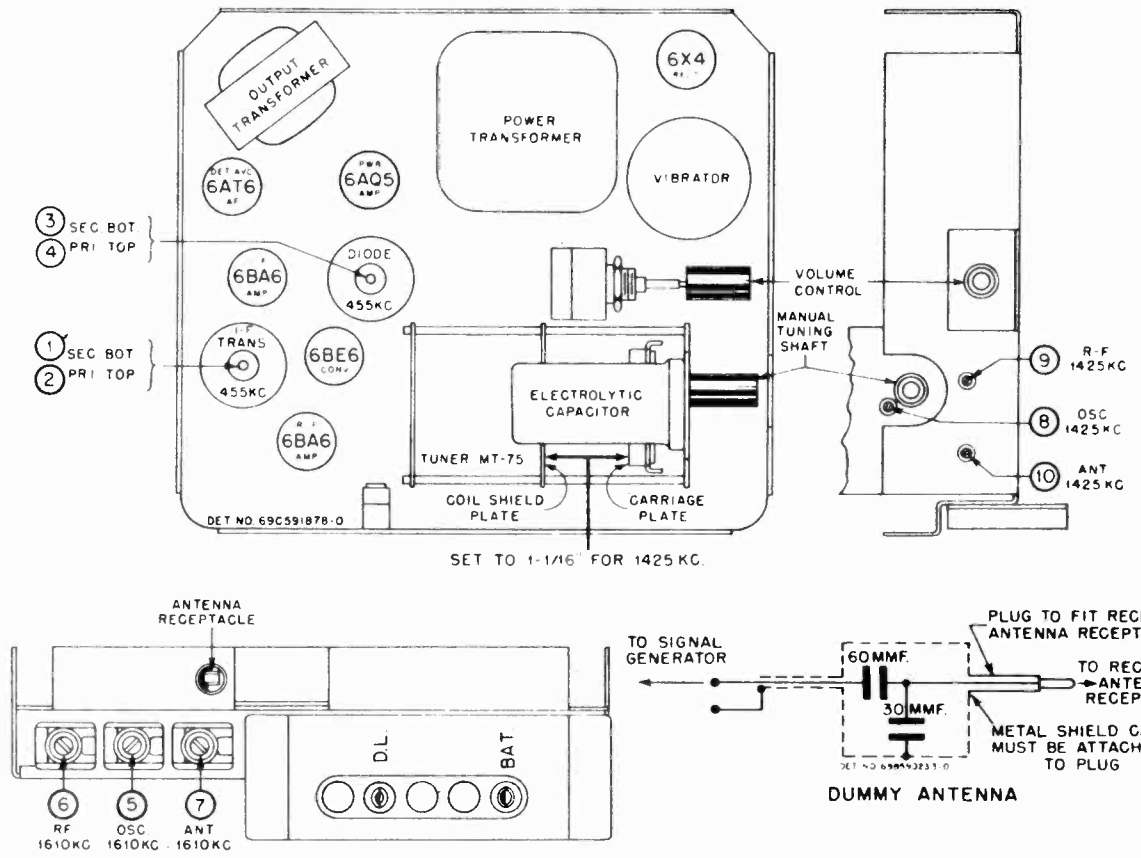


FIGURE 1. TUBE & TRIMMER LOCATIONS AND DUMMY ANTENNA

MODEL 500

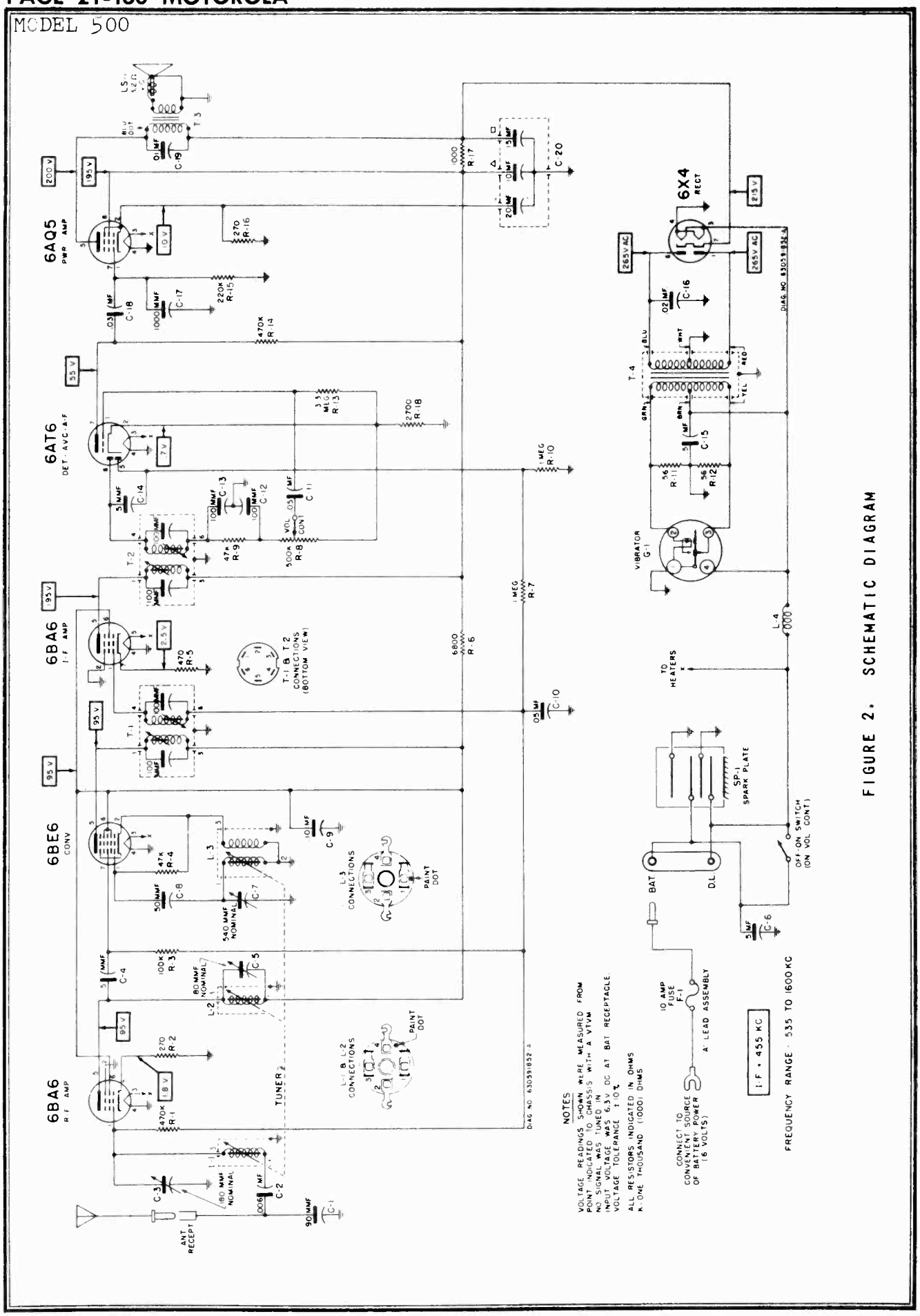


FIGURE 2. SCHEMATIC DIAGRAM

GENERAL INFORMATION

TYPE - Compact automotive type superheterodyne receiver designed for installation in any car when used with appropriate Motorola control head and speaker.

TUNING RANGE - 535 to 1600 Kc IF - 455 Kc

TUBE COMPLEMENT - 6BA6 - RF Amplifier
6BE6 - Converter
6BA6 - IF Amplifier
6AT6 - Det, AVC & AF Amp
6AQ5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 6.8 amps at 6.3 volts

POWER OUTPUT - 3.5 watts (max)

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - ELECTRICAL		
CAPACITORS		
C-1	21A591682	Ceramic: 90 mmf 500V .....
C-2	8C4529	Paper: .006 mf 100V .....
C-3	20K592078	Trimmer, variable: 50 to 280 mmf; on same bracket as C-5 and C-8 (sold only as assembly) .....
C-4	8R13166	Paper: .1 mf 400V .....
C-5	20K592078	Trimmer, variable: 20 to 180 mmf; on same bracket as C-3 and C-8 (sold only as assembly).....
C-6	21K70720	Molded: 5 mmf 500V .....
C-7	21R6513	Mica: 50 mmf 10% 300V .....
C-8	20K592078	Trimmer, variable: 500 to 580 mmf; on same bracket as C-3 and C-5 (sold only as assembly) .....
C-9	8K17028	Paper: .5 mf 100V .....
C-10	8R13514	Paper: .05 mf 100V .....
C-11	8R13514	Paper: .05 mf 100V .....
C-12	21B77562	Ceramic: 100 mmf 500V .....
C-13	21B77562	Ceramic: 100 mmf 500V .....
C-14	21K70720	Molded: 5 mmf 500V .....
C-15	8K17028	Paper: .5 mf 100V .....
C-16	8R490449	Paper: .02 mf 1000V .....
C-17	21K478410	Ceramic: 1000 mmf 500V .....
C-18	8R71911	Paper: .03 mf 400V .....
C-19	8R23690	Paper: .01 mf 400V .....
C-20	23A485677	Electrolytic: 15-10-20 mf/350-350-25V .....

REF. NO.	PART NO.	DESCRIPTION
FUSE		
F-1	65A10266	10 Amp (3AG) .....
VIBRATOR		
G-1	48B3333	Non-sync: 4-pin .....
COILS		
L-1,2	24B591664	RF and Antenna Coil (specify color of paint dots on old coil when ordering) .....
L-3	24B592153	Oscillator Coil (specify color of paint dots on old coil when ordering) .....
L-4,5	24K78026	Choke, RF .....
L-6	24A472535	Choke, hash .....
RESISTORS		
		Note: All resistors are insulated carbon type, 20% unless otherwise specified.
R-1	6R6032	470,000 1/2W .....
R-2	6R6432	270 10% 1/2W .....
R-3	6R6075	100,000 1/2W .....
R-4	6R6056	47,000 1/2W .....
R-5	6R6090	470 10% 1/2W .....
R-6	6R6287	6800 1W N.I. .....
R-7	6R6004	1 meg 1/2W .....
R-8	1A472531	Volume Control: 500,000 ohms; includes SPST switch .....

MODEL 600

PART NUMBER		DESCRIPTION
R-9	6R6056	47,000 1/2W .....
R-10	6R6004	1 meg 1/2W .....
R-11	6R5614	56 10% 1/2W .....
R-12	6R5614	56 10% 1/2W .....
R-13	6R5577	2700 10% 1/2W .....
R-14	6R2118	3.3 meg 1/2W .....
R-15	6R6032	470,000 1/2W .....
R-16	6R6015	220,000 1/2W .....
R-17	6R6336	270 10% 1W .....
R-18	6R6184	1000 1W N.I .....
SPARK PLATE		
SP-1	1X78041	Spark Plate Assembly: complete..
TRANSFORMERS		
T-1,2	24B485670	Diode or IF, 455 Kc: complete with tuning cores and padding capacitors but less shield ...
T-3	25B70171	Output Transformer .....
T-4	25B472533	Power Transformer .....

REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - MECHANICAL		
	42A13177	Clip, center post grounding .....
	42A4215	Clip, vibrator grounding .....
	4S7695	Lockwasher, int: #5;stl; cad pl (terminal strip mtg) .....
	4S7671	Lockwasher, split: #8; stl; cad pl (spark plate mtg) .....
	9A472148	Receptacle, antenna .....
	5S7771	Rivet: .088 x 3/16 steel; nkl pl (tube socket mtg) .....
	5S7706	Rivet: .122 x 1/8; steel; nkl pl (sensitivity control and center post ground clip mtg) .....
	5S7707	Rivet: .122 x 5/32; stl; nkl pl (terminal strip and output trans mtg) .....
	5S7701	Rivet: .122 x 3/16; stl; nkl pl (vibrator grounding clip and output transformer mtg) .....
	3S8140	Screw, sheet metal: #8 x 3/16 PkZ plain hex head; cad pl (tuner mtg)
	3S7454	Screw, sheet metal: #8 x 1/4 plain hex head; stl; cad pl (capacitor bracket assembly and spark plate mtg) .....
	3S3397	Screw, sheet metal: #8 x 5/16 PkZ plain hex head; cad pl (power transformer mtg) .....
	26k485936	Shield (for T-1 & T-2).....
	9A70208	Socket, tube: 4-pin; with grounding lug (vibrator socket) .....
	9A472534	Socket, tube: miniature; 7-prong...
	9k580218	Socket, tube: miniature; 8-prong ..
	31C4079	Strip, terminal: 1 insulated lug, end mtg .....
	31A472573	Strip, terminal:2 insulated lugs, #2 mtg .....
	31k16330	Strip, terminal: 3 insulated lugs, #3 mtg .....

REF. NO.	PART NO.	DESCRIPTION
HOUSING PARTS		
	42A472033	Clip, chassis retainer .....
	13C592086	Escutcheon, complete .....
	1X592087	Housing and Bushing Assembly, rear
	1X592088	Housing, front; with escutcheon ....
	3S7456	Screw, sheet metal: #8 x 1/4 PKA slotted acorn head; antique copper finish (escutcheon mtg and housing screws) .....
ACCESSORIES		
	65X4151	Bulb, pilot light: 6-8V; clear; bayonet base .....
	8A4491	Capacitor, generator .....
	9B473111	Lead Assembly, fuse: complete with 10 amp fuse .....
	1X74340	Lead Assembly, dial light: complete with bulb .....
	1X76859	Lead Assembly, speaker: 2-conductor, 36" long, with pin terminals on one end
	4S7658	Lockwasher, int-ext: 5/16; stl; cad pl (receiver mtg) .....
	2S2863	Nut, hex: 5/16-18 x 9/16; cad pl (receiver mtg) .....
	1K75148	Shaft, flexible: with housing; 24" long .....
	50B592352	Speaker: 6" PM; 3.2 ohm VC; less speaker lead .....
	3A77542	Stud, receiver mtg .....
	6X4141	Suppressor, distributor .....
TUNER PARTS - MECHANICAL		
	Note:	Electrical parts of the tuner are included in the Electrical Chassis Parts List
	1X592301	Manual Tuner MT-75 .....
	1X592099	Base, Sleeve, Shields and Channels Assembly .....
	1X78034	Carriage Plate, Slug Insulator and Center Guide Rod Assembly .....
	42A70184	Clip, core adjustment .....
	46K592080	Core, iron and screw .....
	58k78012	Coupling, manual lead screw .....
	14B78007	Insulator, slug: bakelite .....
	2A77596	Nut, floating: without ear (on manual lead screw) .....
	2A78005	Nut, floating: with ear (on manual lead screw) .....
	64A77593	Plate, tuner front .....
	5S7770	Rivet: .088 x 5/32; stl; nkl pl (slug insulator mtg) .....
	47A78002	Rod, carriage guide .....
	3S7352	Screw, machine: #8-32 x 2 slotted round head; stl; cad pl (front plate mtg)
	43A70881	Sleeve, coil (iron) .....
	41A77595	Spring, coil slug .....
	41A77592	Spring, compression .....
	42A21577	Washer, 'C': spring (manual lead screw mtg) .....
	4A70873	Washer, coil spacer .....
	4A74571	Washer, fishpaper .....
	4A70956	Washer, slug insulator .....
	4K485653	Washer, spring (manual lead screw mtg) .....

MODEL 600

ALIGNMENT

Remove receiver front and rear housings to expose all adjustments.

Connect a 6 volt battery to BAT terminal and chassis.

Connect a low range output meter across speaker voice coil and set volume control at maximum. For greatest accuracy, keep output of receiver at approximately 1 watt (1 watt = 1.79 volts on output meter) throughout alignment by reducing signal generator output as stages are brought into alignment. Use a small fibre screwdriver when aligning IF and diode transformers. A special tool, Motorola Part No. 66A76278, is required for adjusting the tuner cores. IMPORTANT: Do not push in on the alignment tool when adjusting the tuner cores; the slightest inward pressure may move tuner carriage and result in inaccurate alignment.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	6BE6 grid (pin #7) & chassis	455 kc	High frequency end (cores out)	1, 2, 3 & 4	Peak for maximum in order indicated. Check by repeating step.
RF ALIGNMENT						
2.	See Fig. 1	Antenna receptacle through dummy	1610 kc	High frequency end cores should project 1-1/8" from cans. (Screw out if necessary)	5, 6 & 7	Peak for maximum in order indicated.
3.	"	"	1425 kc	1425 kc per Fig. 1	8, 9, & 10	Peak for maximum in order indicated.

4. When receiver is installed in car, extend antenna fully, set dial to approximately 1400 kc and repeak antenna trimmer (7) for maximum volume of a weak station or noise between stations.

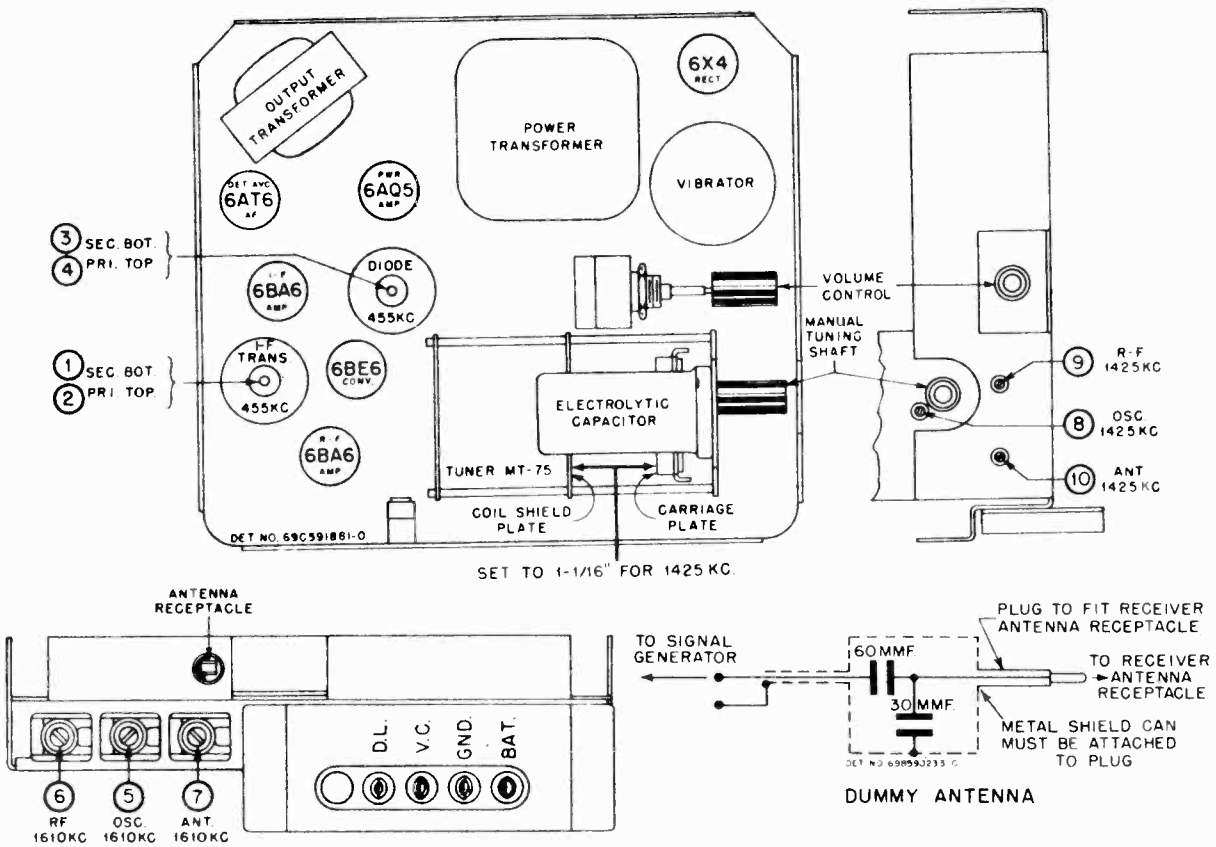


FIGURE 1. TUBE & TRIMMER LOCATIONS AND DUMMY ANTENNA

MODEL 600

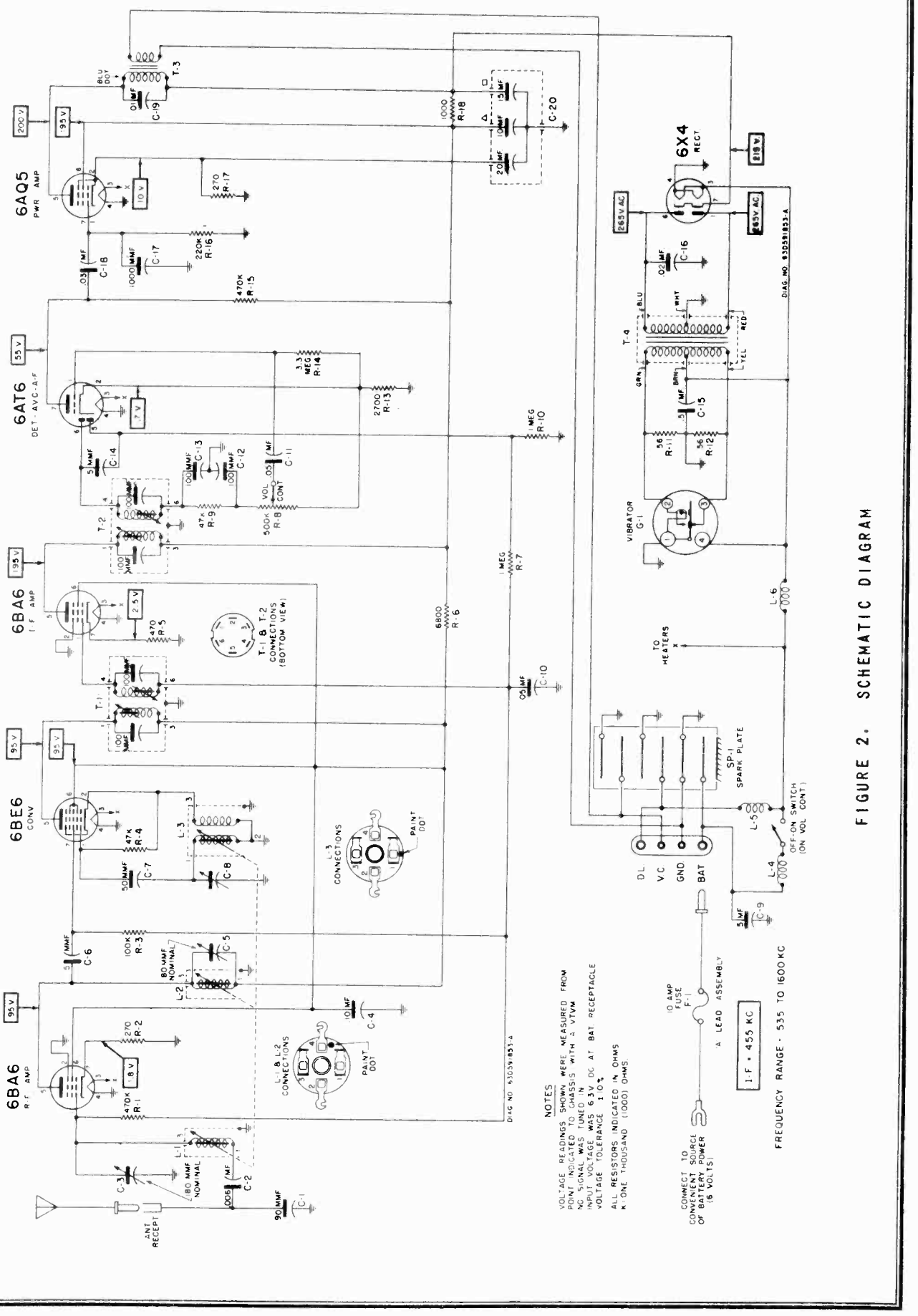
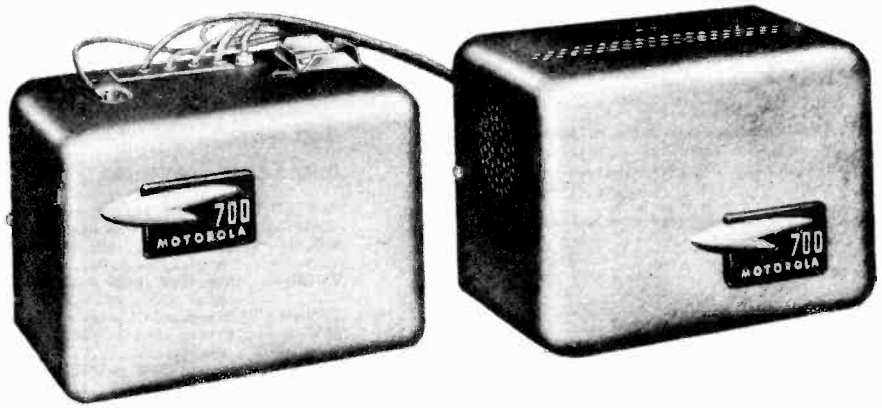


FIGURE 2. SCHEMATIC DIAGRAM

MODEL 700



GENERAL INFORMATION

TYPE -
Compact two-piece automotive type superheterodyne receiver. Receiver consists of a tuning unit and audio & power unit which are connected together by means of an interconnecting cable. This receiver is designed for installation in any car by using with appropriate Motorola control head and speaker kit.

TUNING RANGE - 535 to 1600 Kc

IF - 455 Kc

TUBE COMPLEMENT - Tuner Unit

6BA6 - RF Amplifier
6BE6 - Converter
6BA6 - IF Amplifier
6AT6 - Det-AVC-AF Amp

Audio & Power Unit

6AQ5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 7.0 amps at 6.3 volts

POWER OUTPUT - 3.5 watts (max)

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
		TUNER UNIT
		CHASSIS PARTS - ELECTRICAL
		CAPACITORS
C-1	21B77562	Ceramic: 100 mmf 500V
C-2	8A4529	Paper: .006 mf 100V
C-3	20A592135	Variable, trimmer: 50 to 280 mmf; includes bracket
C-4*	20K481527	Variable, trimmer: 20 to 180 mmf; includes bracket
C-5	21K70720	Molded: 5 mmf 500V
C-6	21K74661	Ceramic: 50 mmf 300V
C-7	21K592327	Ceramic: 500 mmf 5% 500V
C-8*	20K472612	Variable, trimmer: 50 to 80 mmf; includes bracket
C-9	8R13166	Paper: .1 mf 400V
C-10	8A13514	Paper: .05 mf 100V
C-11	8A4529	Paper: .006 mf 100V
C-12	21K70720	Molded: 5 mmf 500V
C-13	8R472035	Paper: .1 mf 100V
C-14	21R6638	Mica: 1000 mmf 500V
C-15	8K17028	Paper: .5 mf 100V
C-16	8K71910	Paper: .006 mf 400V
		PILOT LIGHT
I-1	65X4151	Bulb: 6-8V; bayonet base; type #51
		COILS
L-1,2*	24B71881	RF & Antenna Coil (specify color of paint dot on old coil when ordering)

*Part of Solenoid Tuner ST-78

MODEL 700

REF. NO.	PART NO.	DESCRIPTION
L-3*	24B592153	Oscillator Coil (specify color of paint dot on old coil when ordering)
L-4,5	24K592269	Choke, RF
RESISTORS		
		Note: All resistors are carbon insulated type unless otherwise specified.
R-1	6R6032	470,000 20% 1/2W
R-2	17K484497	Wirewound: 5.6
or	6R488139	5.6 10% 1W
R-3	6R6090	470 10% 1/2W
R-4	6R6075	100,000 20% 1/2W
R-5	6R6056	47,000 20% 1/2W
R-6	6R6090	470 10% 1/2W
R-7	6R6004	1 meg 20% 1/2W
R-8	6R6287	6800 20% 1W N.I.
R-9	1A472531	Volume Control and Shaft Assembly: .5 meg.
R-10	6R6056	47,000 20% 1/2W
R-11	6R6004	1 meg 20% 1/2W
R-12	6R6290	2200 20% 1/2W
R-13	6R3927	2.2 meg 20% 1/2W
R-14	6R2109	10 meg 20% 1/2W
R-15	6R6056	47,000 20% 1/2W
R-16	6R6032	470,000 20% 1/2W
SWITCHES		
S-1*	1B70944	Solenoid Switch
S-2*	40B70952	Selector Switch
S-3*	40A472644	Mute Switch
S-4	1X592220	Tone Relay MR-7
SPARK PLATE		
SP-1	1B592133	Spark Plate Assembly
TRANSFORMERS		
T-1	24B485553	IF, 455 Kc: complete with tuning cores and padding capacitors
T-2	24K485555	Diode, 455 Kc: complete with tuning cores and padding capacitors
TUNER		
	1X592280	Solenoid Tuner ST-78

POWER & AUDIO UNIT

CHASSIS PARTS - ELECTRICAL

CAPACITORS		
C-17	8K17028	Paper: .5 mf 100V
C-18	8K12840	Paper: .006 mf 1600V
C-19	8R71911	Paper: .03 mf 400V
C-20	23A473015	Electrolytic: 30-30-20 mf/350-300-25V
C-21	8K71910	Paper: .006 mf 400V
FUSE		
F-1	65K4637	Fuse: 20 amp
VIBRATOR		
G-1	48B3333	Vibrator, non-sync: 4-pin
COILS		
L-6	24A472535	Choke, hash
RESISTORS		
		Note: All resistors are carbon insulated type unless otherwise specified.
R-17	6R5614	56 10% 1/2W
R-18	6R5614	56 10% 1/2W
R-19	6R3949	470 20% 1/2W
R-20	6R6054	10,000 20% 1/2W
R-21	6R6015	220,000 20% 1/2W
R-22	6R6336	270 10% 1W
R-23	6R6184	1000 20% 1W N.I.
TRANSFORMERS		
T-3	25K590650	Power Transformer
T-4	25B70171	Output Transformer

*Part of Solenoid Tuner ST-78

PART NUMBER	DESCRIPTION
TUNER UNIT	
CHASSIS PARTS - MECHANICAL	
7A592127	Bracket, volume control mtg
42A485548	Clip, coil can mtg
4S7657	Lockwasher, ext: #8; stl; cad pl (tone relay mtg)
2S7000	Nut, hex: 8-32 x 5/16; stl; cad pl (tone relay mtg)
1X70646	Receptacle, antenna
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg)
5S7719	Rivet: .088 x 5/32; stl; nkl pl (terminal strip mtg)
5S7728	Rivet: .122 x 5/16; stl; nkl pl (spark plate mtg)
3S7152	Screw, machine: 6-32 x 1/4 plain hex head; stl; cad pl (volume control bracket mtg)
3S7454	Screw, sheet metal: #8 x 1/4; PkZ plain hex head; stl; cad pl (capacitor bracket and tuner mtg)
9A472534	Socket, tube: 7-prong; miniature
9K580218	Socket, tube: 8-prong; miniature
31A41318	Strip, terminal: 1 insulated lug, #2 mtg
POWER & AUDIO UNIT	
CHASSIS PARTS - MECHANICAL	
1X592233	Cable and Plug Assembly: includes fuse lead, power cable and plug
42A4215	Clip, vibrator grounding
14A592132	Insulator, connector plug
9K592237	Lead Assembly, fuse: includes 'A' lead and fuse receptacle
1X76859	Lead Assembly, speaker
4S7666	Lockwasher, ext: #6; stl; cad pl (power transformer mtg)
29R5238	Lug, solder: #6L
2S7005	Nut, hex: 6-32 x 1/4; stl; cad pl (power transformer mtg)
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg)
5S7706	Rivet: .122 x 1/8; stl; nkl pl (terminal strip mtg)
5S7701	Rivet: .122 x 3/16; stl; nkl pl (vibrator clip mtg)
28A592119	Plug, connector: 4-pin
28K71775	Plug, insulated
9A472534	Socket, tube: miniature; 7-prong
9A70208	Socket, tube: 4-pin (for vibrator)
31K490143	Strip, terminal: 2 insulated lugs, #2 mtg; 1-1/8" long
31A592258	Strip, terminal: 2 insulated lugs, #2 mtg; 1-3/8" long
29K5405	Terminal, insulated pin: black (on speaker leads)
29K5407	Terminal, insulated pin: white (on spkr leads)
HOUSING PARTS	
38A71874	Button, push: includes spring clamp
15C592123	Cover, bottom
13C592121	Escutcheon
1X592241	Housing and Escutcheon Assembly (Tuner Unit)
1X592242	Housing and Escutcheon Assembly (Power & Audio
3S488012	Screw, sheet metal: #6 x 1/4; Shakeproof #25; plain hex head; stl; cad pl (escutcheon mtg)
3S7454	Screw, sheet metal: #8 x 1/4 PkZ plain hex head; stl; cad pl (bottom cover mtg)
3S8114	Screw, sheet metal: #8 x 1/4 PkZ slotted acorn head; antique copper finish (housing screws)
ACCESSORIES	
8A4491	Capacitor, generator
4S7653	Lockwasher, int-ext: 5/16; stl; cad pl (receiver mtg)
2S2863	Nut, hex: 5/16; stl; cad pl (receiver mtg)
1K75148	Shaft and Housing Assembly, flexible 24" long
50R592351	Speaker, PM: 6"; 3.2 ohm VC
6A4141	Suppressor, distributor

ALIGNMENT

MODEL 700

Remove tuner unit front housing and bottom cover to expose all alignment adjustments. Connect power and audio unit to tuner unit. Connect a 6 volt battery to 'A' lead and power & audio unit chassis.

Connect a low range output meter across speaker voice coil and set volume control at maximum.

Place tuner in manual position, either by actuating carriage plate manually or by connecting a control head to receiver and pressing 'M' button.

For greatest accuracy, keep output of receiver at approximately 1 watt (1 watt = 1.79 volts on output meter) throughout alignment by reducing generator output as stages are brought into alignment. Use a small fibre screwdriver when aligning IF and diode transformers. A special tool, Motorola Part Number 66A76278, is required for adjusting the tuner cores.

IMPORTANT: Do not push in on the alignment tool when adjusting tuner cores; the slightest inward pressure may move tuner carriage and result in inaccurate alignment.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	6BE6 grid (pin #7) & chassis	455 Kc	High frequency end (cores out)	1, 2, 3 & 4	Peak for maximum in order indicated. Check by repeating step.
RF ALIGNMENT						
2.	See Fig. 1	Antenna receptacle through dummy	1610 Kc	High frequency end; cores should project 1-1/8" from cans (Screw out if necessary)	5, 6, & 7	Peak for maximum in order indicated.
3.	"	"	1425 Kc	1425 Kc-per Fig. 1	8, 9, & 10	Peak for maximum in order indicated.

4. When receiver is installed in car, extend antenna fully, set dial to approximately 1400 Kc and repeak antenna trimmer (7) for maximum volume of a weak station or noise between stations.

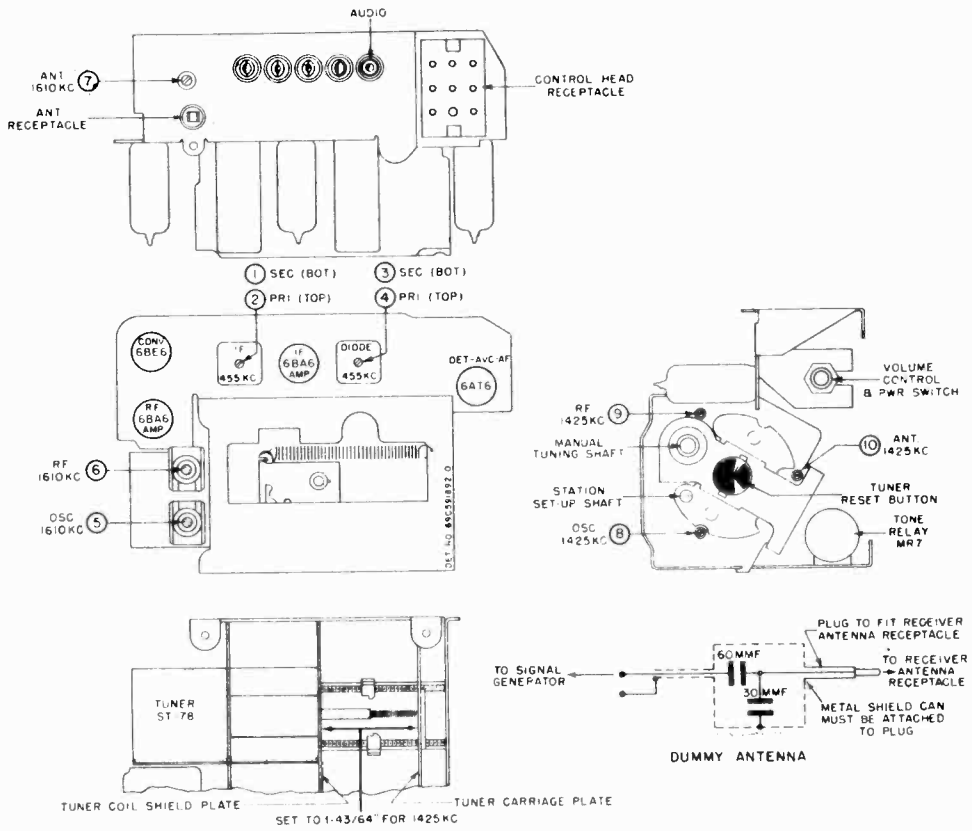


FIGURE 1. TUBE & TRIMMER LOCATIONS AND DUMMY ANTENNA

MODEL 700

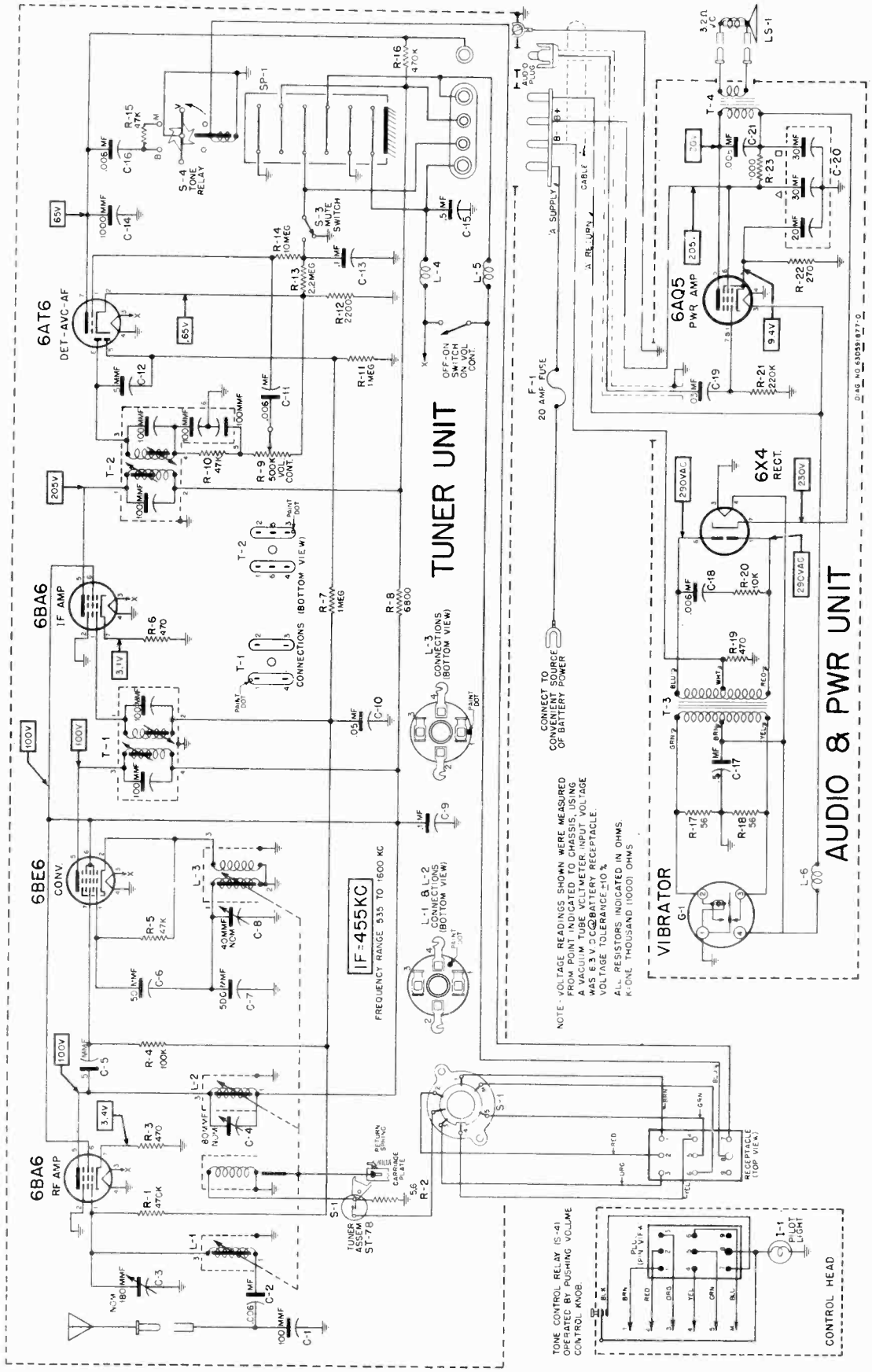
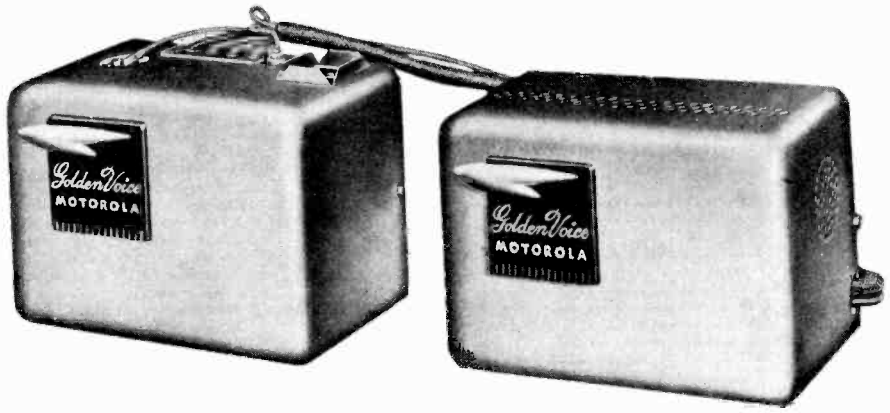


FIGURE 2. SCHEMATIC DIAGRAM

MODEL 800



GENERAL INFORMATION

TYPE -
Compact two-piece automotive type superheterodyne receiver. Receiver consists of a tuning unit and audio & power unit which are connected together by means of an interconnecting cable. This receiver is designed for installation in any car by using with appropriate Motorola control head and speaker kit.

TUNING RANGE - 535 to 1600 Kc IF - 455 Kc

TUBE COMPLEMENT -

Tuner Unit	Audio & Power Unit
6BA6 - RF Amplifier	6AT6 - Audio Inverter
6BE6 - Converter	6AQ5 - Power Amplifier
6BA6 - IF Amplifier	6AQ5 - Power Amplifier
6AT6 - Det-AVC-AF Amp	6X4 - Rectifier

POWER INPUT - 8.2 amps at 6.3 volts POWER OUTPUT - 4.5 watts (max)

REPLACEMENT PARTS LIST

TUNER UNIT -

CHASSIS PARTS - ELECTRICAL

REF. NO.	PART NO.	DESCRIPTION
CAPACITORS		
C-1	21B77562	Ceramic: 100 mmf 500V
C-2	8A4529	Paper: .006 mf 100V
C-3	20A592135	Variable, trimmer: 50 to 280 mmf; includes bracket
C-4*	20K481527	Variable, trimmer: 20 to 180 mmf; includes bracket
C-5	21K70720	Molded: 5 mmf 500V
C-6	21K74661	Ceramic: 50 mmf 300V
C-7	21K592327	Ceramic: 500 mmf 5% 500V
C-8*	20K472612	Variable, trimmer: 50 to 80 mmf; includes bracket
C-9	8R13166	Paper: .1 mf 400V
C-10	8A13514	Paper: .05 mf 100V
C-11	8A4529	Paper: .006 mf 100V
C-12	21K70720	Molded: 5 mmf 500V
C-13	8R472035	Paper: .1 mf 100V
C-14	21R6638	Mica: 1000 mmf 500V
C-15	8K17028	Paper: .5 mf 100V
C-16	8K71910	Paper: .006 mf 400V
PILOT LIGHT		
I-1	65X4151	Bulb: 6-8V; bayonet base; type #51
COILS		
L-1,2*	24B71881	RF & Antenna Coil (specify color of paint dot on old coil when ordering)
L-3*	24B592153	Oscillator Coil (specify color of paint dot on old coil when ordering)
L-4,5	24K592269	Choke, RF

*Part of Solenoid Tuner ST-78

MODEL 300

REF. NO.	PART NO.	DESCRIPTION
RESISTORS		
	Note:	All resistors are carbon insulated type unless otherwise specified.
R-1	6R6032	470,000 20% 1/2W
R-2	17K484497	Wirewound; 5.6
or	6R488139	5.6 10% 1W
R-3	6R6090	470 10% 1/2W
R-4	6R6075	100,000 20% 1/2W
R-5	6R6056	47,000 20% 1/2W
R-6	6R6090	470 10% 1/2W
R-7	6R6004	1 meg 20% 1/2W
R-8	6R6287	6800 20% 1W N.I.
R-9	1A472531	Volume Control and Shaft Assembly: .5 meg...
R-10	6R6056	47,000 20% 1/2W
R-11	6R6004	1 meg 20% 1/2W
R-12	6R6290	2200 20% 1/2W
R-13	6R3927	2.2 meg 20% 1/2W
R-14	6R2109	10 meg 20% 1/2W
R-15	6R6056	47,000 20% 1/2W
R-16	6R6032	470,000 20% 1/2W
SWITCHES		
S-1*	1B70944	Solenoid Switch
S-2*	40B70952	Selector Switch
S-3*	40A472644	Mute Switch
S-4	1X592220	Tone Relay MR-7
SPARK PLATE		
SP-1	1B592133	Spark Plate Assembly
TRANSFORMERS		
T-1	24B485553	IF, 455 Kc: complete with tuning cores and padding capacitors
T-2	24K485555	Diode, 455 Kc: complete with tuning cores and padding capacitors
TUNER		
	1X592280	Solenoid Tuner ST-78

POWER & AUDIO UNIT

CHASSIS PARTS - ELECTRICAL

CAPACITORS		
C-17	8K17028	Paper: .5 mf 100V
C-18	8K12840	Paper: .006 mf 1600V
C-19	23A473015	Electrical: 30-30-20 mf/350-300-25V
C-20	8R71911	Paper: .03 mf 400V
C-21	8R71911	Paper: .03 mf 400V
C-22	8R13165	Paper: .003 mf 1000V
FUSE		
F-1	65K4637	Fuse, 20 amp
VIBRATOR		
G-1	48B3333	Vibrator, non-sync: 4-pin
COILS		
L-6	24A472535	Choke, hash
RESISTORS		
	Note:	All resistors are carbon insulated type unless otherwise specified.
R-17	6R5614	56 10% 1/2W
R-18	6R5614	56 10% 1/2W
R-19	6R3949	470 20% 1/2W
R-20	6R6054	10,000 20% 1/2W
R-21	6R6286	1500 20% 1W N.I.
R-22	6R6069	2200 10% 1/2W
R-23	6R6015	220,000 20% 1/2W
R-24	6R6015	220,000 20% 1/2W
R-25	6R6054	10,000 20% 1/2W
R-26	6R6336	270 10% 1W
R-27	6R6015	220,000 20% 1/2W
TRANSFORMERS		
T-3	25K590650	Power Transformer
T-4	25K472558	Output Transformer

* Part of Solenoid Tuner ST-78

PART NUMBER	DESCRIPTION
TUNER UNIT	
CHASSIS PARTS - MECHANICAL	
7A592127	Bracket, volume control mtg
42A485548	Clip, coil can mtg
4S7657	Lockwasher, ext: #8; stl; cad pl (tone relay mtg)
2S7000	Nut, hex: 8-32 x 5/16; stl; cad pl (tone relay mtg)
1X70646	Receptacle, antenna
5S7719	Rivet: .088 x 5/32; stl; nkl pl (terminal strip mtg)
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg)
5S7728	Rivet: .122 x 5/16; stl; nkl pl (spark plate mtg)
3S7152	Screw, machine: 6-32 x 1/4 plain hex head; stl; cad pl (volume control brkt mtg)
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; stl; cad pl (capacitor brkt & tuner mtg)...
9A472534	Socket, tube: 7-prong; miniature
9K580218	Socket, tube: 8-prong; miniature
31A41318	Strip, terminal: 1 insulated lug, #2 mtg
POWER & AUDIO UNIT	
CHASSIS PARTS - MECHANICAL	
1X592233	Cable and Plug Assembly: includes fuse lead, power cable and plug
42A4215	Clip, vibrator grounding
14A592132	Insulator, connector plug
9k592237	Lead Assembly, fuse: includes 'A' lead and fuse receptacle
1X76859	Lead Assembly, speaker
4S7666	Lockwasher, ext: #6; stl; cad pl (power transformer mtg)
29B5238	Lug, solder: #6L
2S7005	Nut, hex: 6-32 x 1/4; stl; cad pl (power transformer mtg)
5S7771	Rivet: .088 x 3/16; stl; nkl pl (tube socket mtg)
5S7706	Rivet: .122 x 1/8; stl; nkl pl (terminal strip mtg)
5S7701	Rivet: .122 x 3/16; stl; nkl pl (vibrator clip mtg)
28A592119	Plug, connector: 4-pin
28K71775	Plug, insulated
9A472534	Socket, tube: miniature; 7-prong
9A70208	Socket, tube: 4-pin (for vibrator)
31K490143	Strip, terminal: 2 insulated lugs, #2 mtg; 1-1/8" long
31A592258	Strip, terminal: 2 insulated lugs, #2 mtg; 1-3/8" long
29K5405	Terminal, insulated pin: black (on speaker leads).
29K5407	Terminal, insulated pin: white (on speaker leads).
HOUSING PARTS	
38A71874	Button, push
15C592123	Cover, bottom
13C592122	Escutcheon (golden voice)
1X592321	Housing and Escutcheon Assembly (Power & Audio
1X592325	Housing and Escutcheon Assembly (Tuner Unit)..
3S488012	Screw, sheet metal: #6 x 1/4; Shakeproof #25; plain hex head; stl; cad pl (escutcheon mtg).
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; stl; cad pl (bottom cover mtg)
3S8114	Screw, sheet metal: #8 x 1/4 PKZ slotted acor head; antique copper finish (housing screws)
ACCESSORIES	
8A4491	Capacitor, generator
4S7653	Lockwasher, int-ext: 5/16; stl; cad pl (receiver mtg)
2S2863	Nut, hex: 5/16; stl; cad pl (receiver mtg)
1K75148	Shaft and Housing Assembly, flexible 24" long.
50B592351	Speaker, PM: 6"; 3.2 ohm VC
6A4141	Suppressor, distributor

ALIGNMENT

MODEL 300

Remove tuner unit front housing and bottom cover to expose all alignment adjustments. Connect power and audio unit to tuner unit. Connect a 6 volt battery to 'A' lead and power & audio unit chassis.

Connect a low range output meter across speaker voice coil and set volume control at maximum.

Place tuner in manual position, either by actuating carriage plate manually or by connecting a control head to receiver and pressing 'M' button.

For greatest accuracy, keep output of receiver at approximately 1 watt (1 watt = 1.79 volts on output meter) throughout alignment by reducing signal generator output as stages are brought into alignment. Use a small fibre screwdriver when aligning IF and diode transformers. A special tool, Motorola Part Number 66A76278, is required for adjusting the tuner cores.

IMPORTANT: Do not push in on the alignment tool when aligning the tuner cores; the slightest inward pressure may move tuner carriage and result in inaccurate alignment.

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	6BE6 grid (pin #7) & chassis	455 Kc	High frequency end (cores out)	1, 2, 3 & 4	Peak for maximum in order indicated. Check by repeating step.
RF ALIGNMENT						
2.	See Fig. 1	Antenna receptacle through dummy	1610 Kc	High frequency end; cores should project 1-1/8" from cans (Screw out if necessary)	5, 6, & 7	Peak for maximum in order indicated.
3.	"	"	1425 kc	1425 kc-per Fig. 1	8, 9, & 10	Peak for maximum in order indicated.

4. When receiver is installed in car, extend antenna fully, set dial to approximately 1400 kc and repeak antenna trimmer (7) for maximum volume of a weak station or noise between stations.

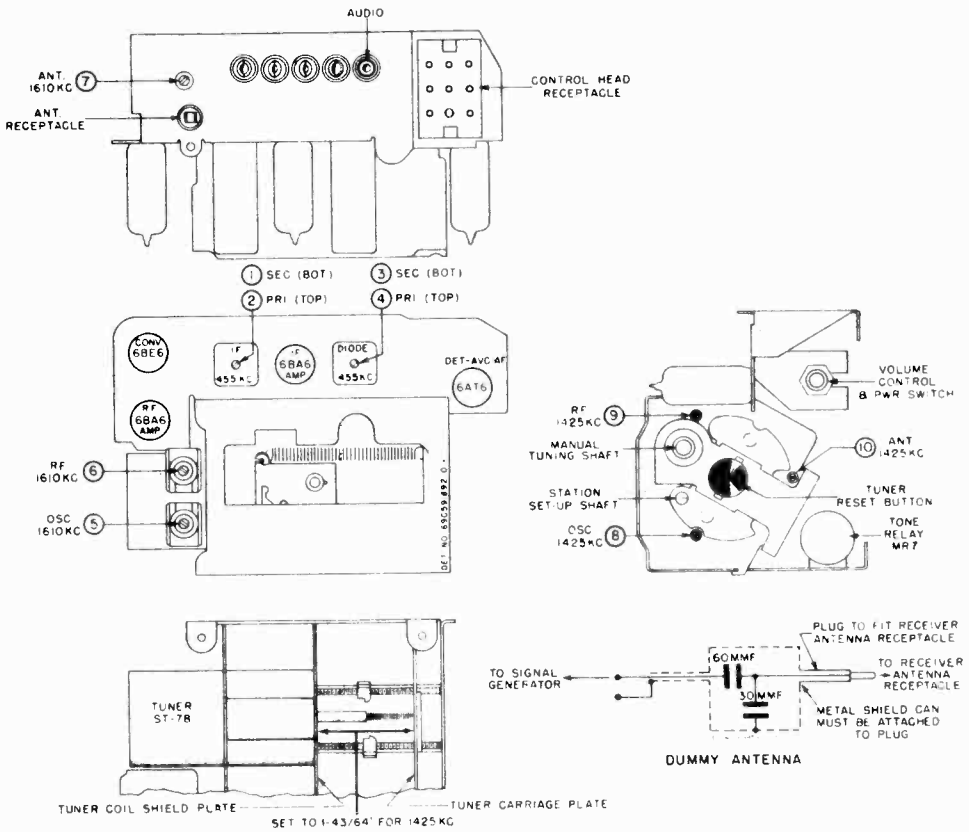


FIGURE 1. TUBE & TRIMMER LOCATIONS AND DUMMY ANTENNA

MODEL 300

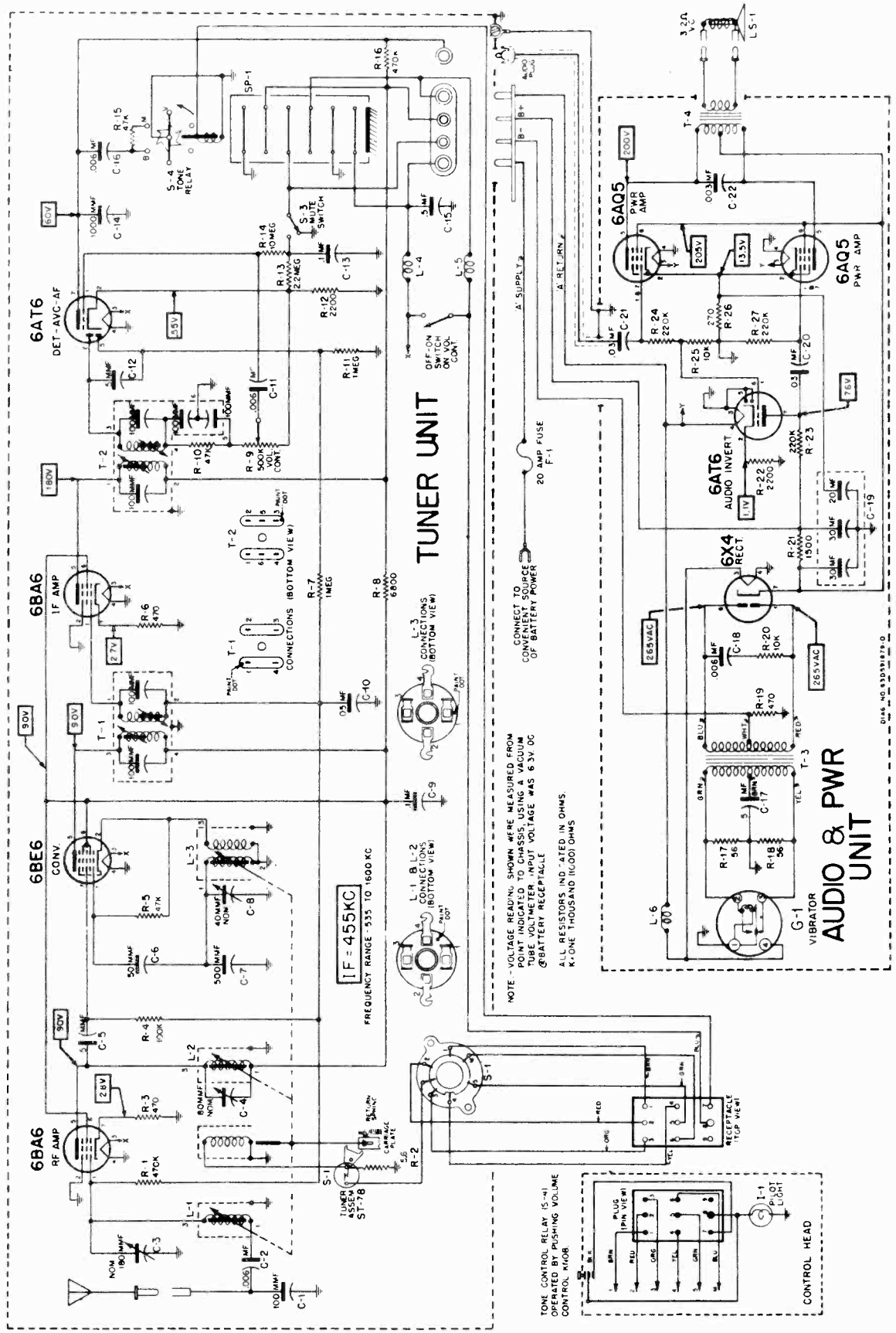
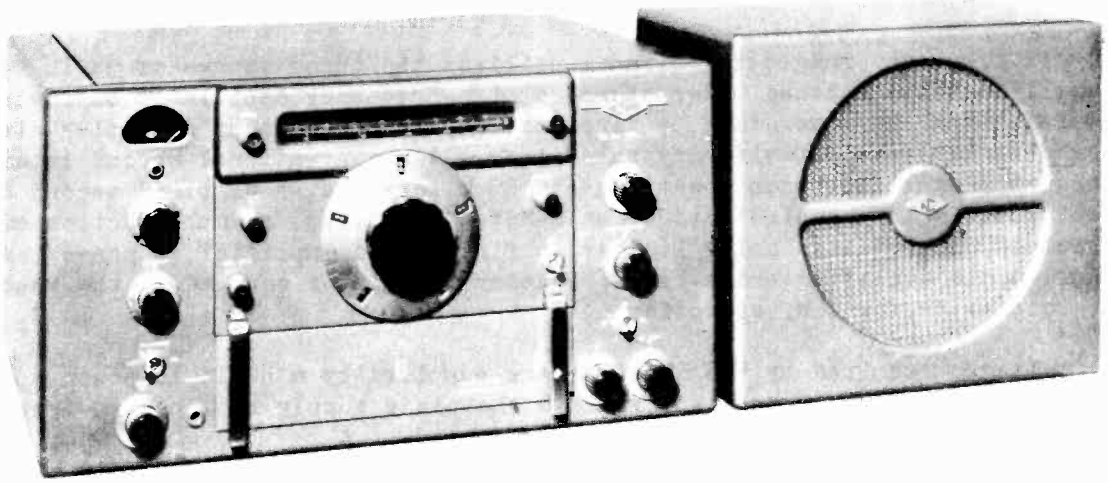


FIGURE 2. SCHEMATIC DIAGRAM



THE HRO-50 RADIO RECEIVER

SECTION 1. DESCRIPTION

1-1. GENERAL

The HRO-50 is a deluxe Radio Receiver featuring performance and versatility. Fifteen tubes, including a rectifier and a voltage regulator tube, are utilized in a superhetrodyne circuit for the reception of code and phone signals throughout its frequency range of 50 to 430 kilocycles and 480 to 35,000 kilocycles. The HRO type Receivers have long been outstanding and proven performers in Communication and Amateur services. This new series of HRO-50 Receivers feature many desirable innovations emanating from the latest advances in receiver circuitry and mechanical design. It is housed in a new and enlarged cabinet styled in an attractive gray finish with a self-contained power supply adequately isolated from the R.F. circuits. A calibrated, illuminated slide-rule dial provides direct reading in megacycles for each of the General Coverage coil sets as well as an additional bandspread scale for those coil sets incorporating this feature. A front-panel mounted oscillator trimmer control is provided to assure precise calibration. Of course, the dial-driving mechanism still features the micrometer dial. Temperature compensation and voltage regulation of the high-frequency oscillator as well as utilization of ceramic insulation in the coil sets and associated connecting brush blocks provide stable operation and freedom from drift. A single front-panel mounted Control switch selects any one of the four modes of operation, C.W., Phone, Narrow-Band F.M. or Phono. Sockets are mounted on the receiver chassis to accommodate the National Type NFM-50 FM adaptor and the National Type XCU Crystal Calibrator Unit. These accessories may be permanently installed and switched On and Off by means of the front-panel switches. At the rear of the Receiver sockets are available for external use of the National Type SOJ-3 Select-O-Ject and National Type 650S Vibrator Power Supply or battery power supply. The S-Meter circuit is designed so that the operator may adjust the sensitivity of the S-Meter. A push-pull audio system delivers the utmost in audio frequency response and undistorted power output from the built-in output transformer. Other highlights include a six position crystal filter, maximum bandspreading of the amateur bands, a quick-acting bandspread switch, dimmer control for the slide-rule dial and S-Meter lamps.

A standard equipment consists of a Receiver, Loudspeaker and coil sets A, B, C and D. Coil sets Type E, F, G, H, J, AA, AB and AC may be obtained as desired. Accessories available include the National types NFM-50 Narrow-Band F.M. adapter, XCU Crystal Calibrator, SOJ-3 Select-O-Ject and 650-S Vibrator Power Supply.

1-2. CIRCUIT

For all frequency ranges the circuit utilizes two tuned stages of radio frequency amplification, a tuned mixer stage, a high-frequency oscillator employing a tube separate from the mixer tube, a first intermediate frequency amplifier stage employing a variable-selectivity crystal filter and a conventional second intermediate frequency amplifier both operating at 455 kilocycles, a combined second detector-automatic volume control stage, an S-Meter amplifier, a double-action adjustable threshold double-diode noise limiter, a first audio amplifier, a phase inverter a push-pull audio amplifier and a beat frequency oscillator coupled to the second detector to provide for C.W. reception.

All voltages required by the Receiver are supplied by a built-in power supply. A voltage regulator tube is used to regulate the plate supply to the high-frequency oscillator and the S-Meter amplifier stages.

1-3. ANTENNA INPUT

Antenna input terminals are provided at the rear of the Receiver. The input circuit is suitable for operation with a single-wire antenna, a balanced feed line or a low impedance 72-ohm unbalanced concentric transmission cable. The actual antenna input impedance is between 300 and 600 ohms depending on the frequency of the input signal.

1-4. TUBE COMPLEMENT

The HRO-50 Receiver is supplied complete with tubes which are tested in the Receiver at the time of alignment.

The tubes employed are as follows:

First R.F. Amplifier	6BA6
Second R.F. Amplifier	6BA6
Mixer	6BE6
High-Frequency Oscillator	6C4
First I.F. Amplifier	6K7
Second I.F. Amplifier	6K7
Second Detector - A.V.C.	6H6
Noise Limiter	6H6
S-Meter Amplifier - Phase Inverter	6SN7GT
First A.F. Amplifier	6SJ7
Audio Output (2)	6V6GT
Beat Frequency Oscillator	6J7
Voltage Regulator	0B2
Rectifier	5V4G

1-5. TUNING SYSTEM

The frequency coverage of the HRO-50 is covered in twelve bands as follows:

COIL SET	GENERAL COVERAGE	BANDSPREAD
A	14.0 - 30.0 Mc.	27.0 - 30.0 Mc.
B	7.0 - 14.4 Mc.	14.0 - 14.4 Mc.
C	3.5 - 7.3 Mc.	7.0 - 7.3 Mc.
D	1.7 - 4.0 Mc.	3.5 - 4.0 Mc.
E	900 - 2050 Kc.	
F	480 - 960 Kc.	

G	180 - 430 Kc.	
H	100 - 200 Kc.	
J	50 - 100 Kc.	
AA		27.5 - 30 Mc.
AB	25 - 35 Mc.	
AC		21.0 - 21.5 Mc.

As shown above plug-in coil set types AA, AC, A, B, C and D provide bandspread coverage of the 10-11, 15, 20, 40 and 80 meter amateur bands. The AA, AC, B, C and D bands are spread out so as to cover 400 dial divisions while the A band is spread 430 divisions on the 500 division main tuning dial. This is accomplished by switching a small variable capacitor in series with each section of the main tuning capacitor, thus reducing its effective capacity range. All of the coil sets are factory aligned in the Receiver using accurate crystal-controlled test oscillators thus assuring precise alignment.

The micrometer type dial drives the main tuning capacitor through a worm drive having a reduction ratio of approximately 20 to 1. Backlash is eliminated by the use of a spring-loaded split worm wheel which assures positive drive in either direction at all times. This dial has an effective scale length of approximately twelve feet and is calibrated from zero to 500.

A slide-rule type dial is synchronized with the micrometer dial by means of an anti-backlash gear and an efficient string drive arrangement to the main tuning dial. A dial drum provides a means of mounting eight scales. Each of these scales is calibrated in megacycles for the general coverage and/or bandspread frequencies depending on the coil set. Mounted on the front panel is a band selector switch for ease in rotating the dial drum to select the proper band scale to correspond to the coil set in use. Each scale is clearly marked with the band designation. Two pilot lamps are used, one at each end of the dial scale drum, for illumination. The degree of illumination is controlled by the front-panel mounted Dimmer control.

1-6. CRYSTAL FILTER

The selectivity characteristics of the HRO-50 are made adjustable by means of a crystal filter. Located in the first intermediate frequency amplifier this crystal filter is designed for extreme flexibility and efficiency of operation. A six-position Selectivity switch and a crystal Phasing control are front-panel mounted for adjustment of the filter. Figure Number 1. shows the selectivity characteristics of the Receiver for each of the six positions of selectivity.

The crystal filter may be used for either C.W. or phone reception; any degree of selectivity from true single-signal to wide band A.M. broadcast reception being available. Operation of the Phasing control provides for efficient suppression of interfering C.W. signals or M.C.W. signals which may produce objectional heterodynes.

1-7. NOISE LIMITER

The noise limiter in the HRO-50 Receiver uses an automatic type double-action circuit resulting in limiting noise pulses on both the positive and negative peaks. It is equally effective on both C.W. and phone reception. The usefulness of this limiter will be most appreciated on the higher frequency bands of the Receiver when automobile ignition noise and other high frequency disturbances are effectually suppressed. A threshold control on the front panel permits adjustment of the level at which limiting action starts.

MODEL HRO-50

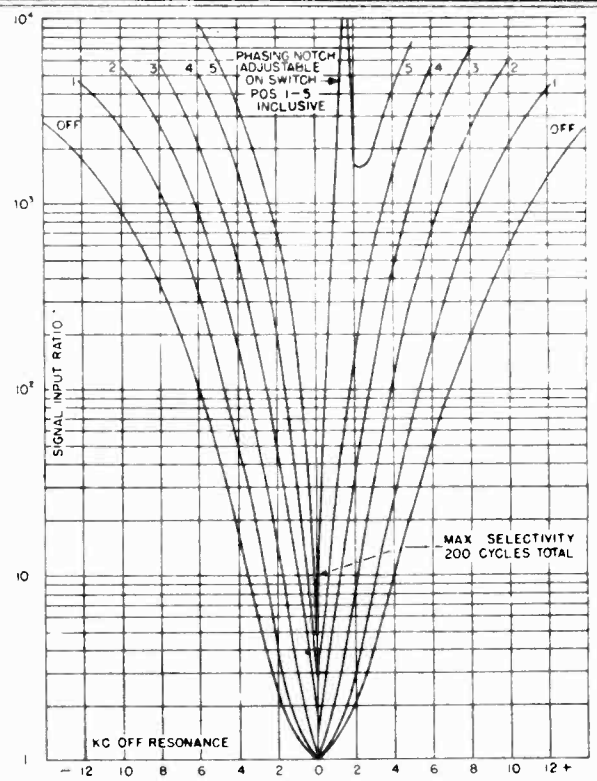
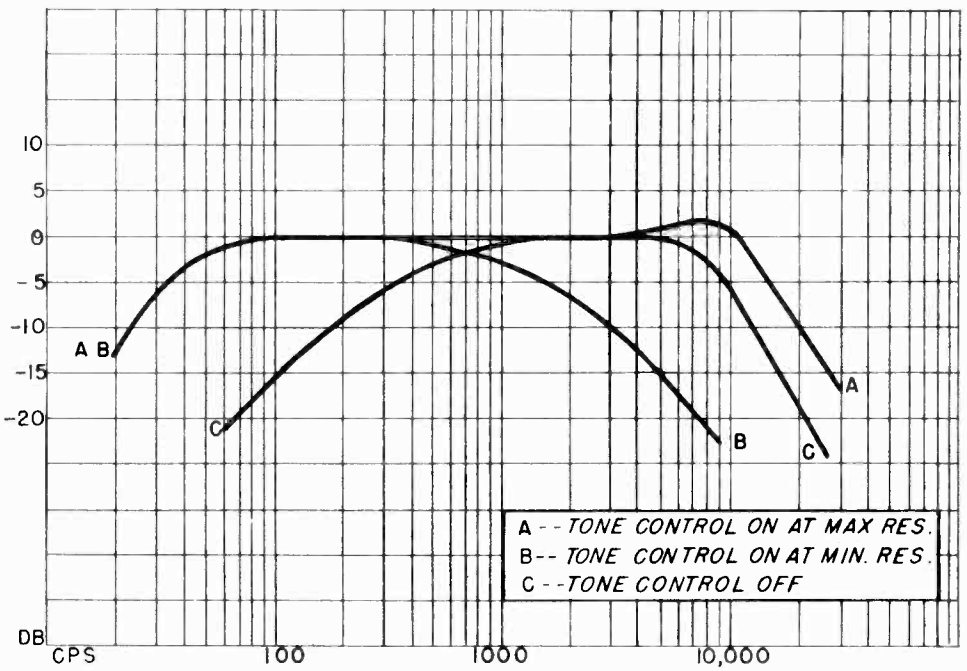


Figure No. 1. Crystal Filter Selectivity Curves

1-8. TONE CONTROL

The Tone control circuit has been especially designed to provide a versatile variance of the frequency characteristics of the audio amplifier output. In the extreme counter-clockwise position the greatest degree of high audio frequency response is obtained. Rotating the control clockwise until the switch mounted on the control just closes provides a comparatively flat response over the entire usable audio frequency range. Further clockwise rotation will result in the high audio frequencies being attenuated as illustrated in Figure Number 2. This control is particularly helpful when receiving weak signals through interference. If a signal is weak and partially obscured by background noise or static, an improvement in signal-to-noise ratio will be obtained by rotating the Tone control in a clockwise position thereby attenuating the higher audio frequencies.

Figure No. 2. Audio Amplifier Response



1-9. TEMPERATURE COMPENSATION

The HRO-50 is compensated for frequency drift due to temperature changes which may detune the Receiver from the desired signal over long or short periods of reception. The most objectionable cause of frequency drift is the change of inductance of the high-frequency oscillator coil as heat from the tubes causes the interior of the Receiver to increase in temperature. This undesirable heating effect in the R.F. coils is minimized by the position of the plug-in coil sets in that they are placed at the bottom of the Receiver underneath the chassis in a separately shielded compartment. A further safeguard against frequency drift is provided for on bandspread operation. The heat which is dissipated in the high-frequency oscillator may change the inter-electrode capacity of the tube and thus cause frequency drift. To offset this effect a small negative temperature coefficient capacitor is placed adjacent to the high-frequency oscillator tube to compensate for any change caused by the internal heating of the tube.

The coil set terminal connecting boards of each shielded coil can as well as their mating brush blocks have been made of ceramic type material. As a result freedom from any possible leakage due to poor insulation assures a low degree of drift. This will be found especially true of the coils operating at the higher frequencies.

1-10. SIGNAL STRENGTH METER

Signal input readings are indicated in S-units from 1 to 9 and in decibels above S-9 from zero to 40 db. on the panel-mounted signal strength meter. A reading of S-9 is obtained with an input signal of approximately 25 microvolts. The meter employs a zero to 1 milliampere movement with its mechanical zero at 40 db. on the dial scale. The S-Meter is connected in series with the plate input of the S-Meter Amplifier tube V-8A and measures the plate current of this tube. With the A.C. supply switch On and the A.V.C. switch set at A.V.C. the S-Meter will read zero in the absence of signal input. A variable resistor is shunted across the meter and with no antenna connected this resistor allows correct adjustment of the pointer to its electrical zero. Any increase in A.V.C. voltage caused by signal input will give a corresponding increase in the meter reading. At the 40 db. meter reading the A.V.C. grid voltage applied reaches the cut-off point of the amplifier tube. Therefore the pointer cannot be harmed by violent contact with the full-scale meter pin. For the purpose of comparing strong signals (which cause the meter to contact the full-scale meter pin) with other stronger and/or weaker signals the sensitivity of the S-Meter may be lowered by retarding the R.F. Gain control. The meter dial lamp illumination is regulated by a Dimmer control mounted on the front panel of the Receiver.

1-11. NARROW-BAND F.M. SOCKET

A standard octal socket, X-1, is mounted inside of the Receiver on the center portion of the power supply compartment chassis. It is designed to mount the National Type NFM-50 Narrow-Band F.M. adaptor. A Control switch is front-panel mounted to provide a means of switching the adaptor into the output of the intermediate amplifier circuit. With the Control switch set at the N.F.M. position the receiver is adjusted for the reception of narrow-band F.M. signals. With the A.V.C. switch set at A.V.C. the S-Meter is operative in the N.F.M. position and the Receiver should be tuned for maximum meter reading to assure efficient operation. Further information concerning the NFM-50 unit is contained in a separate data sheet at the rear of this manual.

1-12. CRYSTAL CALIBRATOR SOCKET

The Crystal Calibrator socket, X-2, is of the standard octal type mounted on top of the power supply compartment chassis inside of the Receiver. It is designed to accommodate a National Model XCU Crystal Calibrator. The Model XCU is compactly constructed and furnished with a drive screw clamping arrangement to hold it firmly in place. A double-pole, three-position toggle type front-panel mounted Calibrate switch marked 100-Off-1000 provides a means of connecting B-plus to the unit for instantaneous use. At the same time by using this toggle switch a resonant crystal-controlled frequency of either 100 or 1000 kcs. may be selected. The output of this unit is loosely coupled to the first R.F. amplifier stage through the socket wiring. Further information concerning the Model XCU unit is covered by a separate data sheet included at the rear of this manual.

1-13. SELECT-O-JECT SOCKET

The Select-O-Ject socket, X-3, is a standard octal type socket accessible at the rear of the Receiver. It is primarily designed to accommodate a National Model SOJ-3 Select-O-Ject unit. The mating plug attached to the SOJ-3 permits a direct connection into this socket in place of the audio-jumper plug originally plugged into the Select-O-Ject socket. By proper adjustment of the controls any single audio frequency selected in the range of approximately 80 to 10,000 cycles may be boosted or rejected. Detailed instructions for proper operation of the Select-O-Ject are contained with the unit.

For convenience a source of 6.3 V.A.C. filament voltage, a 240 V.D.C. high voltage as well as the 105 V.D.C. regulated voltage is available for operation of external apparatus. The Schematic diagram, Figure Number 13 shows a pin view of the Select-O-Ject socket thus providing the information necessary for making the proper connections. External equipment MUST NOT be utilized if the Narrow-Band F.M. adaptor, Crystal Calibrator and Select-O-Ject units are all operated at the same time. Consideration must also be given to the fact that the 105-volt regulated power supply cannot be switched off by the B+ On-Off switch.

1-14. PHONO INPUT JACK

A Phono jack is mounted at the rear of the Receiver and can be used for connecting auxiliary apparatus, such as a record player pick-up or microphone into the audio system of the Receiver. This input circuit is of high-impedance providing a suitable match for such external equipment into the high-gain first audio amplifier stage. The front-panel mounted Control switch must be set at the Phono position when using the Phono jack. Both the A.F. Gain and Tone controls are operative with this type of operation.

The majority of record player pick-ups are terminated in a single shielded wire. The Phono jack on the HRO-50 is the type that accommodates a standard phono tip plug and if the record player to be used is not fitted with such a plug one can easily be attached. If the output circuit of the record player is of low impedance (less than 100,000 ohms) improved efficiency will be obtained if a suitable resistor, with a value as specified for the particular record player, is connected across the phono tip plug or its mating jack to properly load the record player output circuit.

1-15. AUDIO OUTPUT

The HRO-50 features a push-pull output amplifier using inverse feed-back. See Figure No. 2 for the audio system response characteristic. The matching transformer located inside the Receiver provides two audio output circuits as follows:

(1) The transformer secondary leads are brought to a three-terminal Output board located at the rear of the Receiver, having both 8 and 500-ohm terminals and a common ground terminal. The eight-ohm terminal provides output for the speaker voice coil. The 500-ohm terminal is available for connection to a 500-ohm line. Approximately 8 watts of undistorted audio output power is available at the output terminal board and a maximum power of 10 watts is obtainable.

(2) A headphones jack is front-panel mounted and is wired so as to silence the Loudspeaker upon insertion of the headphones plug. The headphones output load impedance is not critical and varying types of headphones may be used including crystal types, as no direct current flows through the headphones.

1-16. POWER SUPPLY

The power supply is built in a separate compartment inside of the Receiver cabinet incorporating a heat-resistant shielded barrier isolating it from the R.F. chassis portion. It is designed for operation from a 110/120 or 220/240-volt, 50/60 cycle A.C. supply source. A toggle switch is mounted on top of the chassis for selection of either 110/120 or 220/240-volt operation. Normal power consumption is approximately 115 watts. The built-in power unit supplies all of the voltages required by the heater and B supply circuits, 4.5 amperes at 6.3 volts and 125 milliamperes at 240 volts respectively. In addition this supply is also capable of furnishing all voltages required by the accessories such as the NFM-50, XCU and SOJ-3. A 2-ampere fuse is connected in one side of the A.C. input supply to protect the Receiver circuits against possible voltage surges in the power line or short circuits in the Receiver. It is located at the rear of the Receiver and easily removed for examination or replacement.

A Power Socket, X-4, is provided at the rear of the Receiver so that either a battery or vibrator power supply may be utilized for portable or emergency service. The National Type 650S Vibrator Power Supply is designed to provide efficient operation of the Receiver with the use of a 6-volt storage battery input. Further information concerning the 650S is contained at the rear of this manual on a separate data sheet.

1-17. LOUDSPEAKER

The HRO-50TS or HRO-50RS Loudspeakers in table or rack mounting styles respectively are designed for use with the Receiver. These are both permanent-magnet type Loudspeakers furnished with a shielded connecting cable from the 8-ohm voice coil for connection to the output terminal board located at the rear of the Receiver. If desirable a 500-ohm shielded line may be used from the Receiver output terminals to the speaker and/or externally operated equipment. In event of a dynamic type loudspeaker being used external means for supplying field excitation voltage will be necessary.

A cabinet furnished to match the Receiver design houses the HRO-50TS Loudspeaker for table mounting. The cabinet is lined with sound absorbent material to avoid mechanical resonance.

SECTION 2. INSTALLATION

2-1. GENERAL

All HRO-50 Receivers are supplied with the following eight scales mounted on the slide-rule dial drum, irrespective of the type of coil sets ordered, A, B, C, D,

E-F, AA, AB and AC. If a coil set or coil sets are ordered with the Receiver and the corresponding scale does not appear on the dial drum it will be found packed with the coil set. The new scale is installed in place of any one of the unused scales previously mounted on the dial drum. Two Phillips head type screws, one at each end of the scale, hold it properly in place. The drum scales for the A, B, C and D coil sets are frequency calibrated in megacycles for both of the available ranges i.e., General Coverage and Bandspread. The E and F coil set ranges are on the same scale, while the remaining scales carry just the one frequency range calibrated in megacycles. Each scale is clearly marked with the band designation.

2-2. LOCATION

The Receiver should not be installed in small, unventilated or warm spaces. Wherever practicable placement should be made to allow freedom of air circulation on all four sides. The Loudspeaker may be located in any desirable position although it is not recommended that it be placed on top of the Receiver as undesirable microphonics may result. The Loudspeaker should not be placed near the antenna terminals.

2-3. ANTENNA RECOMMENDATIONS

The radio frequency input of the Receiver is designed for operation from either a single-wire antenna or other types employing transmission lines having impedances of 70 ohms or more. There is an antenna terminal panel at the rear of the Receiver with three screw-type terminals marked A, A and G respectively. A link is provided on the antenna terminal panel to allow connection of two-wire or single-wire type antennae to the Receiver.

For best impedance matching to the Receiver input circuit an antenna with a 300 to 600 ohm transmission line is recommended. The antenna should be cut to the proper length for the most used frequency. The antenna transmission line feeders should be connected to the two antenna terminals marked A; the grounding link is not used. It must be remembered, however, that an antenna installation of this type will have maximum efficiency over a band of frequencies near that frequency for which it is designed and will be most useful in installations where the Receiver is tuned to one frequency or band of frequencies. For other frequencies, it would be desirable to connect the two transmission line leads together at the antenna terminal at the left of the antenna terminal panel, grounding the other terminal by means of the link. The antenna is thus utilized as a single wire type.

The most practical antenna for use in installations where the Receiver is to be used over a wide range of frequencies is the single-wire type. An antenna length of from 50 to 100 feet is recommended. The antenna lead-in should be connected to the antenna terminal marked A at the left of the antenna terminal panel; the other terminal marked A should be grounded by means of the link.

When a doublet is used, the antenna feeders or balanced transmission line are connected to the two terminals marked A. The grounding link is not used.

The inner conductor of a concentric transmission line should be connected to the terminal marked A at the left of the antenna terminal panel. The outer conductor should be connected to the other terminal marked A and grounded by means of the link to G.

In some cases where a doublet antenna is used with a low impedance concentric or other type transmission line it may be necessary to re-trim the first R.F. amplifier at the high end of each band to provide a better impedance match between antenna and receiver input circuit. Paragraph 4-6 describes this procedure.

In an installation where the Receiver is to be used as the receiving unit in a transmitting station the most efficient operation will result from use of the transmitting antenna as receiving antenna also. This is especially true if the transmitting antenna is of the multi-element, directional type since the same antenna gain is available for both receiving and transmitting - a very desirable condition. For switching the antenna from Receiver to transmitter, an antenna change-over relay should be used. A double-pole, double-throw relay possessing good high-frequency insulation is suitable. A second relay and a three position switch may be used to control the transmitter plate supply and the Receiver B+ circuits. This second relay should be a single-pole single-throw type having one normally open pair of contacts. The schematic diagram of this type of control circuit is shown in Figure 3. With S-1 in the receive position the antenna transmission line is connected to the Receiver by contacts 2, 3, 5 and 6 on relay RY-1; the B+ circuit of the Receiver is completed by the switch. (The B+ switch on the Receiver should be at B+ Off). With the switch in the transmit position RY-1 contacts 1, 3, 4 and 6 are closed transferring the antenna transmission line to the transmitter; contacts 7 and 8 of relay RY-2 close to complete the plate supply circuit to the transmitter. Contacts 7 and 8 of relay RY-2 should be in series with the primary of the transmitter plate supply transformer. Thus, the station is in the receiving condition with switch S-1 in the receive position and in the transmitting condition with S-1 in the transmit position. With S-1 in the mid-position the Receiver B+ circuit and transmitter plate supply circuit are both open thus permitting coil set changing in the Receiver and transmitter. In the mid-position the Receiver B+ circuit is controlled by the B+ switch on the front panel of the Receiver. NOTE

The high-frequency oscillator, C.W. oscillator S-Meter amplifier and the push-pull audio output amplifier are not affected by the external relay connections to the B.S.W. terminal block. Unless the A.C. On-Off switch is set at Off these circuits will obtain an uninterrupted B-plus supply.

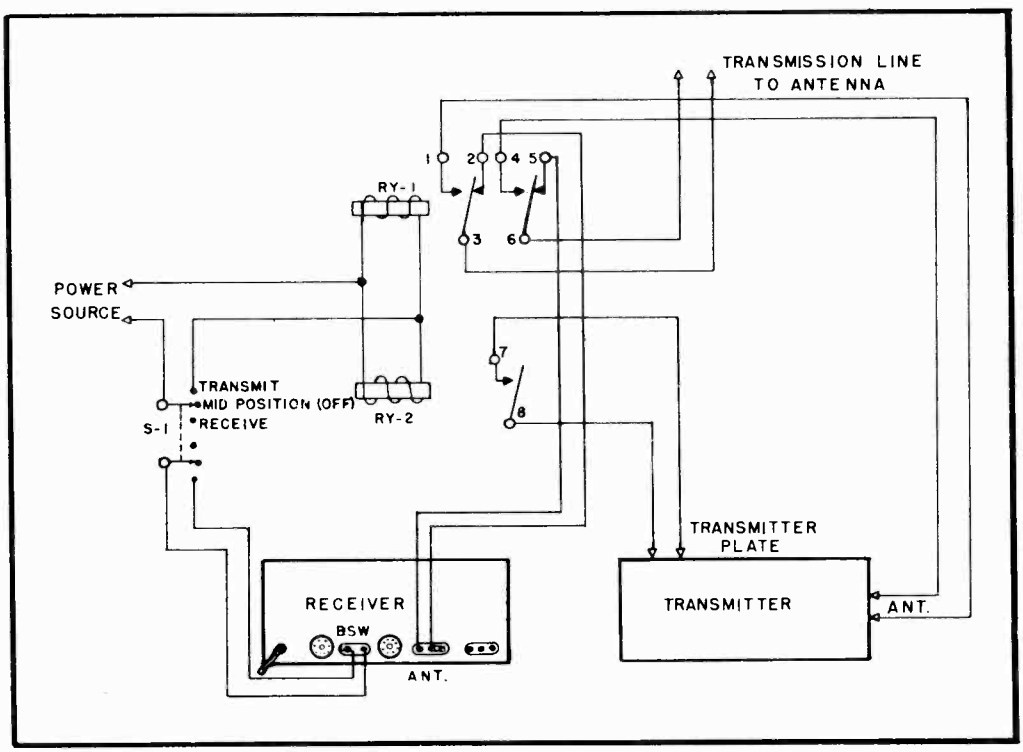


Figure No. 3. Typical Antenna Switching System

2-4. A.C. OPERATION

After unpacking the HRO-50 Receiver and associated equipment proceed as follows:

(1) Make sure that all tubes are firmly seated in their sockets, tube clamps are properly in place and all grid clips securely fastened.

(2) Make sure the plug-in coil set used in the Receiver is firmly in position by pressing down the lever-type handles on the front panel to their maximum vertical position.

(3) Make sure that the front-panel mounted Control switch is set in the proper position. This switch provides four operating positions, C.W., A.M., N.F.M. or Phono.

(4) Connect the antenna as recommended in Section 2-2.

(5) Connect the Loudspeaker cable to the Output terminal board at the rear of the Receiver. This is accomplished by connecting the outer shield lead to the common terminal and the other to the 8-ohm terminal. A 500-ohm terminal is also available on the Output terminal board in cases where a 500-ohm line is utilized for Loudspeaker connection.

(6) Connect the Receiver A.C. line cord to the proper source of voltage. The Primary switch, S-10, must be set at the position corresponding to the line voltage to be used i.e., 110/120 or 220/240 volts, 50/60 cps.

(7) Set the controls as recommended in Section 3 for reception of signals.

NOTE

Where the Receiver is located in the R.F. field of a relatively powerful transmitter, it is advisable to provide some means of preventing damage to the Receiver R.F. coil. If a separate receiving antenna is used a means of disconnecting or grounding it during transmission periods should be provided.

2-5. BATTERY OPERATION

The HRO-50 is readily adaptable for emergency, portable operation or operation in localities where a 115 or 230-volt A.C. power source is not available. It may be operated directly from batteries or a National Type 650S Vibrator Power Supply designed for operation from a 6-volt storage battery. The Type 650S power unit draws 9.0 amperes at 6-volts when furnishing power to the Receiver if the Narrow-Band F.M. Adaptor, Crystal Calibrator and Select-O-Ject units are not used. If these plug-in units are utilized typical operating conditions and power consumption data will be found in Section 6.

The Schematic Diagram Figure Number 13 illustrates pin connections of the Receiver Power socket, X-4. This provides the information necessary for wiring the octal type battery plug which is used in place of the regular A.C. jumper plug. To conserve battery power the battery plug must be disconnected when the Receiver is not being used. For stand-by operation in all cases it is recommended that a switch be placed in the battery B-plus lead as the B-plus switch in the Receiver does not open the B-plus circuit supplying the high-frequency oscillator, C.W.

oscillator, S-Meter Amplifier or the push-pull audio output tubes. A suggested refinement is to include a switch in the A-plus input lead so that the tube heaters may be turned off when the Receiver is not in use without the necessity of removing the battery plug from the Power socket.

2-6. ACCESSORY SOCKETS

Three octal type sockets are available for additional accessories as follows:

(1) A N.B.F.M. socket, X-1, is mounted on top of the chassis inside the power supply compartment. A National Type NFM-50 Narrow-Band F.M. adaptor is designed to fit into this socket and is supplied with a mounting bracket and drive screws to hold it firmly in place. The front-panel mounted Control switch, S-7, provides a means of switching the NFM-50 unit into instant service, as required.

(2) A Crystal Calibrator socket, X-2, is top chassis mounted in the power supply compartment. This socket is wired to accommodate a National plug-in Type XCU Crystal Calibrator Unit. A slotted head screw arrangement bolts the unit firmly in place. The front panel Calibrate switch provides a means of applying B-plus to the unit as well as the selection of either a 100 or 1000 kc. marker signal.

(3) A Select-O-Ject socket, X-3, of the standard octal type is mounted so as to be accessible from the rear of the Receiver. This socket is designed primarily for the use of a National Model SOJ-3 Select-O-Ject unit. The SOJ-3 is fitted with an interconnecting cable and plug for direct connection to the Select-O-Ject socket.

Reference to the Schematic Diagram will show the various connections made to the socket if it is desired to use the voltages available for accessories other than the Select-O-Ject. It will be noted that B+ (240 V.D.C. and 105 V.D.C. regulated) and filament voltages are available. There is a definite limitation on the drain permissible at this socket. The total permissible drain (if the NFM-50, XCU and SOJ-3 are not used) is 1.5 amps. at 6.3 V.A.C., 2.5 milliamperes at 240 V.D.C. and 5 milliamperes at 105 V.D.C. If the 105-volt supply is used it must be remembered that it cannot be switched Off by the B+ On-Off switch or external switching devices connected to the B.S.W. panel unless an additional relay is used.

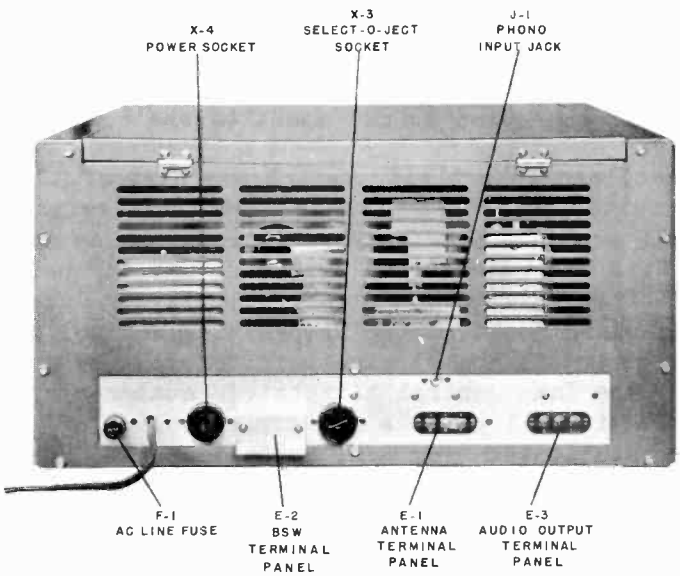


Figure No. 4. Rear View of Receiver

SECTION 3. OPERATION

3-1. CONTROLS

All controls are identified by front-panel markings for ease of identification. The controls are located in a symmetrical manner and are arranged for ease of operation.

The main tuning HRO type micrometer dial is arranged so that the frequency to which the Receiver tunes increases as the dial reading increases. The slide-rule dial pointer mechanism is synchronized with the main tuning dial using an anti-backlash gear plus an efficient string-drive arrangement to provide an accurate relationship between the main tuning dial and the direct frequency calibrated scales on the slide-rule drum assembly. Front-panel mounted is a Band selector switch for switching the proper scale in place for the coil set to be used.

The R.F. Gain control serves to adjust the amplification of the second R.F. first I.F. and second I.F. amplifier stages. Maximum sensitivity is obtained by rotating the control knob to the extreme clockwise position (10) on its circular scale. At the extreme clockwise position all tubes are operating at maximum gain with minimum bias. As the control is rotated counter-clockwise, increasing bias is applied to the cathodes of the second R.F., first I.F. and second I.F. tubes, thus reducing their amplification.

The A.C. On-Off switch is associated with the A.F. Gain control and A.C. power is turned on as the A.F. Gain control is advanced from A.C. Off to zero on its scale.

The B+ On-Off switch is connected in the positive lead of the power supply circuit and its purpose is to disconnect the B-plus during periods of transmission or WHEN CHANGING COIL SETS. This last function is important. The B+ circuits are completed when the switch is set at On. However, the B-plus circuits of the high-frequency oscillator, S-Meter amplifier, C.W. oscillator and push-pull audio output tubes remain On at all times regardless of the position of the B+ On-Off switch providing the A.C. On-Off switch is set at On.

Connected in parallel with the B+ switch and mounted at the rear of the chassis is a pair of contacts marked B.S.W. intended for use with relay control of the Receiver. The B.S.W. panel is covered by a metal shield to prevent accidental contact with the terminals by the operator. Two slots are provided in this shield to bring out wires to connect to an external switch or relay. Care should be taken that these wires for external connection do not short to the B.S.W. shield.

The Phasing control and Selectivity switch are part of the crystal filter. When the Selectivity switch is set at Off the crystal is switched out of the circuit. With the crystal switched out the Phasing control has no influence on Receiver performance. With the Selectivity switch set at any point between 1 and 5, inclusive, the crystal filter is in operation, selectivity increasing as the switch is progressively advanced in position 5. The Phasing control is then used to balance the crystal bridge circuit and eliminate interfering signals or heterodynes. It is recommended that the Tone control be rotated counter-clockwise until the switch is turned Off. This will provide optimum reception of the high audio frequencies when using the crystal filter for A.M. reception. The resultant boost of the higher frequencies tends to compensate for the side-band cutting action of the crystal filter.

The C.W. oscillator is turned on by setting the front-panel mounted Control

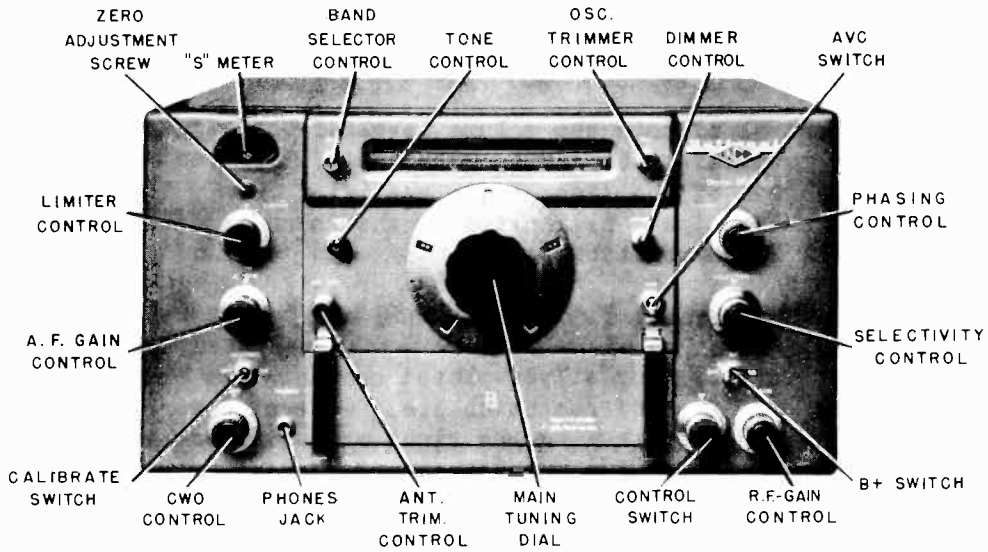


Figure No. 5. Front View of Receiver

switch at the C.W. position. The C.W.O. control provides a vernier tuning adjustment for the C.W. oscillator transformer. This oscillator is used to produce an audible beat note when receiving C.W. signals or to locate the carrier of a weak phone station. With the Control switch set at the C.W. position B-plus is applied to the C.W. oscillator tube providing a constant B-plus supply regardless of the B+ On-Off switch setting or the B.S.W. external control devices. Normally the C.W.O. control is set at zero, however by rotating it either to the right or left of zero the operator can select an audio tone suitable to the ear, or he may set the control for best reception. The C.W. code characters are made audible through the heterodyning action of the C.W. oscillator with that of the incoming signal. Care should be taken to retard the R.F. Gain control to a point where the receiver does not overload.

The Limiter control serves to switch on the limiter and, following this, to adjust the threshold at which limiting action starts. With the Limiter control turned on (at position 0 on the dial scale) limiting action automatically takes place at a relatively high percentage modulation. Rotating the control clockwise progressively lowers the threshold, or percentage modulation, at which limiting action starts until maximum clipping is achieved at 10. This limiter is double-action in that limiting is accomplished by clipping of both positive and negative peaks. Limiting action is equally effective for both phone or C.W. reception.

The Tone control is used to vary the audio frequency characteristic of the audio system. In the extreme counter-clockwise position the greatest degree of high audio frequency response is obtained. Rotating the control clockwise until the switch mounted on the control just closes provides a comparatively flat response over the entire usable audio frequency range. Rotating the control further in a clockwise position will attenuate the high audio frequencies as shown in Figure Number 2. If a signal is weak and partially obscured by background noise or static an inprovement in signal-to-noise ratio is possible by the attenuation of the higher audio frequencies. Excessive attenuation of these frequencies, however, may result in an impairment of A.M. speech intelligibility. When receiving C.W. signals it will be possible to advance the Tone control considerably further than is possible in A.M. reception since audio distortion is relatively unimportant.

The A.V.C. switch is a two-position toggle marked A.V.C.-Off. The automatic

volume control circuits are operative with the toggle switch in the A.V.C. or upper position.

The A.F. Gain control adjusts the volume level of the signal at both the Phones jack and Loudspeaker terminals. Clockwise rotation of this control increases the signal applied to the grid of the first audio amplifier tube. The A.F. Gain control is operative when an audio signal is applied to the Phono input jack with the Control switch set at the Phono position.

A Bandspread switch is mounted on the A, B, C and D coil sets. Inspection of the coil set ceramic terminal panels will show a silver-plated spring metal strip with a slotted center screw. Four silver-plated contacts are provided on the terminal panels; two for each type of reception i.e., General Coverage or Bandspread. The metal strip may be turned either to the right or left thereby selecting the type of reception required. A spring tension detent arrangement provides for proper placement and a firm trouble-free electrical contact in each position. It is only necessary to switch this from the left to the right hand side to change from General Coverage to Bandspread. The lower calibrated scale on the slide rule dial is used when operating in the Bandspread position. A typical coil set showing adjustment locations is illustrated in Figure Number 7 contained in Section 4.

The Ant. Trim. control operates a tuning capacitor which is connected across the first R.F. amplifier section of the main tuning capacitor. This trimmer control is used to tune the first R.F. amplifier stage properly under a wide variety of antenna loading conditions over the entire frequency range of the receiver.

The Dimmer control is a variable resistor actuated by a front-panel mounted dial. It is connected in series with one of the filament supply wires to the S-Meter and slide-rule dial pilot lamps and furnishes a means of varying the degree of illumination as desired by the operator.

The front-panel mounted Osc. trimmer control drives a variable air capacitor connected in parallel with the oscillator main tuning capacitor. Assuming that the Receiver is properly aligned this compensating trimmer may be used for minor calibration adjustments. Calibration can be checked by the use of accurate crystal-controlled test oscillators or by using the National Model XCU Crystal Calibrator. Use of the Osc. trimmer should not be attempted until the Receiver has had a warm-up period of at least five minutes.

A four position Control switch is mounted on the front panel of the Receiver. In the C.W. position the C.W. oscillator is placed in operation. The A.M. position provides normal reception of phone or broadcast signals. In the N.F.M. position the reception of narrow-band F.M. signals is possible provided a National Type NFM-50 adaptor is plugged into the N.B.F.M. socket. With the Control switch in this position the adaptor is connected between the output of the intermediate amplifier and the input of the audio system. When the Control switch is set in the Phono position the Phono jack is connected to the input of the audio amplifier. In the Phono position all of the Receiver circuits except the audio system are rendered inoperative. The A.F. Gain and Tone controls remain operative. If it is so desired the record player may remain connected to the Receiver and normal receiving operation resumed by setting the Control switch to any of the other positions.

3-2. PHONE RECEPTION

After the HRO-50 is properly installed as outlined in Section 2, it is placed in operation by the following adjustments:

1. Set the Control switch at A.M.
2. Set the A.V.C. switch at A.V.C.
3. Set the Selectivity switch at Off.
4. Set the Phasing control at zero.
5. Set the Limiter control at Off.
6. Set the R.F. Gain control at 10.
7. Check the position of the Osc. trimmer control pointer. It is aligned at the factory so that proper calibration is obtained with the pointer in a vertical position with the arrow head pointed to the "S" in the Osc. panel engraving.
8. Turn the A.C.-On-Off switch mounted on the A.F. Gain control to On i.e., zero on the dial scale.
9. Set the Receiver B+ switch at On.
10. Adjust the Band control to select the scale corresponding to the plug-in coil set in use.
11. Turn the A.F. Gain control to the position giving the desired audio volume.
12. Adjust the Ant. Trim. control for a maximum S-Meter reading after the desired station has been selected. Alternately in the absence of a signal the Ant. Trim. control may be set for maximun receiver background noise.
13. Turn the Tone control to a position giving the desired audio output response for the signal tuned in.

The Receiver is now adjusted for the reception of phone signals and will tune to the frequency corresponding to the plug-in coil set in use and the setting of the main tuning dial. If a dual-coverage plug-in coil set is used the position of the Bandspread switch, as previously described in paragraph 1 of this section, will determine the frequency coverage i.e., General Coverage or Bandspread.

The settings given above are of necessity for the reception of signals of average strength. Exceptionally strong or weak signals may require modification of the above settings. Very strong signals may cause overload or distortion in the Receiver with the R.F. Gain control at 10. In this case retarding this control slightly until the overload or distortion disappears is recommended. However, the operator must remember that automatic volume control action will be restricted unless the R.F. Gain control is fully advanced. Audio output should be adjusted entirely by means of the A.F. Gain control.

The A.V.C. - Off switch may be set at the Off position to provide increased sensitivity in some cases. With such a setting the operator must be careful not to advance the R.F. Gain control to a point where I.F. or audio amplifier overload occurs. Such overload is indicated by distortion.

Various types of interference which may be encountered due to adverse receiving conditions can be minimized by utilization of the following controls in the manner described.

Noise Limiter -- When a signal is accompanied by static peaks or noise pulses of high intensity and short duration, the best signal-to-noise ratio will be obtained by turning On the Limiter control. In general, it will be found that turning the Limiter control On to 0 on the dial scale will effectively minimize interference caused by external noise pulses. In cases where the noise pulses are extremely pronounced a higher degree of noise suppression will be realized by advancing the Limiter control to a higher dial setting.

Tone control -- An improvement in signal-to-noise ratio can be realized by setting the Tone control to attenuate the high audio frequencies. When receiving weak

signals which are partially obscured by background noise or static an improvement in reception will be noticed by rotating the Tone control in a clockwise manner. However, too much attenuation of the high audio frequencies may impair the intelligibility of speech.

Selectivity and Phasing -- The selectivity of the Receiver is adjusted by means of the crystal filter Selectivity switch. The normal setting of the Selectivity switch in phone or broadcast reception is at one of the positions affording broad selectivity. Positions marked Off, 1 or 2 are recommended. Selectivity may be progressively increased by turning the Selectivity switch to position 3, 4 or 5. Increasing selectivity will result in the attenuation of the higher audio frequency tones of the signal as well as sharper tuning. If the selectivity is increased too much these higher frequency audio tones will be attenuated to such an extent that phone or broadcast reception may become unintelligible due to excessive side-band cutting. The Phasing control is part of the crystal filter and is used to eliminate or attenuate interfering heterodynes. The Phasing control is inoperative with the Selectivity switch set in the Off position but is operative in all other settings. The normal setting of the Phasing control with the crystal filter On i.e., the Selectivity switch set at 1, 2, 3, 4 or 5 in phone reception is at zero on its scale. If after a desired signal has been tuned in an interfering signal causes a heterodyne or whistle the Phasing control should be adjusted until this interference is reduced to minimum. The setting of the Phasing control should be that which provides a maximum attenuation of the objectionable heterodyne. If the heterodyne is below 1,000 cycles the optimum Phasing control setting will be near either one or the other end of the dial scale, depending upon whether the interfering signal has a higher or lower frequency than the desired signal.

3-3. C.W. RECEPTION

The initial adjustment of the Receiver controls for C.W. reception is the same as given in Section 3-2 except for the following:

1. Set the Control switch at C.W.
2. Set the A.V.C. switch at Off. It is important that the A.V.C. switch is turned Off for C.W. operation since the Receiver will block and become extremely insensitive if this is not done.

For the reception of C.W. signals the action of the crystal filter is similar to that for phone reception except that full use of the sharp selectivity position may be used without the loss of intelligibility experienced in phone reception. When maximum selectivity is used, (Selectivity switch at position 5) care must be exercised since tuning is very critical. When the Receiver is slowly tuned across the carrier of the received signal the beat-note produced will be very sharply peaked in output at a particular audio pitch. This peak in response indicates the correct Receiver dial setting. The setting of the C.W.O. control must be such that the beat-note peak is well within the audible range so that the receiver peak response may be readily observed. A C.W.O. dial setting near zero is recommended. After the Receiver has been correctly tuned, the pitch of the beat-note peak may be adjusted by means of the C.W.O. control to provide an audio tone which is pleasing to copy or coincides with any response peaks in the speaker or headphones. Under these conditions, the Receiver will exhibit pronounced single-signal properties which may be demonstrated by tuning the Receiver to the other side of "zero-beat" so that the pitch is the same as before and observe the marked reduction in output. This dial setting is not recommended for use other than to demonstrate the single-signal properties of the Receiver. With the Receiver tuned to "crystal peak", an interfering signal may be attenuated by proper setting of the Phasing control since

this control has little effect on the desired signal.

Similar to phone reception the Limiter control can be used to great advantage in C.W. reception for the reduction of interference due to external noise pulses. For C.W. reception, however, the Limiter control may be set at a well advanced position on the dial scale as excessive clipping of the modulation peaks will not be experienced as might be the case in phone reception. Also the Tone control may be advanced considerably further for C.W. reception since audio distortion is relatively unimportant.

3-4. N.B.F.M. OPERATION

The HRO-50 Receiver is adaptable for Narrow-Band F.M. reception by utilizing a National Type NFM-50 Narrow-Band F.M. adaptor. Operating instructions as given in paragraph 3-2 of this Section are applicable for the reception of narrow-band F.M. signals except that the Control switch must be set at N.F.M. It is recommended that when the operator is scanning a band for signals that the Control switch is set at A.M. An F.M. signal is indicated by the presence of an audio null in the center of the signal carrier. When an F.M. signal is encountered the Control switch should then be set at N.F.M. and with the A.V.C. switch set at A.V.C. the signal tuned for maximum S-Meter reading.

3-5. MEASUREMENT OF SIGNAL STRENGTH

To measure the strength or intensity of a signal the R.F. Gain control must be advanced to 10, the Control switch set at A.M. and the A.V.C.-Off switch at A.V.C. The crystal filter should be turned Off by means of the Selectivity switch and the Phasing control set at zero. The Ant. Trim. control should be adjusted for a maximum S-Meter Reading after a signal has been tuned in. The Limiter, Tone and A.F. Gain controls do not affect the S-Meter reading.

Tuning the Receiver to a signal will cause the S-Meter to read, indicating the signal input in S-units from 1 to 9 and in decibels above the S-9 level from zero to 40 db. With no R.F. input to the Receiver, or with the antenna disconnected, the S-Meter should read zero plus or minus one-half an S-unit. If it does not the S-Meter circuit compensator requires adjustment. See Section 4-7 for adjustment procedure.

Design of the S-Meter actuating circuit is such that a signal stronger than 40 db. above S-9 cannot cause the meter pointer to come in violent contact with the full-scale meter stop pin thus preventing the possible bending of the meter pointer.

For the purpose of comparing strong signals, which cause the meter pointer to read full scale, with other stronger and/or weaker signals the sensitivity of the S-Meter may be lowered by retarding the R.F. Gain control.

Measurements of the signal strength of C.W. signals cannot be made with the C.W. oscillator in operation.

With the Receiver A.C.-On-Off switch set at Off the meter pointer will return to its mechanical zero located on the right hand or 40 db. end of the meter.

SECTION 4. ALIGNMENT DATA

4-1. GENERAL

All circuits in the HRO-50 Receiver are carefully aligned before shipment using precision test equipment insuring accurate conformability to the alignment frequency. No realignment of the various adjustments will be required unless the Receiver is tampered with or component parts or tube replacements have been necessary.

A definite need for realignment can be determined by checking the performance of the Receiver against its normal operation as outlined in Section 3. A simple check to assure the need of realignment of the I.F. Amplifier is provided in paragraph 4-2. of this section. In no case should realignment be attempted unless tests indicate that such realignment is necessary. Even then it must be remembered that the HRO-50 is a communications Receiver and should not be serviced or realigned by any individual who does not have a complete understanding of the functioning of the equipment and who has not had previous experience adjusting receivers of this type.

Complete alignment of the Receiver can be divided into three steps as follows:

(a) Intermediate Frequency Amplifier alignment including crystal filter adjustments.
(b) General Coverage Alignment
(c) Bandspread Alignment

All circuits must be tuned in the above order when complete alignment is required. All alignment adjustments and controls are shown on Figure Numbers 6, 7 and 10.

4-2. I.F. AMPLIFIER CHECK

The making of any adjustment indiscriminately is cautioned against and no circuit should be realigned unless tests definitely indicate that realignment is necessary.

The alignment of the intermediate frequency amplifier may be easily checked in the following manner:

1. Adjust the Receiver for normal operation with the antenna disconnected.
2. Connect a pair of headphones to the Phones jack.
3. Set the A.V.C. switch at Off.
4. Set the Control switch at C.W.
5. Set the Phasing control at zero.
6. Set the Selectivity switch at 5.
7. Set the R.F. Gain control at 10.

The setting of the A.F. Gain control does not affect the measurement and may be adjusted to provide sufficient headphone output to make the required observations. Adjust the C.W.O. control until a point is found where the predominant pitch of the background noise is lowest and a distinct crystal ring is heard. Note this setting of the C.W.O. control. Disconnect the crystal filter from the circuit by turning the Selectivity switch to the Off position. Once more adjust the C.W.O. control for the lowest predominant pitch of background noise and note the setting. If the I.F. amplifier is correctly aligned to the crystal filter frequency the

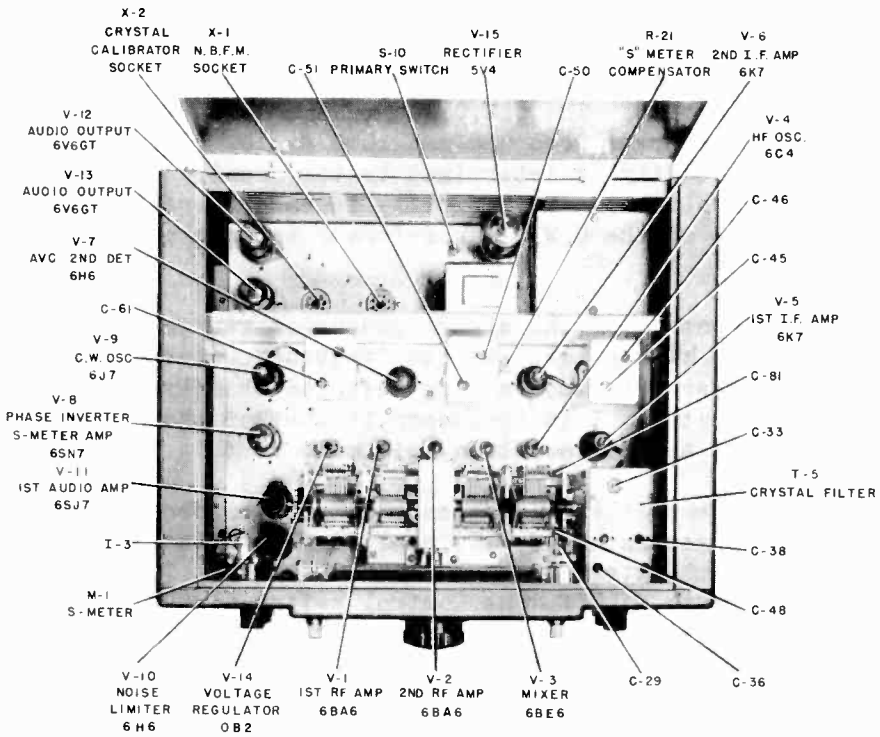


Figure No. 6. Top View of Receiver

setting of the C.W.O. control will be the same for both tests outlined above. If the two settings differ perform the complete I.F. Amplifier alignment procedures in following paragraph 4-3.

4-3. I.F. AMPLIFIER ALIGNMENT

The intermediate frequency of the HRO-50 is 455 kilocycles plus or minus 2 kilocycles. The exact frequency is determined by the quartz crystal resonator, Y-1, used in the crystal filter.

The I.F. transformers, crystal filter and C.W. oscillator transformer are fitted with individual air-type variable trimmer capacitors for alignment purposes. These adjustments are located on Figure Numbers 6 and 10.

The preliminary alignment procedure is as follows:

(1) Connect the high output lead of an accurately calibrated signal generator to the stator portion of the mixer section of the main tuning capacitor, C-5C, and the grounded lead to any convenient point on the chassis. This is a direct connection.

(2) Connect an output meter having an 8 or 500 ohm resistive load to the matching output terminals on the Receiver. As an alternative a high-impedance A.C. voltmeter may be connected to the phones jack.

(3) Set the Control switch at C.W.

(4) Set the A.V.C. switch at Off.

(5) Set the Phasing control at zero.

(6) Set the Selectivity switch at 5.

(7) Set the A.F. Gain control at 10.

(8) Set the R.F. Gain control at 9.

(9) Turn the modulation of the signal generator off to provide a steady

C.W. test signal tuned to approximately 455 kilocycles.

Adjust the output attenuator of the signal generator to provide a signal of approximately 100 microvolts. The C.W.O. control must be set to provide an audio beat-note at some frequency between 400 and 1000 cycles per second. The presence of this beat note can readily be determined by temporarily connecting headphones or a Loudspeaker to the Receiver. If difficulty is encountered in obtaining such a beat-note an adjustment of the C.W.O. transformer trimmer capacitor, C-61, must be made.

Vary the tuning control of the signal generator very slowly between the frequencies of 453 and 457 kilocycles. At one frequency between these limits the I.F. amplifier of the receiver will show a very definite sharply peaked response, as indicated on the output meter. This frequency is that of the crystal filter crystal, Y-1, and I.F. alignment, as outlined below, is made at this frequency.

While making I.F. amplifier adjustments it will be necessary to retard the attenuator of the signal generator if I.F. amplifier gain increases to a point where overload occurs. Without altering the frequency setting of the signal generator set the Selectivity switch at Off, the Control switch at A.M. and turn the modulation of the signal generator On. The I.F. trimmer capacitors C-33, C-39, C-45, C-46, C-50 and C-51 should at this point each be carefully adjusted to give a maximum reading on the output meter. The order in which these adjustments are performed is not important.

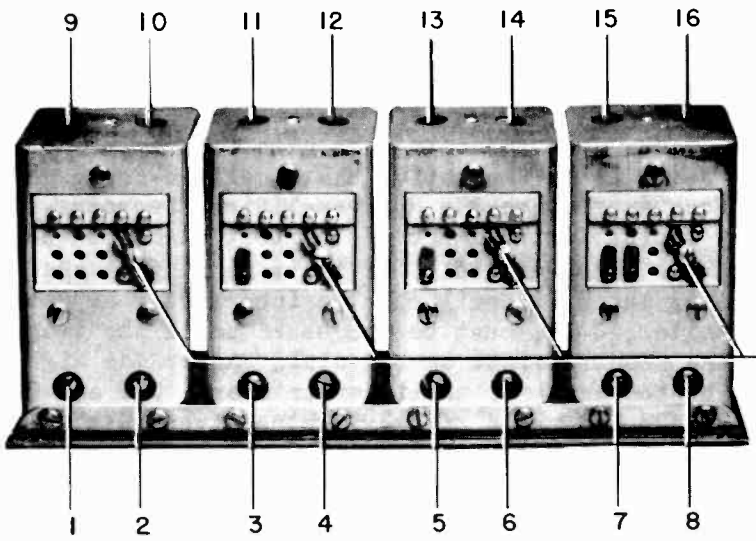
Upon completion of the above adjustments set the Selectivity switch at 1. Set the frequency of the signal generator 2 kilocycles higher and adjust the crystal filter trimmer capacitor, C-33, for a maximum output meter indication. After making this adjustment set the Selectivity control at Off and return the signal generator to the exact crystal frequency (2 kilocycles lower). Tune the Selectivity compensating trimmer capacitor, C-38, for a maximum reading on the output meter.

The Phasing control as set at the factory should need no further attention. When correctly set a predominant decrease in background level will be found with the Selectivity switch at position 5 and the Phasing control set at zero. This same null point should be found by rotating the Phasing control exactly 180 degrees. If not, a slight adjustment of the phase balancing capacitor, C-36, will provide the proper setting.

Turn the modulation of the signal generator Off and set the Control switch at C.W. Rotate the C.W.O. control to its full clockwise position. If in this position the dial control does not coincide with 5 on its scale loosen the dial knob and reset it at 5. Set the C.W.O. control to zero beat with the signal generator signal. If zero beat does not occur at 0 on the control dial carefully readjust the air trimmer capacitor, C-61, of the C.W. oscillator transformer, T-8.

4-4. GENERAL COVERAGE ALIGNMENT

The data given in this section applies to the General Coverage alignment of the H.F. oscillator and R.F. amplifier stages of all coil sets. The original alignment at the National Laboratories is accomplished by the use of precision, crystal-controlled test oscillators. No realignment should be attempted unless a reliable test signal source is available. In the case of General Coverage H.F. oscillator alignment, a test signal source with an accuracy of 1% or better is required. For Bandspread alignment the calibration accuracy demands that the test signal source have the accuracy of precision-calibrated crystals. The entire range



NOTE: INDUCTANCE ADJUSTMENTS AT POSITION NO. 16 ARE AS FOLLOWS:

1. A, B & C COIL SETS---LOOP OF WIRE INSIDE COIL FORM---BENDING THE LOOP ONE WAY OR THE OTHER ADDS OR SUBTRACTS TO THE INDUCTANCE.
2. D COIL SET---ADJUSTABLE DISC INSIDE COIL FORM---MOVING THE DISC TOWARD THE CENTER OF THE COIL DECREASES INDUCTANCE.
3. E, F, G, H & J COIL SETS---A SHORT-CIRCUITED TURN OF WIRE AROUND THE OUTSIDE OF THE COIL---MOVING THIS TURN UP OR DOWN VARIES THE INDUCTANCE.

INDUCTANCE ADJUSTMENT AT POSITION NOS. 9, 11 & 13 OF COIL SETS A, B, C, D, AA, AB & AC IS A LOOP OF WIRE INSIDE COIL FORM---BENDING THE LOOP ONE WAY OR THE OTHER VARIES THE INDUCTANCE.

Figure No. 7. Typical Coil Set Showing Alignment Adjustment Locations

of test frequencies required may be obtained by the use of nine crystals operating at their fundamental and harmonic frequencies. The frequency of these crystals is as follows: 0.05, 0.1, 1.0, 2.0, 3.5, 5.0, 6.8, 7.0, 7.3, 14.4 and 15 megacycles.

The need for realignment of the H.F. oscillator of any band is indicated when the frequency calibration of the Receiver dial is in error by more than 1% at the high frequency end of the band in question. If it is determined that realignment is necessary proceed as follows:

(1) Connect an output meter to the Receiver as described in paragraph 4-3 of this Section and disconnect the antenna.
(2) Set the Control switch at A.M.
(3) Set the A.V.C. switch at Off.
(4) Set the Selectivity switch at Off.
(5) Set the R.F. Gain control at 10.
(6) Set the Bandspread switch in the General Coverage position.
(7) Set the A.F. Gain control to provide a suitable output level.
(8) Check the position of the Ant. Trim. and Osc. trimmer controls.

Alignment should be made with both of the pointers on these controls in a vertical position with the arrow-head pointed towards the top of the Receiver.

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The following Alignment Chart gives the step-by-step procedure to follow in effecting the General Coverage alignment of each coil set. It is important that the chart of adjustments is adhered to in the order shown. It will be noted that General Coverage alignment affects Bandspread alignment, but that adjustment of Bandspread alignment does not affect General Coverage.

Particular care must be taken when adjusting the high-frequency oscillator trimmer, C-26, in each coil set. It is imperative that the high-frequency oscillator is set to operate at a frequency above the R.F. amplifier frequency and not below. This can be checked by tuning in the image of the test signal which must appear 910 kilocycles lower on the Receiver dial. If it is found that the image does not appear at this dial setting the H.F. oscillator is incorrectly adjusted and the capacity of the trimmer capacitor, C-26, must be decreased until the image and fundamental signals appear at the proper points on the dial. After the high-frequency oscillator is correctly calibrated the R.F. amplifier trimmers, C-2 and C-15, and the mixer trimmer, C-21, should be adjusted for maximum receiver gain as measured by the output meter. Coil sets A and D do not use a first R.F. amplifier trimmer but are peak-tuned by the use of the Ant. Trim. control over the full frequency range of each coil set. It may be desirable to align the R.F. Amplifier trimmers, C-2 and C-15, and the mixer trimmer, C-21, using Receiver background noise as an indication of maximum gain, rather than the signal source. If this alternate method of alignment is used the point of maximum gain is that setting of the trimmers which provides the loudest Receiver background noise. However, it is possible to align the R.F. amplifier and mixer stages to the image frequency using background noise as an indicator. A check of this possibility is to tune in the image signal -- if the image is weaker than the fundamental signal the R.F. amplifier and mixer stages are correctly aligned.

Correction of tracking errors of the R.F. amplifier and mixer stages at the low frequency limit of each coil set is accomplished by the adjustments listed on the Alignment Chart. The actual tracking of these stages may be checked by pressing the outside rotor plates of the main tuning capacitor section toward or away from the stator in a manner assuring that the rotor plates will spring back to their original position. Any change in capacity should decrease the Receiver gain if the stage is tracking properly.

The locations of the adjustments referred to on the General Coverage Chart are shown on Figure Number 7. Each variable on the chart is followed by a number in parenthesis to identify its position on the respective coil set. Schematic diagrams of each of the plug-in coil sets are furnished on Figure Numbers 11 and 12.

GENERAL COVERAGE CHART

Step	Coil Set	Adjust Signal Source and Receiver To:	Adjust to Receive Test Signal	Adjust for Maximum Output
1	A	30.0 Mc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4).
2	A	14.4 Mc.	Inductance at Pos. No. 16.	Inductance at Pos. Nos. 13, 11, 9.
3	A	30.0 Mc.		Check step 1. Repeat steps 1 and 2 if necessary.

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GENERAL COVERAGE CHART (CONT'D)

Step	Coil Set	Adjust Signal Source and Receiver To:	Adjust to Receive Test Signal	Adjust for Maximum Output
1	B	14.4 Mc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4), C-2 (Pos. 2).
2	B	7.0 Mc.	Inductance at Pos. No. 16.	Inductance at Pos. Nos. 13, 11, 9.
3	B	14.4 Mc.		Check step 1. Repeat steps 1 and 2 if necessary.
1	C	7.3 Mc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4), C-2 (Pos. 2).
2	C	3.5 Mc.	Inductance at Pos. No. 16.	Inductance at Pos. Nos. 13, 11, 9.
3	C	7.3 Mc.		Check step 1. Repeat steps 1 and 2 if necessary.
1	D	4.0 Mc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4), C-2 (Pos. 2).
2	D	1.8 Mc.	Inductance at Pos. No. 16.	Inductance at Pos. Nos. 13, 11, 9.
3	D	4.0 Mc.		Check step 1. Repeat steps 1 and 2 if necessary.
1	E	2.0 Mc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4).
2	E	1.0 Mc.	Padder capacitor C-100 (Pos. 7).	
3	E	1.4 Mc.	Inductance at Pos. No. 16.	
4	E	2.0 Mc.		Check step 1. Repeat steps 1,2 and 3 if necessary.
1	F	0.9 Mc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4), C-2 (Pos. 2).

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GENERAL COVERAGE CHART (CONT'D)

Step	Coil Set	Adjust Signal Source and Receiver To:	Adjust to Receive Test Signal	Adjust for Maximum Output
2	F	0.5 Mc.	Padder capacitor C-100 (Pos. 7).	
3	F	0.7 Mc.	Inductance at Pos. No 16.	
4	F	0.9 Mc.		Check step 1. Repeat steps 1, 2 and 3 if necessary.
1	G	400 Kc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4).
2	G	200 Kc.	Padder capacitor C-100 (Pos. 7).	
3	G	300 Kc.	Inductance at Pos. No. 16.	
4	G	400 Kc.		Check step 1. Repeat steps 1, 2 and 3 if necessary.
1	H	200 Kc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4), C-2 (Pos. 2).
2	H	100 Kc.	Padder capacitor C-100 (Pos. 7).	
3	H	150 Kc.	Inductance at Pos. No. 16.	
4	H	200 Kc.		Check step 1. Repeat steps 1, 2 and 3 if necessary.
1	J	100 Kc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4), C-2 (Pos. 2).
2	J	50 Kc.	Padder capacitor C-100 (Pos. 7).	
3	J	75 Kc.	Inductance at Pos. No. 16.	
4	J	100 Kc.		Check step 1. Repeat steps 1, 2 and 3 if necessary.
1	AA	30 Mc.	Trimmer capacitor C-26 (Pos. 7).	Trimmer capacitors C-21 (Pos. 5), C-15 (Pos. 3), C-2 (Pos. 1).

GENERAL COVERAGE CHART (CONT'D)

Step	Coil Set	Adjust Signal Source and Receiver To:	Adjust to Receive Test Signal	Adjust for Maximum Output
2	AA	27.2 Mc.	Padder capacitor C-25 (Pos. 8).	Padder capacitors C-20 (Pos. 6), C-14 (Pos. 4), C-1 (Pos. 2).
3	AA	28 Mc.	Inductance at Pos. No. 16.	Inductance at Pos. Nos. 13, 11, 9.
4	AA	30 Mc.		Check step 1. Repeat steps 1, 2 and 3 if necessary.
1	AB	35 Mc.	Trimmer capacitor C-26 (Pos. 8).	Trimmer capacitors C-21 (Pos. 6), C-15 (Pos. 4), C-2 (Pos. 2).
2	AB	25 Mc.	Padder capacitor C-100 (Pos. 7).	Padder capacitors C-99 (Pos. 5), C-98 (Pos. 3), C-97 (Pos. 1).
3	AB	30 Mc.	Inductance at Pos. No. 16.	Inductance at Pos. Nos. 13, 11, 9.
4	AB	35 Mc.		Check step 1. Repeat steps 1, 2 and 3 if necessary. Check step 1.
1	AC	21.5 Mc.	Trimmer capacitor C-26 (Pos. 7).	Trimmer capacitors C-21 (Pos. 5), C-15 (Pos. 3), C-2 (Pos. 1).
2	AC	21 Mc.	Padder capacitor C-25 (Pos. 8).	Padder capacitors C-20 (Pos. 6), C-14 (Pos. 4), C-1 (Pos. 2).
3	AC	21.3 Mc.	Inductance at Pos. No. 16.	Inductance at Pos. Nos. 13, 11, 9.
4	AC	21.5 Mc.		Check step 1. Repeat steps 1, 2 and 3 if necessary. Check step 1.

4-5. BANDSPREAD ALIGNMENT

The data given in this section applies to the Bandspread Alignment of the high-frequency oscillator, R.F. amplifier and mixer stages of coil sets A, B, C and D. It is important that no Bandspread adjustments are made until after completion of General Coverage alignment as General Coverage adjustments affect Bandspread alignment.

The need for realignment of the H.F. oscillator of any band is indicated when the frequency calibration of the main tuning dial is in error by more than ±5 divisions. To effect alignment the Receiver controls are adjusted the same as outlined in Section 4-4, except that the Bandspread switch on each of the plug-in coils must be in the right-hand or Bandspread position.

The procedure in effecting Bandspread alignment is accomplished by adhering to the instructions given in the Bandspread Alignment Chart. The procedure is similar to that for General Coverage except for the method followed in checking tracking errors of the R.F. amplifier and mixer stages at the low-frequency limit of each coil set. To secure an indication of proper tracking check the setting of the Bandspread trimmer capacitors C-3, C-16 and C-22 for the position of maximum Receiver gain. Any change in capacity should decrease the Receiver gain indicating proper tracking. The use of the trimmer capacitors C-3, C-16 and C-22 for a tracking check may destroy their proper settings therefore they must be carefully rechecked at the high-frequency limit of the coil set. The location of the adjustments referred to in this section are shown on Figure Number 7. Each variable on the chart is followed by a number in parenthesis to identify its position on the respective coil set. Schematic diagrams of each of the four combination Bandspread and General Coverage coil sets A, B, C and D are furnished on Figure Number 11.

4-6. FIRST R.F. STAGE ALIGNMENT WITH LOW IMPEDANCE TRANSMISSION LINE

If a low impedance transmission line is to be used with the Receiver, it may be necessary to realign the first R.F. amplifier at the high-frequency end of each band. The tracking of the first R.F. amplifier stage on each of the coil ranges may be checked by rotating the Ant. Trim. control. If two definite peaks in output are observed while rotating the Ant. Trim control, the first R.F. amplifier stage is tracking correctly and the setting at either peak is correct. The lack of a peak in output or the presence of only one peak indicates the stage is not tracking properly and correction should be made. The General Coverage adjustments affect the Bandspread adjustments and must therefore be performed first. The following procedures should be adhered to:

(a) GENERAL COVERAGE

(1) Set the Bandspread switch on each coil to the left-hand side or General Coverage position. Adjust the Receiver for normal operation as follows: Control switch at A.M., Selectivity switch at Off, Ant. Trim control pointer set in a vertical position with the arrow head towards the top of the Receiver, A.F. Gain control set at 10 and the R.F. Gain control set to provide a suitable signal level.

(2) Connect the antenna feeders to the Receiver antenna terminals and tune the Receiver to the signal shown in step 1 on the General Coverage Alignment Chart for the coil set to be aligned. Adjust the trimmer capacitor, C-2, for maximum signal output. Coil sets A and D do not use a first R.F. amplifier General Coverage trimmer but are peak-tuned by the Ant. Trim. control over the full frequency range of each coil set.

BANDSPREAD ALIGNMENT CHART

NOTE: Do not effect Bandspread Alignment until after completion of General Coverage.

Set	Coil Set	Adjust Signal Source and Receiver To:	Adjust to Receive Test Signal	Adjust for Maximum Output
1	A	30.0 Mc.	Trimmer capacitor C-27 (Pos. 7).	Trimmer capacitors C-22 (Pos. 5), C-16 (Pos. 3), C-3 (Pos. 1).
2	A	27.2 Mc.	Padder capacitor C-25 (Pos. 15).	Padder capacitors C-20 (Pos. 14), C-14 (Pos. 12), C-1 (Pos. 10).
3	A	30.0 Mc.		Check Step 1. Repeat Step 1 and 2 if necessary. Check Step 1.
1	B	14.4 Mc.	Trimmer capacitor C-27 (Pos. 7).	Trimmer capacitors C-22 (Pos. 5), C-16 (Pos. 3), C-3 (Pos. 1).
2	B	14.0 Mc.	Padder capacitor C-25 (Pos. 15).	Padder capacitors C-20 (Pos. 14), C-14 (Pos. 12), C-1 (Pos. 10).
3	B	14.4 Mc.		Check Step 1. Repeat Steps 1 and 2 if necessary. Check Step 1.
1	C	7.3 Mc.	Trimmer capacitor C-27 (Pos. 7).	Trimmer capacitors C-22 (Pos. 5), C-16 (Pos. 3), C-3 (Pos. 1).
2	C	7.0 Mc.	Padder capacitor C-25 (Pos. 15).	Padder capacitors C-20 (Pos. 14), C-14 (Pos. 12), C-1 (Pos. 10).
3	C	7.3 Mc.		Check Step 1. Repeat Steps 1 and 2 if necessary. Check Step 1.
1	D	4.0 Mc.	Trimmer capacitor C-27 (Pos. 7).	Trimmer capacitors C-22 (Pos. 5), C-16 (Pos. 3), C-3 (Pos. 1).
2	D	3.5 Mc.	Padder capacitor C-25 (Pos. 15).	Padder capacitor C-20 (Pos. 14), C-14 (Pos. 12), C-1 (Pos. 10).
3	D	4.0 Mc.		Check Step 1. Repeat Steps 1 and 2 if necessary. Check Step 1.

(b) BANDSPREAD

(1) With the Receiver adjusted in the same manner as for General Coverage shift the Bandspread switch on each coil terminal panel to the right-hand side or Bandspread position.

(2) Connect the Antenna feeders to the Receiver antenna terminal and tune the Receiver to the signal shown in Step 1 on the Bandspread Alignment Chart for the coil set being aligned. Adjust the Bandspread trimmer capacitor, C-3, for maximum signal output. If no signal can be received the trimmer may be adjusted for maximum background noise.

4-7. S-METER ADJUSTMENT

The S-Meter balancing resistor, R-21, is used to obtain a zero meter reading in the absence of signal input to the Receiver. To make this adjustment set the controls as follows: set the R.F. Gain control at 0, A.V.C. switch at A.V.C., Control switch at A.M. and the A.C. switch at On. Adjust the S-Meter balancing resistor, R-21, for a zero reading on the S-Meter. This is a screwdriver type adjustment located on the top of the chassis.

SECTION 5. MAINTENANCE

5-1. GENERAL MAINTENANCE DATA

Any repairs in the HRO-50 Receiver which necessitate resoldering of joints must be made with care. A good mechanical connection must be made before the solder is applied.

Failure of a vacuum tube in the receiver may reduce the sensitivity, produce intermittent operation or cause the equipment to be completely inoperative. In such cases, all tubes should be checked either in an analyzer or similar tube testing equipment or by replacement with tubes of proven quality. When any tube is tested, it should be tapped or jarred to make sure that it has no internal loose connection or intermittent short circuit.

Tubes of the same type will vary slightly in their individual characteristics and this fact should be borne in mind when replacements become necessary. The C.W. oscillator, high-frequency oscillator and I.F. tubes should be chosen with care to select a replacement which most nearly approaches the characteristic of the original tube. A replacement high frequency oscillator tube can be readily checked by noting any change in dial calibration, particularly on the amateur bandspread bands. Substitution of new I.F. amplifier tubes may possibly alter overall gain and selectivity characteristics. The necessity for realignment as well as alignment procedure is discussed in Section 4.

In case of breakdown or failure of the Receiver, the fault must first be localized. This can often be accomplished by observation of some peculiar action of one of the controls. Reference to the circuit diagram will aid in checking voltages at the various tube elements. Measurement of voltages in accordance with Section 5-4. will most likely indicate where failure has occurred.

5-2. CIRCUIT FAILURES

All component parts in the HRO-50 Receiver have been selected to assure an ample factor of safety. Failure may occur in individual cases and the most common

cause of failure, excluding tubes, will probably be due to breakdown of a capacitor or resistor.

Bypass or filter capacitors which develop poor connections internally, or which become open-circuited, will cause decreased sensitivity, oscillation or poor stability. The defective unit can be located by temporarily connecting a good capacitor in parallel with each capacitor that is under suspicion.

Failure of any bypass or filter capacitor may seriously overload resistors in associated circuits. Overload of sufficient magnitude to permanently damage a resistor will cause the surface of the resistor to be scorched, making the defective unit easy to locate by visual inspection.

Open or short-circuited resistors can be definitely located by measuring the resistance of each individual resistor. The schematic diagram should be consulted to make sure that any particular resistor under test is not connected in parallel with some other circuit element which might produce a false measurement.

Loose connections which cause intermittent or noisy operation can often be found by tapping, or shaking any component under suspicion with the Receiver adjusted for normal operation.

5-3. STAGE GAIN MEASUREMENTS

The sensitivity measurements listed herein are made with the Receiver set up as specified in Section 3-2 except that the A.F. Gain control is set at 10. Connect an output meter with an impedance to match the Receiver output circuit i.e., 8 or 500 ohms to the output terminal panel in place of the Loudspeaker. It is important that the proper output impedance match be observed.

Connect the high output lead of the signal generator through a 0.01 mf coupling capacitor to the grid cap of each tube as specified in the following table. The ground lead of the generator is connected to any convenient chassis point.

The signal generator, using modulation, is varied between 453 and 457 kilocycles until a pronounced peak reading is obtained on the output meter.

With the generator attenuated to provide a one watt reading on the output meter the signal generator attenuator should read within the limits specified in the following table:

TERMINAL	TEST SIGNAL
Mixer Grid	100 ± 25 Microvolts
First I.F. Grid	1800 ± 100 Microvolts
Second I.F. Grid	80,000 ±5000 Microvolts

5-4. VOLTAGE TABULATION

All voltage measurements should be made using a high-impedance vacuum tube voltmeter. Readings taken with any other type of instrument will differ somewhat depending upon the input resistance of the meter. Voltmeter resistance should be ten times larger than the resistance of the circuit across which the voltage is measured otherwise the voltmeter will indicate a voltage lower than the actual voltage present. The tube socket voltage tabulations contained in Figure Number 8 were taken using a vacuum tube voltmeter with an input resistance of 11 megohms. All voltages are

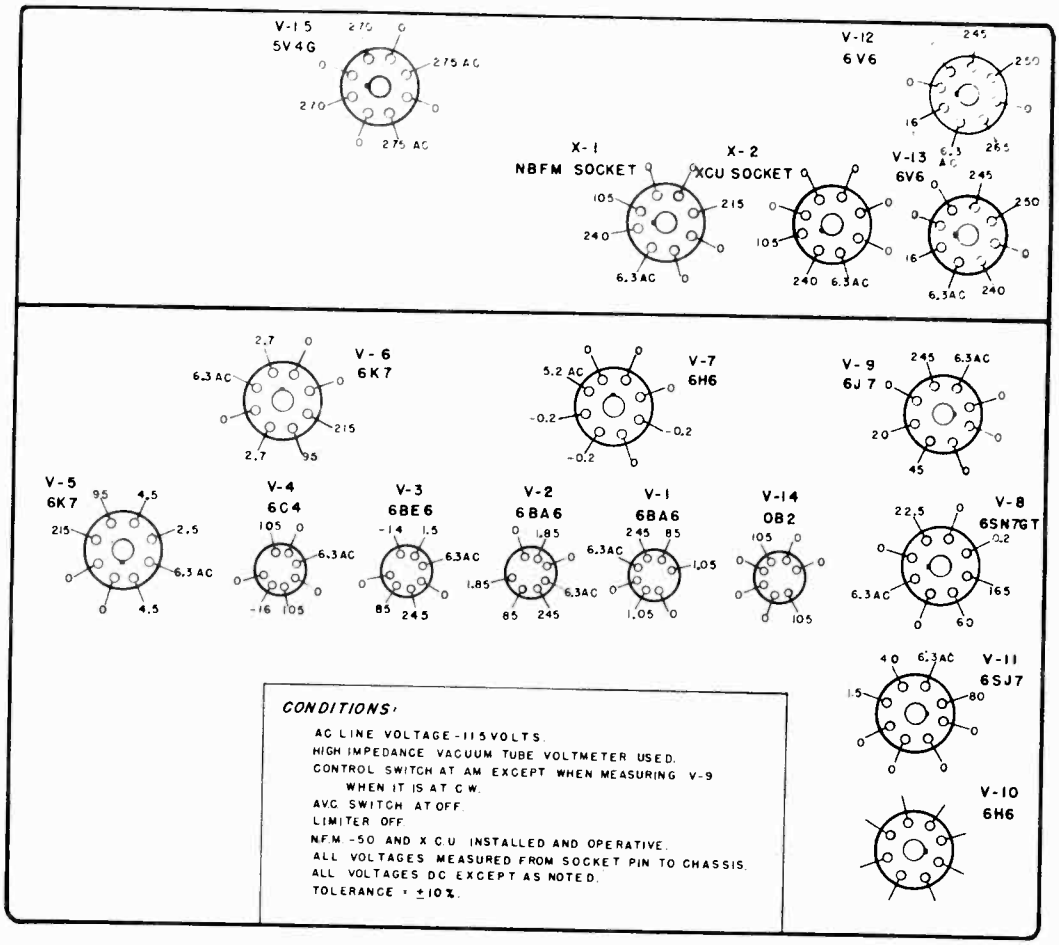


Figure No. 8. Tube Socket Voltages

measured between specified socket terminals and chassis. The control settings to be observed are shown on Figure Number 8.

5-5. MAIN TUNING DIAL

The main tuning dial should normally give no trouble. If, however, the dial should become removed from the Receiver it must NOT be operated until mounted on the capacitor shaft WITH SET-SCREWS TIGHT. This is because the dial is only designed to rotate for ten revolutions (0 to 500) and if turned farther than this the mechanism will be damaged. When mounted on the capacitor, limit stops protect the dial provided the assembly is made properly. The procedure for re-mounting the dial is as follows:

(a) Place the dial on the capacitor shaft, tighten set-screws and turn dial counter-clockwise to fully mesh capacitor rotor plates so that the tips of the rotor plates are flush with the edge of the stator plates.

(b) Loosen set-screws and rotate dial slowly until the dial reading has decreased to zero.

(c) Tighten the set-screws.

(d) Check position of rotor plates at zero. The tips of the rotor plates

must be flush with the edge of the stator plates. A slight adjustment may be necessary and this is done by loosening the set-screws, adjusting the position of the dial and tightening the set-screws again.

If it is necessary to remove the dial at any future time, turn to 250 before removing the dial and do not disturb the setting of either the dial or capacitor until reassembled. If in doubt about the correct position, inspect the springs on the back of the dial. When the dial reads 250 these springs should be straight-up-and-down, they must not be tipped to one side.

It is important that the backplate and dial do not become separated. The backplate is held in place by two springs so that its gear teeth mesh with the dial gear teeth in correct relationship for proper dial operation. If this backplate should be sprung out of place, it may return to an incorrect position and the proper dial numbers will not appear in the windows when the dial is used. To ascertain that the two parts are in correct position, proceed as follows:

(a) Locate small window near outer periphery of dial backplate and also locate dial number window on face of dial which is 180° removed from the small backplate window.

(b) Hold dial so backplate lies flat in palm of left-hand and with right hand rotate dial knob until 250 appears in previously located dial window.

(c) If dial is properly adjusted it will be noted that the pointer at the outer edge of the small window lines up with a marked tooth on the dial itself. It will be found that the dial and backplate can be moved so that the backplate pointer will mesh between teeth at points equi-distant from marked tooth in either direction.

(d) If by checking as in paragraph (c), the dial is found not properly adjusted, it will be necessary to separate the backplate from the dial far enough to bring the two gears out of mesh and then re-mesh the two parts until the proper setting is found. A number of trial settings may be required before the correct mesh is found.

5-6. SLIDE-RULE TUNING DIAL

The slide-rule tuning dial assembly has been adjusted at the factory for accurate synchronization with the micrometer dial. If not tampered with this mechanism will provide complete freedom of mechanical trouble over a long period of continuous use. It is driven by an anti-backlash tuning gear ganged with the main tuning dial. The slide-rule dial pointer is controlled by a string-drive assembly.

If replacement of the string-drive cord is required it will be necessary to remove the Receiver chassis from its cabinet or wraparound. Before removing the micrometer dial reference should be made to Paragraph 5 of this section for proper method of removal. Figure Number 9 illustrates the proper method of replacing the cord. After the cord has been replaced and before the Receiver is returned to its cabinet the micrometer dial should temporarily be replaced (See Paragraph 5-5.) and the slide-rule pointer correctly set in the following manner:

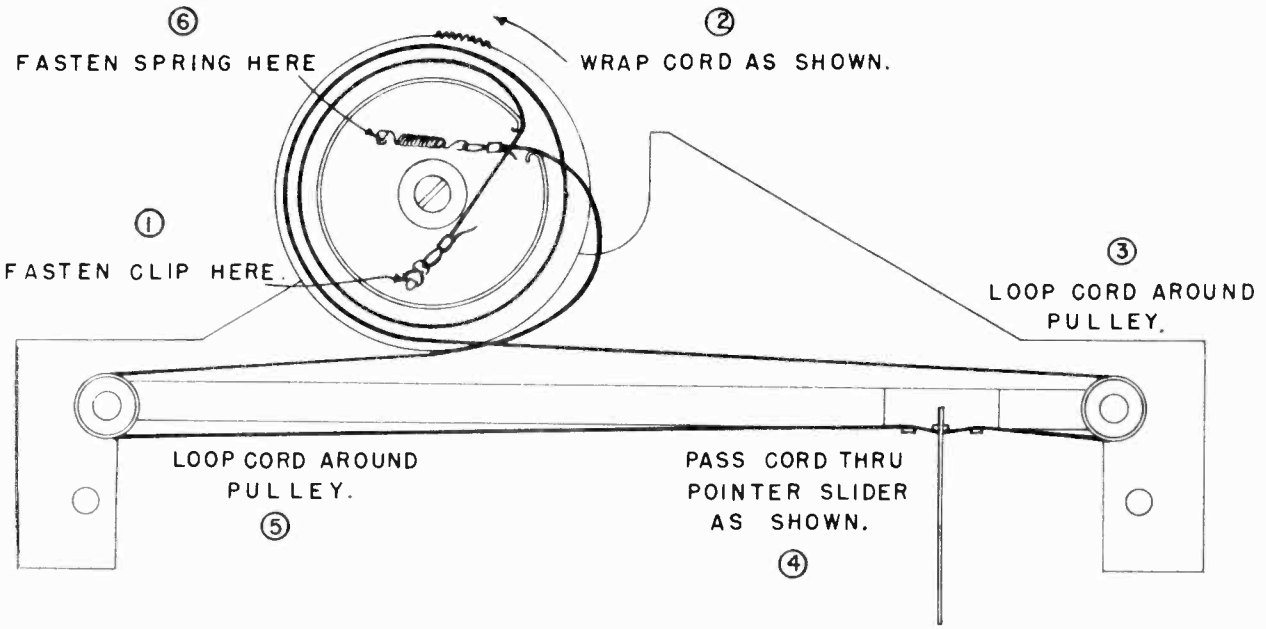
NOTE

This procedure may also be used if a check is desired to assure that the slide-rule dial pointer is properly synchronized with that of the main tuning dial.

(a) Check the main tuning dial at zero on its dial scale. The tips of the rotor plates should be flush with the edge of the stator plates.

(b) Set the Band selector control so that the D coil set scale appears.

(c) Set the main tuning dial at 490 on its dial scale. Correct setting of the slide-rule dial pointer is 4 megacycles on the dial scale. Draw the slide-rule pointer along the cord to its proper position being careful not to disturb the setting on the micrometer dial. After the correct setting has been obtained use a small amount of glyptol or household cement to fastem the dial pointer securely in place on the cord.



NOTE: *CORD SHOWN EXPOSED FOR CLARITY. CORD LENGTH 33 7/8" INCLUDING SPRING AND CLIP.*

Figure No. 9. Instructions for Dial Cord Replacement

PARTS LIST

SYMBOL	FUNCTION	DESCRIPTION	NAT. CO. TYPE
		CAPACITORS	
C-1	T-1 Bandspread Padder used on A, B, C, D, AA and AC Coil sets	Variable, air dielectric	
C-2	T-1 General Coverage Trimmer used on B, C, F, H, J, AA, AB and AC coil sets	Variable, air dielectric	
C-3	T-1 Bandspread Trimmer used on A, B, C and D coil sets	Variable, air dielectric	
C-4	Antenna Trimmer	Variable, air dielectric	
C-5	Main Tuning	Four-section ganged, air dielectric, 225 mmf. max. per section	SA:6592

PARTS LIST (CONT'D.)

SYMBOL	FUNCTION	DESCRIPTION	NAT. CO. TYPE
		CAPACITORS (CONT'D.)	
C-5A	V-1 Tuning	Part of C-5	
C-5B	V-2 Tuning	Part of C-5	
C-5C	V-3 Tuning	Part of C-5	
C-5D	V-4 Tuning	Part of C-5	
C-6	V-1 Grid Filter	Ceramic, .005 mfd., 450 vdcw	K946-1
C-7	V-1 Grid Filter	Ceramic, .005 mfd., 450 vdcw	K946-1
C-8	V-1 Grid Filter	Mica, .01 mfd., 300 vdcw	J666-56
C-9	V-1 Cathode Bypass	Paper, .1 mfd., 400 vdcw	D927-11
C-10	V-1 Screen Bypass	Ceramic, .005 mfd., 450 vdcw	K946-1
C-11	V-1 Screen Bypass	Paper, .1 mfd., 400 vdcw	D827-11
C-12	V-1 Plate Filter	Paper, .1 mfd., 600 vdcw	D827-13
C-13	V-2 Grid Return Bypass	Ceramic, .005 mfd., 450 vdcw	K946-1
C-14	T-2 Bandspread Padder used on A, B, C, D, AA and AC coil sets	Variable, air dielectric	
C-15	T-2 General Coverage Trimmer used on all coil sets	Variable, air dielectric	
C-16	T-2 Bandspread Trimmer used on A, B, C, D coil sets	Variable, air dielectric	
C-17	V-2 Cathode Bypass	Paper, .1 mfd., 400 vdcw	D827-11
C-18	V-2 Screen Bypass	Ceramic, .005 mfd., 450 vdcw	K946-1
C-19	V-2 Plate Filter	Paper, .1 mfd., 600 vdcw	D827-13
C-20	T-3 Bandspread Padder used on A, B, C, D, AA and AC coil sets	Variable, air dielectric	
C-21	T-3 General Coverage Trimmer used on all coil sets	Variable, air dielectric	
C-22	T-3 Bandspread Trimmer used on A, B, C, D coil sets	Variable, air dielectric	
C-23	V-3 Cathode Bypass	Paper, .1 mfd., 400 vdcw	D827-11
C-24	V-3 Screen Bypass	Paper, .1 mfd., 400 vdcw	D827-11
C-25	T-4 Bandspread Padder used on A, B, C, D, AA and AC coil sets	Variable, air dielectric	
C-26	T-4 General Coverage Trimmer used on all coil sets	Variable, air dielectric	
C-27	T-4 Bandspread Trimmer used on A, B, C, D coil sets	Variable, air dielectric	
C-28	T-4 General Coverage Padder		
	A coil set	Mica, .0012 mfd., 300 vdcw	J666-63
	B coil set	Mica, .0026 mfd., 500 vdcw	J666-61
	C coil set	Mica, .0016 mfd., 500 vdcw	J666-21
	D coil set	Mica, .0009 mfd., 500 vdcw	J666-62
	E coil set	Mica, 470 mmf., 500 vdcw	H500-18
	F coil set	Ceramic, 350 mmf., 500 vdcw	D825C-331
	G coil set	Ceramic, 100 mmf., 500 vdcw	D825C-304
	J coil set	Ceramic, 50 mmf., 500 vdcw	D825D-417
	AB coil set	Ceramic, 100 mmf., 500 vdcw	D825C-304
C-29	Calibration Adjustment Trimmer	Variable, air dielectric	
C-30	V-4 Grid	Ceramic, 100 mmf., 500 vdcw	D825D-421
C-31	V-4 Plate	Paper, .1 mfd., 400 vdcw	D827-11
C-32	V-4 to V-3 coupling	Mica, .01 mfd., 300 vdcw	J666-56

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PARTS LIST (CONT'D.)

SYMBOL	FUNCTION	DESCRIPTION	NAT. CO. TYPE
		CAPACITORS (CONT'D.)	
C-33	T-5 Primary Trimmer	Variable, air dielectric	
C-34	Bridge Balancing	Ceramic, 62 mmf., 500 vdcw	J695-3
C-35	Bridge Balancing	Ceramic, 47 mmf., 500 vdcw	J695-1
C-36	Phase Balance Adjustment	Mica, variable, 3.5 to 35 mmf.	D832-2
C-37	Phasing	Variable, air dielectric	SA:3655
C-38	Selectivity Compensator	Mica, variable, 3.5 to 35 mmf.	D832-2
C-39	T-5 output adjustment	Variable, air dielectric, 100 mmf.	SA:1841
C-40	Selectivity Adjusting	Ceramic, 5 mmf., 500 vdcw	D825D-401
C-41	Selectivity Adjusting	Ceramic, 10 mmf., 500 vdcw	D825D-426
C-42	Selectivity Adjusting	Ceramic, 10 mmf., 500 vdcw	D825D-426
C-43	V-5 A.V.C. Filter	Paper, .01 mfd., 600 vdcw	D827-7
C-44	V-5 Cathode Bypass	Paper, .1 mfd., 400 vdcw	D827-11
C-45	T-6 Primary Trimmer	Variable, air dielectric	
C-46	T-6 Secondary Trimmer	Variable, air dielectric	
C-47	V-6 A.V.C. Filter	Paper, .01 mfd., 600 vdcw	D827-7
C-48	Fixed, calibration padder	Ceramic, 10 mmf., 500 vdcw	D825D-437
C-49	V-6 Screen Bypass	Paper, .1 mfd., 400 vdcw	D827-11
C-50	T-7 Primary Trimmer	Variable, air dielectric	
C-51	T-7 Secondary Trimmer	Variable, air dielectric	
C-52	V-6 Plate Filter	Paper, .25 mfd., 600 vdcw	D827-19
C-53	V-7 Load	Ceramic, 270 mmf., 500 vdcw	J633-2
C-54	T-7 to V-7 Coupling	Ceramic, 100 mmf., 500 vdcw	D825D-421
C-55	A.V.C. Filter	Paper, .01 mfd., 600 vdcw	D825-7
C-56	V-9 to V-7 Coupling	Ceramic, 3 mmf., 500 vdcw	J695-4
C-57	V-9 Screen Bypass	Mica, .01 mfd., 300 vdcw	J666-56
C-58	C.W. Osc. Tuning	Variable, air dielectric	SA:6580
C-59	T-8 Grid	Mica, .001 mfd., 500 vdcw	J666-14
C-60	T-8 Fixed Tuning	Ceramic, 100 mmf., 500 vdcw	D825C-304
C-61	T-8 Tuning Adjusting	Variable, air dielectric	
C-62	D.C. Blocking	Paper, .01 mfd., 600 vdcw	D827-7
C-63	A.C. Line Bypass	Mica, .01 mfd., 300 vdcw	J666-56
C-64	A.C. Line Bypass	Mica, .01 mfd., 300 vdcw	J666-56
C-65	Power Supply Filter	Electrolytic, 40+40 mfd., 475 vdcw	K945-3
C-65A	Power Supply Input Filter	Part of C-65	
C-65B	Power Supply Output Filter	Part of C-65	
C-66	V-7 to V-10 Coupling	Paper, .01 mfd., 600 vdcw	D827-7
C-67	V-10 Threshold Filter	Paper, .1 mfd., 400 vdcw	D827-11
C-68	V-10 Plate Filter	Paper, .1 mfd., 400 vdcw	D827-11
C-69	V-10 to X-3 Coupling	Paper, .01 mfd., 600 vdcw	D827-7
C-70	Tone Compensator	Electrolytic, 25 mfd., 50 vdcw	E338-4
C-71	V-11 Cathode Bypass	Paper, .5 mfd., 100 vdcw	D827-49
C-72	V-11 Screen Bypass	Paper, .1 mfd., 400 vdcw	D827-11
C-73	V-11 Plate Filter	Paper, .1 mfd., 400 vdcw	D827-11
C-74	Tone	Paper, .01 mfd., 600 vdcw	D827-7
C-75	V-8B to V-11 Coupling	Paper, .01 mfd., 600 vdcw	D827-7
C-76	V-8B Grid Bypass	Ceramic, 100 mmf., 500 vdcw	D825D-421
C-77	V-8B to V-12 Coupling	Paper, .01 mfd., 600 vdcw	D827-7
C-78	V-8B to V-13 Coupling	Paper, .01 mfd., 600 vdcw	D827-7
C-79	V-12 and V-13 Cathode Bypass	Electrolytic, 25 mfd., 50 vdcw	E338-4
C-80	Tone Compensator	Mica, .0024 mfd., 1000 vdcw	J667-68
C-81	Temperature Drift Compensator	Ceramic, 5 mmf., 500 vdcw	H872-3
C-82	T-1 Fixed Bandspread Padder:	Ceramic, fixed,	
	A coil set	12 mmf., 500 vdcw	D825D-404
	B coil set	5 mmf., 500 vdcw	D825D-401

PARTS LIST (CONT'D.)

SYMBOL	FUNCTION	DESCRIPTION	NAT. CO. TYPE
		CAPACITORS (CONT'D.)	
	C coil set	12 mmf., 500 vdcw	D825D-404
	D coil set	25.7 mmf., 500 vdcw	D825D-412
C-83	T-2 Fixed Bandspread Padder	Ceramic, fixed	
	A coil set	21 mmf., 500 vdcw	D825D-410
	B coil set	5 mmf., 500 vdcw	D825D-401
	C coil set	12 mmf., 500 vdcw	D825D-404
	D coil set	25.7 mmf., 500 vdcw	D825D-412
C-84	T-3 Fixed Bandspread Padder	Ceramic, fixed	
	A coil set	21 mmf., 500 vdcw	D825D-410
	B coil set	5 mmf., 500 vdcw	D825D-401
	C coil set	12 mmf., 500 vdcw	D825D-404
	D coil set	25.7 mmf., 500 vdcw	D825D-412
C-85	T-4 Bandspread Padder used on A coil set	Ceramic, 10 mmf., 500 vdcw	D825D-402
C-86	T-4 Fixed Divider used on D coil set	Ceramic, 21 mmf., 500 vdcw	D825D-410
C-87	T-4 Fixed General Coverage Trimmer	Ceramic, fixed	
	B coil set	10 mmf., 500 vdcw	D825D-437
	AA coil set	68 mmf., 500 vdcw	D825D-439
	AB coil set	68 mmf., 500 vdcw	D825D-439
	AC coil set	68 mmf., 500 vdcw	D825D-439
C-88	T-1 Fixed General Coverage Padder		
	A coil set	Mica, 1200 mmf., 500 vdcw	J666-16
	AB coil set	Ceramic, 120 mmf., 500 vdcw	D825C-305
C-89	T-4 Fixed Temperature Compensator used on B coil set	Ceramic, 10 mmf., 500 vdcw	D825D-437
C-90	T-2 Primary Trimmer used on H coil set	Ceramic, 21 mmf., 500 vdcw	D825D-410
C-91	T-1 General Coverage Trimmer	Ceramic, fixed,	
	AA coil set	5 mmf., 500 vdcw	D825D-401
	AB coil set	10 mmf., 500 vdcw	D825D-402
	AC coil set	50 mmf., 500 vdcw	D825D-417
C-92	T-2 coupling used on AB coil set	Mica, 470 mmf., 500 vdcw	J665-56
C-93	T-2 General Coverage Padder used on AB coil set	Ceramic, 100 mmf., 500 vdcw	D825C-304
C-94	T-3 Coupling used on AB coil set	Mica, 470 mmf., 500 vdcw	J665-56
C-95	T-3 General Coverage Trimmer	Ceramic, fixed,	
	AB coil set	5 mmf., 500 vdcw	D825D-401
	AC coil set	68 mmf., 500 vdcw	D825D-439
C-96	V-2 Cathode Bypass	Ceramic, .005 mfd., 450 vdcw	K946-1
C-97	T-1 General Coverage Padder used on AB coil set	Variable, air dielectric	
C-98	T-2 General Coverage Padder used on AB coil set	Variable, air dielectric	
C-99	T-3 General Coverage Padder used on AB coil set	Variable, air dielectric	
C-100	T-4 General Coverage Padder used on E, F, G, H, J and AB coil sets	Variable, air dielectric	

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C-101	T-3 General Coverage Padder used on AB coil set	Ceramic, 100 mmf., 500 vdcw	D825C-304
C-102	T-2 General Coverage Trimmer on AC coil set	Ceramic, 68 mmf., 500 vdcw	D825D-439
C-103	I.F. coupling to X-1	Ceramic, 10 mmf., 500 vdcw	D825D-402

RESISTORS

R-1	V-1 Grid Filter	Fixed, 470,000 ohms, 1/2 W.	J569-57
R-2	V-1 Cathode	Fixed, 100 ohms, 1/2 W.	J569-13
R-3	V-1 and V-2 Screen	Fixed, 2,200 ohms, 1/2 W.	J569-29
R-4	V-2 Grid Filter	Fixed, 470,000 ohms, I/2 W.	J569-57
R-5	V-2 Cathode	Fixed, 560 ohms, I/2 W.	J569-22
R-6	RF Gain Control	Variable, W.W., 10,000 ohms	K349-3
R-7	V-3 Injector Grid	Fixed, 22,000 ohms, 1/2 W.	J569-41
R-8	V-3 Cathode	Fixed, 220 ohms, 1/2 W.	J569-17
R-9	V-3 Screen	Fixed, 33,000 ohms, 1 W.	J571-43
R-10	V-4 Grid	Fixed, 22,000 ohms, 1/2 W.	J569-41
R-11	V-4 Plate	Fixed, 22 ohms, 1/2 W.	J569-5
R-12	V-5 Grid Filter	Fixed, 470,000 ohms, 1/2 W.	J569-57
R-13	V-1, V-2, V-4, V-5 Screen Bleeder	Fixed, 27,000 ohms, 2 W.	J572-42
R-14	V-5 Cathode	Fixed, 220 ohms, 1/2 W.	J569-17
R-15	V-5 Cathode	Fixed, 330/1000 ohms, 1/2 W.	
R-16	V-1, V-2, V-4, V-5 Screen Dropping	Fixed, 15,000 ohms, 2 W.	J572-39
R-17	V-5 Plate Filter	Fixed, 2,200 ohms, 1/2 W.	J569-29
R-18	V-6 Grid Filter	Fixed, 470,000 ohms, 1/2 W.	J569-57
R-19	V-6 Cathode	Fixed, 330 ohms, 1/2 W.	J569-19
R-20	V-8A Plate Load	Fixed, 47,000 ohms, 1/2 W.	J569-45
R-21	"S" Meter Zero Adjustment	Variable, W.W., 1000 ohms 1 W.	D831-2
R-22	V-7 Plate Load	Fixed, 1.5 meg., 1/2 W.	J569-63
R-23	AVC Filter	Fixed, 1.5 meg., 1/2 W.	J569-63
R-24	V-9 Plate	Fixed, 220,000 ohms, 1/2 W.	J569-53
R-25	V-9 Screen Filter	Fixed, 100,000 ohms, 1/2 W.	J569-49
R-26	V-9 Screen Bleeder	Fixed, 100,000 ohms, 1/2 W.	J569-49
R-27	V-9 Grid	Fixed, 47,000 ohms, 1/2 W.	J569-45
R-28	Dimmer	Variable, W.W., 25 ohms	K915-13
R-29	V-7 Filament Dropping	Fixed, 4.3 ohms, 1 W.	K098-34
R-30	V-10 Filament Dropping	Fixed, 4.3 ohms, 1 W.	K098-34
R-31	V-14 Dropping	Fixed, 5,000 ohms, 10 W.	E959-10
R-32	V-7 Load	Fixed, 22,000 ohms, 1/2 W.	J569-41
R-33	V-7 Load	Fixed, 470,000 ohms, 1/2 W.	J569-57
R-34	V-10 Plate	Fixed, 220,000 ohms, 1/2 W.	J569-53
R-35	V-10 Cathode	Fixed, 220,000 ohms, 1/2 W.	J569-53
R-36	Limiter Threshold Control	Variable, 500,000 ohms	J681-2
R-37	Limiter Threshold Filter	Fixed, 220,000 ohms, 1/2 W.	J569-53
R-38	Limiter Plate Filter	Fixed, 820,000 ohms, 1/2 W.	J569-60
R-39	V-10 Plate Load	Fixed, 470,000 ohms, 1/2 W.	J569-57
R-40	Audio Gain Control	Variable, 500,000 ohms	K347-1
R-41	Limiter Output Divider	Fixed, 220,000 ohms, 1/2 W.	J569-53
R-42	V-11 Cathode	Fixed, 2200 ohms, 1/2 W.	J569-29
R-43	V-11 Cathode Divider	Fixed, 150 ohms, 1/2 W.	J569-15
R-44	Degeneration Feedback	Fixed, 6800 ohms, 1/2 W.	J569-35
R-45	V-11 Audio Screen	Fixed, 100,000 ohms, 1/2 W.	J569-49
R-46	V-11 Plate Load	Fixed, 100,000 ohms, 1/2 W.	J569-49

PARTS LIST (CONT'D.)

SYMBOL	FUNCTION	DESCRIPTION	NAT. CO. TYPE
		RESISTORS (CONT'D.)	
R-47	V-11 Plate Filter	Fixed, 47,000 ohms, 1/2 W.	J569-45
R-48	Tone	Variable, 500,000 ohms	K347-1
R-49	V-8B Grid	Fixed, 220,000 ohms, 1/2 W.	J569-53
R-50	V-8B Cathode Bias	Fixed, 4,700 ohms, 1/2 W.	J569-33
R-51	V-8B Cathode Load	Fixed, 47,000 ohms, 1/2 W.	J569-45
R-52	V-8B Plate Load	Fixed, 47,000 ohms, 1/2 W.	J569-45
R-53	V-13 Grid	Fixed, 220,000 ohms, 1/2 W.	J569-53
R-54	V-12 Grid	Fixed, 220,000 ohms, 1/2 W.	J569-53
R-55	V-12 and V-13 Cathode Bias	Fixed, 220 ohms, 2 W.	J572-17
R-56	Output Load	Fixed, 470 ohms, 2 W.	J572-21
R-57	T-1 Ant. Load A Coil Set Only	Fixed, 22 ohms, 1/2 W.	J569-5
		MISCELLANEOUS	
E-1	Antenna Input Terminal	Screw-Type, three terminals	E261-3
E-2	B+ Switch Terminal	Screw-Type, two terminals	E265-19
E-3	Audio Output Terminal	Screw-Type, three terminals	E259-2
F-1	Fuse 3AG	2 Amps. at 250 V.	F135-4
I-1	Dial Lamp	#47	F136-6
I-2	Dial Lamp	#47	F136-6
I-3	"S" Meter Lamp	#47	F136-6
J-1	Phono Jack	Single-Circuit	J993-1
J-2	Phone Jack	Multi-Circuit	F316-1
L-1	Filter Choke	17 Henries	SA:1694
M-1	"S" Meter	0-1 ma.	J984-5
P-1	Select-O-Ject Plug	Octal	SA:6569
P-2	A.C. Jumper Plug	Octal	SA:3731
S-1	T-1 B.S. - G.C. Switch	Two-position	SA:6749
S-2	T-2 B.S. - G.C. Switch	Two-position	SA:6749
S-3	T-3 B.S. - G.C. Switch	Two-position	SA:6749
S-4	T-4 B.S. - G.C. Switch	Two-position	SA:6749
S-5	Selectivity switch	Six-position, double-pole	E195-3
S-6	A.V.C. ON-OFF switch	SPST, toggle	E230-2
S-7	Control switch	Double-wafer, four-position	SA:6564
S-8	Calibrator switch	DPDT, toggle, center position open	F738-1
S-9	A.C. Line switch	Part of R-40	
S-10	T-10 Primary Selector switch	DPDT, toggle	H340-4
S-11	B+ switch	SPST Bat Handle	E230-2
T-1	First R.F. Amplifier transformer		
	A Band	14.0 - 30 Mc.	SA:6654
	B Band	7.0 - 14.4 Mc.	SA:6755
	C Band	3.5 - 7.3 Mc.	SA:6759
	D Band	1.7 - 4.0 Mc.	SA:6635
	E Band	900 - 2050 Kc.	SA:6513
	F Band	480 - 960 Kc.	SA:6660
	G Band	180 - 430 Kc.	SA:6665
	H Band	100 - 200 Kc.	SA:6803
	J Band	50 - 100 Kc.	SA:6808
	AA Band	27 - 30 Mc.	SA:6814
	AB Band	25 - 35 Mc.	SA:6675
	AC Band	21 - 21.5 Mc.	SA:8073

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PARTS LIST (CONT'D.)

SYMBOL	FUNCTION	DESCRIPTION	NAT. CO. TYPE
		MISCELLANEOUS (CONT'D.)	
T-2	Second R.F. Amplifier Transformer		
	A Band	14.0 - 30 Mc.	SA:6751
	B Band	7.0 - 14.4 Mc.	SA:6650
	C Band	3.5 - 7.3 Mc.	SA:6641
	D Band	1.7 - 4.0 Mc.	SA:6637
	E Band	900 - 2050 Kc.	SA:6540
	F Band	480 - 960 Kc.	SA:6662
	G Band	180 - 430 Kc.	SA:6667
	H Band	100 - 200 Kc.	SA:6669
	J Band	50 - 100 Kc.	SA:6809
	AA Band	27 - 30 Mc.	SA:6673
	AB Band	25 - 35 Mc.	SA:6818
	AC Band	21 - 21.5 Mc.	SA:8074
T-3	Mixer Transformer		
	A Band	14.0 -- 30 Mc.	SA:6752
	B Band	7.0 - 14.4 Mc.	SA:6756
	C Band	3.5 - 7.3 Mc.	SA:6642
	D Band	1.7 - 4.0 Mc.	SA:6638
	E Band	900 - 2050 Kc.	SA:6789
	F Band	480 - 960 Kc.	SA:6794
	G Band	180 - 430 Kc.	SA:6800
	H Band	100 - 200 Kc.	SA:6804
	J Band	50 - 100 Kc.	SA:6810
	AA Band	27 - 30 Mc.	SA:6815
	AB Band	25 - 35 Mc.	SA:6676
	AC Band	21 - 21.5 Mc.	SA:8075
T-4	H.F. oscillator transformer		
	A Band	14.0 - 30 Mc.	SA:6656
	B Band	7.0 - 14.4 Mc.	SA:6678
	C Band	3.5 - 7.3 Mc.	SA:6760
	D Band	1.7 - 4.0 Mc.	SA:6776
	E Band	900 - 2050 Kc.	SA:6631
	F Band	480 - 960 Kc.	SA:6795
	G Band	180 - 430 Kc.	SA:6785
	H Band	100 - 200 Kc.	SA:6805
	J Band	50 - 100 Kc.	SA:6811
	AA Band	27 - 30 Mc.	SA:6816
	AB Band	25 - 35 Mc.	SA:6819
	AC Band	21 - 21.5 Mc.	SA:8076
T-5	Crystal Filter	455 Kc.	SA:3654
T-6	2nd. I.F. Amp. transformer	455 Kc.	SA:2492
T-7	Detector Input transformer	455 Kc.	SA:41G
T-8	C.W. Osc. transformer	455 Kc.	SA:3361
T-9	Audio Output transformer	Pri. 10,000 ohms/Sec. 8/600 ohms, 10 watts	P187-1
T-10	Power transformer	115/230 volt primary	P188-1
V-1	First R.F. Amplifier	6BA6	
V-2	Second R.F. Amplifier	6BA6	
V-3	Mixer	6BE6	
V-4	H.F. Oscillator	6C4	
V-5	First I.F. Amplifier	6K7	
V-6	Second I.F. Amplifier	6K7	

V-7	Second Detector and A.V.C.	6H6	
V-8A	"S" Meter Amplifier	1/2 6SN7GT	
V-8B	Phase Inverter	1/2 6SN7GT	
V-9	C.W. Oscillator	6J7	
V-10	Noise Limiter	6H6	
V-11	Audio Amplifier	6SJ7	
V-12	Audio Output	6V6GT	
V-13	Audio Output	6V6GT	
V-14	Voltage Regulator	OB2	
V-15	Rectifier	5V4G	
X-1	Accessory Connector Socket	Octal	J665-2
X-2	Crystal Calibrator Socket	Octal	J665-2
X-3	Select-O-Ject Socket	Octal	J665-2
Y-1	Crystal Resonator	Quartz, 455 Kc.	E979-1

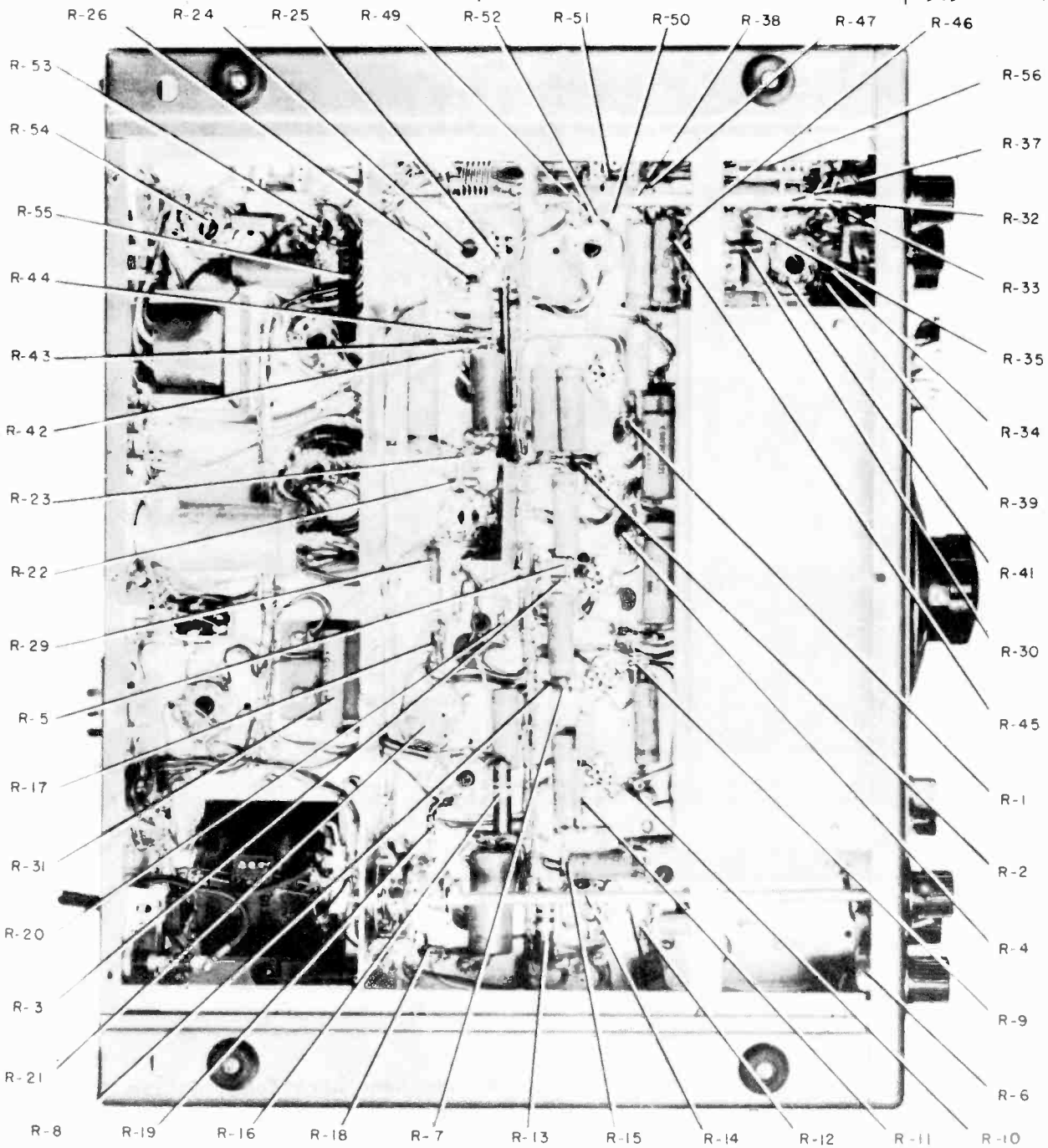

Figure No. 10A. Resistor Locations, Bottom View of Receiver

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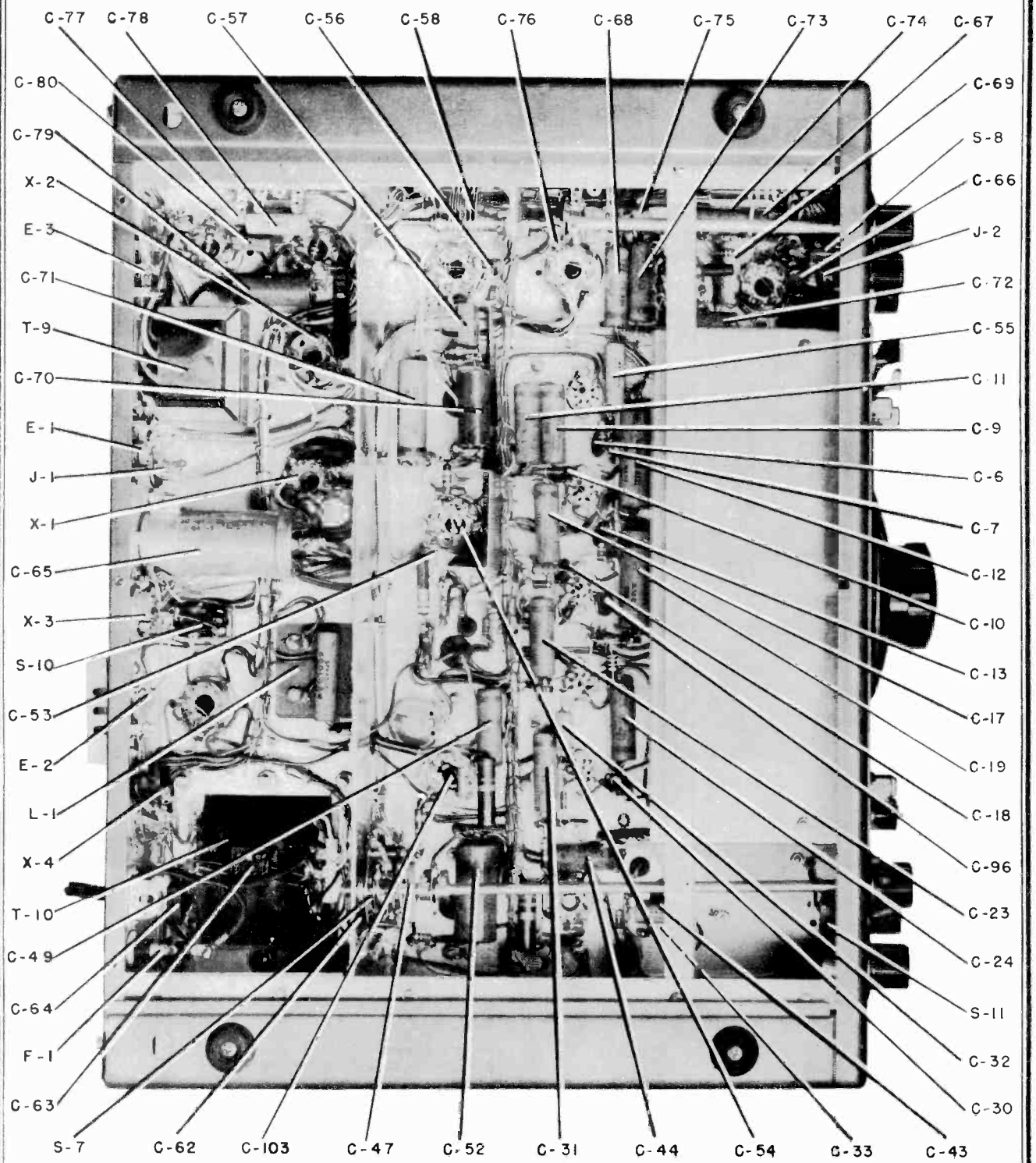

Figure No. 10B. Capacitor and Miscellaneous Component Locations, Bottom View of Receiver

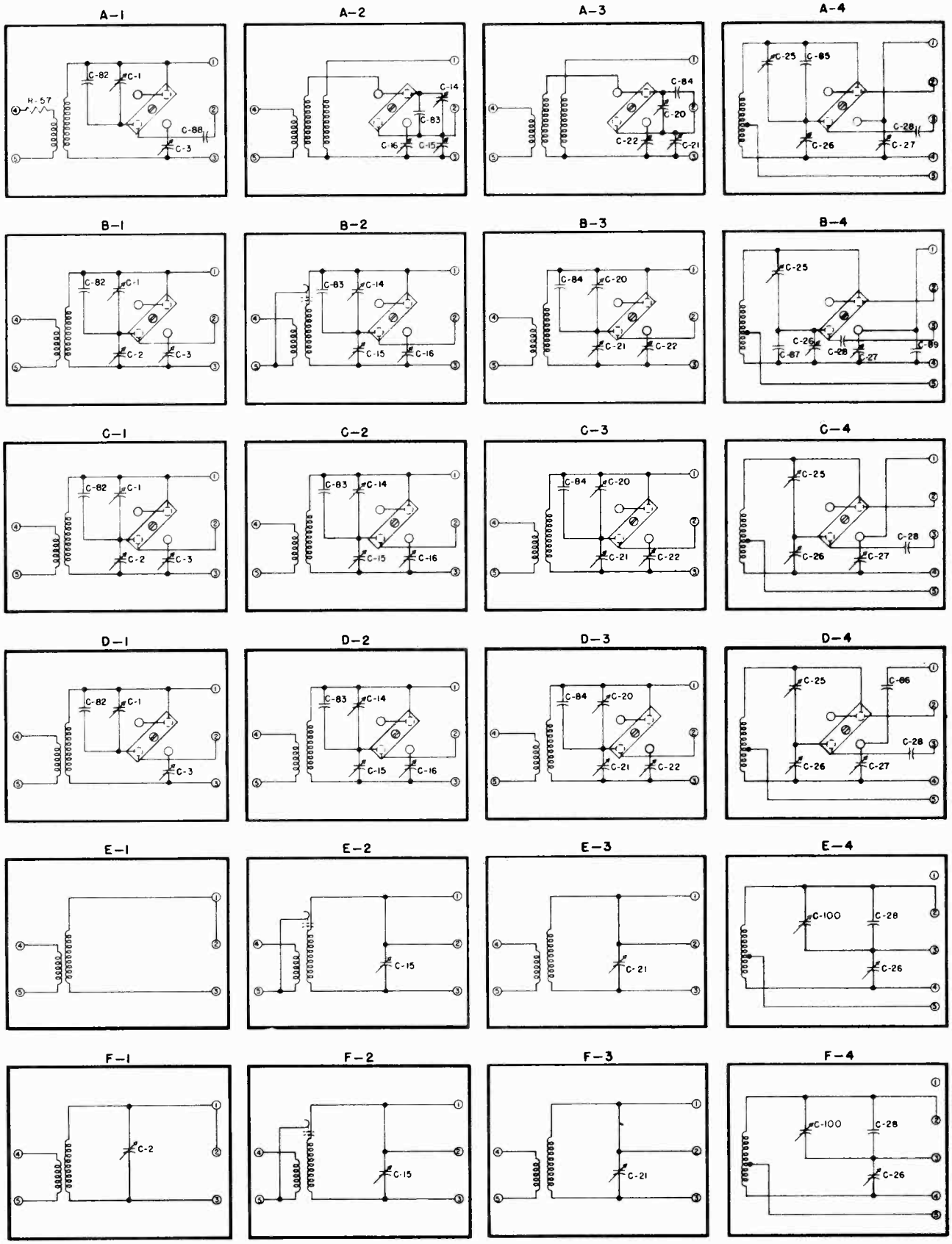

Figure No. 11. Schematic Diagrams, Coil Sets A, B, C, D, E and F

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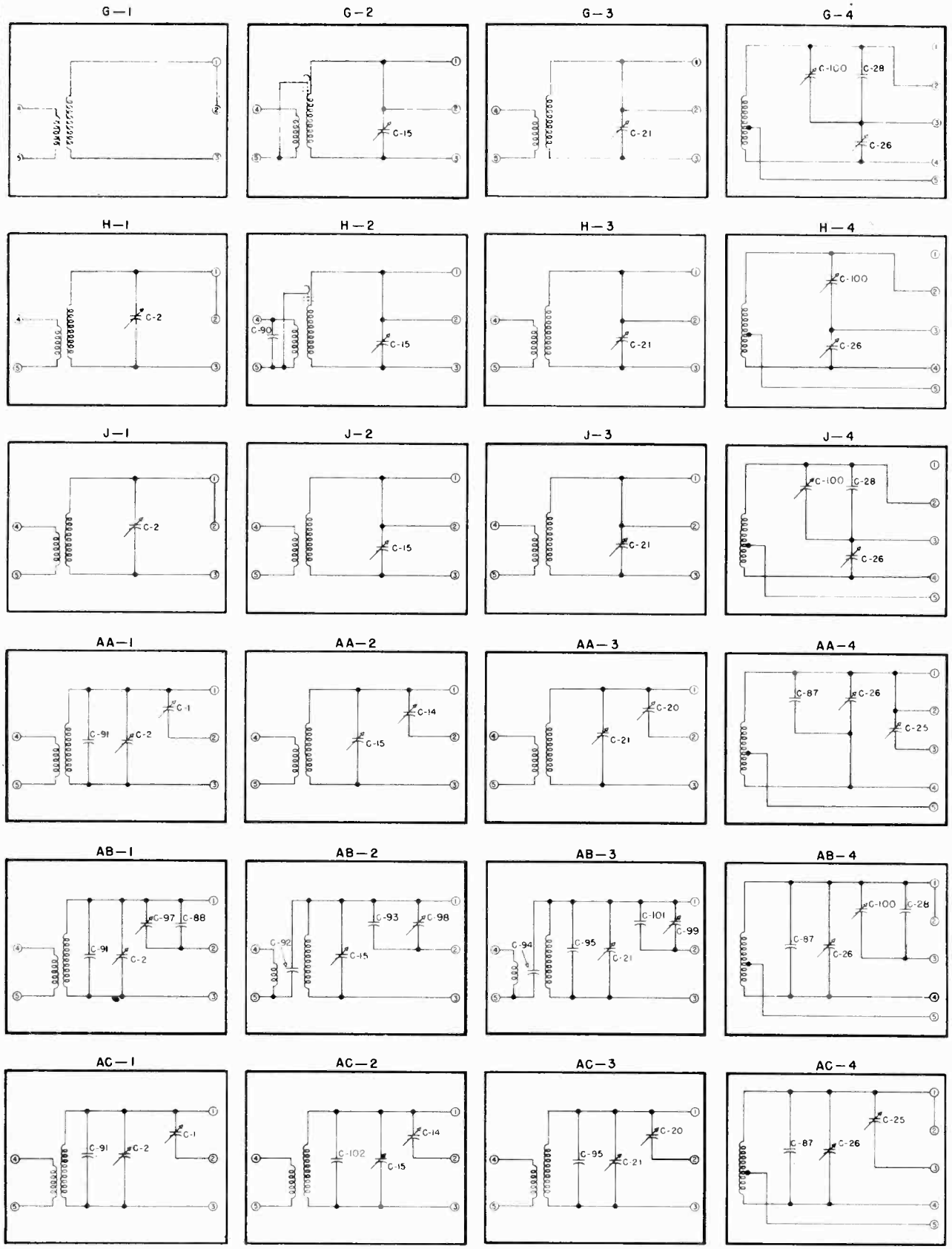

Figure No. 12. Schematic Diagrams, Coil Sets AA, AB, AC, G, H and J

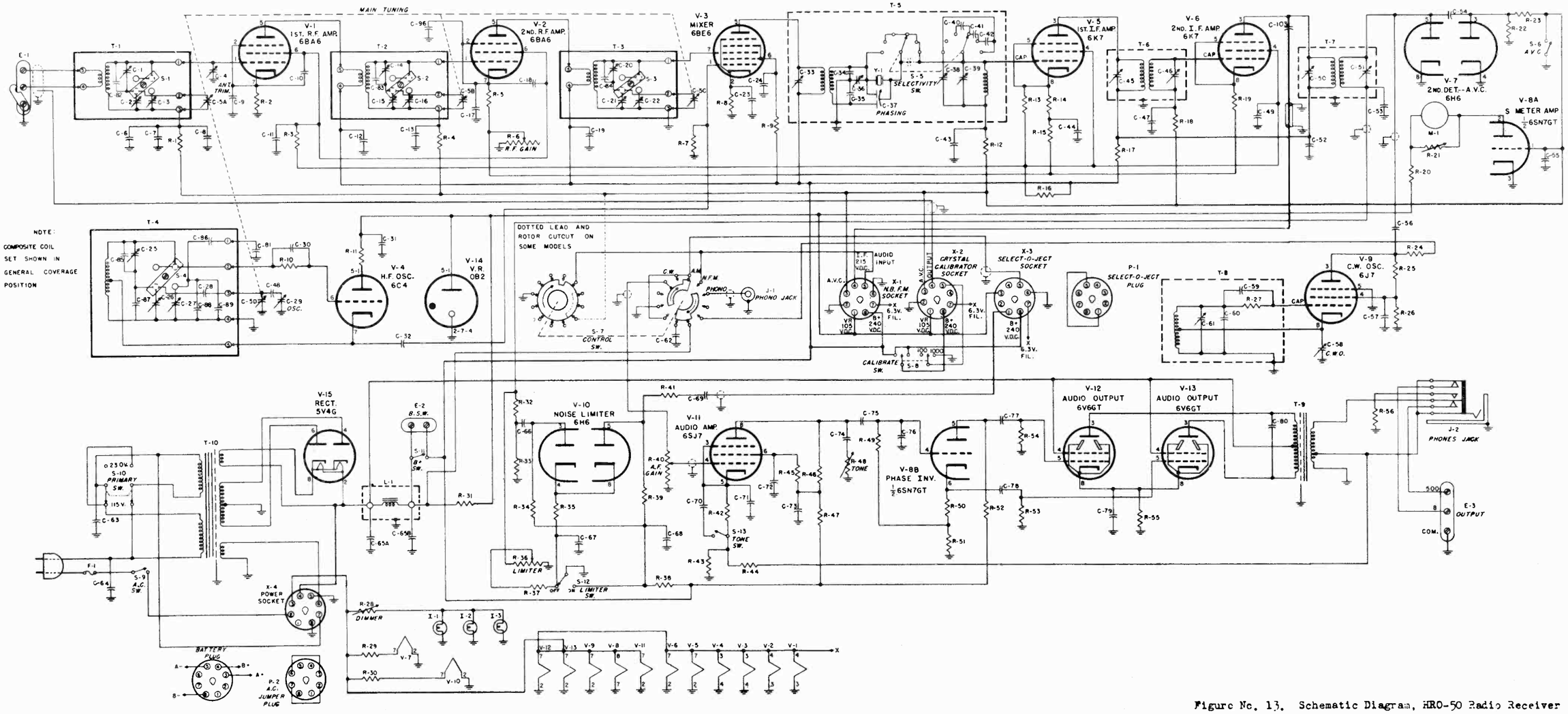

Figure No. 13. Schematic Diagram, HRO-50 Radio Receiver

GENERAL

The type XCU Crystal Calibrator Unit is designed expressly for use within the HRO-50 Receiver. It utilizes an electron-coupled oscillator circuit controlled by a dual-dimension crystal (Bliley type SMC-100). This type of crystal provides two crystal-controlled marker frequencies of 100 kilocycles and 1 megacycle. When plugged into the Crystal Calibrator Socket, X-2, the XCU output is loosely coupled to the first R.F. amplifier input circuit. Selection of either the 100 kilocycle or 1000 kilocycle crystal-controlled signal is made possible by the front-panel mounted Calibrate switch on the Receiver.

INSTALLATION

The XCU calibrator is installed in the HRO-50 Receiver by plugging the unit into the Crystal Calibrator Socket, X-2, on top of the chassis. A slotted-head screw mounted through the top of the unit is provided to bolt the unit to the chassis.

A trimmer capacitor, C-1, is connected across the crystal to permit adjustment of the frequency of the 100 kilocycle output marker when the unit is operated at locations where the temperature is vastly removed from that of normal room temperature. This capacitor should never require adjustment unless such abnormal temperatures are experienced. To make the adjustment proceed as follows:

(1) Plug in a coil set suitable for the reception of WWV on one of the various frequencies utilized by this standard frequency station.
(2) Adjust the Receiver for normal C.W. operation as explained in Section 3-3.
(3) Set the front-panel mounted Calibrate switch at the 100 kilocycle position.
(4) Tune in the signal from WWV.
(5) Adjust the trimmer capacitor, C-1, located at the top of the calibrator unit so that the 100 kilocycle marker signal harmonic is zero beat with the signal received from WWV.

OPERATION

The XCU Crystal Calibrator provides a means of checking the accuracy of the frequency calibration of the Receiver. The front-panel mounted Calibrate switch marked 100-Off-1000 connects B-plus to the Calibrator for instantaneous service. At the same time this switch selects either the 100 or 1000 kilocycle marker signal. To check calibration accuracy tune in the desired marker signal with the Control switch set at C.W. and zero beat the Receiver with the harmonic marker. If the micrometer dial and the slide-rule dial do not read accurately correction should be made by adjusting the front-panel mounted Osc. trimmer control. Only a slight adjustment of the Osc. trimmer control should be necessary. If calibration is way off the plug-in coil set probably requires realignment and reference should be made to Section 4.

PARTS LIST

SYMBOL	FUNCTION	DESCRIPTION	NAT. CO. TYPE
C-1	100 Kc. Tuning	Ceramic, variable, 6 - 20 mmf.	E311-2
C-2	B+ Filter	Paper, .1 mfd. +30%-10% 400 vdcw	D827-11
C-3	Cathode by-pass	Paper, .1 mfd. +30%-10% 400 vdcw	D827-11
C-4	Output Coupling	Ceramic, 10 mmf. ±.5 mmf. 500 vdcw	H872-1
L-1	100 Kc. inductor	5 mh. type R-100	SA:4373
L-2	1000 Kc. inductor	.5 mh. type R-50	SA:2514
P-1	Plug	Octal	K783-1
R-1	Grid	Fixed, 4.7 megohms, 1/2 W.	J569-69

R-2	Cathode	Fixed, 150 ohms, 1/2 W.	J569-15
R-3	Screen dropping	Fixed, 2200 ohms, 1 W.	J571-41
R-4	Plate	Fixed, 470,000 ohms, 1 W.	J571-57
V-1	Oscillator tube	6AK6	
Y-1	Crystal Resonator	Quartz, 100 - 1000 Kc.	P206-1

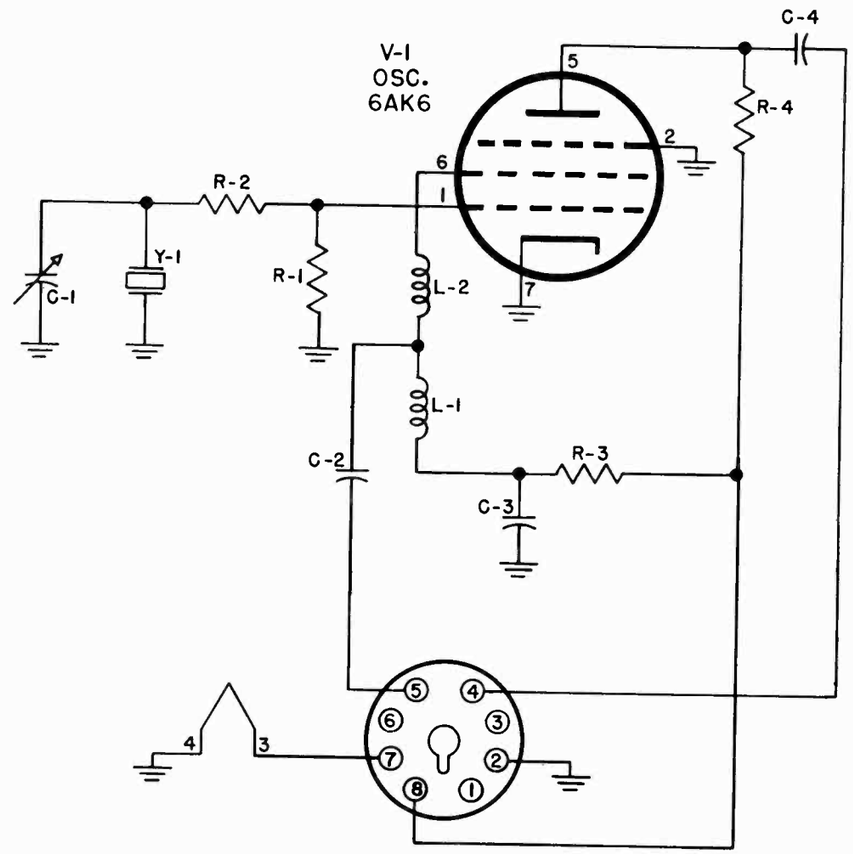

Figure No. 14. Schematic Diagram, XCU Calibrator

INSTRUCTIONS
for the
NATIONAL NFM-50
NARROW-BAND F.M. ADAPTOR

INSTALLATION

The NFM-50 is installed in the HRO-50 Receiver by plugging the adaptor unit into the N.B.F.M. Socket X-1 on the top of the chassis. A mounting bracket is furnished to hold the adaptor unit securely in position.

The adaptor unit is aligned at National Company laboratories and realignment is not necessary. It is necessary to realign the primary trimmer capacitor C-50 in the second detector transformer, T-7, on the HRO-50. See Figure No. 6 in this Instruction Book for the location of this adjustment. Realignment of this capacitor is effected as follows:

1. Install the NFM-50.
2. Adjust the receiver controls for normal A.M. operation.
3. Disconnect the antenna.
4. Trim the capacitor, C-50, for maximum receiver background noise using an insulated alignment tool.

ALIGNMENT

The NFM-50 is carefully aligned before shipment and no realignment is required unless the adaptor is accidently misaligned. The necessity of realignment can be determined by the A.M. rejection capabilities of the adaptor unit. Proper alignment will be indicated when the maximum A.M. rejection occurs at the center of the A.M. carrier. Maximum S-meter reading will indicate the center of the carrier.

The equipment required for alignment is a high-impedance vacuum tube voltmeter and an A.M. signal generator. The signal generator used should have an output resonably free of any frequency modulation. The use of a broadcast station as a signal source, in place of a signal generator, would provide a test signal meeting the above requirement. In any case, the signal strength of the test signal should be of the order to provide an S-meter reading of from 2 to 5 S-units when the HRO-50 is correctly tuned to the test signal.

The preliminary alignment procedure is as follows:

1. Connect the high-impedance voltmeter between the test point jack, J-1, and chassis. The polarity of the voltage will depend on the alignment of the adaptor, connect the voltmeter to obtain an up-scale reading.
2. Connect a signal source to the antenna terminals, A and A, at the rear of the HRO-50. If a signal generator is used make the connection through a 300 ohm dummy load and select a frequency in the standard broadcast band.
3. Set the Control switch at N.F.M.
4. Set the Selectivity switch at Off.
5. Set the Limiter control at Off.
6. Plug in the E coil set, 900 to 2,050 Kc. If this coil set is not available use the D coil set, 1.7 to 4.0 Mc.
7. Set the B plus switch at On.
8. Set the A.V.C.-Off switch at A.V.C.
9. Turn the R.F. Gain control to 10.
10. Adjust the A.F. Gain control for the desired volume.
11. Tune the test signal by adjustment of the Main Tuning knob. The correct tuning point is the setting that produces maximum S-meter reading.

Alignment is effected as follows:

1. Detune both primary, L-1, and secondary L-2, I.F. trimmers by rotating the screw adjustments until they are withdrawn from the shield can as far as possible. The adjustment with the dot of red paint opposite it is the primary trimmer L-1.
2. Tune the primary trimmer, L-1, for maximum reading on the voltmeter. If two peaks in output are observed, the correct peak will be the first one encountered when rotating the screw adjustment into the shield can.
3. Tune the secondary trimmer, L-2, for a zero reading on the voltmeter. It will be noted that there is a crossover in the polarity of the test voltage at this point.
4. Adjust the capacitor, C-9, for a null in the audio output. This capacitor is accessible after removal of the button plug on the side of the adaptor unit.

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5. Adjustment of capacitor, C-9, may affect the zero voltage reading obtained by adjustment of the secondary trimmer, L-2. Retrim L-2 and C-9, as necessary, until both a zero voltage reading on the voltmeter and a null in the audio output are obtained.

PARTS LIST

SYMBOL NO.	FUNCTION	DESCRIPTION	NAT. CO. TYPE
C-1	I.F. Amp. Coupling	Ceramic, 10 Mmf, 500 vdcw	D325D-402
C-2	Input Divider	Ceramic, 38.5 Mmf, 500 vdcw	D825D-414
C-3	I.F. Amp. Cathode Bypass	Mica, 0.01 Mfd, 300 vdcw	J666-56
C-4	I.F. Amp. Screen Bypass	Mica, 0.001 Mfd, 300 vdcw	J665-71
C-5	T-1 Primary Tuning	Mica, 100 Mmf, 500 vdcw	H500-7
C-6	T-1 Secondary Tuning	Mica, 180 Mmf, 500 vdcw	H500-3
C-7	T-1 Secondary Tuning	Mica, 180 Mmf, 500 vdcw	H500-3
C-8	T-1 Secondary Tuning	Ceramic, 38.5 Mmf, 500 vdcw	D825D-414
C-9	T-1 Sec. Balance Adj.	Ceramic, Var., 7-35 Mmf.	E311-4
C-10	Disc. Cathode Filter	Elect. 1 Mfd, 450 vdcw	E338-10
C-11	B Supply Bypass	Mica, 0.01 Mfd, 300 vdcw	J666-56
C-12	R.F. Filter	Mica, 470 Mmf, 500 vdcw	J665-56
C-13	Audio Coupling	Mica, 0.01 Mfd, 300 vdcw	J666-56
R-1	I.F. Amp. Grid Leak	Fixed, 1 Megohm, 1/2 W.	K379-61
R-2	I.F. Amp. Cathode Bias	Fixed, 1,000 Ohms, 1/2 W.	K379-25
R-3	I.F. Amp. Screen Dropping	Fixed, 47,000 Ohms, 1/2 W.	K379-45
R-4	R.F. Filter	Fixed, 47,000 Ohms, 1/2 W.	K379-45
R-5	Diode Load	Fixed, 15,000 Ohms, 1/2 W.	K379-39
R-6	Diode Load	Fixed, 15,000 Ohms, 1/2 W.	K379-39
R-7	Decoupling	Fixed, 4,700 Ohms, 1/2 W.	J569-33
J-1	Test Point	Tip Jack, Bakelite	K421-1
L-1	T-1 Primary Inductor	Adjustable Iron-Core	SA:4892
L-2	T-1 Secondary Inductor	Adjustable Iron-Core	SA:4891
P-1	Adaptor Unit Plug	8 Prong Octal	K783-1
T-1	Discriminator Transformer	Ratio Type 455 Kc.	SA:4890
V-1	I.F. Amplifier	6SK7	
V-2	Discriminator	6H6	

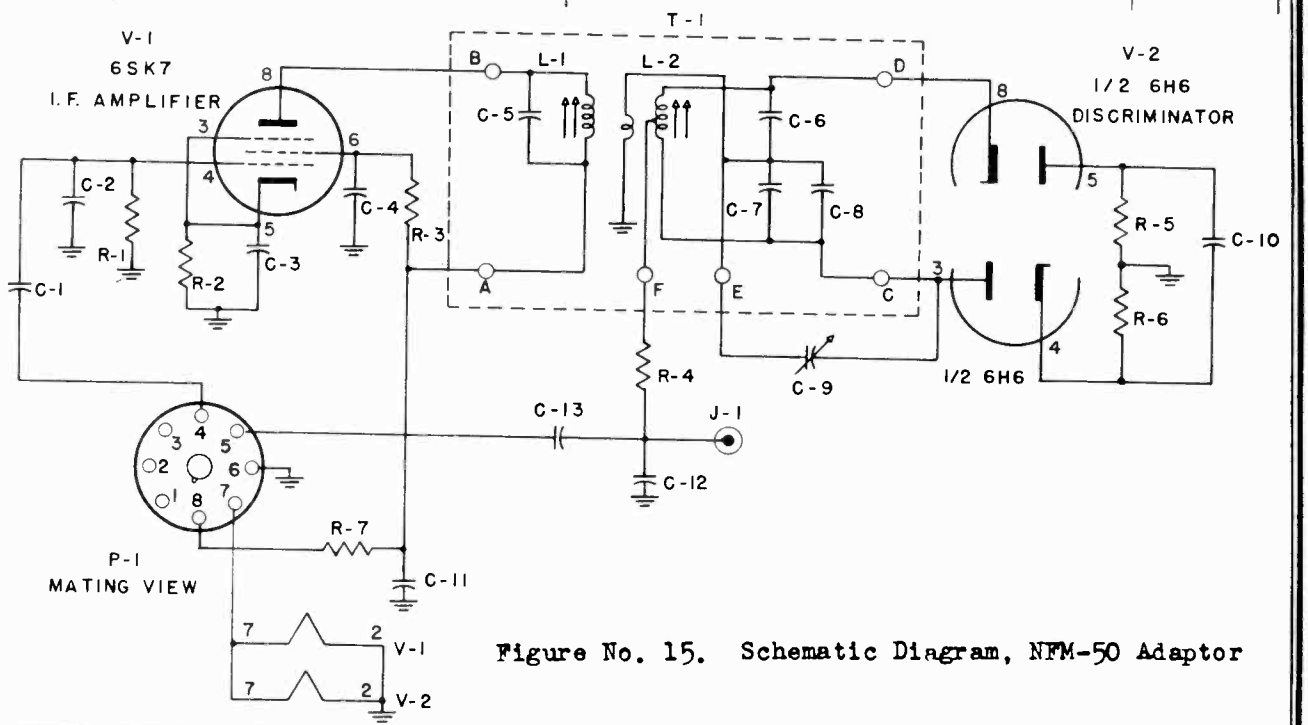

Figure No. 15. Schematic Diagram, NFM-50 Adaptor

INSTRUCTIONS FOR THE NATIONAL TYPE 650S VIBRATOR POWER SUPPLY

GENERAL

The National Type 650S Table Model Vibrator Power Unit has been designed to furnish complete operating voltages for the HRO-50 Receiver. The unit operates from a 6-volt D.C. supply and provides approximately 150 volts D.C. at 70 milliamperes in normal operation. Output voltages for both A and B supply are available at a four prong socket for convenient connection to the Receiver.

The 650S consists of a vibrator unit utilizing an OZ4A type rectifier tube and a vibrator in a circuit employing efficient R.F. filtering of vibrator hash. Further filtering of the low frequency or audio hum component in the output is accomplished by using the regular filter system in the Receiver.

INSTALLATION

The 650S unit is supplied with a battery connecting cable as well as an interconnecting cable to facilitate connection to the Receiver.

Battery clips are provided on the battery connecting cable, W-1, for convenient connection to a 6-volt storage battery or similar source of power. The interconnecting cable, W-2, is terminated at one end in a four-prong plug to mate with the socket, X-1, of the 650S. The other end utilizes an octal plug to mate with the power socket, X-1, at the rear of the HRO-50 Receiver. The Receiver A.C. jumper plug, P-1, used for A.C. operation must be removed from the power socket. Figure Number 16 shows the Schematic Wiring Diagram.

The 650S Vibrapack Unit has been completely tested and adjusted at the factory to provide efficient and economical service when used with the HRO-50 Receiver. An adjustment control switch has been furnished for increasing the B-plus output. This is a screw driver control available through an entry hole provided at the rear of the 650S. The control switch has four steps from approximately 150 volts of filtered D.C. at 70 milliamperes in the extreme counterclockwise position (step 1) to approximately 210 volts at 90 milliamperes in the fully clockwise position (step 4). It is recommended that the Receiver be operated at the lower B voltage of step 1. The total battery drain is approximately 10.5 amperes when furnishing power to the Receiver if the NFM-50, XCU and SOJ-3 units are used. If the Receiver is used without these accessories the total drain is approximately 9 amperes. The V.R. tube does not light under these conditions but the Receiver will operate normally and operation from a storage battery becomes practical. In step 4 the V.R. tube will light and full Receiver output will be obtained but the drain on the storage battery will be approximately 15 amperes when all accessories are utilized. Without these accessories the total Receiver drain from the battery will be approximately 13.3 amperes.

The two intermediate control switch steps 2 and 3 should not be used as the voltage obtained is approximately the value required to fire the V.R. tube in the receiver. Under this condition the V.R. tube may fire on and off sporadically resulting in erratic operation of the receiver.

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PARTS LIST

SYMBOL	FUNCTION	DESCRIPTION	NAT. CO. TYPE
C-1	Filter Capacitor	Elec. 500 mfd. 15 vdcw	E338-7
E-1	Vibrapack Unit	6 V.D.C. Mallory Type VP554	
F-1	Fuse	3 AG 20 Ampere 25 volt	
L-1	6-volt Line Filter	16 microhenries, iron core	SA:869
S-1	6-volt Line Switch	Toggle S.P.S.T.	E230-2
V-1	Rectifier Tube	Type 0Z4A	
W-1	6-volt Line Connector	Two Contact	SA:1999
W-2	Interconnecting Cable	One end terminated in four prong plug; other in an octal plug	
Y-1	Vibrator	6 V.D.C. Mallory Type 825C	
X-1	Output Socket	Four Prong Female	

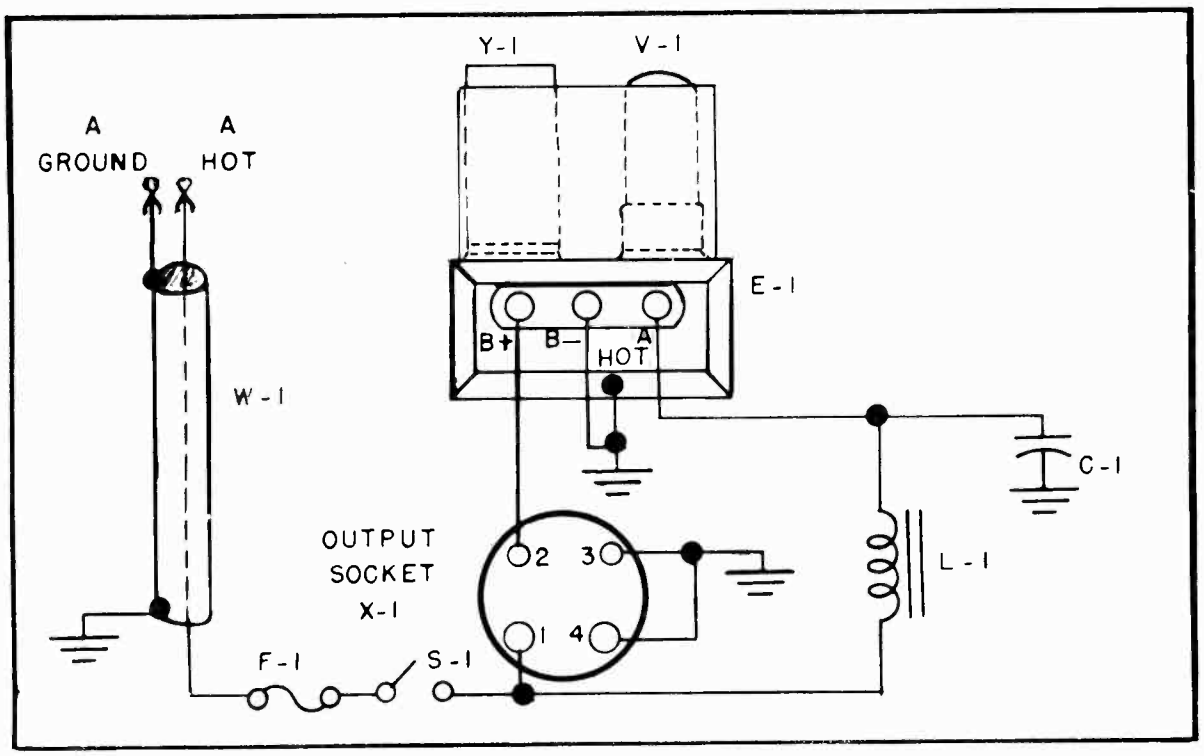

Figure No. 16. Schematic Diagram, 650S Vibrator Power Supply